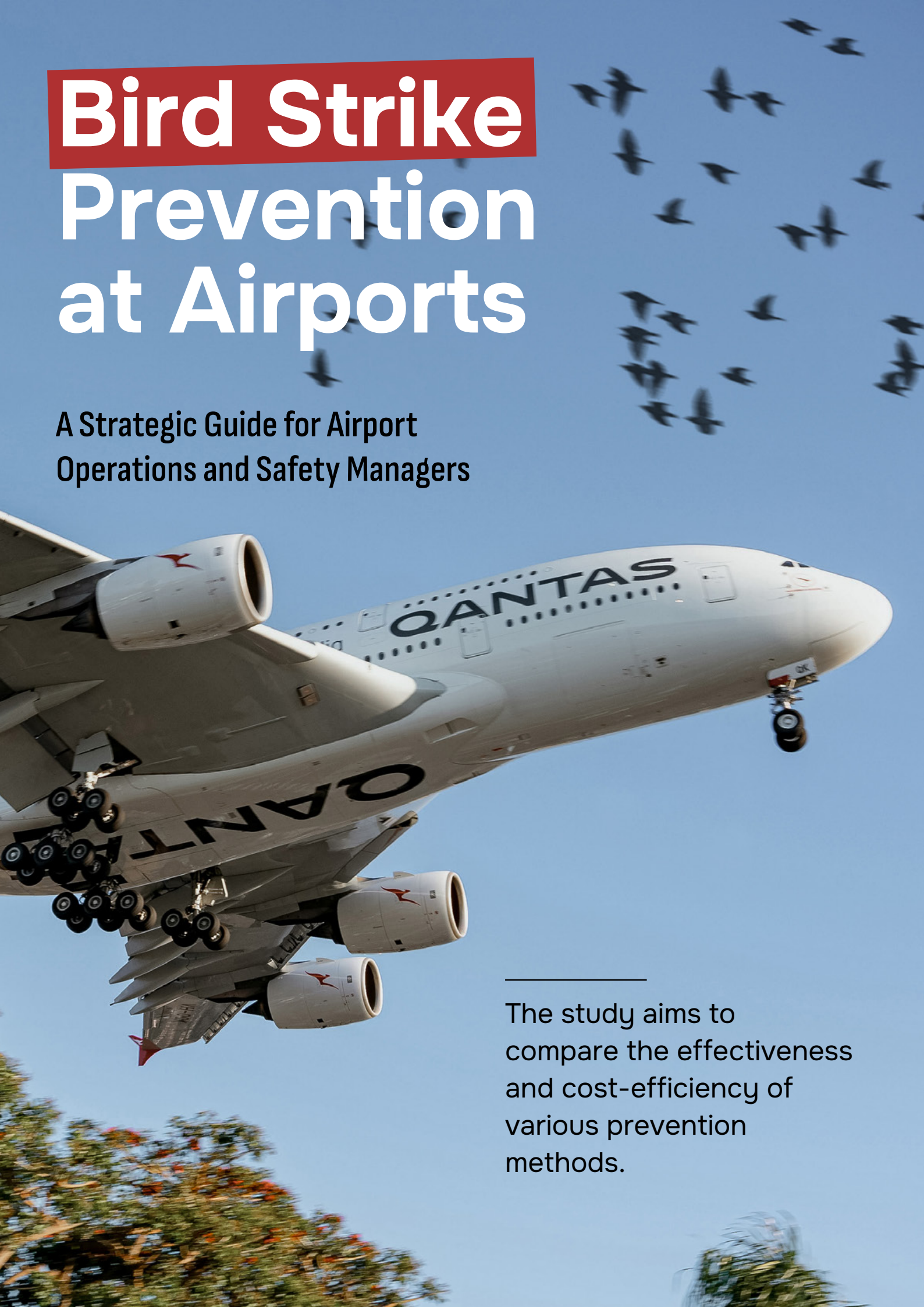
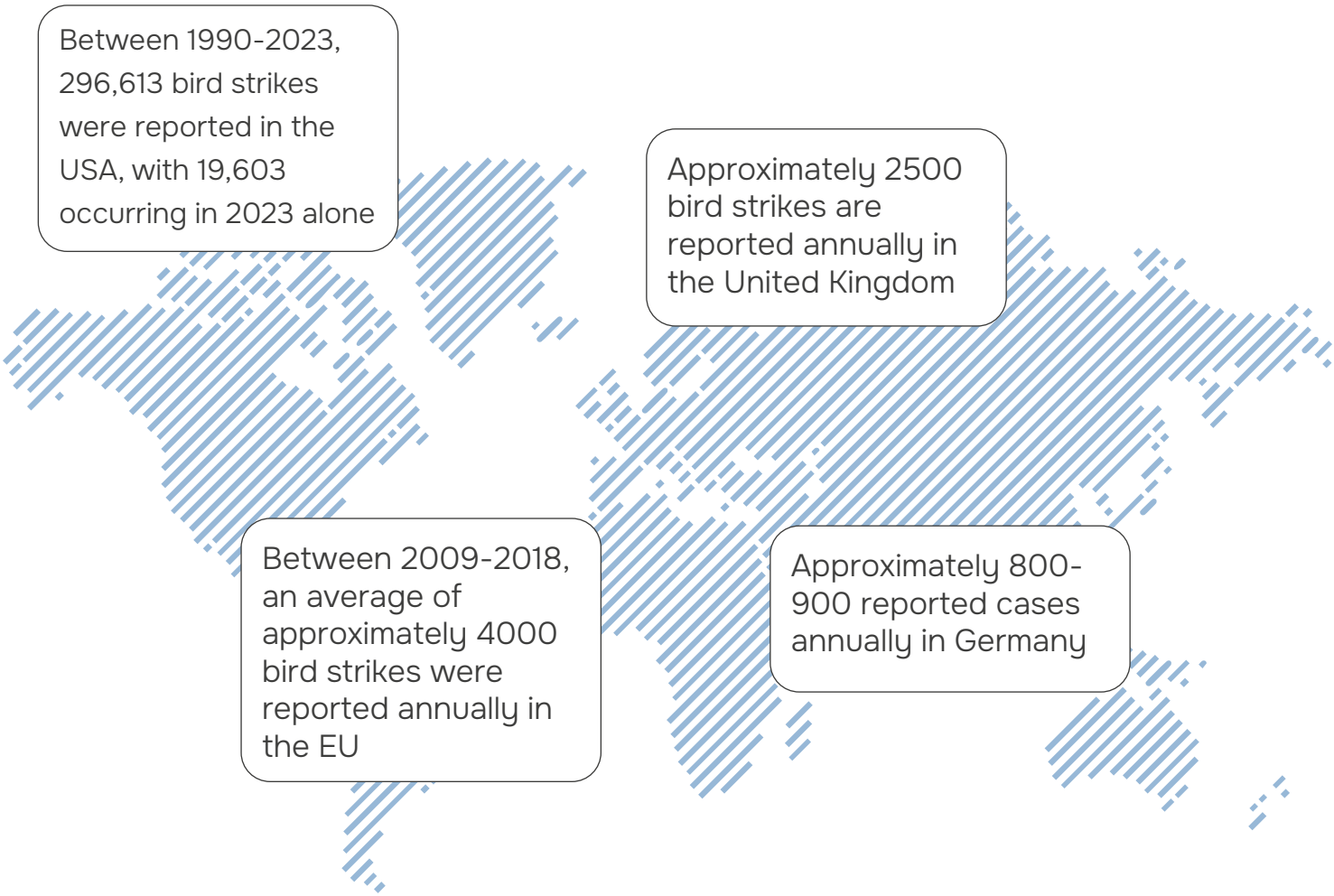
Bird Strike Prevention at Airports

A Strategic Guide for Airport Operations and Safety Managers



The study aims to compare the effectiveness and cost-efficiency of various prevention methods.

Bird strikes represent an increasing challenge for airports year by year:



In USA:
Reporting rates have significantly improved:

- Below 20% in the 1990s
- 39% between 2004-2008
- 47% between 2009-2013
- 91% for commercial flights between 2009-2013

But it's important to note that:

1. European reporting systems vary by country
2. There is no unified database like in the USA
3. Reporting willingness varies by country
4. Many European countries do not make this data publicly available

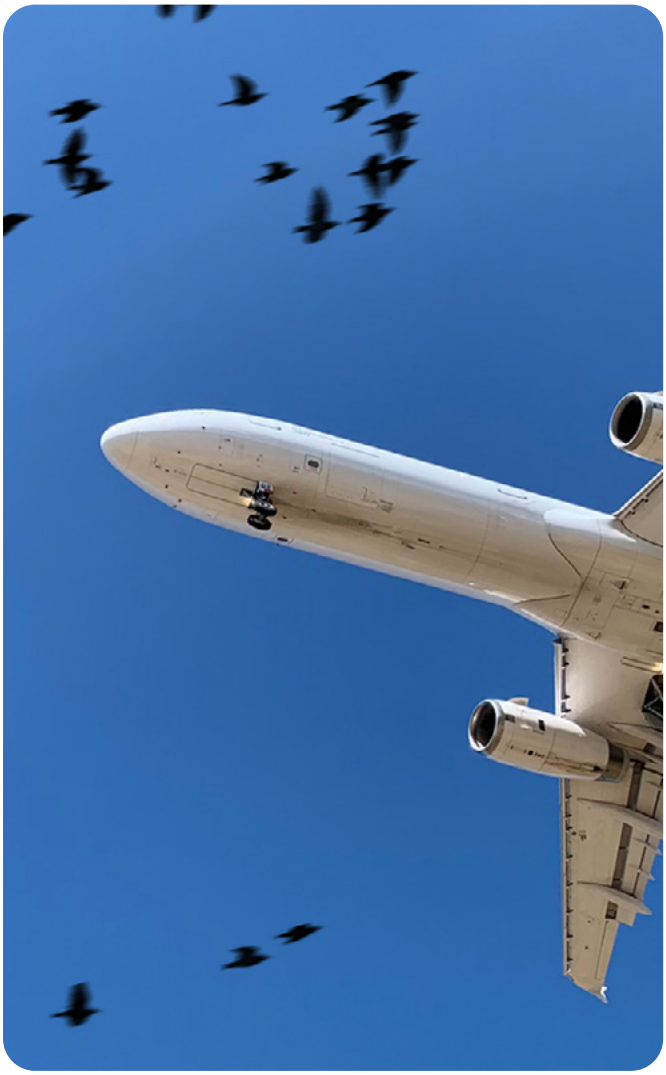
Types of Bird Hazards and Risk Factors

Most Danger ous Bird Species

Between 1990-2023, 651 different bird species were involved in collisions. Bird identification rates improved signifi-cantly: from 30% in the 1990s to 59% in 2023.

- Waterfowl (water birds, gulls)
- Birds of prey (eagles, vultures)
- Pigeons and doves

Larger birds pose the greatest threat - statistics show that every 100-gram increase in body mass increases the probability of damage by 1.27%



Critical Periods and Areas

- 54% of bird strikes occur between July and October
- Strikes are more frequent during landing than takeoff (61% vs 34%)
- 62% of strikes occur during daytime, 30% at night

Environmental Factor Impact

Weather Conditions:

- Wind direction and strength influence bird flight paths
- Increased insect activity during rainy periods attracts birds
- Reduced visibility in foggy conditions makes detection more difficult

Territorial Characteristics:

- Proximity to wetlands (lakes, marshes, reservoirs) attracts waterfowl
- Nearby agricultural areas provide food sources
- Wooded areas offer nesting opportunities
- Landfills attract scavenging birds

Seasonal Changes:

- Migration routes over the airport
- Nesting periods
- Seasonal changes in food sources
- Changes in vegetation periods

Human Activity Effects:

- Changes in land use around airports
- Agricultural activities (plowing, harvesting)
- Construction, land development
- Waste management practices

Active Prevention Methods

1. Bird Distress Calls

Bird distress calls leverage natural fear responses by broadcasting species-specific alarm calls that signal danger to nearby birds. This highly targeted approach creates an uncomfortable environment that encourages birds to leave the area without causing physical harm.

Advantages:

- Use of natural distress calls and predator sounds
- Species-specific solutions possible
- Low energy and maintenance requirements
- Easily programmable, adjustable
- Minimal environmental impact

Disadvantages:

- Birds may identify false alarms over time
- Regular sound sample updates needed
- Reduced effectiveness in windy conditions
- May disturb nearby residents

2. Ultrasonic Devices

Ultrasonic devices emit high-frequency sound waves that are distressing to birds while remaining imperceptible to human ears. These systems provide a discreet deterrent solution that can operate continuously without creating noise pollution for airport staff and nearby communities.

Advantages:

- Inaudible to humans
- Continuous operation possible
- Minimal maintenance required
- Weather-independent operation
- Precisely directable

Disadvantages:

- Not equally effective for all bird species
- Limited range
- Higher energy consumption
- More expensive technology
- May affect other animals (e.g., bats)

3. Sound Cannons

Sound cannons produce sudden, loud blasts that startle birds and trigger immediate flight responses. Their impressive range makes them effective for quickly clearing large areas during critical take-off and landing periods.

Advantages:
- Extremely loud, long range
- Immediate deterrent effect
- Simple installation and operation
- Can be used as mobile units
- Low purchase cost

Disadvantages:
- Significant noise pollution in the area
- Quick habituation by birds
- Requires propane gas refills
- Weather limitations
- Daytime use only
- Possible community opposition

4. Predator Bird Models

Predator bird models exploit innate fear responses by mimicking natural threats such as hawks, eagles, or owls. These visual deterrents provide a constant, passive threat signal that discourages birds from settling in protected zones.

Advantages:
- Triggers natural fear response
- Low purchase cost
- No energy source required
- Easily relocatable
- Weather-resistant design

Disadvantages:
- Quick habituation with static placement
- Requires regular relocation
- May be damaged in strong winds
- Limited range
- Some bird species recognize the deception

5. Reflective Devices

Reflective devices use moving light patterns and unpredictable flashes to confuse and disorient birds, making protected areas seem unsafe. Their simple but effective design requires minimal maintenance while providing continuous protection in daylight conditions.

Advantages:
- Continuous operation in sunlight
- Minimal maintenance required
- Applicable over large areas
- Environmentally friendly solution
- Low cost

Disadvantages:
- Less effective in cloudy conditions
- Doesn’t work at night
- Requires regular cleaning
- Aesthetically questionable
- May degrade from UV exposure

6. Laser Deterrents

Laser deterrents project focused beams that birds perceive as physical threats, causing them to disperse from treated areas. These systems excel in low-light conditions and can target specific locations with precision, allowing operators to clear birds from critical safety zones.

Advantages:
- Long range
- Precise directional control
- Automated operation
- Effective in darkness
- Modern technology

Disadvantages:
- High purchase cost
- Significant energy consumption
- Safety risks
- Special permits required
- Less effective in sunlight

7. LED Flashing Systems

LED flashing systems emit bright, irregular light patterns that disrupt birds' ability to perch or feed comfortably in protected areas. Their energy-efficient design allows for continuous operation while the programmable flash patterns prevent habituation.

Advantages:
- Low energy consumption
- Long lifespan
- Programmable flash patterns
- Day and night operation
- Weather-resistant design

Disadvantages:
- Limited range
- Requires continuous power supply
- Light pollution issues
- Possible resident complaints
- Decreasing effectiveness over time

8. Trained Birds of Prey

Trained birds of prey provide a natural, biological deterrent that triggers genuine fear responses in pest bird populations.

Advantages:
- Natural deterrent effect
- Immediate and long-term deterrence
- Targeted intervention possible
- Environmentally friendly solution
- High effectiveness for specific species
- PR value for the airport
- Can be combined with other methods

Disadvantages:
- High training costs
- Specially trained personnel required
- Continuous veterinary supervision
- Limited daily deployment
- Weather-dependent applicability
- Significant infrastructure requirements

9. Drones and Robots

Drones and robots serve as mobile harassment platforms that can actively pursue birds and prevent them from settling in critical areas. These advanced systems combine movement, noise, and visual deterrents while collecting valuable data on bird behavior and patterns.

Advantages:
- Programmable routes and timing
- 24/7 operation possibility with rotating units
- GPS-based precise area coverage
- Automatic hazard zone identification
- Real-time data collection and monitoring
- Remote-controlled and autonomous operation
- Combinable with camera systems

Disadvantages:
- High initial investment cost
- Regular battery replacement needed
- Requires trained personnel
- Airspace use permits required
- Limited flight time per charge

Passive Prevention Methods

1. Vegetation Management

Vegetation management focuses on creating an environment that's naturally unattractive to problem bird species. By selecting appropriate plants and maintaining optimal growth heights, airports can significantly reduce food sources and nesting opportunities.

Advantages:
- Long-term effectiveness
- Natural solution
- Low technology requirements
- Can be combined with other methods
- Positive environmental impacts

Disadvantages:
- Labor-intensive
- Weather-dependent implementation
- Seasonal restrictions
- Requires continuous monitoring
- Slow results

2. Shade Balls on Open Water Surfaces

Shade balls physically cover water surfaces, preventing waterfowl from landing and utilizing these attractive areas. This method provides a simple but highly effective solution for eliminating one of the most significant bird attractions at airports.

Advantages:
- Effective for waterfowl
- Particularly effective for artificial ponds and reservoirs
- Long-lasting results
- Environmentally friendly
- Low maintenance cost
- Can be integrated with other systems

Disadvantages:
- Higher initial investment

3. Physical Barriers

(fencing, spikes, nets, nest removal)

Physical barriers such as nets, spikes, and fencing create impassable obstacles that prevent birds from accessing specific areas. These permanent installations provide consistent protection without requiring ongoing operational involvement or energy consumption.

Advantages:
- Immediate effect
- Measurable results
- Long-term protection
- Minimal maintenance
- Can be combined with other methods

Disadvantages:
- High initial cost
- Installation challenges
- Aesthetic issues
- Legal regulations
- Periodic renewal required

Strategic Guide

Filling Instructions:

1. Start with completing the situation analysis form
2. Identify the most important bird species and their risks
3. Select the most appropriate prevention methods for your airport
4. Determine seasonal priorities
5. Plan resource requirements

Situation Analysis Table

Waterlands	Environmental Factor	Present/ Absent	Severity 1-5	Notes
Natural water bodies within 3 km				
Artificial lakes at the airport				
Temporary water accumulations				

Migration Routes

Spring migra-tion route				
Fall migration route				
Local bird movements				

Surrounding Areas

Agricultural areas				
Wooded areas				
Landfill				

Bird Species-Specific Risks

1: large birds, 2: medium-sized birds, 3: small birds

Bird types	Presence Frequency	Risk Level	Seasonality
Wild geese (1)			
Herons (1)			
Birds of prey (1)			
Gulls (2)			
Crows (2)			
Swallows (3)			
Sparrows (3)			

Prevention Method Selection Matrix

Acoustic Methods	Applicable?	Cost Framework	Priority (1-5)
Bird distress calls			
Ultrasonic devices			
Sound cannons			

Visual Methods

Predator models			
Reflective devices			
Laser			
LED systems			

Active Prevention

Predator models			
Reflective devices			

Passive Prevention

Habitat management			
Shade balls			
Physical barriers			

Seasonal Priority Determination

Period	Main Risks	Priority Prevention Methods	Notes
Spring March-May			
Summer June-August			
Fall September-November			
Winter December-February			

Resource Planning Table

Personnel	Available	To Be Developed	Deadline
Bird protection expert			
Operating personnel			
Maintenance personnel			

Equipment

Existing systems			
New acquisitions			

Budget

Operating costs			
Investment framework			

Conslusion

INTEGRATED BIRD STRIKE MANAGEMENT

Successfully managing bird strike risks requires a comprehensive, integrated approach tailored to each airport's unique environment. The most effective strategies combine multiple prevention methods adjusted seasonally to address changing bird behaviors and migration patterns. Regular monitoring, data collection, and evaluation are essential to refine your approach over time.

Remember that no single method provides complete protection. Instead, implement a strategic combination of active and passive techniques supported by trained personnel and adequate resources. By following the structured approach outlined in this guide, airport operations and safety managers can significantly reduce bird strike incidents, enhance operational safety, and minimize costly disruptions.

****The statistical data presented in this guide is sourced from a comprehensive study conducted between the Federal Aviation Administration and the U.S. Department of Agriculture Wildlife Service (2023)