Impact Assessment (IA) to solve Aircraft-Wildlife Collisions

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Abstract:
Accidents involving aircraft and wildlife (especially birds) have been a problem since the earliest days of manned flight and are viewed as serious hazards in modern civil and military aviation. Over 90% of collisions with wildlife occur on take-off, landing, climb or final approach as these are relatively low altitude activities. In Namibia, birds are obviously by far the greatest risk, although mammals such as jackal, warthog, aardwolf, and mongoose are known to have traversed the runways and aprons of Namibian airports from time to time. Key habitat factors in and around the airports are assessed for their risk of causing aircraft-wildlife collisions. To reduce such risks management actions are implemented which leads to early reduction of the risk of collisions.

Most current actions taken by airports address symptoms of the problem, dealing with wildlife once they occur on the property. By employing environmental risk assessment methodology, a proactive approach is used to systematically reduce the risk of aircraft-wildlife collisions.
This paper will show how to address problems as close as possible to their root cause, using an holistic integrated approach inspired by environmental assessment science to systematically address hazards which are expected to carry a risk of causing wildlife collisions with aircraft.

1. Introduction

Between 1912 and 2001, available data reveals that 223 people have been killed worldwide as a direct result of wildlife collisions with aircraft(Froneman, 2000) , although the actual figure is thought to be much higher as a result of inconsistent and inaccurate reporting. For this reason an investigation into possible prevention of aircraft-wildlife collisions at Namibian airports was conducted.

Over 90% of collisions with wildlife occur on take-off, landing, climb or final approach as these are relatively low altitude activities. Birds are obviously by far the greatest risk, although mammals such as jackal, warthog, aardwolf, and mongoose are known through personal observation to have traversed the runways and aprons of Namibian airports from time to time (Alexander 1999). This alludes to the fact that key factors in and around the airports need to be identified and addressed, in order to minimize the occurrence of collisions.

Due to the wide diversity of habitats, Namibia regularly hosts up to 660 bird species (Atlas of Namibia, 2002). Namibia lies in the south-western arid zone of Africa, and 104 endemic and near-endemic bird species of southern Africa occur in this zone (Atlas of Namibia, 2002). In addition to this the relative degree of pristine and undisturbed habitat provides refuge to a large number of mammal species. As the occurrence of wildlife in the vicinity of airports is in direct conflict with the prescribed land use, action needs to be taken in keeping wildlife from utilizing the airport properties, while taking care to have a minimal effect on the wildlife populations through responsible environmental management.

A literature investigation (SAIEA 2007) was conducted to establish best practice on the subject of wildlife collisions. The investigation revealed that a large amount of research has been conducted on repelling birds and wildlife from airport vicinities though various innovative means. Most measures in uses are mitigatory, and are treating symptoms of an underlying problem (ecosystem based). The management plan approach recommended in this study aims to address the causes of the problem, to prevent wildlife from being attracted to the airport. This management plan approach is taken from the

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Environmental Impact Assessment (EIA) methodology, where an Environmental Management Plan (EMP) is formulated to manage impact mitigation actions at a practical and preventative level.

2. Methodology and approach to the problem of aircraft-wildlife collisions at Namibian airports
The recommendations of the International Civil Aviation Organization's (ICAO) Airport Services Manual on Bird Control and Reductions (ICAO 1991) were used as a guide to formulate a Wildlife Control and Management Programme for eight Namibian Airports Company (NAC) Airports. This programme is also generally known as a Wildlife Management Plan. Current risks relating to aircraft wildlife collisions were determined at each airport, causes of these risks were determined and the mitigation of these identified risks form the basis of the Wildlife Control and Management Programme for the NAC Airports (SAIEA2007).

To establish the causes of wildlife collisions at Namibian airports a Causal Chain Analysis (Belausteguigoitia 2004) was conducted. This analysis determines the immediate, underlying and root causes of the problem of aircraft-wildlife collisions. It enables management interventions to be recommended as close as possible to the root cause of the problem, making such interventions most effective. Merely treating the symptoms of a problem, by addressing immediate causes can at best have temporary benefits.

Following the literature review, a programme framework was designed, based on best practice within the industry. The programme (or management plan) was developed using a risk assessment methodology commonly used in the EIA discipline. Hazards were identified and rated following aerial photograph analyses and site visits to each of the Namibian airports. The programme is dynamic, and hazards identified initially are reviewed and added to continually to ensure that new hazards are identified early and mitigation measures are put in place for them. Each identified hazard is subjected to a risk assessment matrix by multiplying the probability rating (the likelihood of the hazard occurring) by the severity of the consequence of a collision (how severe would the damages be if this hazard were to cause an accident).

The formula for determining the risk is as follows (SAIEA 2007):
R= P x S
Where:
R= Risk
P= Probability of the hazard causing an accident
S= Severity of consequence

The product is then rated as either low (1-6), medium (7-12) or high (13-25). This is known as the risk score. Below are the categories and risk matrix:

Probability of hazard causing an accident
1- Improbable 2- May occur on the ground 3- May occur infrequently (in the air) 4- May occur frequently (in the air) 5- Will occur (in the air)

Severity of consequences
1- No consequence 2- Minor damage, collision only possible on the ground

| 3- Slight damage, possible emergency situation |
| 4- Possible emergency situation, threat to life possible |
| 5- Threat to life probable |

Risk Score of Hazards (Multiply Probability and Severity of Consequence)
1-6 – Low risk
7-12 – Moderate risk
13-25 – High Risk – Management plan required

		Probability				
		1	**2**	**3**	**4**	**5**
Consequence	**1**	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Management actions are formulated for each risk that falls within the "red-zone" of the risk assessment matrix. The management actions determined for "red-zone risks" are pragmatic and specific and can easily be monitored. For this purpose a monitoring indicator is selected for each action to determine whether the action has the desired effect. Other risks also need to be attended to, and actions to mitigate them should be taken pro-actively. The above approach is often used in Impact Assessment to determine and mitigate for impacts (WSP Walmsley 2003).

It was recommended to the airports (SAIEA 2007) that all hazards are reviewed on an annual basis, and re-subjected to the risk matrix to determine whether any hazard risk ratings have increased to levels of priority importance. This step has yet to be implemented.

3. Wildlife control and reduction programme (Wildlife Management Plan)
As part of this research, a wildlife control and reduction programme was formulated for each airport and has the following steps:

a) Hazard identification
   An initial hazard identification was performed for each airport using aerial photographs and site inspections. This step is repeated on an annual basis to determine possible new hazards.

b) Risk Assessment
   Newly identified hazards, and previously identified hazards are re-submitted to the risk assessment process to determine high risk hazards

c) Management Plan
   A management plan was formulated for each identified risk hazard, to establish mitigation or minimization actions for the hazard

d) Activity Plan
   A specific activity plan for who, when and where the management actions are to be completed was formulated

e) Monitoring programme

Monitoring parameters were set for identified risks, which inform management whether management actions have the desired effect to reduce the risk of hazards.

The programme pro-actively and dynamically assesses new hazards as they arise, making it possible for actions to be taken before risks become serious enough to cause accidents. By assessing hazards' causal chains (as in section 4 below) and identifying and addressing root causes, an effective and pro-active management of risks is possible.

4. Result of the Causal Chain Analysis for the problem of aircraft-wildlife collisions

The Causal Chain analysis for aircraft-wildlife collisions at Namibian airports identified immediate, underlying and root causes as part of this study. From this analysis (SAIEA 2007) the following root causes were identified:

1. Inadequate co-operation from neighbours, where neighbouring land practices entice animals to airport vicinities. Such practices are often avoidable and stem from ignorance
2. Inadequate research into the problem of wildlife collisions, which hampers proper understanding of the problem. This narrows the variety and effectiveness of possible mitigation measures
3. Inadequate housekeeping – which causes a waste problem, and provides areas where animals can shelter. Inadequate waste management is a major attractant of wildlife
4. Inadequate human capacity to deal with the problem.

4.1 Addressing Root Causes

Theoretically, removing the habitat completely, by removing all vegetation, and covering all soil with paving, concrete, or stone chips would completely sterilise the environment, and this would remove the risk of attracting hazardous organisms to the airport, although birds would still pass over, and neighbouring land-use would remain a problem. In practice however this is expensive, and environmentally degrading. It is therefore important to address each root cause through the following:

1. Interactions with neighbours should be open and transparent. The sharing of information through stakeholder forums and information briefs should be encouraged. The effects of neighbouring land use on the risk of aircraft / wildlife collisions needs to be researched, to identify potentially risky land use applications. Although interactions with neighbours will improve the situation, there is no legal requirement for neighbouring land-users to change potentially risky land-use practices. In the case of dealing with un-cooperative neighbours, the airport may be powerless to change a potential risk.
2. Research on aircraft / wildlife risks in and around airport properties needs to be undertaken. The extent of the problem needs to be monitored through rigorous science to credibly determine the extent of the problem, and identify effective and proactive methods to reduce risks. Effective monitoring of wildlife occurrences at the NAC airports needs to be undertaken. This should include analysis of data to determine increases or decreases in hazards, in order to predict risks for aircraft collisions.
3. In general, waste management and housekeeping should be improved. The practice of disposing of waste on site at some airports should be ceased, as waste dumps attract a large number and variety of bird and animals to the area.

There is inadequate human capital to adequately address the problem in a pro-active manner. NAC personnel appointed to address the problem do not possess the knowledge or time to monitor the problem effectively, or pro-actively identify and address the wildlife hazards at airports across

Namibia. Technical (scientific) support and training are needed to build suitable capacity to deal with the problem.

The above-mentioned actions to address root causes formed the basis of management and action plans (Section 3) which are currently being implemented at Namibian airports.

5. Conclusions and recommendations

Following an investigation at eight NAC airports in Namibia it is evident that many actions have been taken to minimise the risk of aircraft collisions with wildlife. Management actions currently include daily fence inspections, regular runway inspections to ensure that runways are clear of wildlife, wildlife repellent actions such as noise, shooting and physical chasing of wildlife from airport runways. The establishment of a wildlife committee and regular meetings of the committee to discuss wildlife occurrences and identify training and action needs has assisted greatly in addressing the problem. However, most of the actions address symptoms of the problem, dealing with wildlife once they occur on the property. Monitoring and reporting of the occurrence of wildlife on airport properties is conducted, although the accuracy of reporting of wildlife occurrences by pilots and air-traffic controllers is questionable.

The approach used in this study attempts to address problems as close as possible to their root cause, using an holistic integrated approach to systematically address hazards which are expected to carry a risk of causing wildlife collisions. The monitoring of wildlife collisions and wildlife occurrences on airport properties needs to be undertaken in a vigorous manner. Staff need to be trained to identify wildlife species, and report any sightings. Monitoring data needs to be analysed to identify trends in wildlife movements, as well as responses of wildlife to implemented management actions. A wildlife control and reduction programme was developed, where hazards need to be risk rated regularly in response to monitoring data, ensuring that possible new unmanaged risks are identified and dealt with in a proactive manner. This approach closely follows management planning and risk assessment as widely used in Impact Assessment practice (WSP Walmsley 2003)..

Assistance of consultants is recommended to implement the programme and provide training to identified staff within each airport, who would be responsible for managing the plan at their specific airport. The implementation of long term monitoring of the occurrence of wildlife and birds at Namibian Airports Company (NAC) airports needs to be considered, as well as scientific monitoring of the effectiveness of management actions to control the problem.

Public participation philosophy, a cornerstone of effective Impact Assessment (Calabash 2003) informs that a partnership should be investigated between the NAC, local major airlines, conservation organizations, landowners and government to effectively deal with the problem of wildlife collisions.

Although the priority regarding wildlife collision risks is to prevent loss of life, and minimize damage to aircraft, it is important that the impact on wildlife populations, especially protected and endemic species is minimized through efficient application of environmental management and conservation principles. Such actions enhance corporate image and credibility, as well as demonstrate NAC's commitment to protecting Namibia's rich natural heritage.

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