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Special focus on airport wildlife management

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IN THIS ISSUE:

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Wildlife Strike Prevention

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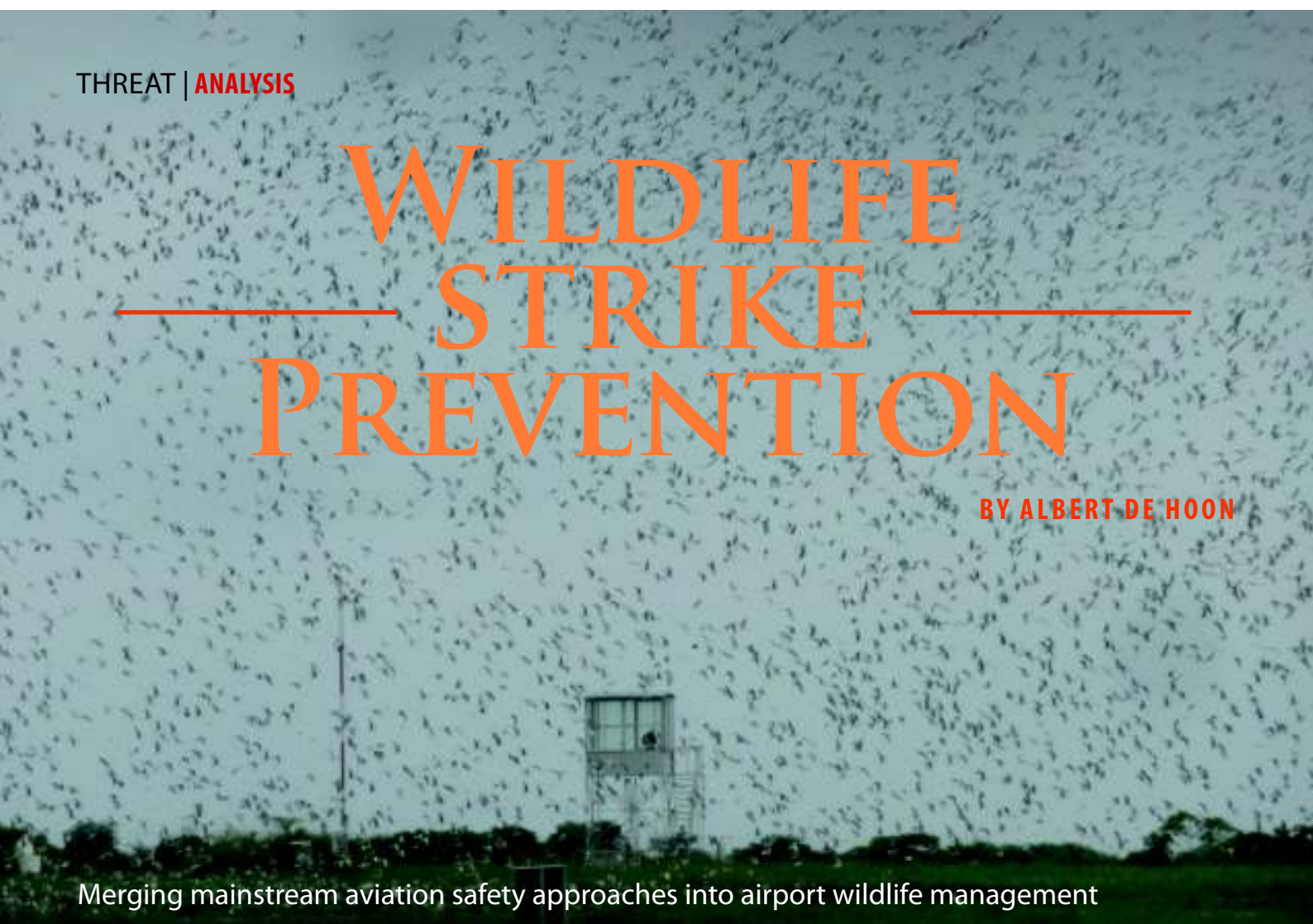

Merging mainstream aviation safety approaches into airport wildlife management

Isn't it ironic that birds which have always been inspiring aircraft manufactures, have turned out to be one of the threats jeopardizing the safety of aircraft, its crew and passengers? World wide, flight operations are challenged by collisions with birds and other wildlife, so called wildlife strikes.

The majority of wildlife strikes have no effect on the aircraft. Some wildlife strikes have flight operational consequences or result in minor damage. However, as history has shown wildlife strikes can cause aircraft to crash. For the wildlife involved, the collision is almost always fatal. As detailed by Kenya Airways in the Kisumu Conference further on in this magazine, the immediate cost of wildlife strikes can be substantial, just as the indirect costs.

AIRCRAFT CHARACTERISTICS

In the past, aircraft flew at slower speeds and had propeller-powered engines that projected the engine noise forward. Wildlife heard the aircraft approaching at an earlier point in time, giving it more time to respond and get out of the way. Modern aircraft are faster and the turbofan-powered jet engines produce noise that is primarily directed backward, away from the wildlife. As a result, wildlife hear the approaching aircraft later and have less time to respond. In addition, the size of aircraft has increased over time, resulting in a larger area with which wildlife can collide. One of the other factors that influence the possible damage as a result of a wildlife strike is the flight phase during which the strike takes place: more damage during the take-off phase than during the landing phase. Another factor that plays a role is the part of the airplane that is struck by wildlife. Jet engines with their fan blades are most vulnerable because of the high speed at which the fan blades spin around. At such high speeds, an upset of the fan blades can release tremendous forces. Each fan blade in turn is a very expensive component as they are made of an expensive titanium alloy. Protection of the engine inlet with mesh wire or otherwise is not possible with the enormous suction that turbofan engines create.

The high speed of modern aircraft does not only mean there is little time for wildlife to avoid the aircraft, it also has a direct relationship to the impact energy when the wildlife is struck. In the impact energy equation, the velocity is squared: kinetic energy of the bird = ½ x mass x velocity^2. When for example a Grey Crested Crane weighing 4 kilograms collides with a plane at rolling down the runway at 145 Knots the kinetic energy is equal to the amount of energy that is released when a car going at 100 km/h is hit by a block of concrete of 25 kilograms – as you know, a small pebble can already cause a crack in a car's front window. The most hazardous wildlife species are those species that are either heavy, and/or operate in flocks/groups.

Aircraft parts have been certified to resist certain impact energies. For example jet engines, depending on the diameter of the engine inlet, are certified to resist wildlife weighing 1.85 kg for small inlets up to 3.65 kg for large inlets. However, many wildlife species at and around African airports are heavier than that.

WILDLIFE AT AIRPORTS

The general public often thinks that wildlife is at a particular place for no obvious reason. However, when studying wildlife, it becomes apparent that the opposite is true. Driven by a need for food, water and a safe place to sleep, rest and to raise offspring, wildlife visits specific locations, at a specific time for a specific reason.

Airports attract all types of wildlife that is hazardous towards aircraft. The most important attractants are plants and animals that are linked with each other in an airport-food-chain, as figure 1 depicts:
In turn, wildlife killed by aircraft attracts small scavengers like Pied crow (~ 0.5 kg) and sometimes large scavengers such as Marabou stork (~ 7 kg). Besides carcasses, scavengers are also attracted by garbage that usually contains food as well.

ICAO GUIDANCE

To safeguard aviation, the International Civil Aviation Organisation ICAO issues Standards and Recommended Practices (SARPs). Standards shall be implemented by the 191 ICAO member states, Recommended Practices are just what they say they are. Just like many other issues addressed by SARPs, wildlife strike prevention is a complex issue that requires specialist knowledge.

In 2003, ICAO upgraded the Recommended Practices on wildlife strike prevention into Standards, laid down in ICAO Annex 14, Volume I, chapter 9.4. This means that the implementation of these Standards is now no longer optional.
Further detailed guidance is provided in the Airport Services Manual Part 3 to Annex 14. This manual on 'Wildlife Control and Reduction' (ICAO Doc 9137) is presently being updated in a 4th edition, with the previous edition dating back 20 years.

The observations from assessments at African airports and discussions with airport personnel during the AviAssist Foundation's wildlife strike prevention trainings in 2009 and 2010 were communicated to ICAO and were more than relevant. A number of these observations will get incorporated in the 4th edition. An example are the recommendations for vegetation management that are now clarified in chapter 4.5.4., which phrases agoraphobian and claustrophobic species (see also further on in this article).

Chapter 5 of the new edition of ICAO Doc 9137 now focuses more on information collected by, and disseminated between aircraft operators, air traffic control and airport operators.

A sample airport food chain

Plants, grasses & seeds	➲ House sparrow (30 grams) ➲ Dikdik (5 kg)
Insects, worms & other invertebrates	➲ Barn swallow (16 grams) ➲ Hadada ibis (1.2 kg)
Rodents, reptiles, amphibians	➲ Black kite (0.6 kg) ➲ Black headed heron (1.1 kg) ➲ Mongoose (2 kg)

Figure 1 Legend: ➲= Attracts

Another important focus in the new edition of ICAO Doc 9137 is that it provides detailed training requirements on "competent, dedicated and trained personnel".

The ICAO standards focus on three processes:
1. collecting information on the presence of living wildlife and wildlife strikes
2. ongoing risk assessments of the wildlife strike hazard
3. measures to minimize the likelihood of wildlife strikes

WILDLIFE INFORMATION – THE 5W'S

When observing wildlife over a longer period of time, it becomes clear that many factors are involved in explaining its presence or absence. Collecting that information along five main questions will give a good insight about living and struck wildlife as input for risk assessments. These five questions could be called the '5 W-questions'.
Figure 2 below shows a spreadsheet for recording the 5 W's: When, Where, Which species, What number and Why wildlife is at your airport. The Why-question is the most important since this provides the information about the nature of the attractant for wildlife. With this information, ways to eliminate or mitigate these attractants can be found in order to discourage the wildlife from visiting the airport.

As the table shows, the spreadsheet could be extended to register for example the results of expelling actions and any other comment. Such data may assist in demonstrating due diligence by an airport operator caught up in a legal battle on liability related to wildlife strikes.

Wildlife strikes shall be recorded on a wildlife strike form for which ICAO gives guidelines in its Doc 9332. Unfortunately, for a variety of reasons that lead to poor reporting standards, very little data on wildlife strikes is available. Despite the ICAO standards, the vast majority of wildlife strikes go unreported. This is a world wide phenomenon with Africa unfortunately not being an exception. In many cases, countries lack a functional reporting system. In other cases, reports are perhaps compiled in company but not submitted to oversight authorities or to ICAO. One of the reasons for this may be the concern that airlines may choose not to operate from airports

The 5 W's - collecting information about wildlife at your airport

When		**W**here	**W**hich species	**W**hat no.	**W**hy	*Action taken*	*Comments*
17-10-2011	10:12	plot 14	Black-h. heron	2	eating	pyrotechnics	left airport
17-10-2011	10:12	plot 14	Pied crow	5	flying	no action	safe distance
17-10-2011	10:43	plot 21	Marabou stork	8	resting	vehicle	left airport
17-10-2011	11:50	RWY02	Hadada ibis	1	struck	removed	see report

Figure 2 - The '5 W-questions'

where many wildlife strikes are recorded.
Information about the struck wildlife, such as the species and number of individuals, is often missing in reports that are submitted. This is understandable in strikes where no carcass is found. But even when the carcass is found and removed as part of a policy to prevent so-called Foreign Object Damage (FOD) of aircraft, the species and number are often not recorded. Without this crucial information about wildlife strikes, developing and evaluating effective wildlife strike prevention management plans is very difficult.

Applying the Risk Assesment Matrix to wildlife management

Probability (chance to get struck ~ the no. of strikes)	Severity (damage risk ~ total body mass (kg) per strike)			
	Very high	High	Medium	Low
High		Black-b. bustard	Black kite	Barn swallow
Medium	Dikdik	Black-h. heron	Hadada ibis	House sparrow
Low	Marabou stork	Mongoose	Pied crow	Little bee-eater

Figure 3 - Sample risk assesment matrix

RISK ASSESSMENT

The collected information is input for a risk assessment with 2 variables:

1. the severity is related to the scale of the damage when a specific species collides with aircraft
2. the probability is the chance of such a collision to occur

Looking at the 5 **W**'s, the data about species (**W**hich) and number (**W**hat no.) is related to the severity. The number is also related to the probability, as are data about date/time (**W**hen), location (**W**here) and activity (**W**hy).

The probability of getting struck may even vary within species. Females and males can behave differently in the same location and can undertake different activities taking more or less time then the activity of the other sex. Furthermore, young birds are more likely to get struck then animals that have been around the airport for longer. Such juveniles are not yet accustomed to approaching aircraft and the danger they pose. The same applies for wildlife visiting a particular airport for the first time, for example when arriving in the migration season. These newcomers won't react the same way as animals that are familiar with the aircraft and the airport.

The outcome of the risk assessment will make it possible for a wildlife control unit to prioritise the most hazardous species in the implementation of the airport wildlife management plan.
Prioritisation by a wildlife control unit will also signal to airport management that the unit appreciates the importance of cost efficiency in a world of scarce financial and human resources.
Figure 3 above provides an example of how to put the two variables probability and severity in a risk assessment. The species placed in the red box are most hazardous to this particular airport, the ones in green are the least hazardous to this particular airport.
Presenting the risk assessment in this manner also has the advantage that it is aligned with the methodology that management is getting more and more familiar with in the framework of implementing Safety Management Systems (SMS).

MINIMISING THE LIKELIHOOD

At many airports, wildlife strike prevention is only taken to a professional level after a wildlife strike with substantial damage or even fatalities – so called Tombstone management. It looks like that such 'wake-up calls' initially lead to airport management calling for killing. However, experience world wide shows that a risk assesment most of the times shows that eliminating food is the most effective. Also personnel and scaring techniques require attention as depicted in figure 4 below.

VEGETATION MANAGEMENT

Besides the wasted food found in garbage, all other food is connected in the airport-food-chain which starts with the vegetation. Since food is the most important attractant, vegetation management is a crucial aspect of wildlife strike prevention. Removing all vegetation would eliminate all food that lives in the vegetation, but small soil invertebrates (earthworms, insect larvae, etc.) would still be present and thus hazardous wildlife feeding on them would still be attracted. Since plants and grasses could re-grow quickly, especially in (sub)tropical airports, removing the vegetation is not a sustainable solution either. Furthermore, vegetation is preventing surface erosion and keeps debris away from the runway.

Minimising the likelihood

Questions	
1. How to eliminate their food?	To successfully discourage wildlife from visiting airports is to eliminate or mitigate the presence or accessibility of its most important attractant: food
2. Who has to do it?	Anyone seems to be able to kill wildlife or to chase it away. However, as ICAO stresses, it is necessary that personnel is competent and trained (see chapter 4.2.1.a. of ICAO Doc 9137) as part of the airport's Safety Management System (SMS)
3. Chase it away?	Many devices to scare wildlife away are available for purchase and all of these are promoted by the seller as the best solution. Unfortunately, the 'silver bullet' has not been found yet. When not properly applied, wildlife habituates quickly to any mechanical scaring device
4. Kill hazardous wildlife?	True, a dead animal won't move anymore. But when the habitat of the killed wildlife is still attractive with food, water or shelter, opportunistic newcomers will soon show up. They may be even more dangerous, since they are not familiar with aircraft

Figure 4 - Minimising the likelihood

Wildlife strike reporting requires information about number and species of the struck wildlife

The height and density of vegetation affects the visibility and accessibility of food. Tall, dense vegetation will disable most hazardous wildlife to walk around in the vegetation and to detect and access food that is present in and on the soil and in the vegetation. Which height and density to aim for depends on the size and manoeuvrability of the hazardous wildlife. Most often, the natural height of the vegetation will be the best. Trees and larger shrubs should be removed since they may hamper aircraft that skids off of the runway. Furthermore, it should be assessed to what extent tall vegetation obstructs the Instrumental Landing System and approach lights. The ILS and approach lights are usually close to the runway so wildlife present in these areas pose a direct hazard.

Vegetation also provides shelter for wildlife. Species that like to hide in the vegetation may become invisible to their enemies. Such species avoid areas with short vegetation or bare soil. Therefore, these 'agoraphobic' species are not likely to enter the runway where predators may see them easily. Other wildlife species prefer short vegetation or areas with bare soil. These 'claustrophobic' species avoid dense, tall vegetation. They rely on their ability to see approaching predators well in advance to enable them to either freeze and trust on their camouflage plumage or to flee in time. This fleeing reaction is exactly how they deal with aircraft. However, as mentioned before, modern aircraft are too fast for them.

Therefore, the most strike prone species are those that prefer open areas with short vegetation or bare soil. They perceive the runways and taxiways as open areas and ideal places to be. Especially during the cooler parts of the day, they like to be on the tarmac warmed by the sun throughout the day.

WILDLIFE CONTROL UNIT

Even with intensive vegetation management, there will be opportunistic animals visiting the area to see if there is something to get. These animals have to be scared away by a team of dedicated and trained personnel, organised in a wildlife strike prevention unit. When salary costs are low, the number of personnel could be increased with for example foot patrollers. However, if not joined with the patrol vehicle, foot patrollers are too static to scare away the dynamic wildlife effectively enough.

Furthermore, it is important that staff is persistent and dynamic to resort effect.

Quite often, wildlife control is not a full-time job, but an extra task for other personnel such as fire fighters or air traffic controllers. According to findings during ICAO audits, one of weaknesses in the African region was the lack of awareness about wildlife hazards. This was due to a lack of formal training of assigned staff and a lack of sensitisation among the airport authorities, its general staff and the surrounding communities.

As part of the AviAssist Foundation's program, leaflets and videos will be produced in the coming years, covering all aspects of wildlife strike prevention. The first video that has gone online on the Foundation's Youtube Channel explains why it is helpful to take pictures of struck wildlife. Sharing these pictures with the members of the AirportWildlifeAfrica Yahoo group will help with the identification of the struck animal. Such identification is a crucial bit of input for the risk assessment.

THE WAY FORWARD

People are inclined to accept hazardous wildlife at airports as normal. Comments like "Well, we've always had hazardous wildlife at our airports, we still have and we will always have." and "This is simply a risk that we have to accept." are quite common, also at African airports. Of course, a goal of 0 wildlife strikes may not be realistic, but the aim has to be As Low As Reasonably Practicable (ALARP).

With airport personnel often being trained as technical professionals, the solution for the wildlife problems is often believed to be a technical one. Many technical scaring devices claim to be the 'silver bullet'. Avian radars have been developed for the detection of birds and other wildlife at the airport and in its vicinity. But since the origin of the problem is not a technical one, the solution isn't either – it is a biological problem, requiring biological solutions and biological expertise.

As mentioned before, the updated ICAO Doc 9137 recognizes that trained and dedicated experts are essential to take effective measures against a wildlife risk to aviation but these measures can only be succesful in a joint effort with aviation operational personnel.

Albert de Hoon has 14 years of world wide experience in practical wildlife strike prevention, covering the whole spectrum from actively wildlife scaring and training airport personnel to auditing airports and writing policy guidelines. Since 2008, he is dedicating his expertise to the airport wildlife management program of the AviAssist Foundation next to his day job as an airport wildlife management specialist.

Further reading & tips:

1. Transport Canada, Sharing the Skies - An Aviation Industry Guide to the Management of Wildlife Hazards (13mB!). To download it in three parts, see AviAssist website <www.aviassist.org>, under 'Downloads' – 'Wildlife hazards & aviation'
2. AviAssist tips on wildlife management 'Made in Africa' on the AviAssist Youtube channel <www.youtube.com/user/AviAssistFoundation>