

bird/aircraft hazards



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at Airports Near Solid Waste Disposal Sites

In 1969, the Inter-Agency Bird Hazard Committee designated 70 airports with bird/aircraft hazards, resulting in part from the proximity of the airports to solid waste disposal sites, where the problem needed to be studied. The Committee ranked 30 airports as high-priority, 16 as medium-priority, and 24 as low-priority study sites. At the request of the Committee, the Solid Waste Management Office* surveyed 32 of these airports, consisting of 27 high-priority, 2 medium-priority, and 3 not on the Committee's list. The 32 surveys were evenly divided between civil (16) and military (16) airports. The survey team inspected 105 land disposal sites near the 32 airports.

The survey consisted of discussions with the airports' personnel to obtain opinions on the bird/aircraft hazard, meetings with State and/or local solid waste management officials regarding the operation of land disposal sites around the airports, and inspections and evaluations of the sites. At 19 airports the bird/aircraft hazard was considered by the local personnel to be extremely serious, and, in fact, most personnel at those airports felt that their respective facilities were extremely fortunate in not having had serious accidents. At the other 13 airports, the bird/aircraft hazard was reported to have been eliminated or nonexistent. Almost all airports practiced

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some type of bird control program either to minimize the attraction of birds to the airport grounds or to scare the birds away. Only 29 of the adjacent disposal sites were classified by the survey team as sanitary landfills; the remaining were open, and sometimes burning, dumps. Birds had been reported at all sites at various times during the year, with gulls being the predominant species. In several cases, a single disposal site was contributing to the bird hazard problem of more than one airport.

Discussions with State and local solid waste management officials and the landfill operators revealed that most officials and operators were unaware of the potential bird/aircraft hazard. Following the discussions, many felt that the need to provide solid waste disposal sites was an equally pressing problem.

Analysis of judgments following two lawsuits resulting from aircraft/bird strike accidents indicated a strong possibility that both government and a disposal site owner could be liable for an accident attributed to birds if the disposal site was knowingly attracting birds and contributing to the risk of bird/aircraft collisions.

The following conclusions were drawn from studies of the U.S. Department of the Interior and the Government of Canada, as well as from discussions with wildlife experts and the Solid Waste Management Office survey.

1. Solid waste disposal sites around airports which attract birds contribute to potential bird/aircraft collisions.

2. The majority of the land disposal sites inspected during the survey were open dumps, which not only contribute to the bird/aircraft hazard but are also sources of environmental pollution. Many of these sites were in violation of State and local regulations.

3. Closing all existing disposal sites around airports will reduce the risk of bird/aircraft collisions at the airports.

4. Although sanitary landfills are less attractive to birds than open dumps, they are not always completely free of birds. Various bird-scare devices

at these sites, however, may be sufficient to keep birds away.

5. The government and a land disposal site owner could be liable for a bird/aircraft collision if the site is known to contribute to the bird hazard.

6. Research is needed to determine methods of operating sanitary landfills that will not attract birds.

RECOMMENDATIONS

The results of the Solid Waste Management Office's study indicated that proximity of land disposal sites to airports was associated with the bird/aircraft hazard at airports. Furthermore, it is suggested that if these sites, most of which are open dumps, were either eliminated or converted to sanitary landfills, the bird/aircraft hazard could be substantially reduced. Thus, the following two alternatives are offered to reduce the bird/aircraft hazards associated with existing land disposal sites. The recommendations are listed in order of potential effectiveness.

- Close all land disposal sites near airports. The closing of all dumps and sanitary landfills around airports is the most effective measure that can be taken to eliminate the food sources attracting and supporting the large bird populations at these sites.

- Operate all such sites as sanitary landfills. Due to the many social, political, and financial problems involved in locating new sites or constructing new disposal facilities, all land disposal sites cannot be closed. Therefore, to minimize the bird/aircraft hazard, all land disposal sites should be operated as sanitary landfills. All waste, particularly food waste, should be covered immediately following deposition. It is probable that some birds will, nevertheless, continue to frequent the site, particularly if it is the only food source in the area. These birds should be frightened away using any measures found effective. Specific details and help on such bird control techniques can be obtained by writing the Bureau of Sport Fisheries and Wildlife Research, U.S. Department of the Interior, Washington, D. C., 20240.

An additional recommendation is presented as a preventative measure for minimizing the bird/aircraft hazard that might arise from sites which are contemplated but not yet operational. The potential bird/aircraft hazard should be considered when planning new solid waste disposal sites around airports. Airport officials and wildlife experts should be consulted for their opinions on the increased risk of an aircraft accident due to the new disposal site.

Finally, an intensive research program should be initiated to determine: (1) methods for the operation of sanitary landfills in such a manner as to minimize their attractiveness to birds; (2) the optimal locations for disposal sites adjacent to airports that will minimize the risk of a bird/aircraft accident.

BACKGROUND AND STUDY

The collision of birds and aircraft is a potential problem at airports throughout the world. Many nations, including the United States, have initiated programs for collecting statistics on such collisions (termed "bird strikes") to assist in determining guidelines for reducing the frequency of the strikes. In the United States, the Federal Aviation Agency and the U.S. Air Force are the principal agencies engaged in collecting data on bird strikes with commercial and private aircraft, and with military aircraft, respectively.

Magnitude of the Problem

A report published by the U.S. Department of the Interior for the Federal Aviation Agency (FAA) stated that commercial U.S. air-carriers reported 476 bird/aircraft strikes in 1966 and 2,196 strikes during the period April 1961 through June 1967.¹ Of the many bird strikes that have occurred since 1960, several resulted in the loss of human life and extensive aircraft damage. Examples include: (1) the accident in Boston, Massachusetts, where in 1960 a flock of starlings contributed to engine power failure on an Electra aircraft resulting in the loss of the aircraft and 62 lives; (2) the strike by a whistling swan at Ellicott City, Maryland, in 1962, which caused the loss of an aircraft, and the death of 17 people; (3) the

collision in March 1963 of a Beechcraft and a loon near Bakersfield, California, resulting in a crash fatal to both pilot and passenger; (4) the loss of a \$1.5 million aircraft in 1968, in Cleveland, Ohio, where a flock of sea gulls was ingested by the engines of a private jet aircraft; fortunately, the three crew members were uninjured.

The U.S. Air Force (USAF) reported that in 1968 there were 1,192 bird-aircraft collisions involving their aircraft, with 363 collisions causing damage and 829 collisions where no damage was sustained.² There were two major accidents involving jet fighter aircraft. Both aircraft were destroyed and one pilot was fatally injured. The total cost of damage to the two jet aircraft was over \$1.5 million.

The FAA reported that most strikes occurred at altitudes of 2,500 feet or less.¹ The USAF reported that over 50 percent of the known military aircraft strikes happened between the ground and 1,500 feet.² These strikes occurred during take-off and landing and during low-altitude flights.

Department of the Interior Surveys

U.S. Department of the Interior studies and surveys showed that "garbage dumps"* located near airports are major attractors of sea gulls, the most common bird species involved in aircraft strikes. Case studies by their Division of Wildlife Research at New York City's Kennedy International, Newark, and Boston's Logan International airports further documented the contribution of solid waste disposal sites to the bird hazard. As many as 8,000 to 10,000 sea gulls were feeding at some of the sites surveyed by the Department of the Interior. The Department of the Interior concluded that the removal of these food sources would alleviate the sea gull hazard considerably around the airports.^{1,4}

Canadian Experience

In 1963, at the request of the Canadian Department of Transport, the National Research

*It is not known whether, in these reports, the term "garbage dump" also refers to a sanitary landfill or whether it is used in its true meaning as defined by the Office of Solid Waste Management Programs, EPA.³

Council of the Canadian Government set up the Associate Committee on Bird Hazards to Aircraft to study the problem and recommend solutions. Initially, the problem was considered to be partly of an aircraft engineering nature, and studies were begun to determine the necessary strength of aircraft components to resist bird impact without serious damage. It soon became apparent that because of the weights of birds involved and speeds of aircraft, not much engineering improvement could be done until international standards were developed.

It also became obvious that to make a completely bird-proof aircraft would involve creation of a structure of such weight that flight would not be economically feasible. After recognizing the difficulty of solving the problem through aircraft engineering, the Associate Committee directed its major effort toward biological solutions. Biological studies were conducted at a number of airports to learn about the bird species involved, the reasons for their presence on airports, and what could be done to disperse them. Studies were also made to determine ways of making airport environments unattractive to the birds.⁵

A major attraction of birds to airport environments was the availability of food, and one of the most important sources was dumps where food wastes were available. The Committee recommended that land disposal sites be moved away from the airport environment. In some cases, complex negotiations with neighboring municipalities were required to remove these sources of attraction.

The Department of Transport spent about \$10 million modifying the immediate environments at the major Canadian airports to reduce bird hazards. The cost benefits were reflected in lower Canadian Airlines hardware replacement costs. Before the airport modifications, average annual hardware replacement costs due to bird strikes for one airline over the 5-year period 1958 to 1963 was about \$240,000. For the 5-year period ending in 1968, the annual average cost was about \$125,000, while for 1969, it was less than \$50,000. Comparable figures are not available for other Canadian carriers, but it is reasonable to assume similar cost savings have occurred.

If the airport habitats had not been modified, the airline could have expected hardware replacement to be about \$360,000 per year. Although it would take about 30 years for hardware replacement costs to equal the expenditure for modifications, the potential saving of lives certainly justifies the costs incurred.

Study Development

In June 1968, the Inter-Agency Bird Hazard Committee (IABHC) requested the U.S. Department of Health, Education, and Welfare* to investigate the relationship between solid waste land disposal practices and bird hazards in airport environments and to identify solid waste disposal sites contributing to the hazard. The Committee reported that many airports have a bird hazard primarily because of solid waste disposal sites in the vicinity of the airports. Studies by the U.S. Department of the Interior and others have shown that disposal sites are a major source of attraction to birds and that the elimination of dumps in these environments will reduce, and in some cases may eliminate, the danger of bird strikes at the airport.

This report summarizes a survey conducted by the Division of Technical Operations, Solid Waste Management Office of the U.S. Environmental Protection Agency to determine the extent to which solid waste disposal sites contribute to the bird hazard at certain airports in the continental United States. It describes the bird hazard at these airports and the operation of the adjacent land disposal sites that are believed to be contributing to the problem. All public and private officials and agencies associated with these problem areas are strongly urged to exert efforts to either improve or eliminate the operation of the disposal sites. Such action is necessary if we are to reduce the risk of bird/aircraft collisions and the possible loss of life.

*In 1970 the Federal solid waste management program was transferred from the Department of Health, Education, and Welfare to the U.S. Environmental Protection Agency.

Study Procedure

The Inter-Agency Bird Hazard Committee identified 70 airports that were judged to have a bird/aircraft hazard resulting in part from solid waste disposal sites. In order to aid the studies the Committee assigned a high priority to 30, a medium priority to 16, and a low priority to 24 (Tables 1 through 5). Because of manpower limitations, the survey concentrated on high-priority airports. If medium- and low-priority airports were located near high-priority airports and required little additional effort, they were surveyed. Several high-priority airports were not surveyed because communications with the safety officers or FAA personnel indicated that a bird hazard did not exist.

A two-man team conducted each survey in three phases. Phase I consisted of interviews with airport managers and other airport personnel to obtain their views on the extent of the bird hazard, the principal causes of the hazard, and methods being used at the airport for bird control. Information on land disposal sites in the area and their relation to the airport's bird hazard was obtained from State and local solid waste management officials as Phase II. In Phase III the land disposal sites were inspected and their operations were evaluated. During Phase III, general information on the type of solid waste handled, size of operation, the expected life of the site, and other background information was gathered. In most cases, the operations were documented by photographs.

FINDINGS

The survey teams conducted the surveys between April and December 1969. The 32 airports surveyed consisted of 27 high priority, 2 medium priority, and 3 not on the original list, and were evenly divided between civil (16) and military (16). All of the airports were located in coastal States or States bounded by the Great Lakes.

Interviews with airport personnel indicated that the severity of the bird hazard varies between airports. Of the 32 airports surveyed, 19 reported a bird hazard and 13 reported that the hazard had been eliminated or did not exist (Tables 6 and 7).

TABLE 1
AIRPORTS REPORTING BIRD HAZARD PROBLEMS
CAUSED BY SOLID WASTE DISPOSAL SITES,
EASTERN REGION*

Airport	Civil (C) Military (M)	Priority [†]
Bridgeport Municipal Bridgeport, Conn.	C	2
Brunswick NAS [‡] Brunswick, Maine	M	1
Eastport Municipal Eastport, Maine	C	2
Presque Isle Presque Isle, Maine	C	2
Fall River Municipal Fall River, Mass.	C	3
Hanscom AFB [§] Bedford, Mass.	M	2
Lawrence Municipal Lawrence, Mass.	C	3
Logan International Boston, Mass.	C	1
S. Weymouth NAS S. Weymouth, Mass.	M	2
Cambridge Cambridge, Md.	C	3
Laconia Municipal Laconia, N.H.	C	3
Newark Newark, N.J.	C	1
Teterboro Teterboro, N.J.	C	3
Floyd Bennett Field NAS New York, N.Y.	M	1
Flushing Flushing, N.Y.	C	2
Greater Buffalo International Buffalo, N.Y.	C	2
John F. Kennedy International New York, N.Y.	C	1
La Guardia New York, N.Y.	C	2
Cleveland Lake Front Cleveland, Ohio	C	1
Philadelphia International Philadelphia, Pa.	C	2
Quonset Point NAS Quonset Point, R.I.	M	2
Norfolk Municipal Norfolk, Va.	C	1
Burlington Municipal Burlington, Vt.	C	1

*Regions are geographical divisions used by the Federal Aviation Agency.

[†]Priority assigned by the IABHC: 1, high; 2, medium; 3, low.

[‡]Naval Air Station.

[§]Air Force Base.

TABLE 2
AIRPORTS REPORTING BIRD HAZARD PROBLEMS
CAUSED BY SOLID WASTE DISPOSAL SITES,
SOUTHERN REGION

Airport	Civil (C) Military (M)	Priority
Elgin AFB Valparaiso, Fla.	M	1
Homestead AFB Homestead, Fla.	M	3
Patrick AFB Cocoa, Fla.	M	1
Hunter AFB Savannah, Ga.	M	1
Moody AFB Valdosta, Ga.	M	1
Tifton Tifton, Ga.	C	3
New Hanover County Wilmington, N.C.	C	3
Seymour Johnson AFB Goldsboro, N.C.	M	1
Wilson Municipal Wilson, N.C.	C	3
Charleston AFB Charleston, S.C.	M	1
Myrtle Beach AFB Myrtle Beach, S.C.	M	1
Shaw AFB Sumter, S.C.	M	1
Norfolk NAS Norfolk, Va.	M	1

Of the 19 airports reporting bird hazards, 10 were military and 9 were civil.

At the airports reporting a problem, most airport managers considered the problem to be serious. In fact, most of them felt that the airport was fortunate that a serious accident had not occurred. At these airports, bird control programs ranging from environmental cleanup activities to bird scare devices had been initiated (Tables 6 and 7). A few airports indicated that the problem was either slight or seasonal. On occasion there were

TABLE 3
AIRPORTS REPORTING BIRD HAZARD PROBLEMS
CAUSED BY SOLID WASTE DISPOSAL SITES,
CENTRAL REGION

Airport	Civil (C) Military (M)	Priority
Glenview NAS Glenview, Ill.	M	3
Hutchinson Municipal Hutchinson, Kans.	C	3
Renner Field Municipal Goodland, Kans.	C	3
Kincheloe AFB Sault Ste Marie, Mich.	M	1
Wurtsmith AFB Oscoda, Mich.	M	2
Duluth International Duluth, Minn.	C	2
Grand Forks AFB Grand Forks, N. Dak.	M	3
Grand Forks International Grand Forks, N. Dak.	C	3
Minot AFB Minot, N. Dak.	M	2
General Mitchell Field Milwaukee, Wis.	C	1
Madison Madison, Wis.	C	2

TABLE 4
AIRPORTS REPORTING BIRD HAZARD PROBLEMS
CAUSED BY SOLID WASTE DISPOSAL SITES,
SOUTHWESTERN REGION

Airport	Civil (C) Military (M)	Priority
Dallas NAS Dallas, Tex.	M	1
Arkansas County Rockport, Tex.	C	3
Mineral Wells Municipal Mineral Wells, Tex.	C	3*

*Before this report was originally published, the FAA reported to the study team that the dump was cleaned up and the problem eliminated.

TABLE 5
AIRPORTS REPORTING BIRD HAZARD PROBLEMS
CAUSED BY SOLID WASTE DISPOSAL SITES,
WESTERN REGION

Airport	Civil (C) Military (M)	Priority
Alameda NAS Alameda, Calif.	M	1
Fremont Municipal Fremont, Calif.	C	3
Hamilton AFB Hamilton, Calif.	M	1
Hayward Municipal Hayward, Calif.	C	3
Los Angeles International Los Angeles, Calif.	C	1
Mather AFB Sacramento, Calif.	M	1
McClellan AFB Sacramento, Calif.	M	1
Oakland International Oakland, Calif.	C	1
San Francisco International San Francisco, Calif.	C	1
San Jose Municipal San Jose, Calif.	C	2
Santa Rosa Santa Rosa, Calif.	C	3
Sonoma Sonoma, Calif.	C	3
Travis AFB Travis, Calif.	M	1
Fallon Municipal Fallon, Nev.	C	3
Milton Sweet Eugene, Oreg.	C	3
Pendleton Municipal Pendleton, Oreg.	C	2
Clallam County Port Angeles, Wash.	C	3
Seattle International Seattle, Wash.	C	1
Spokane International Spokane, Wash.	C	1
Yakima Municipal Yakima, Wash.	C	3

conflicting reports between the airport management and the air controllers or safety personnel regarding the aircraft/bird strike hazard.

Of the 13 airports not reporting problems, two of the airport managers indicated that potential hazards would exist if the number of aircraft

operations increase substantially. One airport reported the problems had ended with the closing of an open dump and a piggery in the area. Another airport manager stated that an open burning dump nearby created visibility problems.

Airport personnel expressed various opinions on the cause of the bird hazard. These opinions varied from land disposal sites to the weather as the principal cause of the hazard. The general opinion was that land disposal sites were one of the principal factors causing bird hazards.

The airport surveys included inspection of 105 adjacent or nearby disposal sites (Tables 8 through 12). The number of disposal sites believed to be contributing to a bird hazard at any one airport ranged from 1 to 14 sites. In several cases, a single disposal site was believed to be contributing to the problems of more than one airport. For example, in the San Francisco Bay area 14 sites were within an 8-mile radius of three airports: San Francisco International, Oakland International, and Alameda Naval Air Station.

The majority (73 percent) of the landfill sites inspected were classified by the survey teams as dumps (Tables 8 through 12). Only 28 of the 105 sites surveyed were judged to be sanitary landfills. Some birds were reported at all sites at sometime during the year. A number of disposal site operators reported that the problem was seasonal, with birds, particularly gulls, frequenting sites only during the winter months. The number of birds and their occurrence at the sites was reported to be dependent on the climate, the type of operation, the type of waste handled, and bird control measure utilized. Other factors which undoubtedly contribute to the attractiveness of land disposal sites are the presence of water and roosting grounds. The number and amount of other food sources available in the area, but not associated with disposal sites, is important. Although these sources were not part of this survey, their relationship to the problem should be determined.

Discussions with State and local solid waste management officials and landfill operators revealed that most officials were not aware of the bird/aircraft hazard. We believe, therefore, that one of the primary benefits already accomplished by this survey has been the enlightenment of these

TABLE 6
STUDY TEAM FINDINGS AT SELECTED AIRPORTS REPORTING A BIRD HAZARD

Airports	Degree of hazard	Bird control measures used						Number of disposal sites contributing to hazard
		Chemical deterrents	Noise devices	Distress recording	Insect & weed control	Shotgun	Vehicle patrol	
Alameda NAS, Alameda, Calif.	severe	X	X	X				12
Hamilton AFB, Hamilton, Calif.	severe	X	X				X	1
McClellan AFB, Sacramento, Calif.	severe (seasonal)	X			X			3
Oakland International, Oakland, Calif.	severe	X						12
San Francisco International, San Francisco, Calif.	severe		X		X	X		12
Travis AFB, Travis, Calif.	severe	X	X	X	X			3
Trumbull, Groton, Conn.	severe		X			X	X	1
Moody AFB, Valdosta, Ga.	severe	X	X		X			0
Brunswick NAS, Brunswick, Maine	severe	X					X	2
Logan International, Boston, Mass.	severe		X	X	X	X		2
Newark International, Newark, N.J.	severe	X	X			X		2 or more
Floyd Bennett Field NAS, New York, N.Y.	slight					X		2
John F. Kennedy International, New York, N.Y.	severe	X		X				2
Burke Lakefront, Cleveland, Ohio	slight					X		0
Charleston AFB, Charleston, S.C.	severe	X	X		X	X		4
Myrtle Beach AFB, Myrtle Beach, S.C.	severe	X	X					7
Shaw AFB, Sumter, S.C.	slight (seasonal)	X						2
Norfolk Municipal, Norfolk, Va.	slight	X	X					5
Traux Field, Madison, Wis.	severe (seasonal)		X				X	2

TABLE 7
AIRPORTS REPORTING TO STUDY TEAM THAT BIRD HAZARDS HAD BEEN ELIMINATED OR DID NOT EXIST

Airports	Bird control measures used						Remarks
	Chemical deterrents	Noise devices	Distress recording	Insect & weed control	Shotgun	Vehicle patrol	
Los Angeles International, Los Angeles, Calif. Mather AFB, Sacramento, Calif.					X		
Bridgeport Municipal, Bridgeport, Conn. Patrick AFB, Cocoa, Fla.	X					X	Potential problem when jet traffic increases. Potential problem but bird control program has presently eliminated it.
Hunter AFB, Savannah, Ga.							No problem; 97 percent helicopter operations.
Bangor International, Bangor, Maine Presque Isle Municipal, Presque Isle, Maine					X	X	Potential hazard exists. Smoke from burning dump provides visibility problem.
Seymour Johnson AFB, Goldsboro, N.C. Dallas NAS, Dallas, Tex.							Potential problem exists from blackbirds. Potential problem if number of flights increases.
Norfolk NAS, Norfolk, Va. Seattle International, Seattle, Wash. Spokane International, Spokane, Wash. General Mitchell Field, Milwaukee, Wis.		X				X	No bird problem since dump closed in 1967. Problem ended with closing of open dump. Problem ended with burning of piggery. Problem, but is under control—a "nuisance."
				X	X		

TABLE 8
DISPOSAL SITE INFORMATION, EASTERN REGION

Airport	Disposal site			Birds reported or observed	
	Name	Size (population served or quantity handled)	Cover material frequency		Expected life (years)
Bridgeport	Bridgeport (incinerator residue)	NA*	occasionally	NA	gulls
Trumbull	Stanford	NA	occasionally	NA	gulls
	Groton	45,000 people	occasionally	10	gulls
Bangor International	Brewer	NA	weekly	10	gulls
	Herman	NA	none	NA	
Brunswick NAS	Bangor	40,000 people	none	3	gulls
	Topsham	5,000 people	twice monthly	10	gulls
	Brunswick (conical burner)	25,000 people	none	10	none
Presque Isle	Brunswick NAS	NA	weekly	NA	gulls
	Presque Isle	15,000 people	none	NA	none
Logan International	Saugus	500,000 people	daily	1+	gulls
	Wintrop	20,000 people	occasionally	5	gulls

TABLE 8 (Continued)

Airport	Disposal site			Birds reported or observed	
	Name	Size (population served or quantity handled)	Cover material frequency		Expected life (years)
Newark International	Oak Island (Newark)	1,000 cu yd/day	weekly	1	gulls
	Disposal Area Inc.	1,900 tons/day	daily (top)	2-3	gulls
	Rozelle	3,500 tons/day	daily (top)	2	gulls
	Hackensack	2,500 tons/day	daily (top)	NA	gulls
	Staten Island	8,000 tons/day	weekly	4-7	gulls
John F. Kennedy International and Floyd Bennett NAS	Fountain Avenue	3,500 tons/day	daily	3-4	gulls
	Edgemere Landfill	380 tons/day	daily	15-20	gulls
Burke Lake Front	Rockside Hide-Away	2,000 cu yd/day	daily	3	few gulls when lake frozen
	Garden Park (demolition wastes)	100 tons/day	daily	2	few gulls
	Ridge Road (incinerator residue)	300 tons/day	none	6-8	no

TABLE 8 (Continued)

Airport	Disposal site				Birds reported or observed
	Name	Size (population served or quantity handled)	Cover material frequency	Expected life (years)	
Norfolk NAS and Norfolk Municipal	Naval Base	NA	none	NA	gulls
	Hampton	NA	none	NA	gulls
	Williamsburg- Newport News	NA	NA	NA	NA
	Chesapeake Sanitary Landfill	170 tons/day	daily	18-20	gulls (winter)
	Virginia Beach	250-500 tons/day	daily	5	gulls
	Norfolk	NA	none	NA	gulls
	Little Creek Naval	NA	none	NA	gulls

*Not available.

TABLE 9
DISPOSAL SITE INFORMATION, SOUTHWESTERN REGION

Airport	Disposal site				Birds reported or observed
	Name	Size (population served or quantity handled)	Cover material frequency	Expected life (years)	
Dallas NAS	NAS Landfill Irving	closed 100,000 people	daily	2	gulls, blackbirds, starlings gulls, crows, blackbirds pigeons, gulls, blackbirds
	Grand Prairie	55,000 people	weekly	5	
	Dallas Landfill	NA	daily	NA	

TABLE 10
DISPOSAL SITE INFORMATION, CENTRAL REGION

Airport	Disposal site				Birds reported or observed
	Name	Size (population served or quantity handled)	Cover material frequency	Expected life (years)	
General Mitchell Field	Milwaukee County	300 tons/day	daily	3	crows
	South Milwaukee (no food wastes)	NA	no	10	none
	Oak Creek (no food wastes)	NA	no	NA	none
	Oak Creek Disposal Co.	NA	no	NA	crows
	Hunt Landfill	NA	daily	10	none
Traux Field	Nipe	NA	no	10	gulls, crows
	Mineral Point	125 tons/day	daily	1	sparrows
	Traux Landfill	500 tons/day	daily	2-3	none
	Olin Street	NA	no	NA	gulls, blackbirds
	Maple Bluff	1,600 people	no	60	gulls, blackbirds

officials to the hazard and the relationship of the hazard to the adjacent disposal sites.

DISCUSSION

From this and previous studies, there is little doubt that improper solid waste disposal sites in many areas of the country contribute to the bird/aircraft strike hazard at airports. Several important questions are raised when the bird hazard/solid waste disposal relationship is considered:

1. Are both dumps and sanitary landfills equally attractive to birds?

2. How should a solid waste disposal site be operated to discourage birds from visiting it?

3. What is the critical radius for the location of solid waste disposal sites near airports, or, more clearly stated, how far from an airport should a disposal site be located so that there will be no interference to air traffic?

In answering question (1), we must remember that a dump is an area where wastes from various sources are discarded and sometimes burned. The wastes are infrequently or never covered, and there is little or no control over the disposal operation. At these sites, birds find food and water available to them. In addition, these areas make ideal roosts and shelters from inclement weather.

In contrast to the operation of a dump, a sanitary landfill is a controlled method of disposing of solid waste on land which minimizes environmental pollution, nuisances, or hazards. In a sanitary landfill the solid wastes are unloaded, spread, compacted, and covered with a layer of compacted soil each day. No solid wastes are left exposed and therefore available as harborage and food. Operation of a disposal site as a sanitary landfill decreases the attractiveness of the site to birds by reducing and eliminating the food and water supply.

In answering question (1), we have partially answered (2). All conditions which attract birds to an area must be removed before the birds will discontinue their visits. By quickly covering the deposited solid waste and providing adequate drainage from the site, the sources of food and water are minimized. However, some birds may continue to visit the area to roost and seek shelter, as they will in other cleared areas, unless repelled by scare devices.

TABLE 11
DISPOSAL SITE INFORMATION, SOUTHERN REGION

Airport	Disposal site				Birds reported or observed
	Name	Size (population served or quantity handled)	Cover material frequency	Expected life (years)	
Moody AFB	AFB Landfill	NA	every 2 days	10-12	blackbirds, crows
	Valdosta	75 tons/day	occasionally	1	none
Patrick AFB	Hahira	2 tons/day	twice weekly	10	none
	AFB Landfill	350 cu yd/day	occasionally	5	gulls
	Melbourne	50,000 people	weekly	5	gulls
	Brevard County	50,000 people	daily	3	gulls
	Cape Kennedy	1,000 tons/day	daily	10	gulls
Hunter Army Field	Army Landfill	3,800 cu yd/month	daily	indefinite	crows, gulls
	Savannah	330 tons/day	daily	3	gulls
	Port Wentworth	10 tons/day	occasionally	30-40	blackbirds
	Cole	20 tons/day	occasionally	NA	gulls
Myrtle Beach AFB	AFB Landfill	NA	daily	10	none
	Myrtle Beach	NA	every 2 days	50	crows, gulls
	Garden City	NA	none	NA	gulls
	State Camp Site	NA	none	NA	crows
	Gravels Gully	NA	occasionally	NA	gulls, crows
	Surfside	NA	occasionally	NA	gulls

TABLE 11 (Continued)

Airport	Disposal site			Expected life (years)	Birds reported or observed
	Name	Size (population served or quantity handled)	Cover material frequency		
Seymour Johnson AFB	S-J AFB Landfill	12,000 people	daily	1	few sparrows
	Mt. Olive	20 tons/day	none	1	sparrows
	Goldsboro	115 tons/day	daily	NA	crows, blackbirds, sparrows
	Cherry Hospital	4 tons/day	twice weekly	NA	none
	Pikeville	3 tons/day	NA	NA	NA
Charleston AFB and Charleston Municipal	Fremont	6 tons/day	NA	5-10	NA
	Eureka	1 ton/day	NA	NA	NA
	AFB Landfill	20 tons/day	daily	5-10	gulls
	Charleston	200 tons/day	occasionally	2-3	gulls
	North Charleston	80 tons/day	daily	NA	gulls
	St. Andrews	65 tons/day	monthly	10	blackbirds
	Hanahan	20 tons/day	occasionally	NA	gulls
	Roadside (I-26)	White goods	none	10	none
Shaw AFB	AFB Landfill	NA	daily	1½	no
	Sumter County	NA	occasionally	NA	blackbirds, crows
	Fish Road	NA	none	NA	blackbirds, crows

TABLE 12
DISPOSAL SITE INFORMATION, WESTERN REGION

Airport	Disposal site				Birds reported or observed
	Name	Size (population served or quantity handled)	Cover material frequency	Expected life (years)	
24 Hamilton AFB Los Angeles International	Redwood Landfill	250 tons/day	twice weekly	20	gulls, crows
	Toyon Canyon	3,500 tons/day	daily	10	gulls (infrequently)
Mather AFB	Mission Canyon	4,000 tons/day	daily	15	no
	Palos Verdes	4,000 tons/day	daily	3-4	swallows, gulls
	Mather AFB	8,000 people	NA	15	gulls
	McClellan AFB	NA	NA	NA	NA
	Incinerator (Residue Site)				
	Gerber Road	NA	every 2 days	20	gulls
	Sacramento	250,000 people	weekly	10	gulls, crows
White Rock	500 tons/day	daily	20	gulls	

TABLE 12 (Continued)

Airport	Disposal site			Birds reported or observed	
	Name	Size (population served or quantity handled)	Cover material frequency		Expected life (years)
San Francisco International	NAS Site	150 tons/day	sporadically	2-3	gulls
Oakland International	Turk Island	25 tons/day	daily	NA	gulls
Alameda NAS	West Winton	400 tons/day	daily	NA	gulls
	San Leandro	60 tons/day	daily	NA	gulls
	Davis Street	975 tons/day	daily	NA	gulls
	Alameda	225 tons/day	sporadically	NA	gulls
	Berkeley	95 tons/day	sporadically	NA	gulls
	Fleming Point	165 tons/day	daily	NA	gulls
	Richmond	880 tons/day	NA	NA	gulls
	San Mateo	400 tons/day	daily	NA	gulls
	San Mateo Rubbish	NA	daily	NA	gulls (few)
	Burlingame Rubbish	100 tons/day	daily	NA	gulls

TABLE 12 (Continued)

Airport	Disposal site			Expected life (years)	Birds reported or observed
	Name	Size (population served or quantity handled)	Cover material frequency		
Travis AFB	AFB Landfill	15,000 people	occasionally	4-5	blackbirds, starlings, crows
	Vacaville	60 tons/day	occasionally	10+	blackbirds, gulls
Seattle International	Fairfield	48 tons/day	occasionally	10+	gulls
	Kent Highlands	700 tons/day	daily	10	crows
	Midway Landfill	700 tons/day	daily	NA	very few crows
Spokane International	King County	1,400 tons/day	daily	20	crows
	Hog Farm— destroyed by fire in 1969.				

The scope of this study was limited to identifying solid waste disposal sites that contribute to the bird hazard and has not provided an answer to question (3). As a result, a primary recommendation of the report is that additional investigations be made to resolve this question.

The disposal sites mentioned in this report have a special significance because of the possible relationship of the bird/aircraft hazard to the specific airports. Many of these sites are supporting large bird populations which contribute to the risk of a serious aircraft accident. Regardless of who has the major responsibility to assure the proper operation or the closing of these sites, the responsibility is upon the shoulders of all officials, agencies, and the public who are associated with the problem. Good solid waste disposal facilities are expensive and are not easily constructed or operated. Nevertheless, when a problem exists, responsible officials must take immediate action.

Failure to accept responsibility may result in a catastrophe similar to the Boston accident, where sixty-two people were killed and ten were injured in the crash of an Eastern Airlines Lockheed 188 Electra.

Three suits involving fatalities and one involving injuries to a survivor arising from that crash were transferred to the United States District Court, Eastern District of Pennsylvania. All were tried by the Court without a jury. On January 20, 1967, Judge Harold K. Wood found for the plaintiffs, stating in Paragraph 7 of his conclusions of law: "The Government was negligent in failing to require the Massachusetts Port Authority at Logan Airport to remove the attractions to birds on the airport surfaces by filling in the ponds, closing the dumps, cutting down the phragmites and prohibiting the dumping of garbage and food particles on the airport surface and in failing to take adequate measures to insure that birds would not act as airport hazards when planes were taking off." Accordingly, judgment was entered against the Federal Government for a total of \$374,000 in the three cases involving fatalities. The personal injury case was not decided at the time of this decision.

The judgment was based in part upon a section of the Federal Airport Grant Act, 49 U.S.C.A. 1101(a)(4), which states: "Airport hazard means any structure or object of natural growth located

on or in the vicinity of a public airport, or any use of land near such airport, which obstructs the air space required for the flight of aircraft in landing or taking off at such airport or is otherwise hazardous to such landing or taking off of aircraft.”

Appeals were perfected and the cases were remanded to the trial court for consent judgments against the United States. One wrongful death and survival action was settled for \$8,374.62. One personal injury was settled for \$15,030, and Eastern Air Lines was awarded \$7,477.50 in a cross-claim in that case. Another wrongful death and survival claim was settled for \$31,735.12, with an additional award of \$253,881 which was not assessed against the United States. In all consent judgments against the United States it was agreed by the parties that payment was a compromise, not an admission of liability or an adjudication on the merits.

The results of this court decision indicate that any person, either public or private, who is responsible for an aircraft hazard in the vicinity of an airport could be liable for death and accident. For this reason, all operators of land disposal sites should take adequate measures to prevent a bird hazard.

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