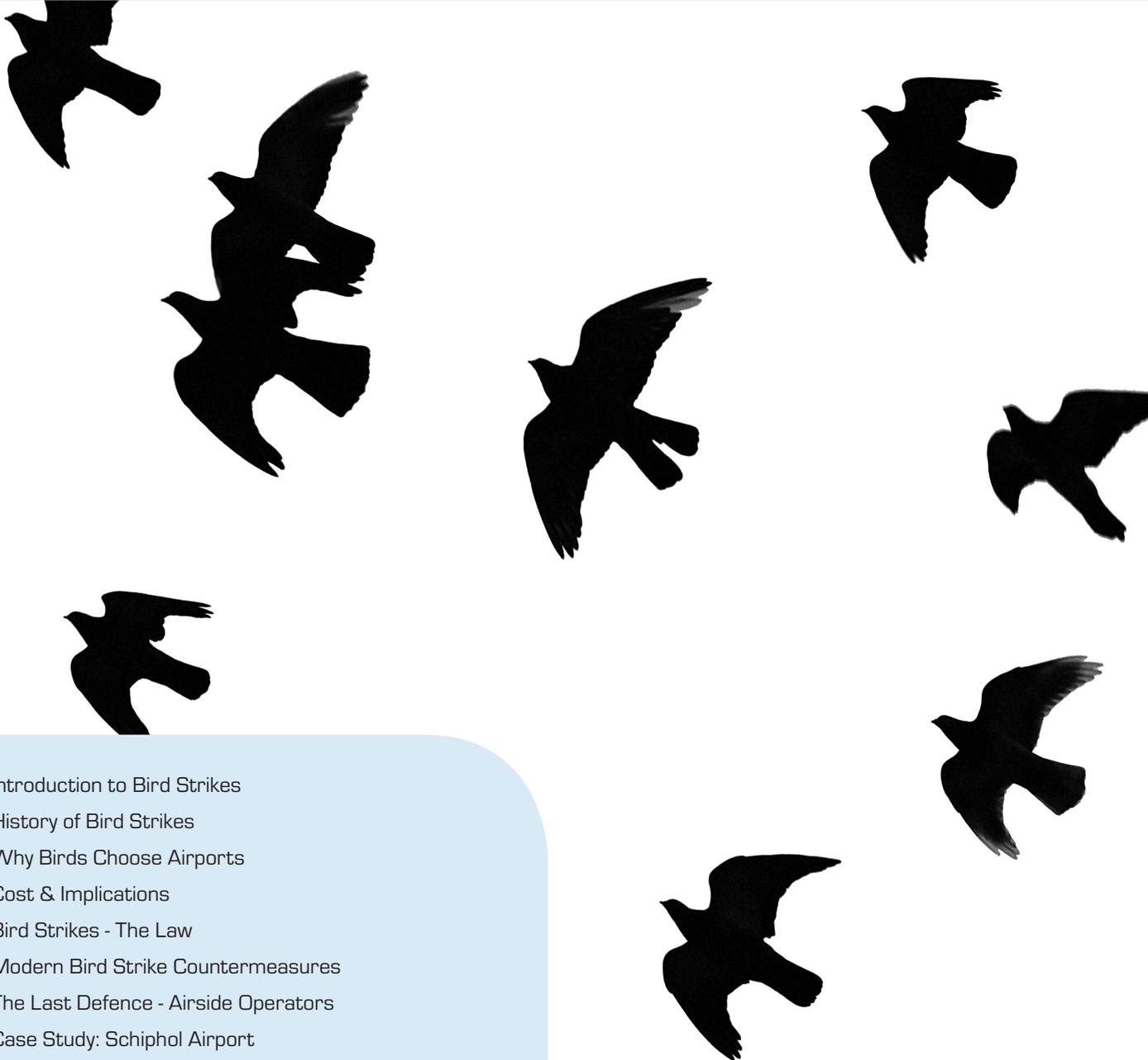




Mitigating Bird Strikes

Bird Scaring Whitepaper

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Introduction to Bird Strikes

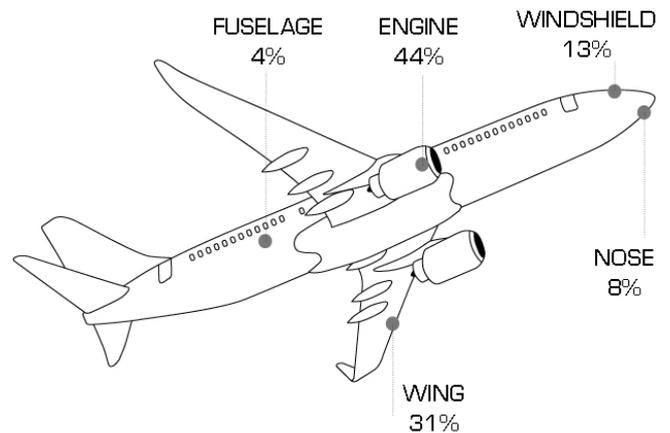
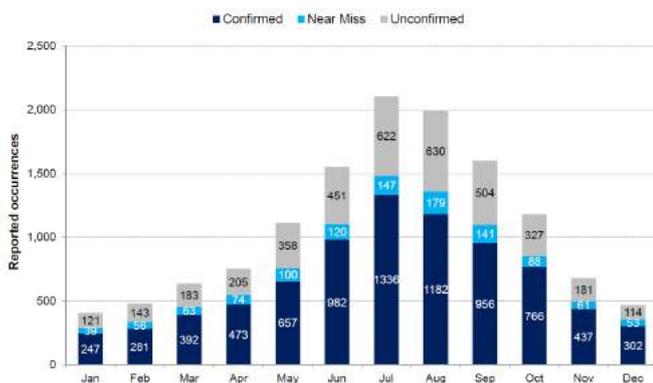
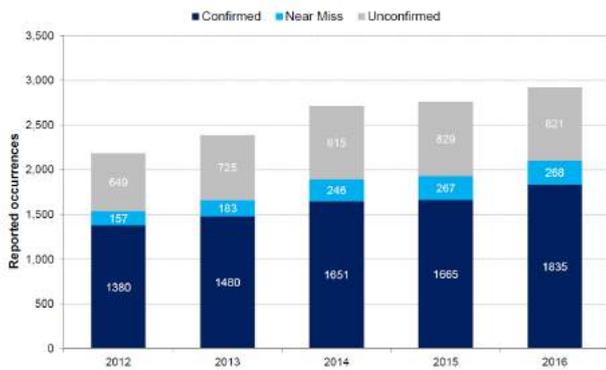
“The civil and military aviation communities continue to understand that the threat from aircraft collisions with wildlife is real and increasing. Globally, wildlife strikes have killed more than 262 people and destroyed over 247 aircraft since 1988. Factors that contribute to this increasing threat are increasing populations of large birds and increased air traffic by quieter, turbofan-powered aircraft.”

In 2016, 2924 confirmed, unconfirmed and near miss bird strikes were reported to the CAA in the UK, a figure that has risen for five consecutive years. Unfortunately there is no sign of the problem going away, despite the increased awareness and efforts from worldwide airports and pressure from airlines (who generally pick up the cost) to reduce the number of bird strikes on their aircraft. Given the cost and hazards involved, it is within all stakeholders interest to reduce the number of bird strikes across the world before the situation becomes out of control.



History of Bird Strikes

Bird Strikes are common and although rarely causing damaging or even an operational effect, in some cases can be a significant threat to aircraft safety. For smaller aircraft, significant damage may be caused to the aircraft structure and all aircraft, especially jet-engined ones, are vulnerable to the loss of thrust which can follow the ingestion of birds into engine air intakes. This has resulted in a number of fatal accidents.



Generally when smaller aircraft or even large aircraft with large or flocking birds involved, the hazard is significantly greater to air safety.

Bird strikes may occur during any phase of flight but are most likely during the take-off, initial climb, approach and landing phases due to the greater numbers of birds in flight at lower levels. Since most birds fly mainly during the day, most bird strikes occur in daylight hours as well. Data in the UK has also shown a peak in reported bird strikes through the summer months. The most famous bird strike was on US Airways Flight 1549 in 2009 which caused a loss of all engine power and consequently left the pilot no option but to ditch the aircraft into the Hudson river. Although this was probably the most high profile incident, major bird strikes have been occurring since the first aircraft took to the skies and are now a daily occurrence across the world.

Over half of bird strikes occur from July to October which is when young birds fledge from nests and fall migration occurs.



- The first ever recorded wildlife strike happen on September 7th, 1905, during one of the first flights of the Wright brothers (Orville), while the first lethal bird strike was suffered on April 3rd, 1912 at Long Beach California.

- In 1911 French pilot Eugene Gilbert encountered an angry mother eagle over the Pyrenees Mountains en route from Paris to Madrid. He was able to ward off the large bird by firing pistol shots at it but did not kill it.

- The greatest loss of life directly linked to a bird strike was on October 4, 1960, when a Lockheed L-188 Electra, flying from Boston as Eastern Air Lines Flight 375, flew through a flock of common starlings during take-off, damaging all four engines. The aircraft crashed into Boston harbour shortly after take-off, with 62 fatalities out of 72 passengers.

- In 1988 Ethiopian Airlines Flight 604 sucked pigeons into both engines during take-off and then crashed, killing 35 passengers.

- In 1995, a Dassault Falcon 20 crashed at a Paris airport during an emergency landing attempt after sucking lapwings into an engine, which caused an engine failure and a fire in the airplane's fuselage; all 10 people on board were killed.

- On November 28, 2004, damaged the nose landing gear of KLM Flight 1673, a Boeing 737-400, struck a bird during take-off at Amsterdam Airport Schiphol.

- In April 2007, a Thomson fly Boeing 757 from Manchester Airport to Lanzarote Airport suffered a bird strike when at least one bird, supposedly a crow, was ingested by the starboard engine.

i About 62% of bird strikes with civil aircraft occur in the day, 9% occur at dawn or dusk, and 29% occur at night.

- On November 10, 2008, Ryanair Flight 4102 from Frankfurt to Rome made an emergency landing at Ciampino Airport after multiple bird strikes caused both engines to fail. After touchdown, the left main landing gear collapsed.

Why Birds Choose Airports

Given the noise and activity associated with airports you would imagine that birds would stay well away. This is not the case and there are a number of reasons why birds will congregate around airports and the surrounding areas.

“As airports become busier and schedule flights with greater frequency and alternative habitats continue to shrink, more and more birds will seek refuge near airports, causing potentially dangerous situations...”

- Because airports are usually placed on the fringe of large urban centres, they frequently have large tracts of unused, undeveloped land surrounding them as noise and safety buffers.

- It is that undeveloped land that is attractive to birds, particularly as suitable habitat shrinks due to urban expansion.

- At the same time, the general bustle of the airport often discourages large predators, giving birds a safer sanctuary.



- Many airports are also near substantial wetlands or drainage ponds – water is a superb noise dampener which is attractive to migratory waterfowl, gulls and other large birds.

- Most airports contain considerable areas of grass within their perimeters. Even dry grass can be attractive as a loitering area for birds by day or night.

Cost and Implications

Although only around 8% of Bird Strikes have an operational impact on flights such as aborted take-off, return or diversion or a technical malfunction, and less than 5% reported any damage to the aircraft, the cost to the aviation industry is still significant.

Approximately 60% of bird strikes with civil aircraft occur during landing phases of flight (descent, approach and landing roll); 37% occur during take-off run and climb.



“Airlines have won an important court battle over whether a bird strike counts as an ‘extraordinary circumstance’ in relation to compensation claims.

Judges at the Court of Justice of the European Union have ruled that airlines won’t have to pay out if a flight is delayed or cancelled as a result of bird strike damage.”

Whilst the cost impact may have been reduced for Airlines, it is still true that the number of bird strikes is increasing every year and remains to be a significant hazard to aircraft safety, and will continue to incur other costs associated with the incidents.

- With added pressures by Airlines and Airports to reduce costs by delays or incidents, the Airlines and Airports are now partnering with independent industry experts to best advise how to deal with this now common occurrence.

- Since the biggest number of these collisions occur at airports and their vicinity, airport operators are primarily held responsible for the damage.



“The aviation industry spends a minimum of US\$1.2 billion (888 million euros) per year on bird strike damage and delays”

Due to the delays caused by Bird Strikes, passengers seeking compensation, cost of repairs and cancelled flights, airlines are generally hit with the highest cost.

Bird Strikes - The Law

Until May 2017, Airlines by law had to pay compensation to passengers delayed by a bird strike under EU passenger-rights rules. Recently, this has changed:

- The risk of bird strikes at a particular airport will continue to be a significant consideration for airlines when choosing their destinations.

- Therefore airports must increasingly place emphasis on their wildlife management and bird strike mitigation strategies to remain favourable to airlines.

Modern Bird Strike Countermeasures

Aircraft

- Aircraft designs have changed to accommodate large impacts. Engines can automatically shut down and the fuselage and windscreen can take up to 1.8kg of impact.

- Radars and Strobe Lighting also increase the ability for the aircraft to ward off and deter potential strikes.
- Pilot training and preventative strategies.

Aerodrome / Airports

- Ground Radars to identify flocks of birds on or near runways specifically designed to help Pilots and Ground staff manage the take-off or landings where most strikes occur.
- Airport Habitat Management - grass and surface water (including transient accumulations) management, exclusion of roosting opportunities in buildings and trees within the airport perimeter.
- Airport Locality Habitat Review (i.e. that area beyond the airport perimeter where bird attractants or related bird activity have the potential to directly affect the operational safety of aircraft using the airport) - note the ICAO definition of a 13km radius circle around the airport.
- Active on-airport control systems - bird activity monitoring, Pyrotechnic / 12G bird deterrence methods, ATC alerting channels.

The Last Defence - Airside Operators

Many of the 'tools' at the disposal of airport operators will find at least some place in any risk management plan but not necessarily to the same degree. Although long term preventative measures will ultimately be key in reducing the number of bird strikes in the future, this will never eradicate all bird strike hazards.

The CAA suggests airport bird control risk mitigation measures in which they recommend and promote on-airfield bird control programmes to reduce bird populations in the vicinity of airfields.

Whilst they recognise many airfields already have effective programmes, they believe this should be introduced as standard globally. In addition to this, the CAA regard frequent bird patrols and the use of bird scaring and dispersal techniques as **essential** to back up the longer term measures.

92% of bird strikes occur at or below 3,500 feet AGL (above ground level). **i**



The most active measures for wildlife management at airports worldwide are bio-acoustics, pyrotechnics, trapping and relocation, and lethal control.

Bio-acoustics advantages:

1. It can easily start by pressing a button.
2. Many airports worldwide are not allowed to use firearms, and therefore pyrotechnics.
3. It switches the mind of wildlife from the safe mode to the unsafe mode, usually instantly and as they start looking around the chance to see the aircraft approaching increases.

Bio-acoustics disadvantages:

1. Distance, as the calls cannot sometimes be heard far from the speakers.
2. Distribution of the sound, during days with strong winds.
3. Time, since it takes occasionally some time to build the unsafe mode in the mind of wildlife.
4. The response effect of wildlife. Bio-acoustics are based on positive or negative phonotaxis, which is the reaction of wildlife to the sounds (positive when moving towards the source, negative when moving far from the source).

While the problem of the use of bio-acoustics regarding the distance and the distribution can be solved using a LRAD, this is an expensive solution, while the rest of the disadvantages may play some role. Not to forget that LRAD is not easy to be handled.

So in cases there are firearms available as a measure, pyrotechnics and/or lethal control should be used to enforce bio-acoustics.

Lethal control, either to enforce bio-acoustics or as stand-alone practice has some disadvantages:

1. You cannot kill too many individuals at the airfield even if you got a permit for this.
2. You have to collect the dead wildlife.
3. The range of the shotguns is restricted.

Pyrotechnics should be made available where possible at an airport to play two vital roles:

1. As a stand-alone measure, that can escalate the range of your deterrent ability up to 150m downwind.
2. As an enforcement of bio-acoustics and other bird scaring methods. Guiding the birds to certain directions should be considered as part of this enforcement.

It is recommended that the various active measures mentioned for bird dispersal are alternated in order to avoid habituation. This is achievable within the pyrotechnics sub category through alternating cartridge selection for varying effects.



Common Misconceptions about Bird Strikes i

- Birds don't fly at night.
- Birds don't fly in poor visibility, such as in clouds, fog, rain, or snow.
- Birds can detect airplane landing lights and weather radar and avoid the airplane.
- Airplane colors and jet engine spinner markings help to repel birds.
- Birds seek to avoid airplanes because of aerodynamic and engine noise.
- Birds dive to avoid an approaching airplane.

i Primetake's pyrotechnic bird scaring cartridges are a **non-lethal** solution.

Case Study: Schiphol Airport

An airside safety survey conducted by ACI Airports Council International looked at the various wildlife management strategies, techniques and activities of some of Europe's busiest airports. Schiphol Airport of Amsterdam, Netherlands, which is Europe's third busiest airport took part in the study:

Q: Do your staff attend recognised bird control training courses?

A: Yes, courses are provided by Bird Management LTD (formerly Fera).

Q: Are your bird control staff working on the airfield continuously, hourly, less than hourly?

A: Continuously.

Q: What specialist equipment do you employ for bird control?

A: Pyrotechnics (Primetake), lasers, and acoustics.

Q: Do you carry out a bird strike risk assessment?

A: Yes, a yearly assessment by an external advisor.

Q: Do your staff log all their bird control activities (to manage success in dealing with the problem, and to use in defence in case of lawsuits)?

A: Not all bird control activities are logged, a minimum of 16 logs per person per shift are logged. The average is roughly 40 logs per shift.

Q: Does your airport have problems with other wildlife (deer, for example) and, if so, how are these issues being addressed?

A: Hares – structural population reduction.

i Engines are the component most frequently damaged by bird strikes; engines account for 44% of all damaged aircraft components.



The Recognised Solution for Bird Strike Mitigation

Many Airside Operators know that driving around the Airfield using the standard fitted Squawk Box and stepping out of the patrol vehicle will potentially disperse the birds. However Due to the memory imprint that these Birds have, they know only too well that they carrying 12 Gauge Bird Deterrents will be the deciding factor in dispersal.

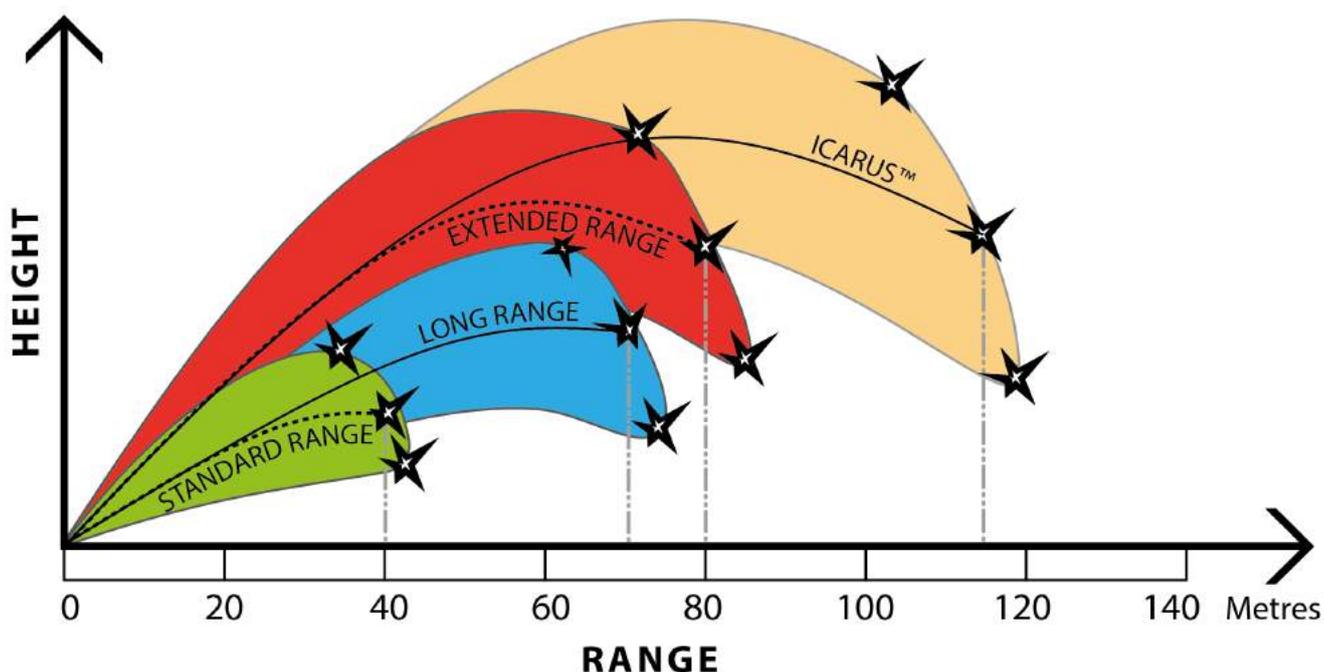
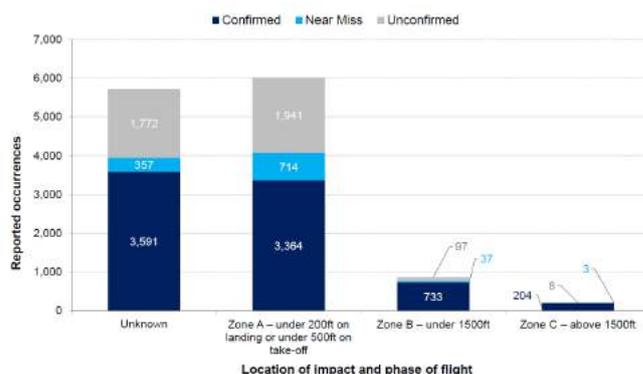
The Cartridges are designed to achieve varying distances, depending on angle of fire and cartridge selection.

They will produce a loud report (or continuous screech) at the height or range which may be most effective for their use. Some even have a Green trace.

12 gauge pyrotechnic bird scaring cartridges are often the first choice for bird dispersal for airside operators.

i Most bird strikes are reported by pilots and airport personnel.

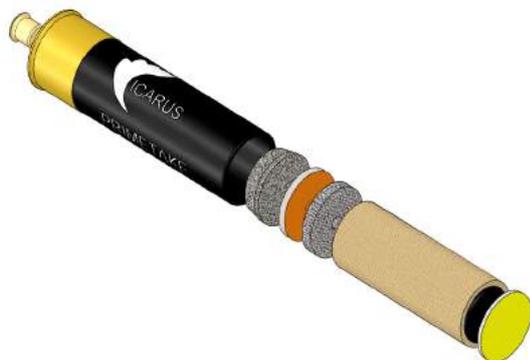
This is due to their ability to be accurately and rapidly deployed into a specific space and used as few or many times as required to disperse birds.



The Cartridges

Cartridges are available for use in either a 26.5mm or 38mm Signal Pistol with 12 Gauge adaptor, some variants are also available for use in an unchoked 12 Gauge shotgun.

- Blank
- Standard Range
- Long Range
- Long Range Nitro (Shotgun)
- Screech
- Screech (Shotgun)
- Extended Range Tracer
- Icarus™



Controlling Your Airspace – Mitigating Bird Strike Risk

Primetake's full portfolio of 12 gauge bird scaring cartridges has been developed as a tool kit for an airport's designated wildlife management team to be able to rapidly and effectively mitigate bird strike risk – without the need for large scale capital investments in equipment or training.

Given the vast majority of bird strikes occur on or around airports, pyrotechnic cartridges give users an excellent method of controlling this space. Effective bird scaring capability within the entire immediate airspace is possible with the four main variants of Primetake bird scaring cartridges; Standard Range, Long Range, Extended Range and Icarus™. Depending on the selected cartridge, they are fired through the Primetake Signal Pistol with 12G Adaptor, or an unchoked shotgun. With a calculated selection of both cartridge and angle of fire, the user is able to produce bird scaring effect at intervals out to 120 metres. Varying Screech, Loud Report and Trace effects provide additional bird scaring capability.

i Primetake's pyrotechnic bird scaring cartridges are in use internationally at some of the worlds busiest airports.

User Feedback

"The Icarus bird scaring cartridge is what the industry has been waiting for; there seems to be no other cartridge on the market that provides the same outstanding performance and reliability. The cartridge has a farreaching height and deployment range that seems unrivalled by comparative products, and, as with other Primetake products, maintains superb reliability and safety."

Longer range, and an increased flight time and height all relate directly to a significant reduction in bird strike risk on and round the airfields we work on.

"Utilisation of this nonlethal cartridge means we can more effectively disperse birds from a wider area in a rapid yet cost effective way; ultimately further reducing the risk of bird strikes and reinforcing airports wildlife management and safety."

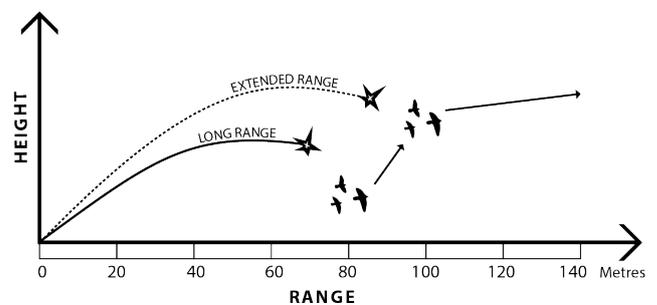
*Ian Whittaker.
Director NWBC Ltd.
July 2016*




Benefits of Pyrotechnic Cartridges

Pyrotechnic bird scaring cartridges are popular with users as an easily and rapidly deployable method of bird dispersal, which often proves to be the most effective option. Cartridges are safe and cost effective for airports and do not require much training to use. The cartridges have been designed to limit the amount of FOD produced, and therefore users are free to use the cartridges as much as required.

Training in the optimum use of the cartridges is given because singular use of cartridges can sometimes only provide short term effective control and further dispersal is required to ensure safety. Multiple use deployment is a way to make the continuous



movement of the birds reach the desirable distance required - ultimately maintaining full control of the airports immediate vicinity. Many alternative methods are not nearly as cost effective, rapid or easy to use and therefore multiple use may not be viable, which could detract from users ability to disperse birds.

Summary

It is an undisputed fact that bird strike hazards are an increasing problem globally and are unlikely to solve themselves naturally. As air traffic continues to increase and bird habitats diminish the likelihood of bird strikes are becoming ever more significant. The 2009 major bird strike incident leaving US Airways Flight 1549 ditched in the Hudson river was a lucky escape from disaster, it unfortunately seems that more incidents like this are inevitable and will become more frequent unless steps are taken now to reduce hazards.

Not only are bird strikes a major hazard to aviation safety, they represent huge financial cost to the industry which could become unsustainable in the future. Clearly it is within all stakeholders interest to reduce bird strike hazards.

Whilst identifying long-term preventative wildlife management strategies are key to bird strike mitigation in the future, this will never provide a complete solution. Short-term reactive bird dispersal techniques are likely to play a significant role at airports for the foreseeable future, as endorsed by the UK CAA. Non-lethal pyrotechnic bird scaring cartridges, such as the built-for-purpose Primetake range provide an excellent solution, and are already employed by hundreds of airports globally including some of the worlds busiest international airports.

Recognising the requirement for both preventative and reactive strategies, Primetake have partnered up with various suppliers in order to offer both long and short term solutions. Through Primetake's partners, they can provide the following services in addition to pyrotechnic bird scaring cartridges.

- Migration pattern analysis
- 13km Surveys - Environment Assessment
- Weed and insect control, grass management
- Consultancy services for grass and soil
- Full habitat surveys
- Bird Strike remains analysis

Bird Scaring by Primetake

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