BIRD STRIKE DATA ANALYSIS AT SOUTH AFRICAN AIRPORTS AND SPATIAL REPRESENTATION OF BIRD PATROLS IN RELATION TO BIRD STRIKE OCCURRENCES.

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Abstract

The bird hazard risk at South Africa Airports has been monitored for the past 5 years through the ACSA – EWT Strategic Partnership. Reporting of bird strike occurrences and subsequent data management forms an integral part of the activities of the partnership.

This paper provides a statistical overview of the bird strike incidents reported at Airports Company South Africa Airports over the past five years 1999 - 2004. In excess of 1500 bird strike occurrences have been reported and the data review presented here will focus on the following factors: seasonal variation, time of day, aircraft model, species, size of bird, effect on flight, and part struck / damaged.

The data presented is used on a regular basis to assess the effectiveness of control measures being implemented on the airfield both in terms of proactive as well reactive interventions on the airfield.

Bird Strike data collected is also represented spatially on a map of the airfield to establish high frequency bird strike zones on the runways of the respective airports. The paper will present the spatial distribution of bird strike data from the airfields where sufficient data with regard to exact locations of incidents have been recorded over the past five years.

At Durban International Airport a Global Positioning System (GPS) tracking of wildlife control patrols was recently implemented. A geographic Information System is used to overlay this information onto bird strike occurrence locations and times and as a result the effectiveness of presence and location of patrols out on the airfield can be assessed.

Key words: Bird Strike data collection; Bird Strike statistics; Bird scaring patrols; Global Positioning Systems; Geographic Information Systems.

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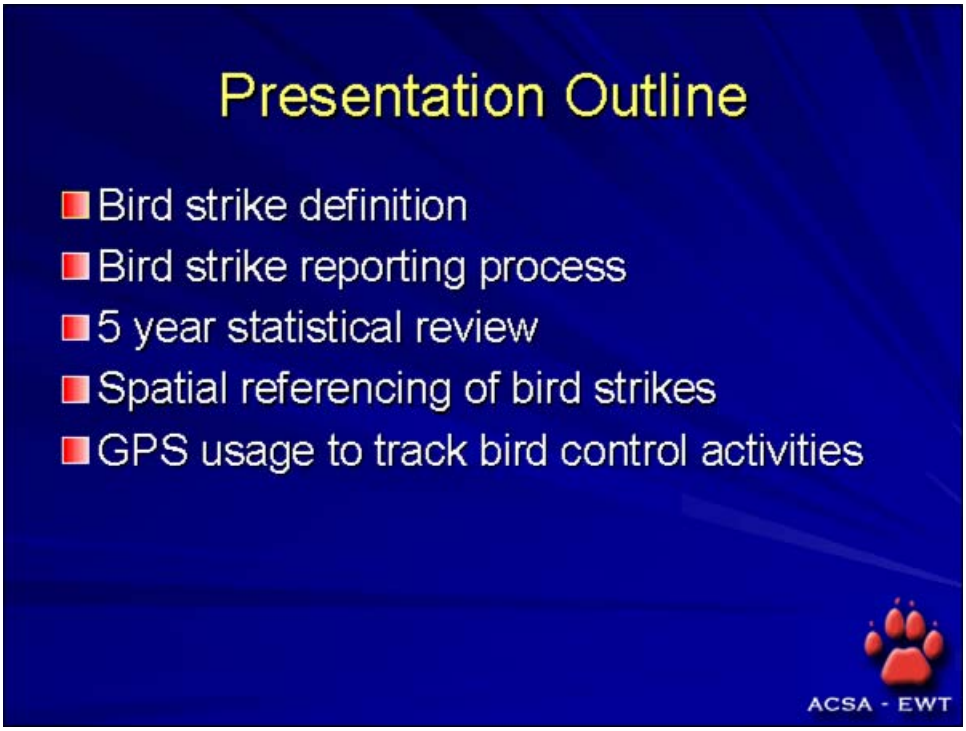
Endangered Wildlife Trust – a leading conservation non profit organization in SA

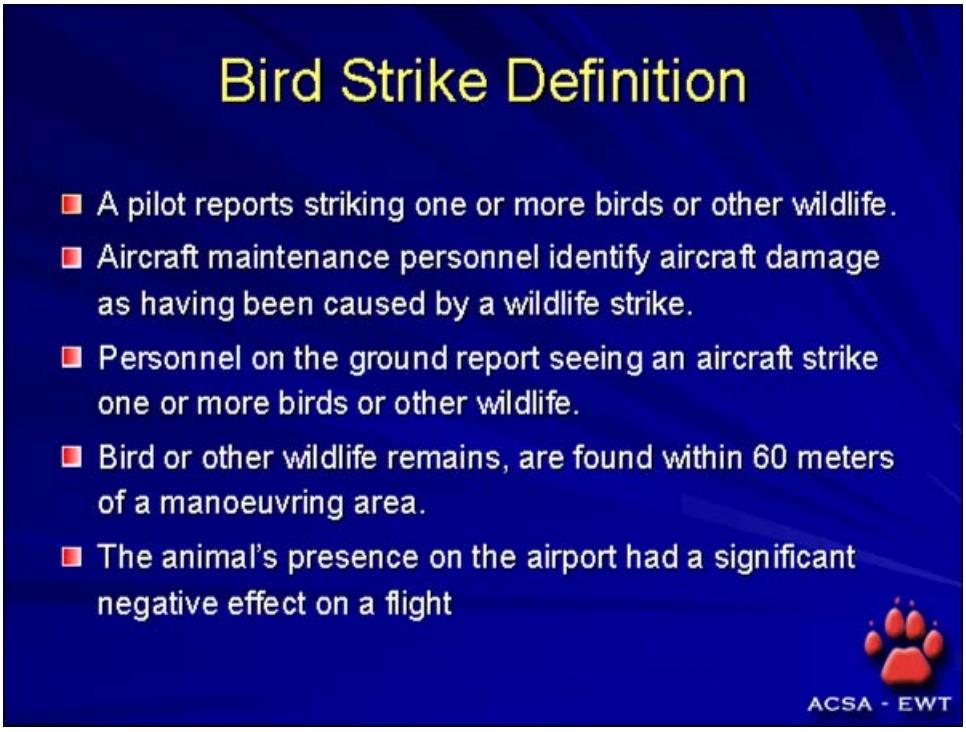
The Strategic Partnership between Airports Company South Africa (ACSA) and the Endangered Wildlife Trust (EWT) was initiated in 1999 to reduce the number of bird strikes at the 10 ACSA owned or managed airports in SA in an environmentally friendly manner. Efforts are focused on the two

busiest airports (in terms of air traffic movements & bird strikes) Johannesburg International Airport and Durban International Airport. The remaining airports that the partnership operates at are Cape Town International, Bloemfontein, Port Elizabeth, George, East London, Upington, Kimberley, Pilanesberg.

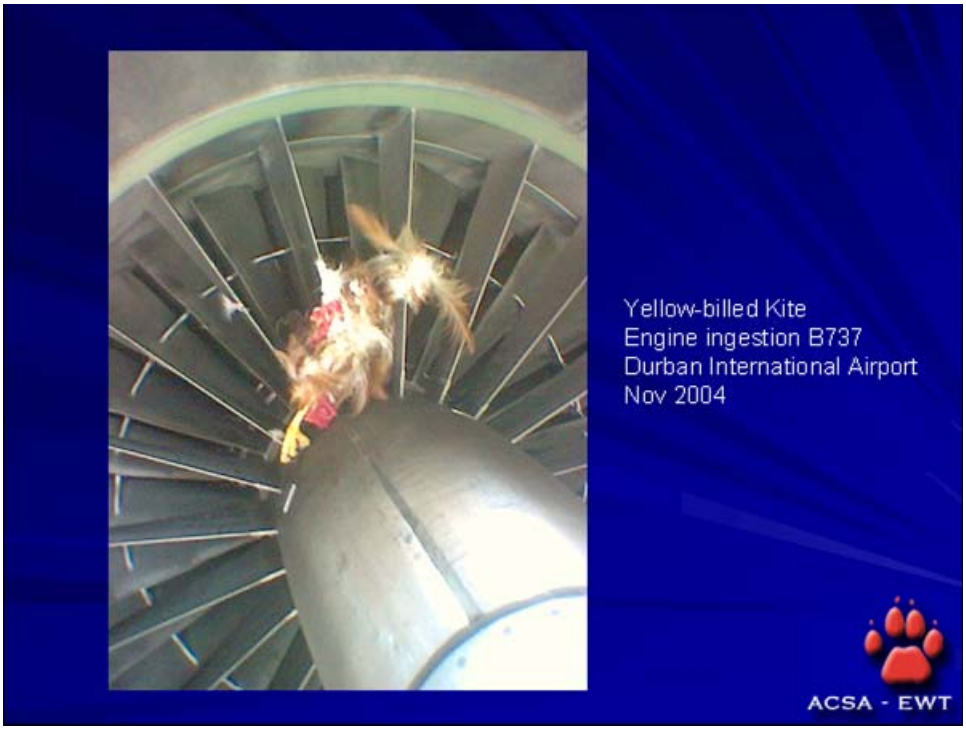


The paper includes the following:

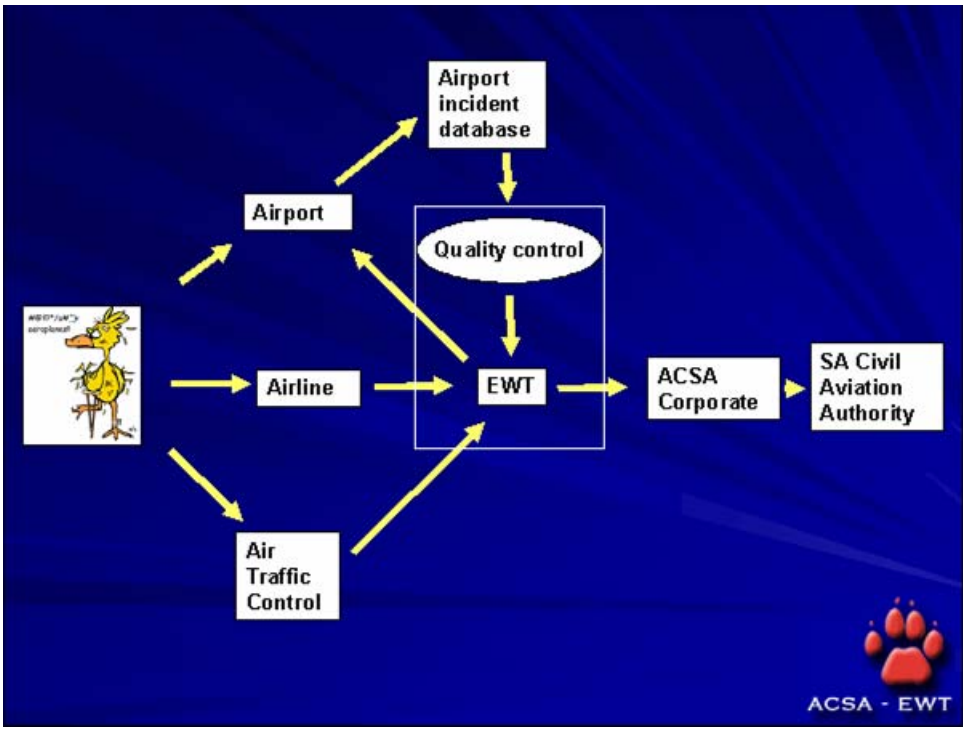
- An attempt to define a bird strike
- A description of the process involved in reporting bird strikes at ACSA airports, and the roles played by the different stakeholders
- A review of the bird strikes statistics for the period 1999 to 2004
- A brief introduction to the way in which Global Positioning Systems and Geographic Information Systems are used at Durban International Airport to spatially reference bird strikes and wildlife control efforts.



The bird strike definition currently in use at ACSA airports utilizes some or all of the above criteria.

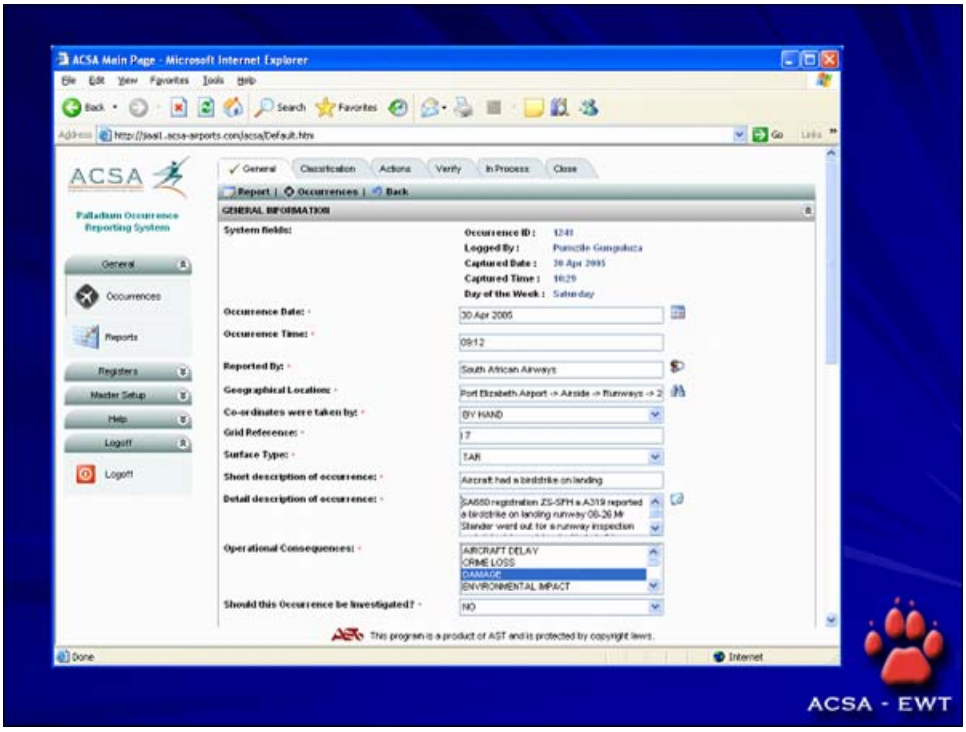


In the figure above, a Yellow-billed Kite carcass can be clearly seen in the fan blades of a Boeing 737-200 engine.

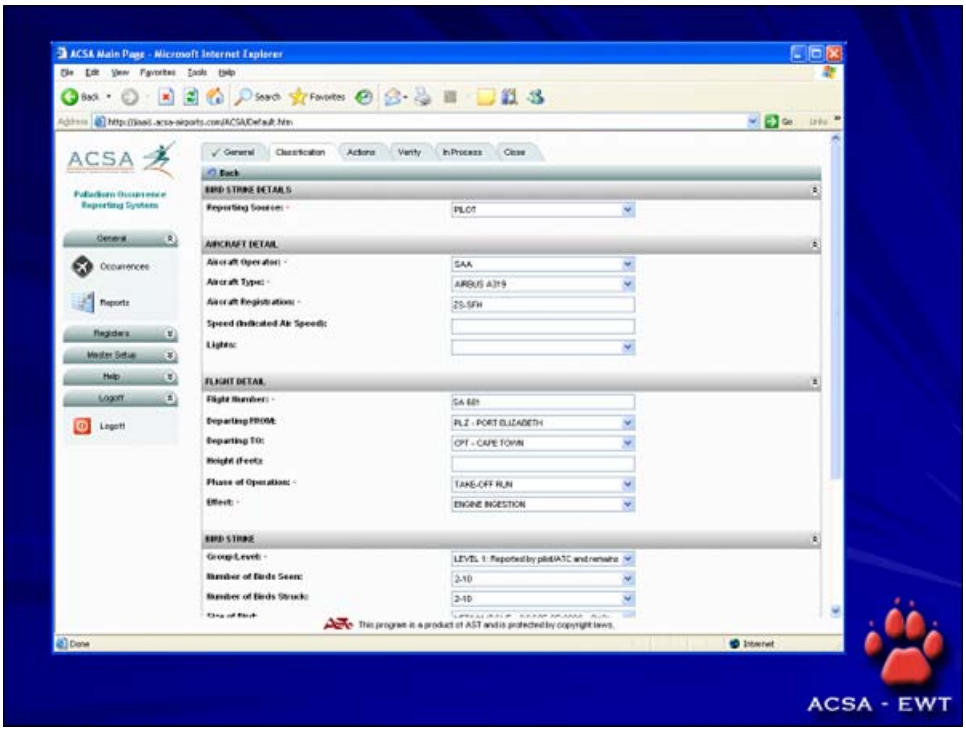


The above slide shows a flow diagram of the process involved in reporting bird or wildlife strikes at ACSA airports. During 2005 ACSA implemented an Occurrence Reporting System whereby all occurrences or incidents at all airports are logged, including bird or wildlife strikes and near strikes. The process is as follows:

- A bird or wildlife strike or near strike occurs
- It is reported to either the specific airport authority, the airline, or Air Traffic Control (ATC)
- If it is reported to the specific airport authority, it is then logged onto the airport incident database (Palladium Occurrence Reporting System)
- If it is reported to the airline or ATC, these parties send this info through to the EWT, who distributes it back to the relevant specific airport authority, who then logs it onto the airport incident database
- Summary reports are drawn off the incident database by EWT who performs a quality control at this stage
- This summary information is then relayed to ACSA Corporate, who would pass it on to the Civil Aviation Authority of South Africa



In the incident database the GENERAL information captured by the person logging the incident includes the following: date; time; location; short description of incident, operational consequences. Most of this information is captured by means of drop down menus, ensuring a degree of standardisation and minimizing errors.



The logger then classifies the incident according to a number of criteria including: reporting source; operator; aircraft type; flight number; departure airport; destination airport; phase of operation; bird

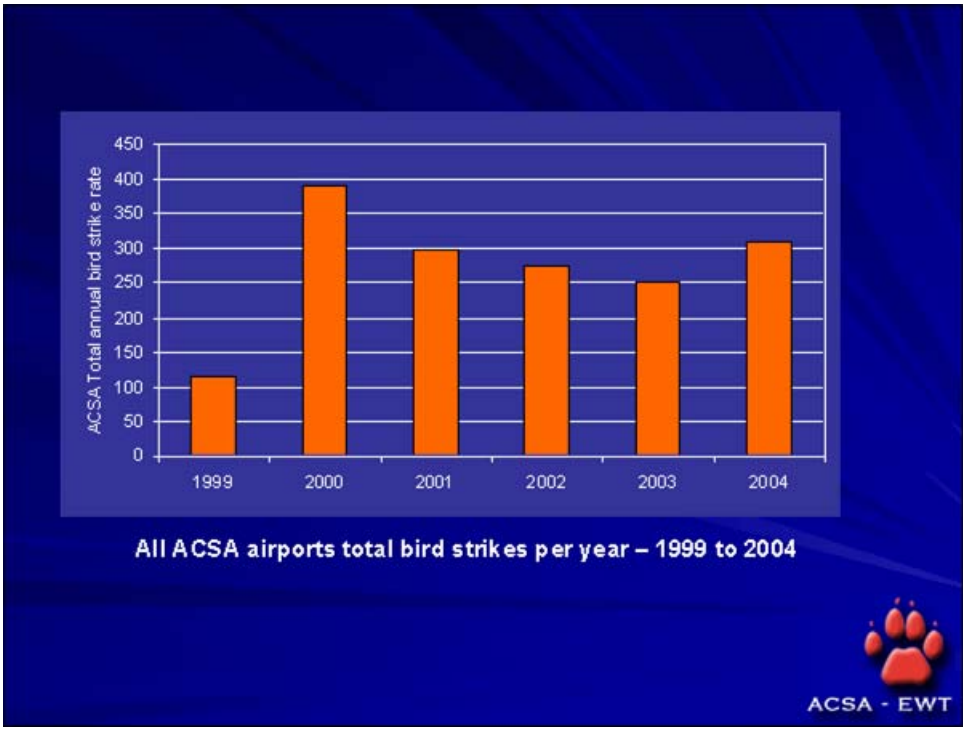
strike level; bird species, bird size, aircraft part struck, aircraft part damaged. All the required fields as described by ICAO are catered for in the system.

Another important criteria is that of bird strike level. This can be 1, 2 or 3 as described below:

Level 1 strike: A bird strike is reported by the pilot or ATC, and a carcass is found by airport staff when they patrol in response to the report

Level 2 strike: A bird strike is reported by the pilot or ATC but no carcass or other evidence is found

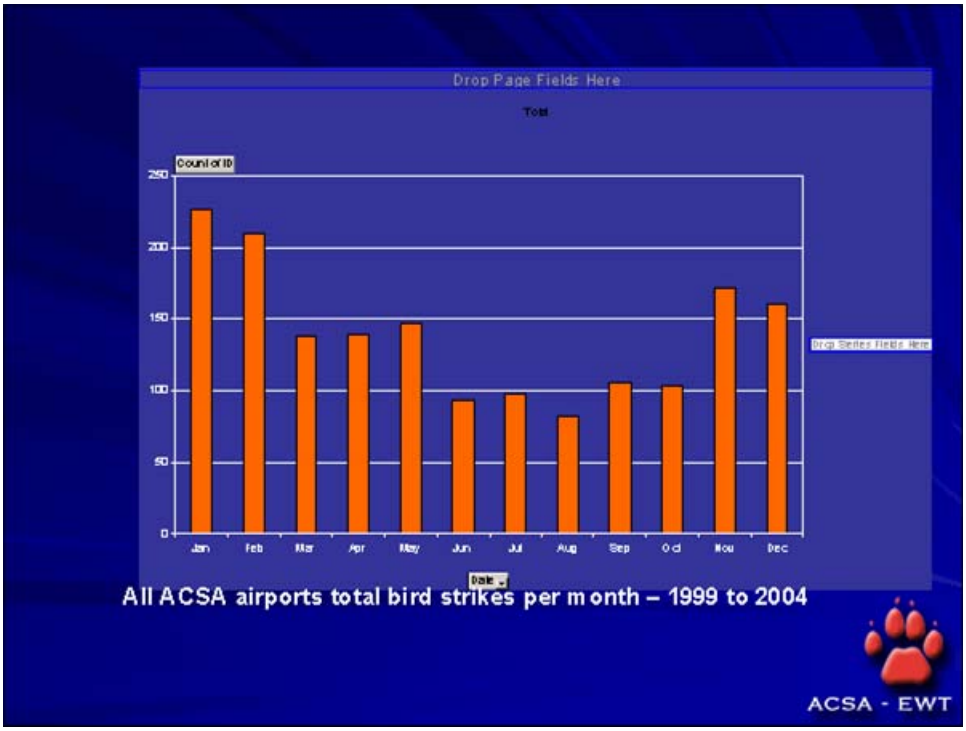
Level 3 strike: A carcass is found on the maneuvering area, without having been reported at all.



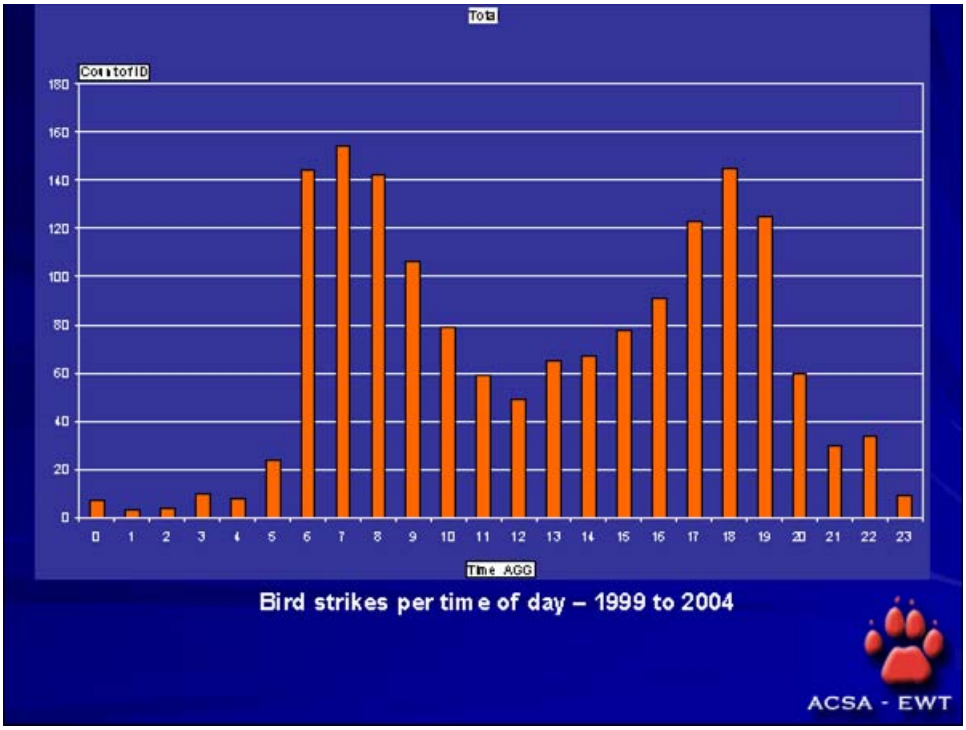
When the project was initiated in 1999 one of the first aims was to increase awareness and reporting of bird strikes by all relevant parties. This resulted in an increased number of bird strikes being reported in 2000. Although this looks bad, it is actually a more realistic situation than that in 1999. Since 2000 there has been a steady decline in the number of bird strikes per year, until 2004 where there is a slight increase again. This overall trend is testimony to the efforts of the project and the measures implemented.

In 2004 an increase in bird strikes at two airports i.e. Durban International and Bloemfontein is largely responsible for the overall increase. Measures to address this situation at these two airports are already underway in 2005 and include the appointment of additional wildlife control staff at both airports.

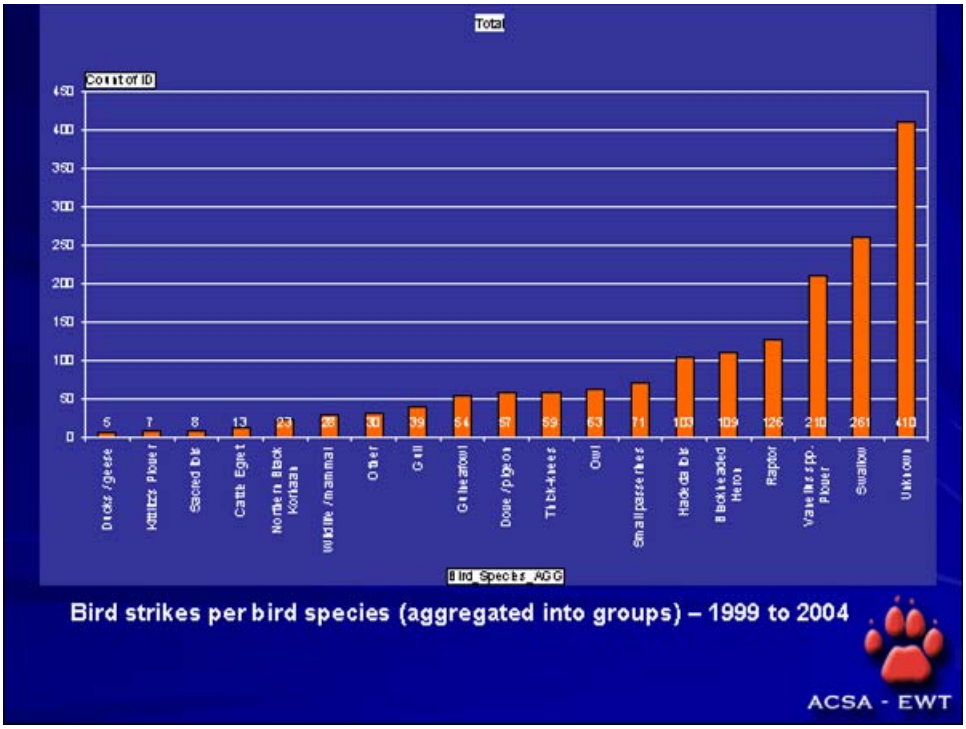
The monthly bird strike graph across all ten airports shows a typical seasonal pattern in bird strikes, with a peak in the summer months, and a “trough” in the winter months. This is to be expected in SA, predominantly a summer rainfall area in the southern hemisphere. The slight secondary peak that is evident in April and May, could be



attributed to the increased activity of young birds at the end of the summer breeding season.

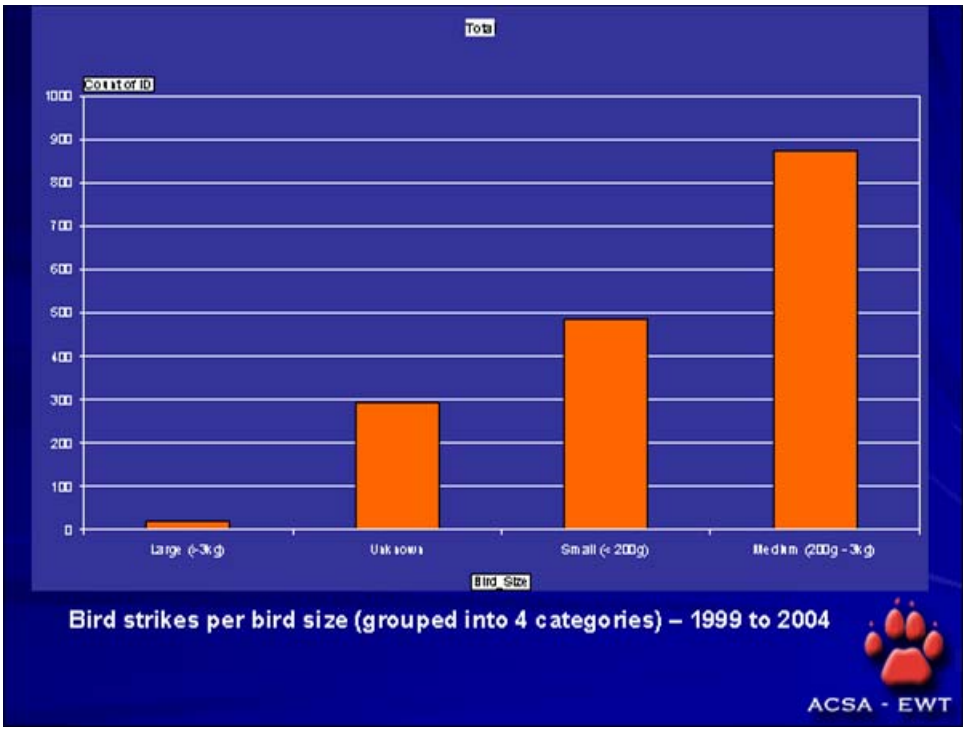


The temporal graph of bird strikes across all airports also shows an interesting pattern. Two significant peaks are evident, in the early morning from about 06h00 and in the late afternoon from about 16h00. This is believed to be due to the generally accepted theory of increased activity of birds during these time periods. However a confounding factor in this case is that of the frequency of air traffic movements. The early morning and late afternoon are the times when most flights are scheduled as these are the start and close of business hours. It stands to reason then that if there are more flights at these times, there are likely to be more strikes.

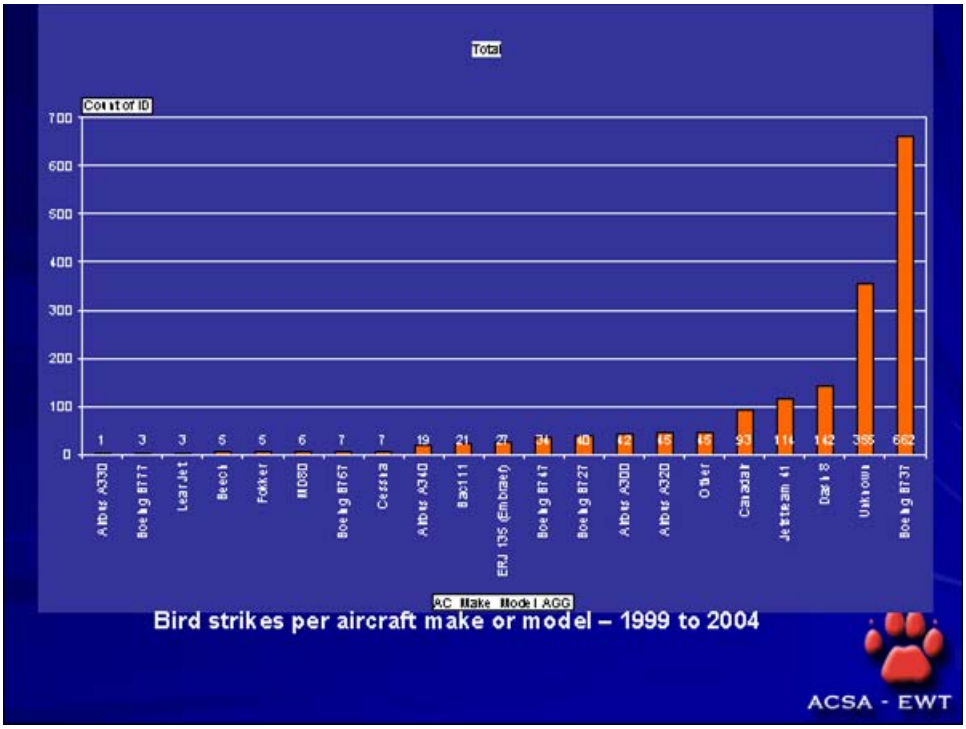


The graph of bird strikes per bird species shows a total of 19 pre defined categories. Included are the categories of “unknown” and “other”. “Unknown” features at the top of the graph on the right with the most bird strikes. This can be attributed to a large number of Level 2 strikes i.e. where no carcass was found, and the pilot never got a clear view of the bird, and/or where the airport staff were unable to identify the bird species from the carcass. Second highest is swallows, a small bird that is of little concern unless many are struck at the same time. Hadeda Ibis, Black-headed Heron, Raptors and Vanellus spp. Lapwings are probably the most common species found on most airports in South Africa. With the exception of the raptors, these species are all mostly controlled by normal bird scaring methods such as noise deterrents and border collies. The raptors pose a different problem as they mostly fly above the airfield hunting. Potential control methods include thunder flash flare guns, noise deterrence, trapping and relocating etc.

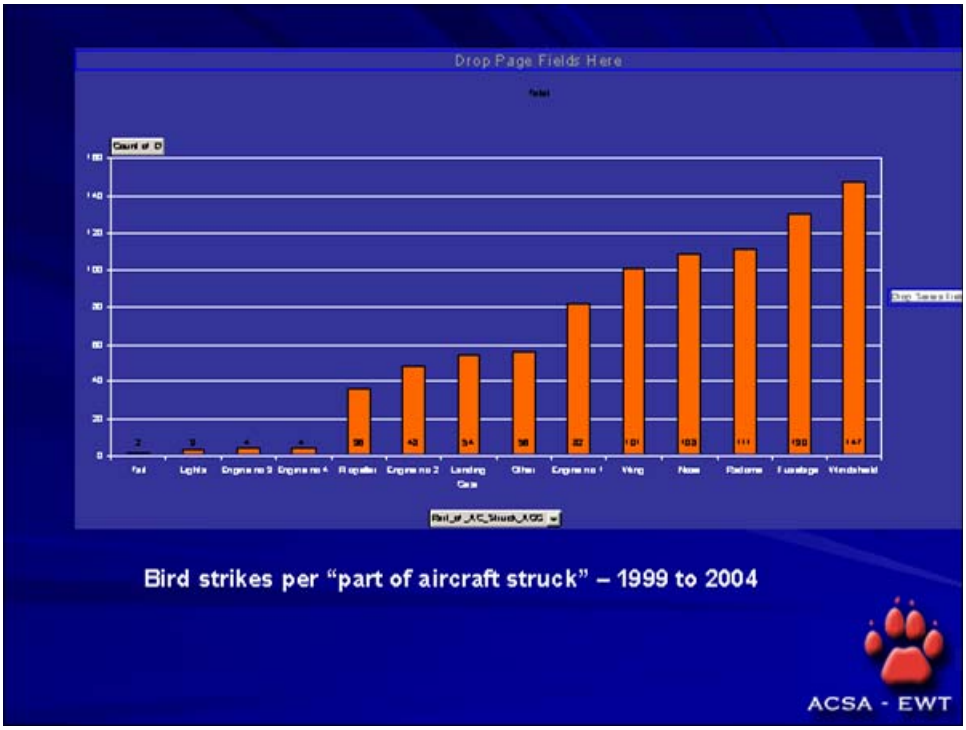
The above bird species are some of those most commonly struck at ACSA airports since 1999 as per the previous figure. They are from left to right, top to bottom: Crowned Lapwing; Lanner Falcon; Black-headed Heron; Helmeted Guineafowl; Spotted Thick-knee; Hadeda Ibis.



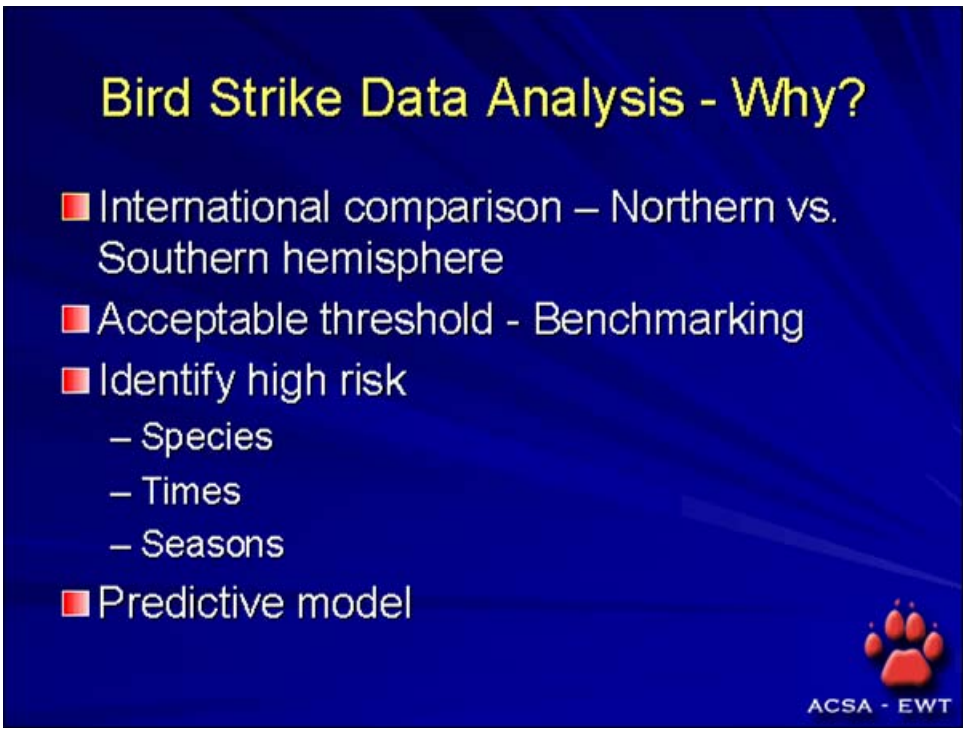
The bird strikes per bird size graph shows that most bird strikes occur on medium size (200g to 3kg) birds. Once again a large number of the bird strikes are on “unknown” bird sizes. This is again due primarily to carcasses not being found. It is encouraging to note that very few strikes have occurred on large birds of over 3kg, as these are obviously the birds with the most potential to cause damage to aircraft.



The bird strikes per aircraft type graph shows that the vast majority of strikes have occurred on Boeing 737's. This probably atleast in part due to the fact that it is one of the most common aircraft type flown in South Africa during the study period. Most of the Airbus aircraft are low down on the graph, perhaps due to their relatively recent introduction into the country. The "unknown" category is again high, due to the large number of Level 3 bird strikes – where a carcass was found without aircraft details having been reported, meaning that there is no way of identifying the type of aircraft that struck the bird.

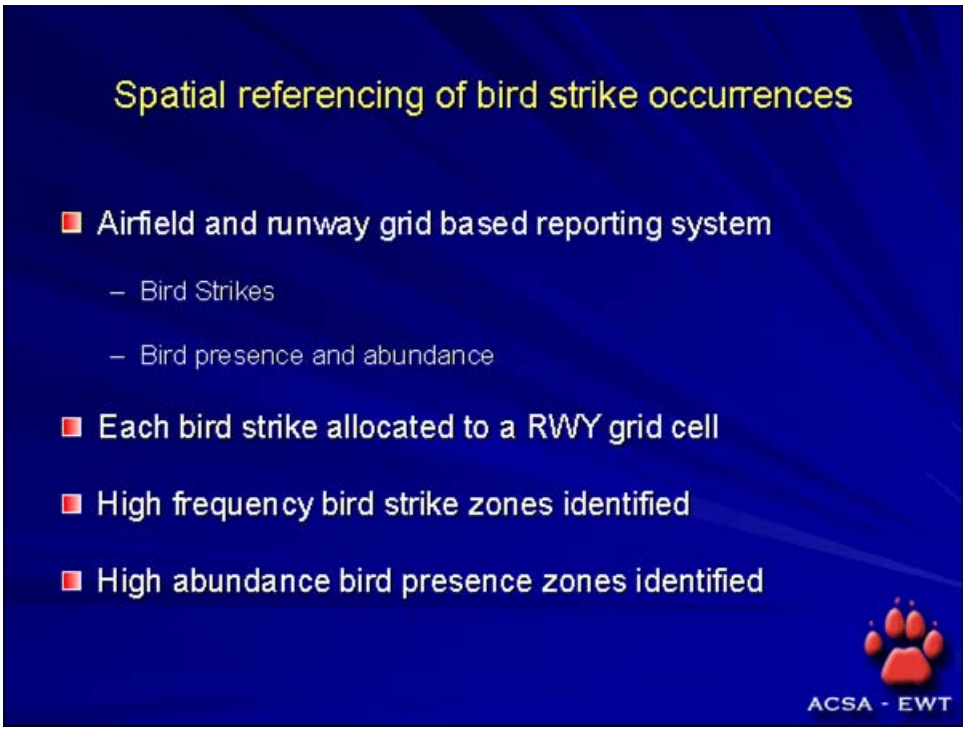


The bird strikes per part of aircraft struck graph is predictable in that most of the front parts of the aircraft feature high up the graph such as the windshield, radome, nose etc. Of interest is that the engines are relatively low down the order which is important as they are probably the aircraft part most vulnerable to expensive serious damage with safety implications.



Bird Strike Data analysis is important to the ACSA-EWT partnership for a number of reasons:

- It allows comparison between different international countries, situated in both hemispheres. This allows discussion around the relative effectiveness of measures implemented in the various countries.
- It allows the establishment of an acceptable threshold for bird strikes at each airport. This enables year on year comparison and the identification of increasing or decreasing risk at each airport, which in turn can focus management input.
- It enables us to identify high risk times, species, seasons and direct our efforts and resources towards these high priorities.
- Ultimately, and perhaps most importantly, it allows us to develop predictive capabilities what will enable proactive measures to be implemented at airports, rather than always acting reactively.



In order to spatially reference bird strikes and other information, airfields have been overlaid with artificial gridlines. In this way each bird strike or any birds counted during the regular bird counts can be allocated to a specific grid cell e.g. A1. Over time this enables the identification of high frequency bird strike zones on the airfields and this can be compared to the grid cells with high bird abundances as per the bird counts. It must be noted that the location at which a bird carcass is found is not necessarily in the same grid cell as where it was struck.

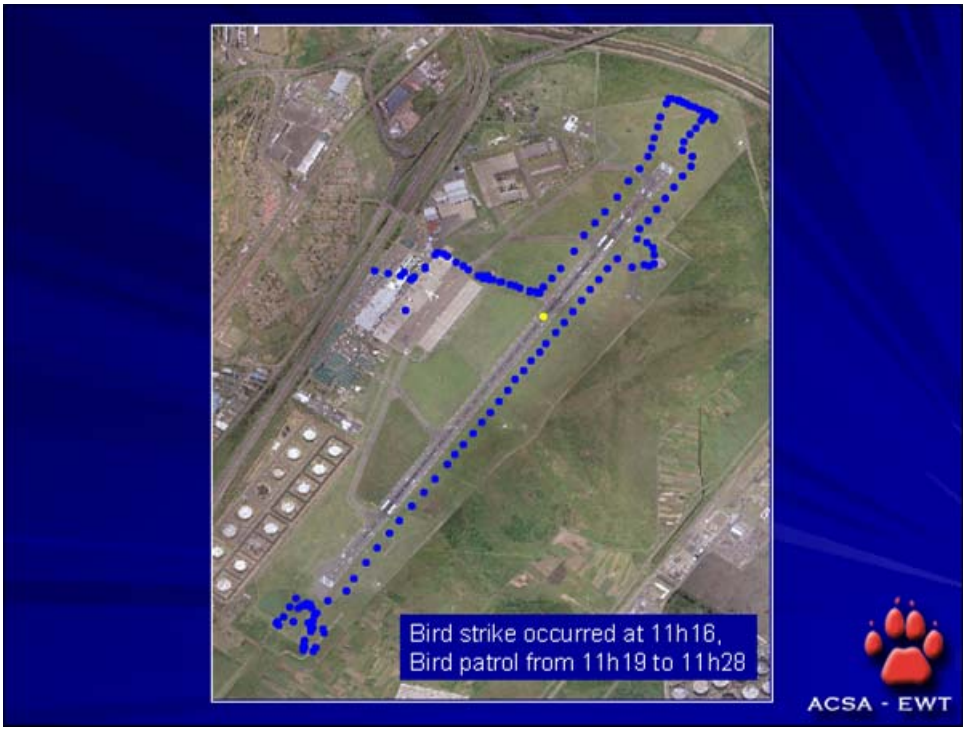
In the above figure, the locations of bird strikes with raptors have been plotted on an aerial photograph of Durban International Airport. All raptor strikes i.e. for take off and landing in both directions have

been plotted together. The larger dots represent larger frequency of strikes. It is clear that the highest frequency is in the middle of the runway.

In this figure, only raptor strikes that occurred on the landing phase of runway 24 (direction represented by arrows) are plotted. Again a fairly significant grouping of strikes can be seen in the area where most aircraft would touch down.

Similarly all raptor strikes on landing phase on runway 06 are plotted, and again a grouping of high frequency of strikes is seen towards the end of the runway.

At Durban International Airport, a system was introduced in 2004, whereby the Wildlife Control Officers use a hand held Global Positioning System (GPS) during their daily bird patrols. This unit logs the wildlife units' exact position at a predetermined time interval while they are out on the airfield. When this data is downloaded, it can be displayed using Geographic Information System (GIS) software and overlaid onto the aerial photograph of the airfield. Since each point/position that is captured by the GPS unit has attribute data attached, e.g. time, date etc, it is easy to monitor the time spent on the airfield during patrols. This allows detailed analysis of the wildlife control efforts relative to the time and location of wildlife strikes. It also reduces the paper work load for wildlife control staff.



As discussed above, each dot in the above figure represents a position that was logged by the GPS unit during the patrol. Since the positions are logged at a time interval, in the above figure, the distance between dots/positions relates to the speed that the wildlife unit was traveling. In the bottom left of the figure the unit was probably driving slowly around in one area, probably chasing birds. In the middle of the figure, to the left of the runway, the unit was driving relatively fast – presumably because there were no birds to scare. The yellow dot on the runway marks the position of a bird strike that occurred at 11h16. From the attribute data of the GPS log it can be seen that this particular bird patrol was carried out from 11h19 to 11h28. It can be assumed with relative certainty then that the wildlife control officer was radioed by ATC to report the bird strike at 11h16 and responded 3 minutes later, in other words this patrol was reactive. Likewise by examining the times of the previous patrol it could be determined how recently before this bird strike, birds had been scared in that area. If for example no bird patrols had been done for an hour or so before the strike, questions could be asked of the wildlife officers. This is the case in the next example.

Another example of a bird patrol completed at Durban International Airport from 06h07 to 06h56.

A bird patrol conducted from 08h05 to 09h03 in the morning.

On this day, a short patrol was conducted in the morning, and then no further patrols were conducted before the bird strike which occurred at 13h18 in the afternoon. Possible explanations for this could be that the wildlife officers had administrative duties to fulfill during that time. Midday is usually also quiet in terms of bird activity so this strike was probably an exception to the rule.

Activities of the ACSA – EWT Strategic Partnership in the future will include:

- Continued data collection at all ACSA airports in order to enable continued analysis of trends and patterns as presented elsewhere in this paper.

- Improved and expanded use of the GPS system. To date we have just scratched the surface of the potential of this system for wildlife control on airfields. The possibilities are endless and need to be explored.
- Analysis such as discussed above will allow us to focus our limited wildlife control resources into priority areas, airfields, seasons, times of day, bird species etc.
- Automation of reporting of bird patrols by using the GPS will reduce the amount of time that wildlife officers need to spend completing paperwork each day, thereby maximising their time out on the airfield.