BIRD STRIKE COMMITTEE EUROPE

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BIRD STRIKES DURING 1974 TO EUROPEAN REGISTERED CIVIL AIRCRAFT

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SUMMARY

The strikes, reported during 1974 throughout the World by nine European operators, to aircraft greater than 5700 kg (12,500 lb) have been analysed. The results are discussed, some problem areas highlighted and recommendations proposed.

CONTENTS

1 INTRODUCTION

1.1 In the past reports containing data on bird strikes have been produced by different organisations, such as airlines, aviation authorities and ornithologists. The information has been presented in various forms, using different guidelines. These reports have seldom contained data on aircraft movements, such that the most useful form of comparison, strike rate, can be determined.

1.2 In order that a common basis for the analysis of bird strike data could be agreed, a Working Group of the Bird Strike Committee Europe was formed in 1972, led by the representative from the United Kingdom Civil Aviation Authority Airworthiness Division at Redhill. After consultation with other member countries sets of Analysis Tables with Explanatory Notes were circulated to all members of the BSCE, together with a request that each country produce an Analysis of their Bird Strikes. At the 1973 BSCE Meeting in Paris it was agreed that each country would provide a separate Analysis of their Civil, and of their Military bird strikes, commencing with 1972. At the 1974 BSCE Meeting in Frankfurt the Analysis Reports for the year 1972 were presented. The Civil Report was subsequently produced as CAA Airworthiness Division Technical Note No. 110. At the 1975 BSCE Meeting in Stockholm the Analysis Reports for the year 1973 were presented.

1.3 This report contains the Third Annual assessment of the data which has been provided by BSCE members, and covers strikes to civil aircraft recorded during 1974. The strikes to military aircraft are reported separately.

1.4 Appendix 1 contains the tables of data related to this report.

1.5 Appendix 2 lists reportable accidents caused by birds, world-wide during 1974 and 1975.

1.6 A separate report has been produced of bird strikes to engines during 1973 and 1974 (see BSCE/11-WP/3).

2 SCOPE

For the following reasons, the detailed analysis only includes civil aircraft of over 5700 kg (12,500 lb) maximum weight (i.e. light aircraft are excluded):

(a) the airworthiness requirements relating to bird strikes are different for the smaller class of aeroplanes,

(b) much more is known about the reporting standard, and movement data of operators of transport types, and the movement data is more readily available than that from air taxi or private owner aircraft,

(c) the 5700 kg and less classification is, in general, a much slower aircraft with a different mode of operation, requiring less airspace, and a noticeably different strike rate would be expected.

3 COUNTRIES (see Table 1)

A total of nine European countries (2 more than last year), have provided information on 1146 bird strike incidents. The data from Germany was not available using the comprehensive BSCE layout and could only be used in some of the Tables. The overall strike rate is 4.1 per 10,000 movements (two movements per flight). This compares with a rate of 3.5 for 1973 and 3.1 for 1972 for the countries which reported in those years. As in previous years the Netherlands and Germany reported the highest strike rate. Since the rates are for strikes reported world-wide, it should be noted that it is probable that two factors affect the rate reported by a particular country

- Reporting standard
- National bird strike problem

Furthermore since some countries were unable to provide their movement data, estimates using ICAO sources have been used.

4 AIRCRAFT TYPES (see Table 2)

4.1 General

It may be that aircraft types which appear to be similar to humans, are not similar to birds, and that there are other factors, such as noise patterns, size, and use of lights, which affect the rate. The continued long term collection of statistics will provide fuller information.

4.2 Jet Aeroplanes

As in the previous report there appears to be little correlation, possibly for the reason suggested above, between aircraft of similar types the DC8 rate again being much higher than the Boeing 707. The 707 and DC8 are in wide use and operate on many identical routes, so a similar rate could be expected, although the rate for a type used by an operator who makes a high percentage of his movements at one particular airfield which has a bad bird problem, could affect the results. As a group, the wide-bodied aeroplanes, the Boeing 747, Douglas DC10, Lockheed Tristar and Dassault Mercure all show above average, although not the highest, rates, with the exception of the A300 B Airbus which had only made a small total of movements.

4.3 Turboprop Aeroplanes

The extent to which turboprop aeroplanes are used has declined considerably, however the BAC Viscount, and H.P. Herald have a significant strike rate. The average rate for all turboprops is slightly lower than that for jets.

4.4 Piston Aeroplanes

The Convair 440 is the only one which is in wide use which has been reported on, and has a rate similar to the rate for jets.

4.5 Helicopters

Only four strikes were reported to helicopters, and these were not able to be related to hours or flights to provide a comparative rate.

5 AERODROMES (see Table 3 and 3A)

5.1 The aerodrome data is of particular importance as it shows where bird control measures may need to be taken. Again, several countries were able to provide data on Nationally registered Transport Aircraft movements at each aerodrome. The number of strikes would be expected to be high at, for example, Paris-Orly, which is a particularly busy airport.

5.2 In Table 3 the rate for Copenhagen relates to the strikes to, and movements by, aircraft registered in Denmark. It can be seen that of the airports where movement data is available some of the smaller Scandinavian airports have a high strike rate, and that of the major airports Basle, Belfast, Ronaldsway-Isle of Man and Glasgow appear to have a rate that is well above average.

5.3 The strikes reported by several different countries at one airport, and thus for which no movement data is available, are shown in Table 3A. The number of strikes will be very dependent on the movements made by European operators, and the number of strikes can only be used as a guide.

6 BIRDS (see Table 4)

It can be seen that of the 444 reports where there was identification of the bird species, 54% were gulls, (1973 - 53%, 1972 - 58%). The most commonly reported sort of gull was the Black-headed Gull (Larus ridibundus). The next largest total were Lapwings (Vanellus Vanellus) and Swallows (Hirundo rustica), with 7.9%. Only 2 strikes were known to involve birds of over 1.8 kg (4 lb) in weight.

7 MONTH OF THE YEAR (see Table 5)

As data on aircraft movements in each month is only available from two countries, it has been assumed that these are typical of the whole of Europe, in order to calculate a comparative strike rate. The months with the worst strike rates are October and September.

8 TIME OF DAY (see Table 5A)

The data provided for this year shows that only 71% of strikes occurred during the day, when most of the aircraft movements take place, and when the majority of birds are active. However 18.5% (1973 - 12%, 1972 - 20%) of the strikes were at night when the number of aircraft movements are comparatively low. The short periods of "dawn" and "dusk" also account for a significant percentage of strikes. Unfortunately, in very few of the incidents at night were the birds identified, and further investigation of night time strikes should be made, with particular emphasis on identification of remains, feathers, etc.

9 AIRSPEED

Since only 6.7% (1973 - 3.7%) of strikes occurred at speeds up to 80 knots, it could be concluded that at low speed the birds generally are successful in avoiding the aircraft. Between 80 and 100 knots a further 16.7% (1973 - 13.6%) of strikes occurred, which tends to support the above conclusion. Only a small proportion (2.8%) of strikes occurred at high speed, mainly because the aircraft are above the altitude at which birds are common. These percentages may well be affected by the amount of time that the aircraft spends in each speed band.

10 ALTITUDE (see Table 6A)

Overall 75% of the strikes were recorded as being between 0 and 200 ft., with 9.5% between 201 and 800 ft. However 8.9% occurred at altitudes above 2500 ft., where, unfortunately the bird species is seldom identified. The percentages are virtually identical to those of the 1972 and 1973 Reports.

11 FLIGHT STAGE (see Table 7)

The take-off accounted for a slightly higher percentage of strikes than the landing (36.3% as against 36%), but 16% were recorded during the final approach. It should be noted that during the Climb, Cruise and Descent 9.2% of the strikes were recorded, the phases when speeds are high. The percentages are again very close to those of the 1972 and 1973 Reports.

12 PART OF AIRCRAFT STRUCK (see Table 8)

The nose section, including the radome received 34.2% of strikes (1973 - 32%), of which the radome received 6.0% (1973 - 9.3%). Engines received 18.2% (1973 - 18.4%), and windscreens 13.7% (1973 - 16%). In 1974 there were only 4 incidents which affected more than one engine, compared with 10 in 1973 (1973 - 1.6% of incidents).

13 EFFECT OF STRIKE (see Table 9)

13.1 One of the most notable aspects is that a total of 37 engines were changed (30 in 1973), 13 of the cases were on twin-engined aeroplanes. There were also 29 cases of damage necessitating repairs to fans/rotor/propellers. Paper BSCE/11-WO/3 gives more detailed analysis of selected engine strikes.

13.2 A total of 10 windscreens were changed (1973-2), out of the 160 strikes on windscreens. There were 12 cases of radome change (14 in 1973) out of the 70 cases where the radome was struck.

14 EFFECT versus AIRSPEED versus WEIGHT OF BIRD (see Table 9A)

The number of cases where damage is caused and the airspeed and bird weight are known, are comparatively few. However from the limited information so far available it appears that the greatest risk of damage lies in the 101-150 knot range, from birds of weight up to 1.8 kg (4 lb). Continued collection of data will provide a better sample.

15 COST (see Table 10)

Only four countries were able to provide information on cost, 25 incidents costing a total of 803,000 US dollars. If the cost from these four countries (218 strikes) is related to the 1146 strikes covered in this report, the total cost for this one year is in excess of 4 million US Dollars.

16 AIRCRAFT OPERATORS (see Table 11)

This table provides a guide to the airlines which either suffers the worst strike rate, or has the best reporting standard. It is probable that it is considerably affected by the airport(s) at which the airline has its main base.

17 CONCLUSIONS

17.1 The overall rate for the nine European countries which have provided information is 4.1 per 10,000 movements. This is slightly worse than 1973 (3.52). The Netherlands again has the highest rate, or possibly the best standard of reporting with a rate of 9.2

17.2 There does not appear, on the available data, to be any correlation between the strike rate and the aeroplane type. The strike rate for the group comprising wide bodied aeroplanes, on the evidence of this year, does appear to be above average.

17.3 Of the major airports where movement data was available Basle, Belfast, Ronaldsway and Glasgow have markedly above average strike rates.

17.4 Gulls were struck more frequently than other species, being involved in 54% of the incidents. Only two incidents involved birds of greater than 1.8 kg (4 lb).

17.5 The month with the highest strike rate, and number of strikes was October.

17.6 Although the majority of strikes occurred during daylight, 18.5% (similar to previous years) occurred at night, when the number of aircraft movements is very low.

17.7 As 93% of strikes occurred above 80 knots, it appears that up to that speed there is a very good chance that birds can successfully avoid aircraft.

17.8 A total of 84.5% of the strikes were recorded below 800 ft., however, 8.9% were above 2,500 ft. where speeds tend to be much higher.

17.9 The final approach and landing, as in the previous reports, accounted for the same percentage of strikes as the take-off.

17.10 The nose section and radome were struck in 34% of the incidents, whilst engines accounted for 18.4%.

17.11 The major effect on the aeroplane is that one in six radome strikes necessitated a radome change (1 in 4 in 1973). There were a total of 37 engine changes and 29 cases of fan repairs.

17.12 Based on the information provided by four countries, the estimated total cost of bird strikes to European airlines was approximately £ 4 million for 1974.

17.13 The percentages in certain aspects of the investigation have been consistently the same for each of the three annual reports. The aspects concerned are Month of the Year, Time of Day, Airspeed, Altitude, and Flight Stage.

18 PROPOSED ACTIONS

18.1 That those European countries which did not provide analysis using the BSCE tabulations should again be requested to provide the information. The countries concerned are Austria, Belgium (expected for 1975), Germany, Italy, Portugal and Spain.

18.2 That the Authorities responsible for airports with above average strike rates should be made aware and requested to investigate and take appropriate action.

18.3 That investigation of those aspects for which the answers are now known, i.e. Month, Time of Day, Airspeed, Altitude and Flight Stage, should be deleted from the BSCE analysis in order to concentrate attention on those areas where further information is needed.

18.4 That Analysis of:-
Aircraft Type
Aerodrome
Bird Species
Part Struck
Effect of Strike
Effect versus Airspeed versus Weight of Bird
Cost
should be continued.

18.5 That the use of Landing and High Intensity Anti-Collision Lights be investigated.

18.6 That greater emphasis should be placed on the need for identification of bird remains recovered from aircraft.

BIRD STRIKE ANALYSIS

EUROPEAN OPERATORS 1974

CIVIL AIRCRAFT OVER 5700 KG. (12,500 LB.) MAXIMUM WEIGHT

Notes: 0.1 The following are NOT included in this Analysis:
(a) aircraft of maximum weight 5700 kg. (12,500 lb.) and under
(b) all military type and operated aircraft

0.2 All Tables are for strikes reported World-Wide, except for Table 5 and 5A which are for Europe only.

0.3 The **TOTAL** columns of many of the Tables are different, as some countries have not been able to provide full information for every Table.

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TABLE 1 - COUNTRY

Country	Number of Incidents	Number of Movements	Rate per 10,000 Movements
Denmark	46	175,950	2.6
Finland	7	129,800†	0.5
France*	62	354,270	1.75
Germany**	325	489,025†	6.60
Netherlands+	187	203,370	9.20
Norway	39	206,710	1.8
Sweden	58	223,800†	2.6
Switzerland++	52	182,940	2.8
United Kingdom	370	911,150	4.1
TOTAL	1146	2,877,000	4.1

Notes:- 1.1 There are two movements per flight

*1.2 Data from France does NOT include piston-engined aircraft

**1.3 Data from Germany used only in Tables 1, 2, 5 and 8

+1.4 From KLM airline only

†1.5 Approximate movement data from ICAO sources

++1.6 Data from Switzerland only includes jet aeroplanes

1.7 Movements Total does not correspond exactly to Table 2 Total, since in Table 1 some unspecified aircraft with stated movements but nil strikes have been included.

TABLE 2 - AIRCRAFT TYPE

Type	Aircraft	Number of Countries Reporting	No. of Strikes	No. of Movements	Strikes per 10,000 Movements
JET					
4 engined	Douglas DC8	6	95	100,724	9.48
	Boeing 747	7	37	73,840	5.0
	Boeing 707/720	5	88	184,290	4.8
	BAC VC 10	1	12	41,196	2.9
	Convair 990 Coronado	1	6	19,636	3.1
	HS Comet 4	1	3	19,450	1.5
3 engined	Boeing 727	4	134	275,570	4.9
	Douglas DC 10	5	32	46,948	6.8
	HS Trident	1	80	170,610	4.7
	L 1011 Tristar	2	4	3,696	10.8*
2 engined	A300 B Airbus	1	0	4,400	0
	Boeing 737	5	162	237,084	6.8
	Douglas DC9	6	152	453,170	3.3
	BAC 1-11	2	62	240,500	2.6
	Sud 210 Caravelle	6	40	241,520	1.7
	HS 125	1	3	11,660	2.6
	Jet Falcon	2	4	13,880	2.9
	Lear Jet	2	2	2,970	6.7*
	Dassault Mercure	1	2	2,180	9.2*
	Fokker F28 Fellowship	4	12	52,754	2.3
	Corvette	2	2	-	-
TURBOPROP					
4 engined	BAC Viscount	2	76	161,524	4.7
	BAC Vanguard/Merchantman	1	10	30,360	3.3
	BAC Britannia	1	1	5,000	2.0*
	HS Argosy	1	1	2,220	4.5*
	Canadair CL 44	1	0	7,720	0*
2 engined	Herald	1	22	56,090	3.9
	Fokker F27	4	15	88,972	1.7
	HS 748	2	3	32,710	0.9
	Short Skyvan	1	1	5,630	1.8*
	DH Twin Otter	1	1	76,290	0.1
	Nord 262	2	4	22,674	1.8
PISTON					
	ATL Carvair	1	2	15,550	1.3
	Convair 440	4	50	127,765	3.9
	Douglas DC3	1	1	12,790	0.8
	DH Heron	1	0	2,270	0*
UNKNOWN		1	25	-	-
HELICOPTERS					
	S 61N	-	2	-	-
	Bell 212	-	1	-	-
	Bell 47	-	1	-	-

TABLE 2A - SUMMARY OF AIRCRAFT TYPES

Jet	932	2,196,078	4.2
Turboprop	134	489,190	2.7
Piston	53	158,375	3.3
Helicopter	4	-	-
Unknown	23	-	-
TOTAL - Including those with NIL Strikes	1146	2,844,000	4.1

Notes:- 2.1 There are two movements per flight.
*2.2 Rates for types with less than 10,000 movements are included in the Table, but are subject to some error.
2.3 Rates for aircraft types where ICAO data has been used are only approximate (ICAO data on Charter Operators is not comprehensive).

TABLE 3 - AIRFIELD - EUROPEAN DATA 1974

AIRFIELD	INCIDENTS TO NATIONAL REGISTERED AIRCRAFT	MOVEMENTS OF NATIONAL REGISTERED AIRCRAFT	STRIKES PER 10,000 MOVEMENTS
DOMESTIC - Strikes reported by the airlines of the individual country, related to the movements by those airlines.			
Denmark			
Copenhagen, Kastrup	11	71,635	1.5
Arlborg	2	2,430	8.2*
Esbjerg	3	2,781	10.8*
Rønne	2	1,464	13.7*
Sønderborg	2	3,500	5.7*
Tirstrup	2	2,233	9.0*
France			
Paris, Orly	7	211,000	0.3
Paris, Le Bourget	2	100,000	0.2
Nice	5	45,000	1.1
Lyon-Bron	5	103,000	0.5
Marseilles	3	65,000	0.5
Saint Yan	2	94,000	0.2
Bordeaux	2	67,000	0.3
Norway			
Oslo, Fornebu	3	76,310	0.4
Kristiansand	2	21,435	0.9
Lista	2	1,624	12.3*
Bergen	6	31,668	1.9
Trondheim	3	39,181	0.8
Tromso	2	15,333	1.3
Switzerland			
Zurich	5	51,888	1.0
Basle	9	9,775	9.2
Geneva	5	31,949	1.6
U.K.			
Belfast	37	22,700	16.3
Blackpool	9	6,100	14.7 *
Ronaldsway, Isle of Man	15	13,100	11.4
Glasgow	30	37,400	8.0
Birmingham	13	19,450	6.7
East Midlands	8	13,800	5.8
Luton	11	20,850	5.3
Liverpool	8	14,400	5.5
Teeside	4	7,700	5.2*
Prestwick	14	27,450	5.1 *
Bristol Lulsgate	3	6,050	4.9 *
Newcastle	6	12,200	4.9
London Stansted	9	18,600	4.8
Glamorgan/Rhoose	4	9,150	4.4 *

See next page for footnote to this Table.

TABLE 3A

U.K. (cont.)			
Edinburgh	9	23,050	3.9
Southend	3	11,750	2.5
London Heathrow	35	140,800	2.4
Aberdeen	4	20,500	1.9
London Gatwick	11	62,850	1.7
Manchester	6	35,200	1.7
Wick	2	-	-
Kirkwall	2	-	-
Exeter	2	-	-

FOREIGN - Alphabetical list of airfields where more than one strike has been reported by European countries, and where the movements are not known.

Anchorage (US)	2	Kuopio (Finland)	3
Amsterdam (Netherl.)	74	London-Heathrow (UK)	11
Alicante (Spain)	2	Le Touquet (France)	3
Angelholm (Sweden)	3	Lisbon (Portugal)	3
Aalborg (Denmark)	3	Malaga (Spain)	4
Banjul (Gambia)	4	Monastir (Tunisia)	2
Beirut (Lebanon)	3	Munich (Germany)	3
Barcelona (Spain)	2	Manila (Phillipines)	2
Brussels (Belgium)	6	Milan-Linate (Italy)	2
Berlin-Temp (Germany)	3	New York-JFK (US)	7
Copenhagen (Denmark)	16	Nairobi (Kenya)	2
Colombo (Sri Lanka)	2	Nice (France)	2
Calcutta (India)	3	Norrkoping (Sweden)	3
Curacao (Antilles)	2	Ostend (Belgium)	2
Dusseldorf (Germany)	5	Palma (Spain)	4
Dakar (Senegal)	6	Paris-Le Bourget (France)	5
Dublin (Eire)	3	Port of Spain (Trinidad)	2
Delhi (India)	3	Paris-Orly (France)	3
Esbjerg (Denmark)	2	Rome-Leonardo (Italy)	3
Entebbe (Uganda)	2	Rotterdam (Netherl.)	4
Frankfurt (Germany)	2	Rome-Fuman (Italy)	3
Freetown (Sierra Leone)	2	Stockholm-Bromma (Sweden)	4
Gottenburg (Sweden)	2	Stockholm-Arl (Sweden)	3
Glasgow (UK)	3	Sundsvall (Sweden)	3
Groningen (Netherl.)	3	Tel Aviv (Israel)	2
Guernsey (UK)	3	Tunis (Tunisia)	2
Halmstad (Sweden)	2	Umea (Sweden)	2
Hamburg (Germany)	4	Venice (Italy)	3
Helsinki (Finland)	5	Visby (Sweden)	3
Istanbul (Turkey)	6	Zurich (Switzerland)	5
Jonkoping (Sweden)	2	Zagreb (Yugoslavia)	2
Jersey (UK)	5		

Other airfields with single strikes	114
En-route	23
Unknown	63
TOTAL	816

Notes: *3.1 Rates for airfields with less than 10,000 movements are included in the Table, but are subject to some error.

3.2 Some airfields appear twice, first - where the strikes are related to movements, and second - where the reports are by several different countries and cannot be related to movements.

3.3 Does not include German data.

ENGLISH NAME	SCIENTIFIC NAME	APPROX. WEIGHT	CATEGORY	NUMBER OF STRIKES	% BASED ON 444
'Gull'	Larus sp.	300g-) 1.8Kg)	B	199	-
Black-headed Gull	Larus ridibundus	300g	B	22	-
Herring Gull	Larus argentatus	1.1Kg	B	12	-
Common Gull	Larus canus	450g	B	6	-
TOTAL GULLS	-	-		239	53.8
Lapwing	Vanellus vanellus	250g	B	56	12.6
Swallow	Hirundo rustica	15g	A	35	7.9
Pigeon	Columba sp.	450g	B	26	5.8
"Sparrow"	Small - Passeriformes	18-40g	A	16	3.6
Birds of Prey	Falconiformes	up to 800g	B	8	1.8
Rook/Crow	Corvus spp.	400- 550g	B	8	1.8
Kestrel	Falco tinnunculus	200	B	6	1.5
Swift	Apus apus	30g	A	4	0.9
Oystercatcher	Haematopus ostralegus	550g	B	3	0.7
Heron	Ardea sp.	up to 1.8 kg	B	3	0.7
Large unknown birds	-	-	C	3	-
Tern	Sterna sp.	40-240g	B	3	0.7
Starling	Sturnus vulgaris	85g	A	2	-
Sparrowhawk	Accipter nisus	200g	B	2	-
Hawk	-	assumed	B	2	-
Pheasant	Phasianus colchicus	1.2Kg	B	2	-
Barn Owl	Tyto alba	200g	B	2	-
Black Kite	Milvus migrans	1Kg	B	2	-
Buzzard	Buteo sp.	800g	B	2	-
Sandpiper	Fam. Scolopacidae	20-300g	B	1	-
Curlew	Numenius arquata	800g	B	1	-
Vulture	-	assumed	C	1	-
Owl	O. Strigiformes	170-) 380g)	B	1	-
Kite	Milvus sp.	1 Kg	B	1	-
Golden Plover	Pluvialis apricaria	200g	B	2	0.7
Ringed Plover	Charadrius hiaticula	50-60g	A	1	-
Thrush	Turdus sp.	60-120g	A	1	-
Redstart	Phoenicurus ph.	12g	A	1	-
Skylark	Alauda arvensis	40g	A	1	-
Snow Bunting	Plectrophenax nivalis	35g	A	1	-
Wheatear	Oenanthe oenanthe	24g	A	1	-
Sand Martin	Riparia riparia	15g	A	1	-
Redpol	Acanthis flammea	14g	A	1	-
Stork	Ciconiiformes	up to 3 kg	C	1	-
Jackdaw	Corvus monedula	230g	B	1	-
Tawny Owl	Strix aluco	400g	B	1	-
Wigeon	Anas penelope	900g	B	1	-
Egret	Ciconiiformes	-	B	1	-
White Crow	Corvus albus	500g	B	1	-
Unknown	-	-	-	373	-
TOTAL	-	-	-	818	-

Notes: 4.1 Bird weights and Latin names are based on Canadian Field Note No. 51 by G. Kaiser, unless there is positive evidence to the contrary, the AVERAGE weight is assumed.

4.2 The Bird Categories based on current Civil Airworthiness requirements are:

CAT A - below 110g (¼ lb.)
CAT B - 110 to 1.81 Kg. (¼ lb. to 4 lb.) i.e. includes all "gulls"
CAT C - Over 1.81 Kg. to 3.63 Kg. (4 lb. to 8 lb.)
CAT D - Over 3.63 Kg. (8 lb.)

4.3 Those birds not positively identified are tabled as Unknown.

4.4 Percentages are based on incidents where birds are identified.

TABLE 5 MONTH OF YEAR

MONTH	WEIGHT* UNKNOWN	CAT A and CAT B	CAT C and CAT D	TOTAL	NUMBER OF MOVEMENTS (UK & Switz.)	COMPARATIVE RATE
January	19	18	-	37	48,200	.37
February	11	15	-	26	44,900	.28
March	50	17	-	67	52,100	.61
April	32	12	-	44	58,800	.36
May	27	15	-	42	62,600	.32
June	37	33	-	70	68,300	.48
July	45	34	-	79	71,300	.52
August	38	52	1	91	71,000	.61
September	58	56	-	114	67,800	.80
October	87	37	-	124	58,900	1.00
November	30	33	1	64	48,400	.63
December	29	14	-	43	49,100	.41
Month Unknown	6	11	-	17	-	-
TOTAL	469	347	2	818	-	-

TABLE 5A TIME OF DAY

TIME	WEIGHT UNKNOWN	CAT A and CAT B	CAT C and CAT D	TOTAL	% BASED ON 367
Dawn	1	19	1	21	5.7
Day	51	209	1	261	71.1
Dusk	1	16	-	17	4.6
Night	36	32	-	68	18.5
Unknown	6	7	-	13	-
TOTAL	95	283	2	380	-

Notes:- 5.1 Restricted to strikes reported in Europe.
5.2 Table 5 includes data from Germany.
5.3 Table 5A does not include data from Germany, Sweden and Netherlands.
5.4 In the absence of Movement data from all countries, the Movement data from Switzerland and UK has been used to produce a comparative rate.
5.5 Percentages are based on known totals.

TABLE 6 AIRSPEED

AIRSPEED (kts IAS)	WEIGHT UNKNOWN	CAT A	CAT B	CAT C & D	TOTAL	% BASED ON 432
0 - 80	4	2	23	-	29	6.7
81 - 100	9	6	56	1	72	16.7
101 - 150	63	37	143	2	245	56.7
151 - 200	25	10	15	1	51	11.8
201 - 250	17	1	5	-	23	5.3
Over 250	10	-	1	1	12	2.8
Airspeed Unknown	72	9	118	2	201	-
TOTAL	200	65	361	7	633	-

TABLE 6A ALTITUDE

ALTITUDE (ft)	WEIGHT UNKNOWN	CAT A	CAT B	CAT C & D	TOTAL	% BASED ON 560
0 - 200	93	45	278	3	419	74.8
201 - 800	23	11	19	-	53	9.5
801 - 2500	20	2	16	-	38	6.8
Over 2500	35	4	9	2	50	8.9
Altitude Unknown	29	3	39	2	73	-
TOTAL	200	65	361	7	633	-

Notes:-

6.1 When the Altitude is not specifically stated, but the Flight Stage is quoted as take-off or landing the 0 to 200 ft division is assumed.

6.2 Birds found dead on the runway are included in the 0 to 200 ft division.

6.3 The percentages are based on the known totals.

6.4 These Tables do not include data from Netherlands and Germany.

TABLE 7 FLIGHT STAGE

STAGE	WEIGHT UNKNOWN	CAT A	CAT B	CAT C & D	TOTAL	% BASED ON 664
Taxying	1	0	3	0	4	0.6
Take-off	49	21	131	2	241	36.3
Initial climb	6	0	4	0	10	1.5
Climb	18	3	6	1	30	4.5
Cruise	11	2	5	0	19	2.9
Holding	0	1	0	0	1	0.1
Descent	10	0	1	1	12	1.8
Final Approach	42	6	38	0	103	15.5
Landing	31	25	196	0	239	36.0
Touch & Go/ Overshoot	1	1	3	0	5	0.7
Unknown	27	5	37	2	153	-
TOTAL	196	64	424	6	817	-

Notes:-

7.1 It is not possible to provide a precise definition of these stages as the altitudes vary with aircraft type, and particular operation.

7.2 Birds found dead on the runway are divided equally between take-off and landing.

7.3 The percentages are based on the total where the stage is known.

7.4 Does not include data from Germany.

TABLE 8 PART OF AIRCRAFT STRUCK

PART	WEIGHT* UNKNOWN	CAT A	CAT B	CAT C & D	TOTAL	% BASED ON 1168
Fuselage	73	9	40	-	122	10.4
Nose (excluding radome and windscreen)	229	19	82	-	330	28.2
Radome	41	13	14	2	70	6.0
Windscreen	103	17	40	-	160	13.7
Engine number unknown	93	-	-	-	93	18.4
1 engine struck	40	1	72	3	116	
2 out of 3 struck	0	-	2	-	2	
2 or more of 4 struck	2	-	-	-	2	
all engines struck	-	-	2	-	2	
Wing	136	2	60	-	198	16.9
Landing Gear	25	1	36	1	63	5.4
Empennage	11	-	3	-	14	1.2
Part unknown	73	10	87	-	170	-
TOTAL	826	72	438	6	1342	-

Notes:-

8.1 The totals in Table 8 are higher than the others, as one bird can strike several parts.

8.2 The percentages are based on incidents where the part struck is known.

8.3 Where both landing gear, or both wings are struck, two incidents are recorded.

*8.4 The data from Germany and Netherlands for which the weights are not known, are included.

TABLE 9 EFFECT OF STRIKE

EFFECT	WEIGHT UNKNOWN	CAT A	CAT B	CAT C	CAT D	TOTAL	% BASED ON 755
Loss of life/aircraft	0	0	0	0	0	0	0
Flight Crew Injured	0	0	0	0	0	0	0
Engines prematurely Changed on:-							
2 engined aircraft	3	-	9	1	-	13	1.7
others	17	-	7	-	-	24	3.2
Windscreen cracked or broken	5	-	5	-	-	10	1.3
Radome changed	9	-	3	-	-	12	1.6
Deformed structure	9	-	5	2	-	16	2.1
Skin torn, light broken	8	1	4	-	-	13	1.7
Skin dented	10	1	20	-	-	31	4.1
Propeller/Rotor damaged/Fan	21	-	8	-	-	29	3.8
Aircraft system lost	2	-	4	-	-	6	0.8
Nil damage	301	61	237	2	-	601	79.6
Unknown	27	24	69	-	-	120	-
TOTAL	412	87	371	5	-	875	-

TABLE 9A EFFECT - AIRSPEED - WEIGHT OF BIRD

EFFECT	AIRSPEED / WEIGHT	0-80		81-100		101-150		151-200		201-250		over 250	
		A&B	C&D	A&B	C&D	A&B	C&D	A&B	C&D	A&B	C&D	A&B	C&D
Loss of Life/Aircraft													
Flight Crew Injured													
Engines Prematurely Changed on:-													
2 engines aircraft				1		5	1						
other aircraft				1		5							
Windscreen Cracked/ Broken				1	1	2				1			
Radome Changed						1		1					
Deformed Structure						2		1					
Skin Torn						3							
Skin Dented				3		13	1					1	
Propeller/Rotor Damaged				1		5							
TOTAL				7	1	36	2	2		1		1	

Notes:- 9.1 Data from Germany is only included for engines and fans in Table 9.

9.2 If, for example, skin is torn in two places, or both windscreens are broken, two incidents are recorded.

9.3 The TOTALS of Table 9A are very low as it includes only damaging strikes where bird weight and airspeed are known.

TABLE 10 COST - FRANCE, DENMARK, SWEDEN AND SWITZERLAND ONLY

TYPE OF STRIKE	INCIDENTS	TOTAL COST (US DOLLARS)
Where cost is known	25	803,000
Where cost is known to be NIL	102	0
AVERAGE COST		$ 6,322

Notes:-

10.1 The cost includes the following:-

(a) Engineering rectification costs.

(b) Loss of revenue.

(c) Incidental costs, i.e. diverted aircraft, passenger accommodation etc.

10.2 The engineering rectification cost on ENGINES is offset by the hours remaining before overhaul.

TABLE 11 AIRCRAFT OPERATOR REPORTING STRIKES

OPERATOR	NUMBER OF STRIKES	NUMBER OF MOVEMENTS	STRIKES PER 10,000 MOVEMENTS
DENMARK			
Cimber Air	2	9,360	2.1*
Conair	3	7,012	4.3*
Maersk Air	3	23,486	1.3
SAS	27	85,486	3.2
Sterling Airways	9	47,150	1.9
Others	2	1,966	10.2*
FINLAND			
Finnair	6	-	-
Helicopter Service	1	-	-
FRANCE			
Air France	25	301,660	0.8
Air Inter	22	95,325	2.3
UTA	3	15,474	1.9
Air Ceylon/Afrique	4	21,263	1.9
Air Alpes	1	24,000	0.4
TAT	1	17,000	0.6
Uni Air	1	3,902	2.6*
Euralair	1	-	-
EFS	1	6,765	1.5*
Service de la Formation Aeronautique	3	-	-
NORWAY			
SAS	26	85,500	3.0
Braathen Safe	9	65,604	1.4
Helicopter Service	3	51,842	0.6
Widerøe	1	76,294	0.1
SWEDEN			
SAS	25	-	-
Linjeflyg	30	-	-
Transair AB	2	-	-
SWITZERLAND			
Swissair	52	182,942	2.8
UK			
British Airways European) Scottish & Channel Divs)	141	-	-
British Airways Overseas	50	-	-
British Caledonian	30	-	-
British Island Airways	21	-	-
Dan Air	7	-	-
Laker	8	-	-
Britannia Airways	18	-	-
Cambrian	21	-	-
Court Line	8	-	-
Monarch	4	-	-
MAM	1	-	-
McAlpine	2	-	-
British Midland	9	-	-
British Air Ferries	2	-	-
International Av Services	1	-	-
Air Anglia	4	-	-
British Airtours	3	-	-
Invicta	1	-	-
Air Bridge Carriers	1	-	-
North East	14	-	-
TOTAL	906	-	-

NOTES:- 11.1 The movements of operators who did not report any strikes are not included.

11.2 Leased aircraft are included against the operator.

SERIOUS BIRD STRIKE INCIDENTS WORLD WIDE 1974

6.10.74	Douglas DC10-30CF	PH-MBG	Martinair	Amsterdam

During night take-off from Amsterdam using full power from runway wet with light rain, birds were struck at approx 140 knots. After rotation but before gear-up vibration felt and flight engineer stated "maximum vibration engines 2 and 3" and that engine 3 N_1 rpm had touched 114%. Thrust was decreased on engine 3 but vibration remained at maximum and engine was shut-down. During shut-down Tower reported seeing flames, there was no fire warning but one extinguisher shot was used. Vibration decreased, and at 2,000 ft aircraft was cleaned up. Increasing power to maintain 277 knots caused vibration to increase and engine 2 vibration reached maximum at 76% N_1. Fuel jettisoned for return to airport at max landing weight of 191 tons, but last part of tank 2 took too long so landing at 198 tons was prepared. Made radar monitored ILS approach with 2 engined procedure. During the initial approach with flaps 22°, power on engine 2 had to be increased to MCT in order to keep flying level. On the glide path engine 2 kept at 75% N_1, with varied power on engine 1. Automatic approach down to 100 ft, landing normal with minimum descent at touchdown, reverse idle on engine 1 and 2. Approx 20 dead gulls found on runway, the only complete gull weighed 450 gm (1 lb). The core of engine 3 showed blade rub on compressor stages 2, 3, 4 and each stage had a few blades with nicks or a curled tip. Damage was only slight and operationally insignificant. The core of engine 2 was not damaged, but fan debris caused dents and punctures of inlet duct, and bellmouth seal was pierced near fan speed sensor. No debris passed outside engine cowls.

25.9.74	Lear Jet 24D	Business Air Service	Västerås

During early morning take-off struck gulls at 135 kts, 30 ft, both engines were damaged such as to be unserviceable.

12.12.74	SN 601 Corvette	Air Alpes	Chambéry

During take-off struck jackdaws (Corvus monedula) at 50 ft, 120 kts. Both engines were damaged and both pitot tubes required replacement (total cost of incident 60,000 US dollars).