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EVALUATING THE COST OF BIRD-RELATED DAMAGE TO CIVILIAN AND MILITARY FLIGHTS AS A VITAL TOOL TO INCREASE FLIGHT SAFETY

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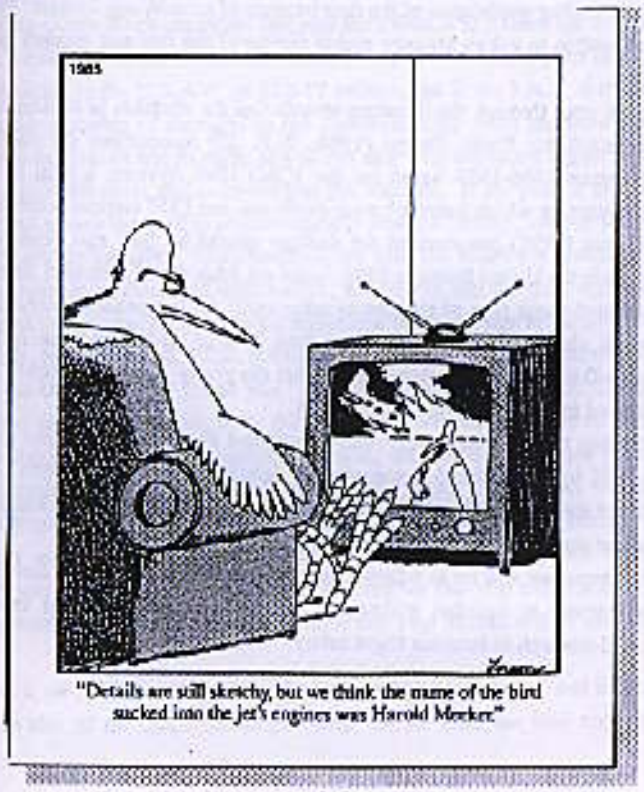
SUMMARY

This paper attempts to evaluate the global cost of bird-related damage to civilian and military flights. We believe that the global yearly direct and indirect damage reaches several billion dollars. We suggest that the BSCE initiate the establishment of a global database for bird strikes as a tool for decision makers to invest money to increase flight safety.

Keywords:

Warning System,Migration,Radar, Visual,Aircraft, Airline,Civil Aviation, Military Aviation,Low Level,Risk Assessment.



"Details are still sketchy, but we think the name of the bird sucked into the jet's engines was Harold Meeker."

INTRODUCTION

In the last two decades, numerous papers were presented at BSCE meeting summarizing the data on damage from birds to civilian and military flight in various differing profiles. As far as we know, no attempt has been made to try and evaluate the yearly economic damage from birds in the global scale. The ability to effect the data systematically is improving as fast as the usage of computers; additionally, a greater number of airforces, airlines, and airport authorities publicize the data.

A European database of military bird strikes has been established in the RNAF (Decker 1994, W.P. 20). By March 1994, the database contained information on 25,569 bird strikes from 9 airforces covering a period of 3 to 17 years. Richardson (1994, W.P. 21) summarized the circumstances of 131 accidents in which military aircraft crashed and 40 crew members were killed in 10 airforces. 14 fighter jets and one helicopter crashed between 1980-1994 in the Indian Airforce (averaging 1 per year). All aircraft crashed due to one species of bird: the Indian whitebacked vulture, *Pseudogyps bengalensis* (Satheesan, 1994, W.P. 23).

In many airforces, the data is still not collected and analyzed systematically, and many others are withholding publication of the data because of security regulations. For these reasons, it is almost impossible to get an accurate global picture of the rate and number of air collisions in military flights.

A quick scan through the literature reveals that the situation in civilian flight is almost the same as that in military flight. Thorpe (1994, W.P. 28) summarized the number of civilian air collisions between 1986-1990 based on the ICAO IBIS System: a total of 22,331 incidents occurred in 5 years, in which 3 aircraft were destroyed and 1310 engines were damaged. Dolbeer, Wright & Cleary (1995) summarized the damage caused by bird and other wildlife strikes to civilian aircraft in the United States in 1994: based on FAA data 2,150 bird strikes were reported, and 22% indicated some type of damage or other cost. An independent analysis of strike records for a major US airport estimated that fewer than 20% of all strikes were included in the FAA Wildlife Strike Database. They also estimate that the yearly damage probably exceeds the $112 million estimated for military aircraft in the USA.

According to preliminary information presented in the Bird Ingestion Conference held on 11 January 1996 by the National Transportation Safety Board (NTSB), John Goglia, member of NTSB, claimed that only 15% of air collisions with birds are reported, and that bird ingestion represents about one-third of total aircraft damage.

In this paper we will try to estimate the damage of birds to military and civilian flights as a vital tool to present to decision makers, in order to convince them to invest more money, manpower, and research to increase flight safety.

MILITARY FLIGHTS

There is a large discrepancy in the character of air collisions between countries depending on their location on the globe: a country like Israel at the junction of 3 continents will face more air collisions in the migration season, despite its small size (74% of severe air collisions in Israel occured in the migration month). The location of Israel on the Eastern part of the Mediterranean Sea attracts vast numbers of soaring birds over the limited air space. The soaring birds avoid crossing the sea, instead hugging the coastline, and thus the potential risk of collided with these heavy birds, many weighing over 2 kilograms are much higher than in a country like The Netherlands, which will have a higher proportion of waders and a lower potential of risk. The Northern countries will have a higher risk during the summer when the birds are back in their nesting areas and the counties closer to the equator will have a higher risk in the winter, when the population of birds winter there.

The level of monetary damage to different airforces also depends on the type of aircraft used: F-15/I coust $100 million each, as compared to the Mig 21 or Skyhawk which costs only a few million dollars. A single pelican which collided with the strategic bomber B-1B in the USA caused $28? million in damage and killed 3 crew members. The same level of damage occurred with 12 Canadian Geese which destroyed last year the EWACS in Alaska and killed 24 people.

There is currently no standardization of the prices of each aircraft; for example, the loss of an F-16 is calculated in the U.S.A.F. at $16-17 million, but in the I.A.F. it is calculated as $27 million. Also, the reporting of damages is not comprehensive: most airforces calculate only the direct damage to the aircraft and its parts, and do not deal with the much higher cost of manpower to obtain and repairs the parts, and to investigate the accident. If the pilot is injured or killed, the hospital costs and money required to psychologically treat the family, and the lost cost of training the pilot should also be included. Unfortunately, we tried but could not obtain this data from the IAF, since it is considered classified information. We believe that the true, comprehensive cost is at least two times (if not more) as high as the direct cost of the damage to the aircraft.

Sqn. Ldr. Bob McCloud, FS2b, published in 1992 a paper with statistics of air collisions with birds in the UK. McCloud found that "the Maintenance Analysis and Computing Division (MACD) carried out a most valuable study during 1991 to determine the cost of birdstrikes both in terms of hard cash and operational capability.... During the period of the study (Oct 89 to Sep 90), nearly 61,000 man-hours were expended on birdstrike repair or, in other words, a permanent work force of 40 men at a cost of 1 million pounds. The cost of spares accounted for a further 13 million pounds and the total downtime was equivalent to 14.4 aircraft being permanently grounded.... If you have a birdstrike, there is a 20% chance that you will not have achieved all of the aims of the sortie and when you land, it is likely that your aircraft will be off-line for the rest of the day."

In table 1, we published data of 6 airforces which are incomplete and difficult to compare, but can give an idea of the scope of the problem. In the IAF, the total cost of direct damage

Table 1: Evaluating the cost of Damage of 6 Air Forces

A)Country/ Air Force	B) No. of air-collisions (no. of years)	C)%with damage	D) Estimation of damage	E) Average of air collisionwith damage	F)No.of aircrafts lost
1)U.S.A.F (Arington1994) U.S.A	1989-1993(5) 13,427 (2685 per year)	15% (402per year)	$85 million = ($17 million per year)	$42,288	8 (1.6 per year) 6 F-16, 2 T-38
2)R.N.A.F (Decker,1994) The Netherlands	1978-1993(16) 2709 (168 per year)	30% (55 per year)	?	?	4 (0.25 per year) (Richardson,1994)
3)G.A.F (Decker,1994) Germany	1979-1992(14) 7328 (523 per year)	20% (105 per year)	?	?	7 (0.50 per year) (Richardson, 1994)
4)R.A.F (Decker,1994) U.K	1980-1993(14) 9534 (681 per year)	40% (272 per year)	£15-20 million per year (Thorpe,1994 W P1)	£64,338 (596,507)	15 (1.07 per year) (Richardson, 1994)
5)F.A.F (Decker,1994) France	1977-1992(16) 2526 (157per year)	90% (142 per year)	?	?	4 0.25 per year (Col. Dudret, PER. COM.)
6)I.A.F (Leshem, 1994) Israel	1972-1994 (22.5) 2639 (117 per year)	29% (34 per year)	$109 million 1983-1995) $8.3 million per year	$247,117	7 (0.29 per year) (Leshem, 1996)

between 1983-1995 was $109 million, an average of $8.3 million per year. Most of these data come after we succeeded in dramatically reducing collisions in the migration season by 88% since 1984. If the research and the regulation of Bird Plagued Zones (B.P.Z.) had not been undertaken, the damage would have been an order of magnitude higher.

The IAF's fighter planes are mainly F-16s and F-15s, and soon will get the F-15/I, which will raise the potential cost of damage **two orders of magnitude higher** than only two decades ago, when the airforce was composed of Mirages, Skyhawks, and Phantoms.

CIVILIAN FLIGHT

Thorpe (1994) showed that between 1986-1990, 4,466 accidents were reported per year, and 262 engines were damaged or lost per year. As indicated by different sources, it seems that only about 15-20% of the real cost of damage is reported, bringing the numbers to around 20,000 air collisions per year and damage or loss of 1300 engines per year.

Richard King (Per. Com.), an expert in flight insurance for different leading insurance companies, reports that in most airlines have a $800,000-$1,200,000 deductible for accidents. This might be one of the reasons that the reporting rate and knowledge of accidents is less than the true numbers. It is likely that airlines only report major damages.

Boeing engines are expensive and cost between $1-5 million. The price for aircraft that can hold more passengers is rising rapidly, as is the daily rate of take-offs and landings at airports, thus raising the potential for air collisions with birds. Dolbeer et al. (1995) revealed that the total reported down-time to aircraft in the USA in 1994 was 40,280 hours. Richard King (Per. Com.) claims that **the comprehensive cost of each collision is about 4 to 5 times higher than the direct cost of the damage.** For example, an engine of an El Al Boeing 737 ingested a hooded crow on take-off from Ben-Gurion Airport for New York in April 1996. The pilot was forced to land the plane in London because the engine lost power. It was discovered that several blades of the engine had been destroyed in the impact. All of the passengers had to be taken to a hotel, and El Al flew in a replacement engine from Amsterdam. Three other scheduled flights for that aircraft had to be canceled, and this domino effect cost El-Al 5 times more than the direct cost of the damage to the engine. Also in the USA, the comprehensive cost of damage is 4 to 5 times higher than the direct cost of damage (Seegar, Per. Com.). Seegar claims that the yearly comprehensive cost of damage from birds in the USA only reaches $1-1.25 billion.

As previously stated, there is an urgent need for a reliable global database. It seems that the yearly damage to civilian and military aviation from birds exceeds several billion dollars per year.

CONCLUSIONS

1) Evaluating the cost of bird-related damage to civilian and military aviation can be a vital tool for decision makers to take action to increase flight safety.

2) It is estimated that the data provided on birdstrikes is only 15-30% of the real picture. The Statistic Working Group of the BSCE suggests that the BSCE urge governments, airforces, airlines, airport authorities, and other organizations like the European Market and insurance companies to cooperate and coordinate a more efficient data collection system.
3) The BSCE should push for greater publicity of the problem at different levels by producing explanatory material, videos, and publishing data.
4) We suggest that the BSCE be the leading organization to initiate a global database for civilian and military birdstrike data to be established and funded by airlines and governments who are suffering from the problem. The database will be initiated by urging 2 representatives from each country (one for civilian and one for military aviation) to collect and analyze their own data on one global system, making overall analysis easier and more efficient, as currently done in the 13 airforces of the European Military BirdStrike Database in the RNAF.

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If you think safety is too costly, try an accident!

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Left: 27 September, 1994. El Al Flight 001, a Boeing 747, while taking off from Ben-Gurion Airport collided with six cranes. Four penetrated engine number 2 (82.8 million thereafter), and two hit the side of engine number 4. **Above:** 25 December, 1968: A golden eagle penetrated the engine of an F-16 over the Judean Desert, Israel, while flying 420 knots, 300 feet AGL. The F-16 crashed but the pilot ejected a few fast seconds. **Below:** December, 1995. Remains of a Iranian collision with a Hercules (CH-53) over the Northern Negev.

On 10 August 1995, 5 days before we started regulating the Bird Plagued Zone (B.P.Z), preventing low level flights, an F-15 flying 550 knots, 1000 feet AGL over the Negev Desert, Israel, collided with 3 migrating white storks. Both the pilot Capt. Lev and navigator Capt. Vivante were killed. The aircraft crashed 5 seconds after 2 storks hit the body and the third bird penetrated the engine. **Above left:** Remains of 2 of the storks. **Below left:** Remains of the F-15 scattered in an area 400x400 meters. **Above right:** The engine **Below right:** Remains of the tail.