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AN EVALUATION OF THE BIRD/AIRCRAFT STRIKE HAZARD MINOT AIR FORC--ETC(U)
SEP 77 L T CLARK, R T THORNTON, R D SMEDLEY

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AN EVALUATION OF THE BIRD/AIRCRAFT STRIKE HAZARD MINOT AIR FORCE BASE, NORTH DAKOTA,

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TYNDALL AFB
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AFCEC MEMORANDUM -8-77

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PREFACE

This study was conducted under Program Element 91212F, AFCEC JON 00DE9P11. Inclusive dates of the study were 2-13 September 1977.

This memorandum has been reviewed and is approved.

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ABSTRACT

The bird/aircraft strike hazard (BASH) at Minot Air Force Base, North Dakota, was surveyed during the period 2-13 September 1977. Special emphasis was placed on the bird strike hazards from gull populations on Minot AFB. Recommendations aimed at reducing airfield bird strike potential are included.

SUMMARY OF OBSERVATIONS AND RECOMMENDATIONS

1. There is a definite bird/aircraft strike hazard at Minot Air Force Base because of the following factors:

a. Large numbers of gulls are being attracted by the sewage lagoons and landfill.

b. Mowing operations in the airfield vicinity expose insects and result in favorable feeding and resting opportunities for gulls.

c. Small flying insects, mainly mosquitoes, are attracting significant numbers of swallows to the airfield.

d. An abundance of marshes and standing water on Minot AFB and its surrounding area is supporting considerable populations of insects and insectivorous birds.

e. Minot AFB is located in the Central Flyway, which is used by millions of birds during the spring and fall migrations.

f. Various species of raptors (birds of prey) frequently hunt on or near the airfield, feeding on small animals and birds. When their food source increases, an increase in raptors can be expected.

2. Recommendations

a. The base should organize a Bird Hazard Working Group to develop a bird control and avoidance plan.

b. A BIRD WATCH should be set up to inform pilots of bird densities which require temporary operational changes.

c. A bird dispersal team should be established by the base and should be staffed with personnel knowledgeable in bird behavior and control techniques.

e. Bird control personnel should have a uniquely marked vehicle so that the birds will learn to associate the vehicle with danger.

f. The chemical Avitrol should be procured to aid in the dispersal of gulls from the landfill and lagoons.

g. Grass should be maintained at 20 to 30.5 centimeters to discourage gulls from resting around the airfield.

h. An insect control program should be established to reduce a food source for insectivorous birds. Vegetation should be cut in the water drainage system and in depressions to reduce mosquito breeding habitats.

i. Air Traffic Control personnel must maintain a constant vigilance for birds.

j. During the fall migration season, local night sorties and multiple approaches should be reduced.

k. Hunting should be allowed to discourage ducks from the sewage lagoon.

These observations and recommendations are discussed in greater detail in the body of this report.

TABLE OF CONTENTS

LIST OF FIGURES

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SECTION I

INTRODUCTION

Minot Air Force Base occupies 204.4 hectares of Ward County, North Dakota, and is located 19.32 kilometers north of the city of Minot. The base is on a nearly level plain that consists of native grasslands. The airfield elevation is 1668 feet above mean sea level (MSL).

Most of the base vegetation consists of seeded grasses, natural grasses, and other herbaceous species. Of this grassland, some 416 hectares along the runways and some open fields are mowed by a contract farmer who bales the grass for feed. All trees and shrubs on Minot AFB were planted during base construction along roads, near recreation and housing areas to reduce damage caused by high winds and to control snow drifting. Trees found on base include Colorado Blue and Black Hills Spruce (*Picea* sp.), Green Ash (*Frazinus pennsylvanica*), Russian Olive (*Elaeagnus augustifolia*), Drobmore Elm (*Ulmus* sp.), Cottonless Cottonwood (*Populus* sp.), lilac (*Syringa* sp.),caragana (*Caragana* sp.), and Spirea Vanhoutte (*Spirea saxifrage*) (Reference 1). The trees, shrubs, and grasslands on Minot AFB provide a variety of habitats for birds that are hazardous to aircraft.

The extended centerline of runway 11/29 is located near or over several bodies of water of varied sizes, including base sewage lagoons. These attract several species of gulls and waterfowl which are hazardous to aircraft.

Aircraft assigned to the base include B-52s, KC-135s, F-106s, T-33s, UH-1Fs, and newly assigned T-38s. The fact that only three damaging bird strikes were reported from 1970-1976 is misleading in terms of bird/strike hazard potential. According to a 91 CSG/DEE undated letter to Mr. John Page, base aircraft were involved in a total of 14 bird strikes (ten gulls and four ducks) during the seven-month period of March to September, 1976. Although only two of these met reported criteria in AFR 127-4, the large number of strikes involving gulls and ducks indicate that Minot AFB has a serious bird hazard potential.

Positive action is needed to reduce this hazard which is most serious during late summer and early fall. This report includes a list of observations and recommendations to help the base reduce the bird strike potential. Some

recommendations will require long-range programs, while others can be carried out immediately as short-term answers to the problem. Bird/aircraft strike hazard reduction requires a continuing program with cooperation from all base agencies.

The BASH team strongly recommends the development of a comprehensive Bird Hazard Management Plan. This plan will be the central core from which a thorough and effective program can be developed.

SECTION II

OBSERVATIONS AND RECOMMENDATIONS

1. OPERATIONAL CHANGES AND BIRD WATCH

Airfield bird populations can be managed by environmental changes or active population control that will help reduce bird hazards to aircraft, but no program will ever eliminate all birds from the airfield. Gulls, waterfowl, blackbirds, and swallows will continue to fly over the field and gulls, horned larks, and swallows will occasionally rest or feed on the airfield. Operational changes then will be necessary until the birds pass or are dispersed.

Recommendations

a. The base should organize a Bird Hazard Working Group to develop a bird control and avoidance plan with representatives from Flying Safety, Civil Engineering, Flight Facilities, and Airfield Management. This group will provide for implementation of a plan which will include development of procedures and delegate responsibility for bird control. The group will also notify and inform pilots of bird hazards and coordinate operational changes designed to reduce the bird strike potential. The group should meet on a regular basis and may function as a portion of the base's Air Traffic Control Board. Additional emphasis should be given to reviewing operational procedures and beginning informational programs before large flocks of birds arrive in late summer and early fall.

b. After operational procedures have been established, they should be published as a part of Minot AFB Regulation 55-3 to insure compliance by local aircrews.

c. To inform pilots of bird densities which require temporary operational changes, we recommend that the term "BIRD WATCH" be used. Similar to MET WATCH for weather, BIRD WATCH alerts aircrews to possible flight hazards from increased bird activity. Declaration of BIRD WATCH will depend on operational changes for bird avoidance recommended by the Bird Hazard Working Group. The supervisor of flying, tower personnel, or aircrews should notify the Chief of Airfield Management who then declares a BIRD WATCH condition and implements procedures to reduce the risk of bird strikes.

d. BIRD WATCH conditions should be relayed to aircrews through radio communication between air traffic control personnel and the aircraft. The use of Notices to Airmen (NOTAMs) is encouraged for severe situations which may affect air safety for several days or longer. An example would be the arrival of large flocks of gulls which loaf on the airfield daily in late summer and early fall. The NOTAM would remain in effect until the birds leave for the winter.

2. GULLS

Large numbers of Ring-billed Gulls (*Larus delawarensis*) and Franklin's Gulls (*Larus pipixcan*) were seen flying over and resting on the airfield (see Figure 1). According to air traffic control personnel, these gulls present a hazard for four to six weeks each year during August and September. The birds may be present on or over the airfield any time between dawn and dusk.

Approximately 5000 gulls were observed on the base sewage lagoons (cells 4 and 5) on several occasions. Many gulls roost overnight on the lagoon and begin to leave the lagoons just after dawn, some moving to the base sanitary landfill (see Figure 2). Others fly over the airfield to feed in the farmlands south of the base, frequently alighting on the runway or taxiways before leaving the base.

Gulls are attracted by the sewage lagoons and landfill, and are probably attracted for several other reasons. It is well documented that they prefer areas which provide them good visibility and allow them to detect approaching danger (Reference 2). Runways, taxiways, and short grass areas of the airdrome provide this advantage, serve as resting spots during morning and evening flights between their roosting sites on the sewage lagoons, and feeding areas south of the base. Gulls frequently are found merely loafing on the airfield and may be found there during any time of the day.

Current contract mowing operations on the airfield also contribute to the gull problem. Studies in Canada and Europe (Reference 2) have shown conclusively that gulls are attracted to short grass while being repelled by tall grass (taller than 20 centimeters). The contractor mows 416.6 hectares in late summer, providing a large area with good visibility. This operation also exposes large numbers of insects, the primary food source of Franklin's and Ring-billed Gulls. We suspect that the mowing operation greatly increases the attractiveness of the the airfield, and adds to the difficulty of dispersing the gulls from the airfield.

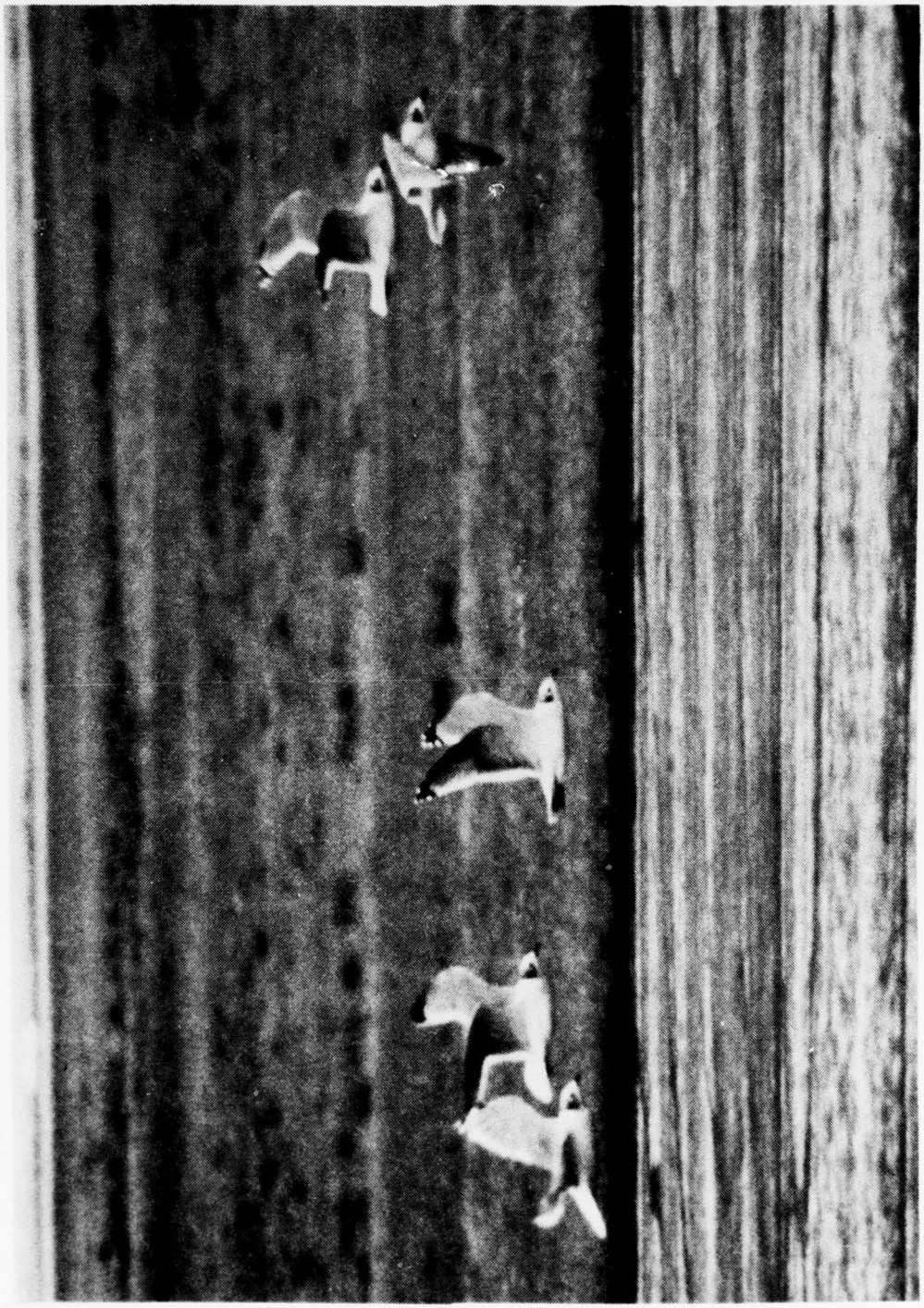

Figure 1. Gulls Overflying Runway

Figure 2. Gulls at Sanitary Landfill

Recommendations

a. A bird dispersal team must be established by the base. This team should be composed of individuals knowledgeable of bird behavior and control techniques, and it must be able to respond immediately during August and September. When birds are observed resting on the airfield, the team should begin dispersal procedures within 5 minutes.

The team must be in radio contact with the Air Traffic Control Tower to assure complete coordination of dispersal activities. No dispersal should be attempted when aircraft are departing or arriving unless the aircraft are instructed to hold until the birds have dispersed. This will preclude increasing the hazard by flushing birds into the path of an aircraft.

The team should be armed with either shotguns, firing shellcrackers and live ammunition, or the M-1 pyrotechnic pistol firing the M-74 airburst. Both have been very effective in dispersal of and controlling the flight direction of bird flocks. Shellcrackers, the less desirable of the two, cost approximately $0.30/round. When fired from the shotgun, a small propellant charge sends an explosive projectile approximately 92 meters before it explodes with a sharp noise and flash of light. The shellcrackers are not 100 percent reliable and have been known to explode prematurely. Because of this potential hazard, goggles, gloves, and ear protectors should be worn by team members. Only open-choke guns should be used and the barrel must be checked after each round for wads which may have stuck in the barrel. Field loads of bird shot are also effective in dispersing birds.

Bird control personnel should have a uniquely marked vehicle so that birds will eventually associate the vehicle with danger. Bird control contractors at USAF installations in the United Kingdom stated that birds soon flee at the sight of the control vehicle, thus saving dispersal resources (Reference 3).

The M-74 airburst (FSN 1370-028-6007), fired from the M-1 pyrotechnic pistol, is more satisfactory than the shellcracker for two reasons. First, it is safer and more readily available through military supply channels. It also has a larger charge, and a better range, and is more effective against most birds.

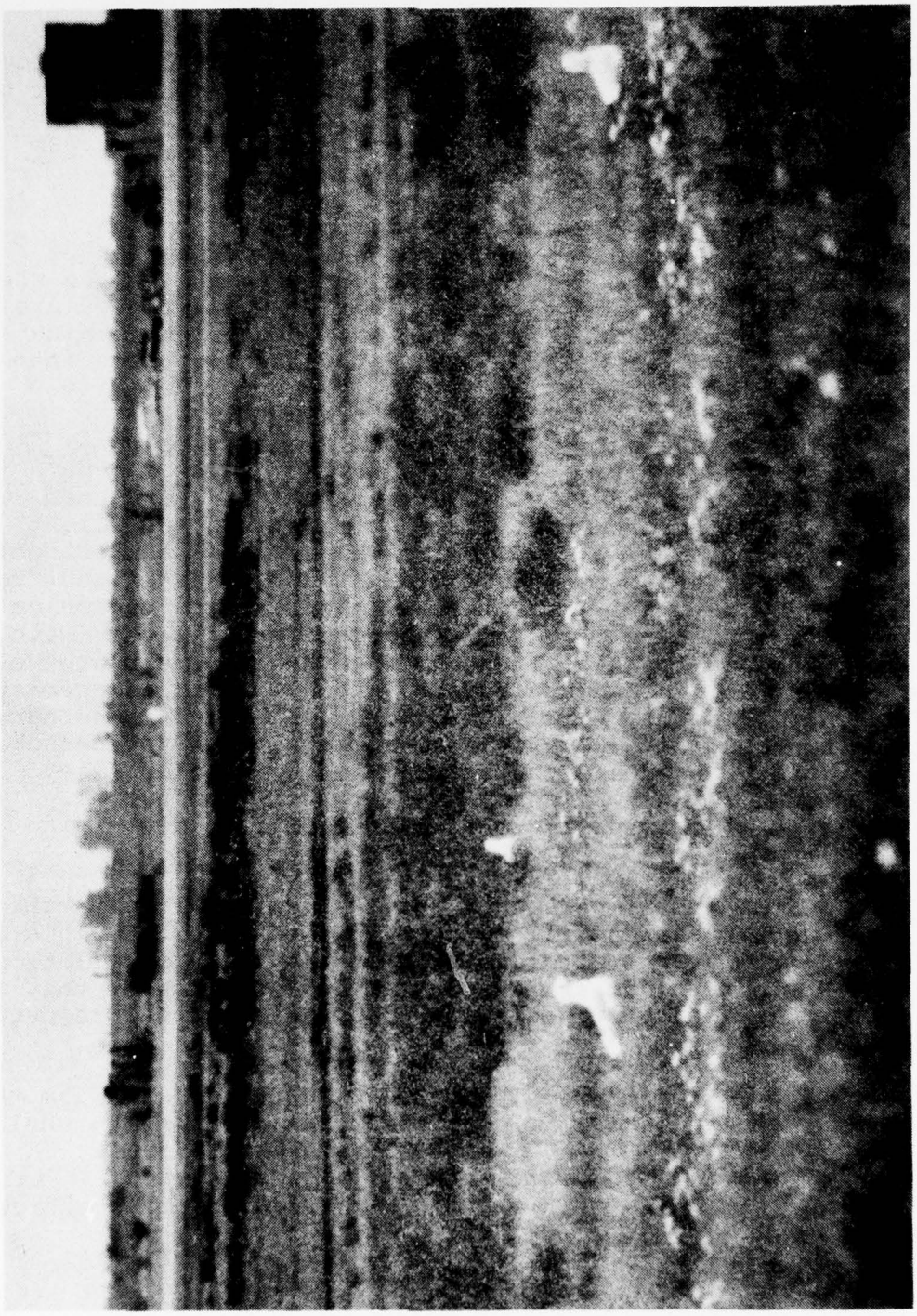

Figure 3. Gulls Loafing in Short Grass

When using the airburst or shellcrackers, the operator should position himself between the runway and the birds or opposite from the desired direction of dispersal and fire toward the birds. The bursts should detonate on the near side of the flock, driving them in the desired direction. Again, we emphasize that firing MUST be coordinated with the tower, and firing near aircraft should be avoided. Projectiles exploding near the ground may start a grass fire. A fire extinguisher should be standard equipment.

Such a harassment program must be continuous, the team responding whenever birds are found on base, seven days a week. The team should fire only the minimum number of rounds needed for dispersal to minimize habituation to harassment techniques. The gulls should also be kept off the sewage lagoons and landfill because gulls allowed to mass in large flocks close to the airdrome may move onto the runway area.

If harassment is not successful, or if the gulls begin habituating to the shellcrackers or airburst, killing a few birds may be necessary. The 91 SPS has already obtained permits for killing birds on the airfield. An individual bird should be killed occasionally to reinforce the effectiveness of shellcrackers or airbursts. A combination of several techniques insures better success.

b. The chemical, Avitrol, has also been effective in dispersing gulls. Avitrol may be used to scatter gulls from the landfill and lagoons. This chemical is EPA registered for bird control by qualified pest control personnel only. It is hazardous and must be applied in strict accordance with label instructions.

c. Because short grass attracts gulls (see Figure 3), we recommend that airfield grasses be maintained from 20 to 30.5 centimeters during August and September. This could be done by requiring completion of contract mowing no later than mid-July or mowing after the gulls leave for the winter (October). If the contractor will not agree to this arrange--ment, CES personnel could mow the airfield. One mowing in early July would suffice except for extremely wet years. The small increase in annual costs (loss of contract revenue and cost of mowing the airfield) could be offset by increased aircrew safety and reduced bird strike-related repair costs.

d. An insect control program on the airfield would reduce an abundant food source for gulls and other insectivorous birds. This program should be geared toward reducing the late summer insect populations as discussed under Observation 3.

e. When large numbers of gulls are present on or over the airfield, a condition BIRD WATCH should be declared and avoidance procedures developed by the Bird Hazard Working Group should be carried out.

f. The use of falcons has been somewhat successful in dispersing gulls from airports in Canada (Reference 4). The team does not generally recommend the use of falcons in bird control because of the expense involved; however, SSgt William R. Magee (91 CSG/OT), a licensed falconer, has volunteered to train and fly falcons against gulls on the airfield. Due to this unique situation, we feel that his talents could be used in this area. To accomplish this task, SSgt Magee should be given ample time to train his birds. He is also experienced in other bird control techniques, making him an excellent choice for the base bird dispersal team chief. In fact, he could be the entire team if assigned full time to bird control, at least during August and September. SSgt Magee is willing to use his personal vehicle, which would meet the requirement of a uniquely-marked vehicle; however, he would need a portable radio for communication with the tower.

3. INSECTS

Insects provide a good food source for many birds found on Minot AFB. The insect population at Minot AFB is abundant along the runway, around the sewage lagoons, and around the base's open drainage areas. Small flying insects such as mosquitoes attract large numbers of swallows (see Observation 5) to the airfield. These swallows normally fly in loose flocks at altitudes of 2-50 feet AGL, creating a hazard to arriving or departing aircraft. Gulls also feed on these small flying insects; however, the primary food sources for gulls on the airfield are the large populations of grasshoppers. Mowing operations on the airfield expose insects previously hidden in the tall grass, and make them more available to the gulls. Observation 2 discusses the bird/aircraft strike hazard created by gulls.

Recommendations

a. Remove vegetation from the present water drainage system as discussed in Observation 6. This would help reduce much of the marsh area that is conducive to insect breeding, particularly mosquitoes.

b. Set up procedures to insure that an adequate insect control program is begun by the Base Civil Engineer. The present mosquito program of fogging with Malathion should be augmented in standing water with the use of the larvicide, Tosit, except in areas where contamination of off-base water areas may result.

c. Implement a comprehensive program to control flying and ground-dwelling insects on the airfield. This program should include fogging for flying insects and spraying for such ground-dwelling forms as grasshoppers. Malathion could be used for both; however, Sevin may be more effective against grasshoppers. Fogging may be required through the warm seasons for mosquito control, but this program for reducing bird populations should begin in early August with an initial spraying of the airdrome and associated clear zones. Another spraying may be needed in early September, depending on weather conditions. Fogging should accompany spraying and the combination of the two will effectively reduce insects attractive to both gulls and swallows.

It should be emphasized that any pesticide applications must be accomplished as discussed in the label instructions and only by qualified personnel.

4. BIRD AVOIDANCE DURING ARRIVAL AND DEPARTURE

During much of the year, birds fly over and around the airfield at low altitudes, rarely exceeding 1000 feet AGL. The greatest risk to aircraft operating on and around Minot AFB occurs during takeoff and landing when the aircraft is flying at low speeds. Bird strikes on landing are less hazardous than those occurring on takeoff, because of greater aircraft gross weight and high power settings during takeoff and departing climb. Engine ingestions of small birds during takeoffs have caused losses of aircraft. An Air Force T-38 at Randolph AFB (Reference 6) was lost due to engine ingestions of Brown-headed Cowbirds (*Molothrus ater*).

As described elsewhere in this report, several species of hazardous birds are found in the vicinity of Minot AFB. Some may frequent the base, flying over or loafing/feeding on the airfield, while others are seen off-base in large flocks.

Traffic arriving under VFR must maintain 2100 AGL until 4 miles DME (Distance Measuring Equipment) when entering the overhead pattern. VFR traffic pattern altitude for

multi-engine jet and conventional aircraft is 1200 feet AGL. Arrival aircraft on IFR (Instrument Flight Rules) flight plans are routinely as low as 1600 feet AGL within a 20-mile radius of the base and may be that low as far out as 30-40 miles. Both VFR and IFR traffic may be exposed to altitudes of high bird densities for relatively long periods.

When bird activity around, over, or on the airfield increases, special precautions and procedures are needed to reduce the hazard to arriving and departing aircraft.

Recommendations

a. Air Traffic Control personnel must maintain constant vigilance for birds. Tower personnel should routinely scan local airspace with binoculars before aircraft arrivals or departures to determine whether hazardous birds are present. If birds are observed, aircrews should be advised of the hazard. Crews should be informed that avoidance procedures, as established by the Bird Hazard Working Group, may be necessary.

b. Require departing aircraft to delay takeoff until hazardous birds have dispersed. Once airborne, aircraft should make maximum performance climbs to at least 1500 feet AGL to minimize exposure to the most birds. A further climb to 3000 feet AGL significantly reduces the risk of bird strikes. Aircraft executing Dickinson-Two or Aberdeen-Two departures from Runway 29 are exposed to higher bird strike probabilities than those from Runway 11 because of the large avian populations in the Lake Darling/Souris River area. These departures should be avoided whenever possible during the migratory season. When they must be used, aircraft should make maximum performance climbs to at least 3000 feet AGL.

c. Arriving aircraft should watch for flocks of birds, especially when planning approaches to Runway 11. Lake Darling and the Upper Souris National Wildlife Refuge, located approximately 8 miles out within the approach zone of Runway 11, may support as many as 65,000 ducks during the peak of the fall migration. All arriving aircraft should remain above 3000 feet AGL as long as possible until further descent is necessary for a safe landing.

5. SWALLOWS

A hazardous population of swallows was observed on Minot AFB. The majority of the birds were Barn Swallows (*Hirundo rustica*) with Bank Swallows (*Riparia reparia*), Tree Swallows (*Iridoprocne bicolor*), Rough-wing Swallows (*Stelgidopteryx rulicollis*), and Cliff Swallows (*Petrochelidon pyrrhonota*), comprising the remainder of the population.

Although these birds are small in size, their flocking nature and their tendency to feed on the airfield make them a potential hazard to aircraft. Flocks of over 1000 swallows were observed feeding on the airfield during the daylight hours. This dangerous situation was brought about because the swallows are attracted to the airfield by large populations of small flying insects. At least one strike involving swallows has occurred so far this year (Reference 5).

Finally, some of the structures on base provide excellent nesting sites for the swallows. Swallow nests were seen underneath bridges and at other edifices; however, the removal of these nests would have no great effect on the swallow population.

As with the gulls, swallows present the greatest hazard in late summer when they begin gathering into large flocks for the winter migration. These large flocks fly at low altitudes while feeding on flying insects.

Recommendations

a. To reduce the presence of swallows on the airfield, their food source must be diminished. To accomplish this, a comprehensive insect control program should be implemented on the airfield as described in Observation 3.

b. When large numbers of swallows are found on the airfield, crews of arriving and departing aircraft should be notified of the hazard. Procedures, as developed by the Bird Hazard Working Group, should also be carried out, depending on bird densities.

c. The use of pyrotechnics, as described in Observation 2, is not effective in dispersing swallows. However, shell-crackers could be used to move the swallows from directly over the runway. Unfortunately, the birds can be expected to return within a minute or two.

6. MARSHES AND STANDING WATER

Water attracts birds in several ways: Large areas of standing water, such as sewage lagoons (Figure 4), provide drinking water as well as resting and feeding habitats for many birds, especially waterfowl and gulls. Marshlands furnish birds with breeding habitats, protective cover, and a food source. Large populations of insects thrive in these areas and attract large numbers of insectivorous birds such as swallows and gulls which have been involved in bird/aircraft collisions at Minot AFB.

Minot AFB has a large amount of standing water on base and is also affected by the large amounts of standing water off base. These include the very large Lake Darling, 12.9 kilometers northwest of base and in line with the centerline of Runway 11/29. The primary water areas on base include the five sewage lagoons. Two sewage lagoons totalling 61 hectares are located 1.6 kilometers north of the approach end of Runway 11, while the other three, totalling 44 hectares, are located 3.22 kilometers north-northwest of the eastern portion of the runway. The runway is paralleled by the Souris and Des Lacs Rivers, which are between 11.25 and 14.5 kilometers south of the runway. These off-base rivers and lakes, combined with the small ponds and potholes found throughout the base and county, attract numerous waterfowl and gulls which are extremely hazardous to aircraft.

Marshlands and open drainage ditches containing vegetation attract birds to the immediate area of the base by providing excellent breeding areas for insects which are a major food source for birds (Figure 5). There are several marsh areas along the runway (Figure 6) and around the base. Examples of these marshy areas are the two open drainage ditches that exist on base. One starts at SAC Alert Pad Number 2, and the second starts west of Base Operations going northwest behind Building 546, past the trailer park and ending near the base Riding Club. Each of these locations has areas of open standing water and dense stands of cattails (*Typha* sp.) and rushes (*Juncus* sp.) creating a favorable situation for insect breeding. All marshy areas on base were found to have an abundant number of insects, thereby attracting large numbers of swallows.

Recommendations

a. Clear open drainage ditches and depressions along the runway and taxiways of vegetation to allow unrestricted

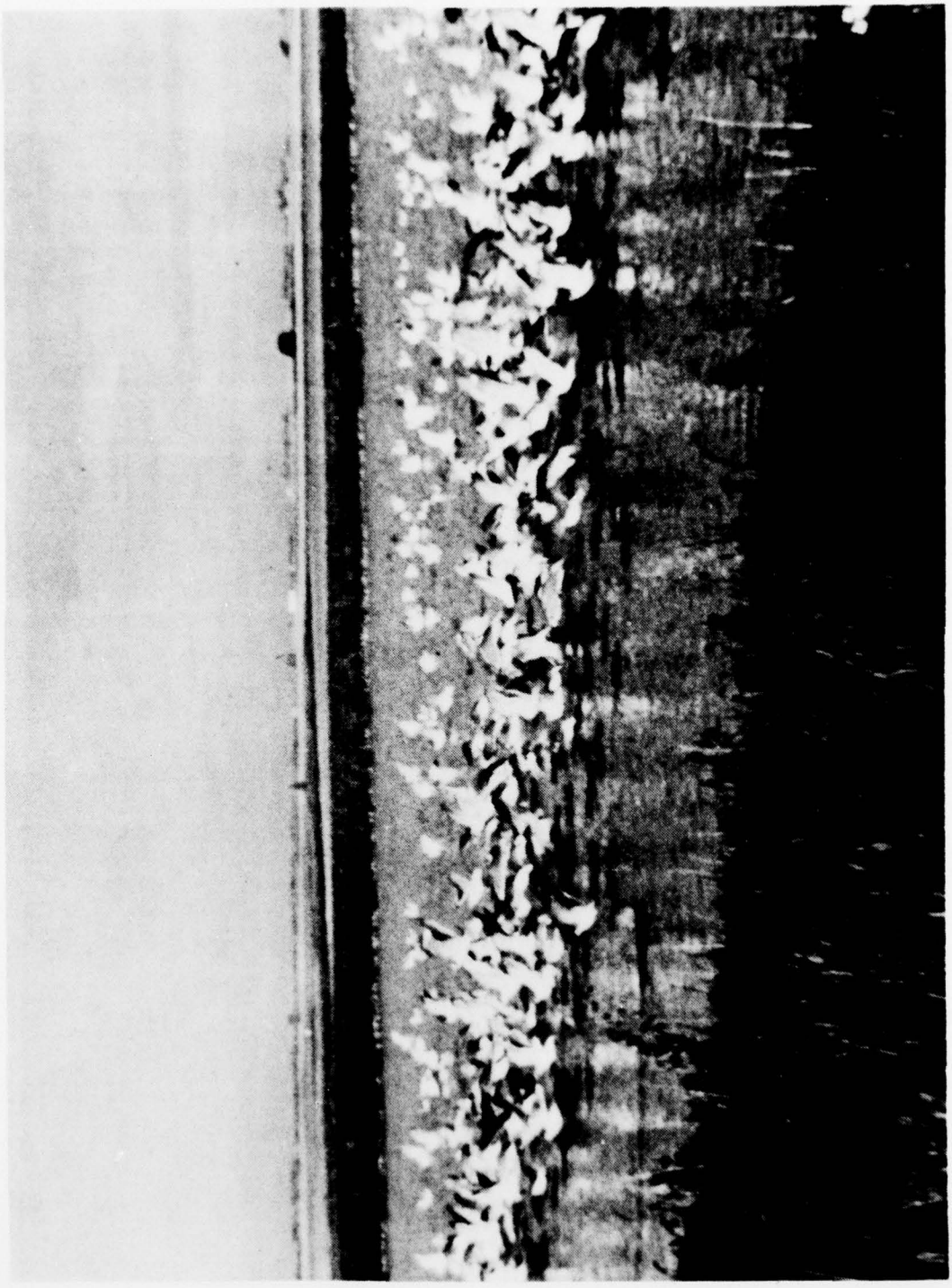

Figure 4. Gulls at Base Sewage Lagoon

Figure 5. Blocked Drainage Ditch

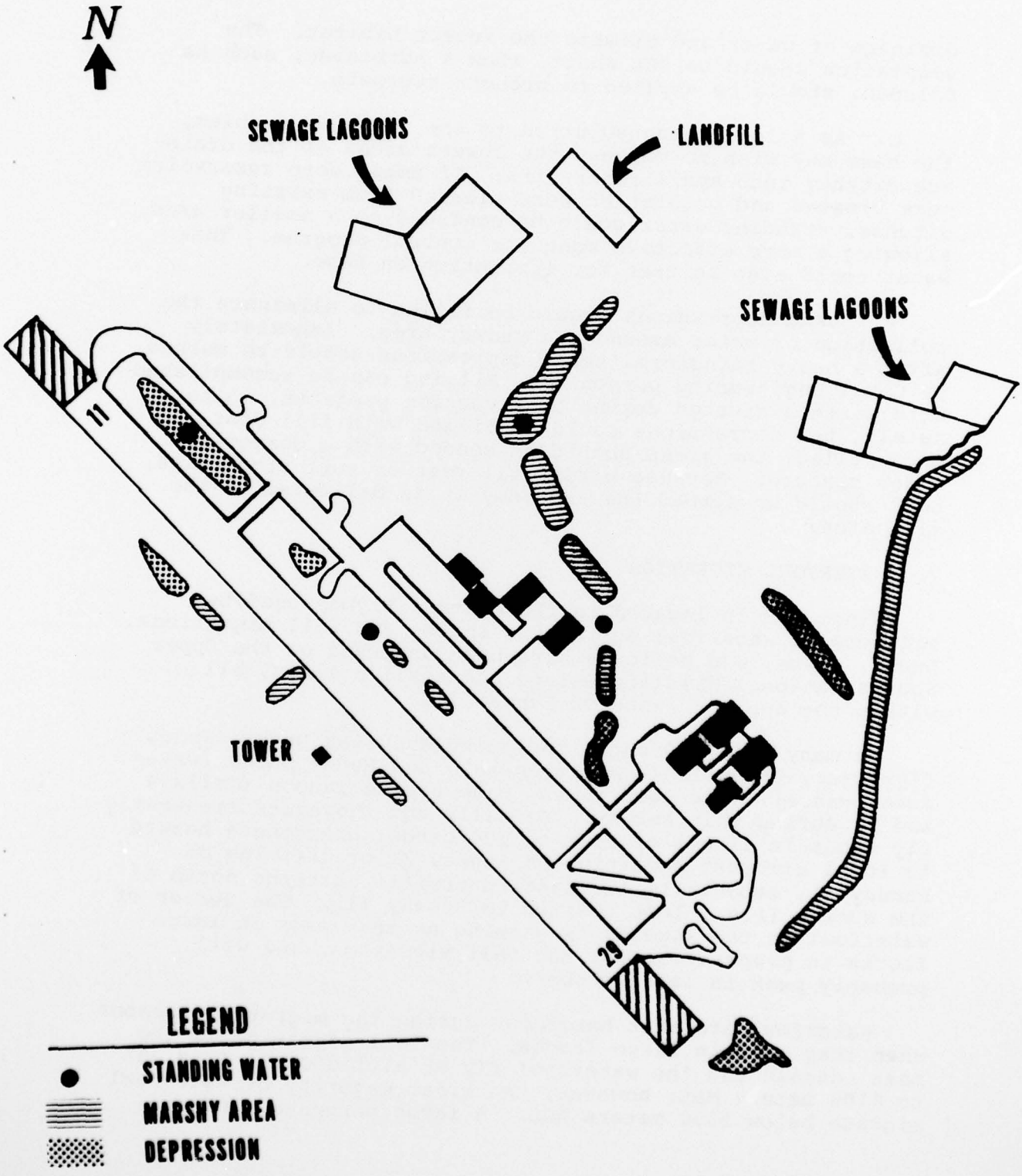

Figure 6. Standing Water and Marshy Areas

drainage of water and elimate the insect habitat. The vegetation should be cut short, then a herbicide, such as Dalapon, should be applied to prevent regrowth.

b. As a long-range solution to the drainage problem, the base may wish to convert the lowest areas of the drainage ditches into small reservoirs. If small deep reservoirs were created and vegetation were cleared from existing ditches, standing water could be confined to a smaller area, allowing a more effective mosquito control program. This water could also be used for irrigation on base.

c. Land depressions should be filled to eliminate the collection of water around the runway area. Immediately after a heavy rainstorm, small depressions should be marked by Civil Engineering personnel. Filling can be accomplished with earth excavated during construction projects. Alternately, the depressions could be filled with fill dirt. Once filled, the areas should be seeded with a commercial grass mixture. Because birds will rest on soil stockpiles, soil should be spread the same day it is delivered to the fill area.

7. WATERFOWL MIGRATION

Minot AFB is located in the Central Flyway used by millions of waterfowl during the spring and fall migrations. Ducks, geese, and pelicans have been observed on the Upper Souris National Wildlife Refuge and smaller lakes, all within the approach zone of Runway 11.

As many as 5,000 ducks including Shoveler Ducks (*Spatula Clypeata*), Gadwalls (*Anos strepera*), and Ruddy Ducks (*Oxyura jamaicensis*), were seen on the base sewage lagoon (Cells 4 and 5) during this survey. Gadwalls and Shovelers frequently fly about in flocks of four to 150 birds, creating a hazard to local aircraft departing on Runway 29 or arriving on Runway 11, especially aircraft in traffic patterns north of the runway (i.e., left traffic to Runway 11). The number of waterfowl on the lagoons is growing as they mass in large flocks in preparation for the fall migration, and will probably peak in late October.

Waterfowl are most hazardous during the migratory seasons when they move in large flocks. The fall migration is the most intense and the waterfowl fly at altitudes of from 305 to 6100 meters MSL; however, the great majority of waterfowl migrate below 3050 meters AGL. A large percentage of

waterfowl migration occurs at night. In North Dakota spring migration lasts from approximately mid-March through May, while fall migration occurs in September, October, and November.

Recommendation

a. During the fall migration season, local night sorties and multiple approaches should be reduced. Prudent flight scheduling, especially for the T-38 aircraft, can greatly reduce exposure to damaging bird strikes from mid-September to early November.

b. Waterfowl should be discouraged from using the sewage lagoons, especially from August until they migrate south. This can be accomplished effectively at the same time the gulls are being dispersed from the lagoons. During the hunting season, the lagoons could be open for waterfowl hunting on a limited basis. Hunting hours should be scheduled during periods of low aircraft activity to avoid scaring birds into the flight path of aircraft operating to or from Minot AFB. Weekend hunts are recommended for this reason.

8. SMALL MAMMALS

A small resident population of whitetail jackrabbits (*Lepus townsendi*) and Richardson ground squirrels (*Citellus richardsoni*) were observed on Minot AFB. Both of these small mammals furnish food for birds of prey and will attract these large birds to the airfield. Because of their size and habit of occasionally crossing the runway, jackrabbits are also a threat to landing and departing aircraft. Aircraft collisions with European hares (similar in size and behavior to jackrabbits) highlight this need for concern. In one instance, a T-39 struck a hare during landing, causing nose gear failure (Reference 7).

Recommendations

a. Jackrabbits and ground squirrels have not caused any problems, however, population control should be initiated. Controlled hunting is probably the best method for decreasing the number of jackrabbits on the airfield. Whenever base rabbit populations reach hazardous levels, a special hunt should be scheduled. The base Rod and Gun Club could be the coordinator for these periodic hunts. Weekend hunts are desirable because of limited aircraft operations; thus, the hunting would have minimum impact on airfield operations.

b. If hunting proves unsatisfactory for jackrabbit control, a jackrabbit round-up could be conducted by a Security Police detail and volunteers if needed. The round-up would include a line of "chasers" walking the entire length of the airfield, chasing the rabbits ahead of them. A gun team would be stationed at the opposite end of the field to shoot the jackrabbits as they flee the chasers.

c. The ground squirrel population can be controlled in two ways. Either the squirrels can be poisoned by placing strychnine-treated oats in their burrows, or forcing carbon monoxide down their burrows. Both methods are being used with good success at Malmstrom AFB.

d. If these methods are undesirable, Animal Damage Control (US Fish and Wildlife Service) personnel may be contacted for further advice.

9. RAPTORS

Marsh Hawks (*Circus cyaneus*) and other hawks (see Figure 7) were observed hunting on or near the airfield. Large numbers of hawks migrate through the Minot area each fall. These birds are normally seen alone at all altitudes up to 10,000 feet AGL.

On base food sources for raptors such as reptiles, amphibians, birds, small mammals and insects, are found in moderate numbers on the airfield. When available food sources increase, an increase in raptor activity can be expected, especially in the fall.

Recommendations

a. Tower personnel and airfield management personnel must be aware of the potential for hazards associated with raptors, especially on warm afternoons. Aircrews should be alerted to the presence of any large birds over the airfield. If pilots know the birds are present, collisions may be avoided.

b. Birds of prey are protected under federal law, complicating control measures. The most feasible means of raptor control is reduction of food sources (see Observations 3, 7, and 8). If a hazardous resident population of raptors does develop, the hawks and/or owls could be trapped and relocated. Because the capture and possession of raptors is strictly regulated, this work must be accomplished by someone experienced in working with raptors.

Figure 7. Cooper's Hawk on perimeter fence

10. OVERFLIGHTS OF BLACKBIRDS

Large trailing flocks of blackbirds were observed in the immediate vicinity of Minot AFB during the survey. These flocks were seen crossing over the runway centerline at altitudes of 30.5 to 305 meters AGL.

Recommendations

Overflights of birds which neither roost nor feed on the base cannot be controlled. The only way to reduce the hazard is avoidance by aircrews. Crews should be informed of local bird hazards through radio communication and implementation of BIRD WATCH as described in Observation 2.

In addition, permits must be obtained from the US Fish and Wildlife Service and the North Dakota Department of Fish and Game. SSgt William R. Magee, 91 CSG/OT, a licensed falconer, would be an excellent choice for this assignment.

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