

## KEYWORD INDEX FOR BIRD - AVIATION BIBLIOGRAPHY

John Thorpe  
Chairman, Bird Strike Committee Europe  
Civil Aviation Authority  
Aviation House  
Gatwick Airport  
West Sussex  
RH6 0YR

### ABSTRACT

The Paper proposes keywords which are an amalgamation of:

- a proposal from J J Short, USA at BSCE21,
- the work of a previous BSCE Chairman, L-O Turesson, Sweden who had indexed all previous BSCE Papers and
- the German Bird Strike Committee Index.

It is proposed that this Paper be used as a basis for discussion and agreement by BSCE Members with any comments or changes to the Author by 30 October 1994. This is so that the agreed system can be published in the Proceedings and used on all BSCE 22 Papers.

## BIRD - AIRCRAFT KEYWORDS

### **Aerodrome Surveys, Case Studies and Problems**

- Africa
- Asia & Middle East
- Australasia
- Central & South America
- Europe
- North America
- World

### **Aerodrome/Airport Design**

- Buildings
- Landscaping
- Lighting
- Siting

### **Attractants**

- On Aerodrome
  - Agriculture
  - Buildings
  - Garbage
  - Insects
  - Lighting
  - Loafing/roosting
  - Shelter (man made)
  - Sanctuaries
  - Seeds
  - Worms
  - Weather effects
  - Water/wetlands/reservoirs
  - Woodlands/scrub
- Near Aerodrome
  - Agriculture
  - Aerodrome lights
  - Garbage
  - Gravel pits
  - Fish
  - Insects
  - Loafing/roosting
  - Sanctuaries
  - Sewage processing
  - Vegetation (non agricultural)
  - Water/reservoirs/wetlands
  - Worms

### **Behaviour of Birds**

- Flocking/density
- Local movements
- Migration

### **Books**

### **Control methods**

- Bio-acoustic
- Buildings (see Aerodrome Design)
- Depreciation/killing
- Chemicals

- Falconry
- Shooting
- Trapping
- Habitat
  - General
  - Long grass
  - Landscaping
  - Refuges
  - Trees & shrubs
  - Water
- Scaring/discouragement
  - Arm waving
  - Chemical repellents
  - Dogs
  - Effigies
  - Lasers
  - Mechanical devices
  - Model aircraft
  - Pyrotechnics/shell crackers
  - Ultrasonics

### **Detection**

- Electronic
- Radar
- Sound
- Visual

### **Engineering**

- Airframe
  - Lights, strobe/landing
  - Radome
  - Structure
  - Transparencies
- Helicopter Rotor
- Powerplant
  - Engine
  - Markings
  - Noise
  - Propeller/prop fan
- Testing
  - Rules
  - Substitute birds

### **En-route Aspects**

### **Homing/Racing Pigeons**

### **Inflight Avoidance**

### **Identification of Remains**

- Biochemical
- Carcasses
- Feather
- Weights

**International Organisations including  
Regional Committees**

**Legal Aspects**

- Conservation/protection
- Hunting
- Siting of attractants
  - Abattoirs
  - Impact assessment
  - Landfills
  - Water

**Management**

- Bird control team
- Regulations
- Training/Education (including Public Relations)

**Physiology**

- Hearing
- Other
- Sight
- Smell
- Species profile

**Populations**

- Distribution (see also Warning maps)
- Disease
- Local movement
- Migratory

**Statistics**

- Civil
  - Airport
  - By country
  - By airline
  - By airport
  - General
  - Serious/accident
- Engine
- General aviation
- Helicopter
- ICAO
- Military
  - Aerodrome
  - By Country
  - General
  - Serious/accident
- Risk Assessment
- Reporting

**Warning Systems**

- Birdtam/Notam
- Controller
- Maps (see also populations)

**Weather Influence**

- Cloud
- Rain
- Wind
- Winter

**Weights** - see Identification

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## 5 PLENARY DISCUSSION, MONDAY 28 AUGUST

- **WP1 'The Effect of Birds on Aircraft' by J Thorpe , UK**

Visual presentation covering the main problems.

- **WP2 'Canada Geese and Great Cormorants as a Threat for Aviation in the Eastern Baltic Area', by J Shergalin, Estonia**
- **WP3 'Feral Canada Geese as a Hazard to Aircraft in Europe: Options for Management and Control' by J Allan, UK**

**O Stenman, Finland** provided more information on the Baltic areas concerning the Great Cormorant where there has been an increase in numbers, particularly in Sweden there has been a great increase, 7,000 pairs breeding at present. In Russia first breeding colonies where in total 400 nestlings were ringed in 1994. In Finland there are not yet any breeding colonies. The birds fly very low in sea areas. **J Allan, UK** confirmed the same pattern in Sweden and Denmark as for UK and they are frequenting towns and cities.

**J Seubert, USA** What is the limit of food, for Canada geese is that the cause of large numbers of breeding birds?

**J Allan,** replied that large areas of grass were required for feeding and breeding sites. Females only wanted to breed at their original breeding site.

**J Briot, France** Can there be a way to get a licence to kill the birds?

**J Allan** replied that the European Birds Directive can be changed for a while in certain areas with special needs.

**J Briot** Could it be changed if all countries wanted it to? J Allan did not think this was possible.

- **WP15 'Comeback of the Grey Heron' by H Weitz, Germany**

**P Vogt, USA** Pest control conference showed herons on lakes with steep banks, and they will learn to go on deep water.

**H Weitz, Germany** Only a few will learn it and there will be a need to use nets.

**P Vogt** Thinks that they will learn to fly under the nets.

**H Weitz** pointed out that the IWRB produce a regular Newsletter from their Slimbridge, UK Headquarters.

- **WP4 'Superabundancy in Birds: Trends and Aviation' by L Buurma, Netherlands**

In summary two points:-

- aviation alone cannot force the issue,
- bird life international classifies Canada Goose as non-European, we must find out how to handle the problem.

**Chairman** - An important point. Birds learn the safe and unsafe places and communicate about it.

- **WP5 'Nature Conservation and Flight Safety - A Controversy?' by A Klaver, Netherlands**

The speaker noted that the translation of his name in English is 'clover', and the Chairman had just pushed him out of his job as he had said 'you must avoid clover on an airport', yet he had spent 20 years preventing bird strikes.

**Chairman** - Airports that have taken all the right precautions have lowered the rate of strikes but you cannot get rid of all bird strikes, as stated by a UK judge at a High Court. It was important to hear things from airport management point of view.

- **WP6 'European Wetlands, Views of International Wetlands Research Bureau', by G Aubricht, Austria**

**J Short, USA** USA mitigate wetlands for no net loss, they also want to improve the quality and quantity of wetlands and could lead to problems in the approach path and airport area.

**O Stenman, Finland** Co-operation with IWRB in Europe. CIC 'Hunting Council' WG, started protection of wetlands first in Africa now in N Europe and Russia. How to hunt birds and in what amounts.

**G Aubricht, Austria** IWRB interested in results for government use, including water bird numbers and how many can be shot. CIC also has regular newspapers.

**J Allan, UK** IWRB have a view on introduced bird species Canada geese, Snow geese and Egyptian geese re birds being eradicated on conservation grounds.

**G Aubricht** IWRB are aware of the problem but he is not aware of the policy.

**The Chairman** stated that there was a possible plan for the 1996 BSCE meeting to visit the IWRB headquarters at Slimbridge while others went to Rolls Royce. The subject had bridged a gap in the interests of both the aviation world and the conservation world.

- **WP7 'Bird Collision (AB) Light System to Prevent Bird Strikes in Aviation' by R Steffen, Germany**

The presenter stated that this device is to fill in the open gap between 100 ft and unlimited and the highest bird strike was at 37,000 ft. The Chairman commented that Roxie Laybourne identified the feathers as a Ruppels griffon vulture and **Y Leshem, Israel**, commented that the Israeli airforce had a strike at 50,000 ft on a military aircraft.

The system is switched on until 15,000 ft. Flashing lights get attention 200 times better than steady according to a University in Germany, various colours were tried and a colour close to ultra-violet is better by a factor of 5. Some say birds are not scared by flashing lights, but observation during a thunderstorm shows they really react. Directional information is from two horizontal lights, aircraft fitted with a light top and bottom always shows the wrong direction of turn, which is misleading to the bird. A check of Swissair bird strike data shows that more than 90% of the strikes were within one metre of a light, which is why for the last ten years Swissair have been flying with the nose light OFF and just the wing lights ON. Birds directly hit the light. This is well documented. At the moment ten Swissair DC9s have the special strobe lights. It is useful on the Reporting Form to have a head on diagram so the impact point can be noted. There were problems with the spray pattern on a wet runway hiding the lights but Swissair strikes had been reduced by 90%. The results will be published at the end of the year.

**Dr B Bruderer, Switzerland** challenged the claimed 90% reduction, he could see no reduction in the last few years.

**The presenter** replied that he was only talking 90% reduction when the aircraft is airborne, from statistics office, problems on the ground and in crew training flights for example in Malta, where there are many birds as it is on a migration route. Instructor pilots say they have no problems when the aircraft is airborne, with for instance gulls, otherwise problems when birds are above the "shadow" line of the lights. **The Chairman** commented on the test that crew training is carried out in Malta and there are no birds there because in Malta the hunters shoot everything - he had been to Malta there were no gulls even in a fishing village.

**H Lehmkuhl, Germany** - Do you also compare the range of destinations?

**R Steffen** The statistics office check the flight destinations and all in European sector compensate for the destinations.

**M Puxkandi, Austria** - Do you, as a pilot, switch on all lights for landing and take-off?

**R Steffen** - Do not switch on the nose light or light near engines, Swissair only switch on the landing lights at the very tips of the wing on the DC9.

**M Puxkandi** Fokker 50 has landing lights on leading edge of wing very close to the nacelle and nosewheel light. Has had no damaging bird strikes, 8 aircraft only 16 strikes.

**J Becker, Germany** Scientific proof doubtful. Its not as simple as R Steffen says. At lighthouses you find dead birds especially in bad weather they are disoriented. Results should reflect general light condition, eg day, night etc.

**R Steffen**: Birds in trouble will always fly into a steady light not a flashing light. Steady light is dangerous, strobe light OK.

**P Karmeniemi, Finland** In Finland the landing lights are left on both nose and wing especially in sunshine to avoid hitting other aircraft.

**The Chairman** pointed out that in SAS all birdstrikes are when landing lights are ON, because SAS requires them to be on below 10,000 ft, thus there are no strikes with lights OFF. Anything done on the birds strike side must not degrade the air traffic see and be seen aspects.

- **WP8 'Anti-Collision Strobe Lights, Field Experiments on Indian Birds', by B Pito, India (summarised by the Chairman)**

These were ground tests only and were not found to have any effect on Indian birds. The Chairman commented that what was needed was wider statistically valid information to determine whether or not the ABS system was effective. On the road motorbikes with 2 head lights appeared to be much easier to see than those with only one.

- **WP9 'Harmonising Engine Design Rules United States - Europe', by R Parker, USA**

The Chairman commented that there will be a lot of old engines around for many years to come, so its airport measures that will have to deal with the problem.

**J Seubert, USA** Any idea why sometimes an 8 lb bird is sliced up and everything is fine, whereas with others all hell breaks loose? What's the difference?

**R Parker, USA** Depends where the bird goes through the fan stream, once sliced by the fan its a ball of fluid and if small enough can go through the core without damage. Orientation of the bird can vary, worst is on one blade.

The Chairman invited Rolls Royce to contribute because it is a shared problem.

**I Martindale, UK** - The fan can be up to 3 metres in diameter and weigh hundreds of kilos, with provision for fan blade containment. The harmonisation has got to make sure that:

- improved air safety stand
- uniform, level set of standards for all manufacturers to work to so all can design for lowest possible weight and highest possible efficiency.

When results of FAA ingestion survey were looked at the conclusion was that having previously been pressing the European viewpoint of tougher tests rather than heavier birds, Rolls Royce decided to set itself the target of achieving an in-service reliability figure of 1 serious event in 100 million flights and so independently we decided to design the new big fan engines for 2½ lb flocking birds at high altitude take-off and high day temperature take-off that gives you the highest rotational shaft speeds. The worst condition for the ingestion of a bird into a big fan is a combination of the bird speed, the rotational speed of the fan and the angle of the fan blade - draw triangles and you will find the worst condition of the mass being sliced off and when the bird velocity reaches a maximum, this is the case at which the certification tests are done. The regulations are generally in terms of take-off conditions, high fan speed and bird input speed of around 160 to 170 knots. Contrast between fan blades on pre-1974 engines where the fans are very thin and nowadays they are wide chord fan blades which are more efficient but horrendously heavy. It is important that there is a harmonisation of regulations so everyone can design to the same rules and use skill best to minimise the weight of the components and still meet the requirements.

The Chairman thanked Rolls Royce for their contribution.

- **WP10 'The Central Science Laboratory Bird Strike Research Club', by J Allan, UK**

**A Eudot, France** We think that this programme is not due to the density of the bird but due to the feather and make of the bird that is going in the hole of the engine, if use dummy bird don't take this point in order so what do you think of this programme?

**J Allan, UK** - Not suggesting replace real birds for the final certification test but dummy birds give a more repeatable and cleaner preliminary test. Given that often they test with different birds the suggestion is that there should be a standardised dummy bird and should ensure that that dummy is as representative of a real bird as possible. At the moment there is no suggestion of not using real birds for the final test for the reasons suggested by Eudot.

Showed a video where now slicing up birds is not needed, using magnetic resonance images (like body scanners in hospitals) to capture 3 dimensional structure of the bird and feed that directly into the computer programme. This shows complexity of internal structure of birds which is thought to be why dummy birds will never replace real birds.

- **WP12 'French Exhibition on Bird Strike Hazards', by J L Briot and A Eudot, France**

**A Eudot** explained that as well as the exhibition panels, the life size gull that was being shown surprised pilots when they saw the size and how much damage it had done to the fan blades on display in the exhibition.

The Chairman commented that exhibitions of this sort were a most important part of education for all aviation personnel.

- **WP13 'Bird Control and Reductions on Vienna Airport', by W Lischak, Austria**

The **Chairman** commented that it is good to see that the measures we've talked about over many years; long grass, garbage etc. show as a good result in the statistics although one of the dangers is that when you carry out measures on an airport all the pilots fill in the reporting forms much better, and you can show an increase in strike rate, so it is nice to hear that at Vienna you have got a good result. We look forward to visiting the airport on Thursday.

- **WP14 'An Annotated Bibliography of Bird Hazards to Aircraft (ABBHA)', by J J Short, USA**

The **Presenter** noted that he would be demonstrating the ABBHA Bibliography System on a lap top computer and could make a copy of it available for participants to use at home on their own IBM compatible diskette, 400 citations of bird hazards to aircraft. The system uses a library system Papyrus, a \$100 programme. About 2/3 of the references are in the birdstrike engineering fields so he has narrowed his down to the biological and management aspects. BSCE covers both of those, so he has included the engineering in BSCE citations. One copy was distributed to each country of the complete reference, it does not include BSCE 1 to 9, 15, 16 and 21. The **Author** asked participants to look at it and provide comments. **Ralph Speelman** at the Wright Dynamics Directorate has undertaken a separate effort to undertake a windshield durability data base. **John Thorpe** has proposed a new paper, which has new keywords in some aspects, the **Author** has kept his very simple to appeal to those not familiar with bird strike work. The main thing is - who is going to do this work, who is going to look after it? In the USA it was on the Tyndall AFB library with the BASH team, but they have now moved. Which organisation is prepared to look after it.

**J Allan, UK** He endorsed the **Author's** work and said it is unbelievably difficult to track down references and it is extremely valuable. He is willing to see if the Central Science Laboratory can take it on, but someone has got to do it.

The **Chairman** thanked **J Allan** for the wonderful offer. He also said that his Paper, No 16 (distributed in error with No 26 on it) contained a number of different key words because a simple system means lots of entries in any one area. He has a complete set of all BSCE Proceedings and in archives all the Canadian Field Notes which set the ball rolling on the birdstrike problem in the mid to late 1960s. There is some good material in the Field notes and it is likely that if they were examined, it would be found that we were re-inventing the wheel and repeating work done many years ago.

- **Closing of Plenary**

The **Chairman** closed the Plenary with a number of announcements and thanked everyone for their attention in what was a long day.

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