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ANALYSIS OF BIRD STRIKES REPORTED BY EUROPEAN AIRLINES 1981-1985

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SUMMARY

Birdstrikes reported world-wide between 1981 and 1985 by European airlines from 12 countries have been analysed. The analysis of over 7[illegible] strikes includes the annual strike rate for countries, aircraft types, airports, all based on aircraft movements. It also covers bird species, weights and damage, part of the aircraft struck and the effect of the strike.

The Paper shows the overall strike rate was 5.7. per 10,000 movements, slightly higher than previously. Gulls were involved in 40% of incidents where the type of bird was known, slightly lower than before. Only 1.1% of bird strikes involved birds over 1.8 kg (4 lb). About 1.3% of incidents resulted in multiple engine strikes i.e. about 1 in every 75,000 flights. There were no deaths, injuries or aircraft losses but 488 engines were damaged. There was insufficient data to produce meaningful information on the cost of bird strikes.

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This study is based upon information supplied and the accuracy and detail are only as good as that reported. This Paper is the work of an individual author and may not reflect the final views of the UK Civil Aviation Authority.

1. INTRODUCTION

In order that a common basis for the analysis of bird strike data could be agreed, a Working Group of Bird Strike Committee Europe was formed in 1972, led by a representative for the United Kingdom Civil Aviation authority Safety Regulation Group at Gatwick. Papers covering the individual years 1972 to 1985 inclusive have been presented to BSCE meetings and a series of 5-year papers have been published. A paper using data from 1972 to 1975 which was presented at the Third World Conference on Bird Hazards in Paris, October 1977 was later published as CAA Paper No 77008. It included aspects which are consistent from year to year and do not need to be repeated in this paper, eg month of year, time of day, airspeed, altitude and flight stage. A paper covering the years 1976 to 1980 was published as CAA Paper No 84019. This paper covers the years 1981 to 1985.

1.2 Appendix 1 contains Tables of data relating to this paper.

1.3 Appendix 2 provides brief details of world-wide bird strike incidents resulting in loss of life/crash of transport aircraft and executive jets, from 1960 to 1989.

2. SCOPE

For the following reasons, the analysis only includes civil aircraft of over 5700 kg (12,500 lb) maximum weight, and executive jets which weigh just less than 5700 kg , eg Lear and Citation:

- the airworthiness requirements relating to bird strikes are different for the smaller general aviation class of aeroplanes,
- much more is known about the reporting standards of operators of transport types, and the movement data is more readily available than that of air taxi or private owner aircraft,
- aircraft of less than 5700 kg are in general, much slower with a different mode of operation, requiring less airspace, and a noticeably different strike rate would be expected.

3. DISCUSSION

3.1 Annual Rate / Country (See Table 1)

a) Information has been obtained from 14 European countries of which 8 have been able to provide full information every year. Some countries have not been able to provide data for every Table, so the totals from Table to Table may not be consistent.

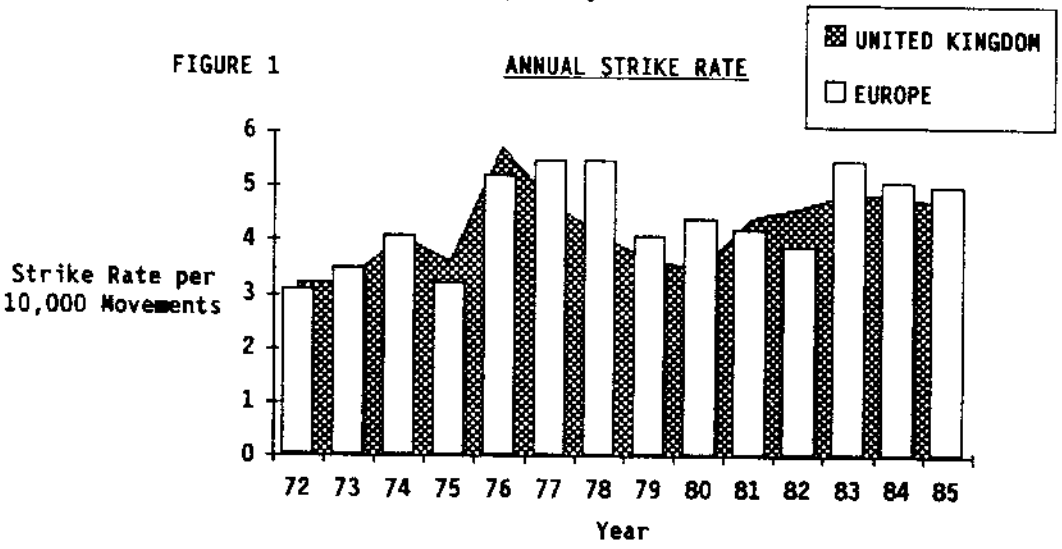
b) The strike rate reported by each country is significantly influenced by two major factors:-

- reporting standard
- the bird strike problem at airports within that country and that country's airlines route structure.

c) The overall strike rate for the 7544 incidents (and 15 million aircraft movements) contained in the analysis is 5.7 per 10,000 movements (two movements per flight). This is somewhat higher than the rate of 4.7 recorded in the previous 5 year period (3.5 between 1972 and 1975). This is in spite of the fact that two of the most efficient reporting countries Germany and Switzerland have only been partially included; thus a lower rate could have been expected. It therefore indicates either an improved overall reporting standard or a general upward trend in bird strikes.

d) **FIGURE 1** shows the annual strike rate for each year for the past 14 years. The UK data (which comprises about 30% of the European data) is shown for comparative purposes. There appears to be a general upward trend, which could have been influenced by improved reporting standards.

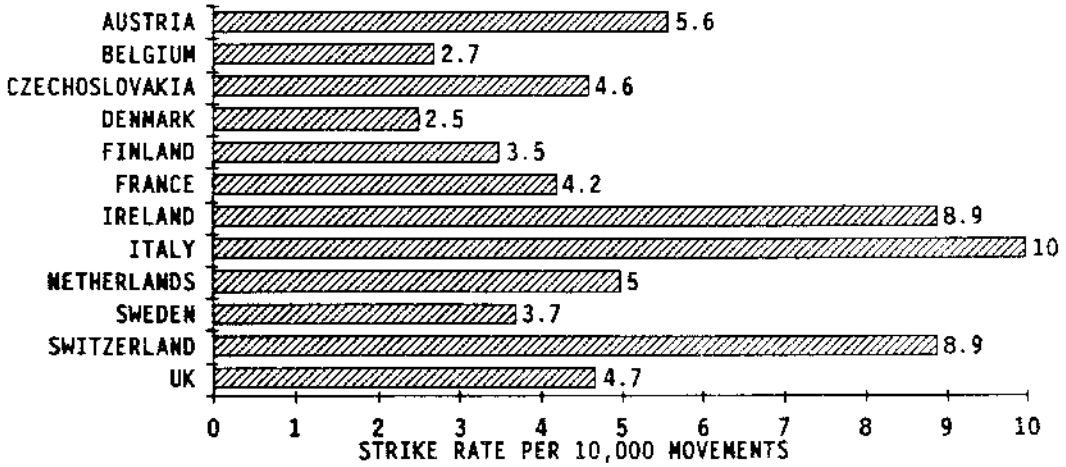
FIGURE 1 ANNUAL STRIKE RATE



e) **FIGURE 2** shows the rate for each reporting country, some have only presented a limited amount of data. Although each country is reporting strikes world-wide, a high proportion of its aircraft movements are within its own country and its record will thus be influenced by its own countries' bird-strike problem.

f) There is considerable variation in the rate of damage from country to country, these at least are likely to be consistently reported by each country, and about one in ten strikes cause damage. Thus countries which exhibit a damage rate significantly greater than one in ten, may not be reporting all of their non-damaging strikes.

FIGURE 2 STRIKE RATE BY REPORTING COUNTRY - 1981 to 1985



3.2 Aircraft Type (See Table 2)

a) Jet Aeroplanes

i) For several years there has been no consistent correlation between aircraft of similar design. **FIGURE 3** shows that aircraft which appear similar can have very different rates, for example the DC8 (used by eight countries) has a rate of 9.0 compared with the B707 (used by 6 countries) which has a rate of 5.9. Similarly, the DC10 (used by 11 countries) rate is 10.0, much higher than the L1011 (used by only two countries) rate of 5.8. It therefore appears that there is little meaningful correlation between individual aircraft type and strike rate. However, the strike rate for twin-engined, three engined and four engined does follow a logical progression based on frontal area.The group of aircraft which are wide-bodied, have a considerably higher strike rate than the group of narrow bodied aircraft.

FIGURE 3

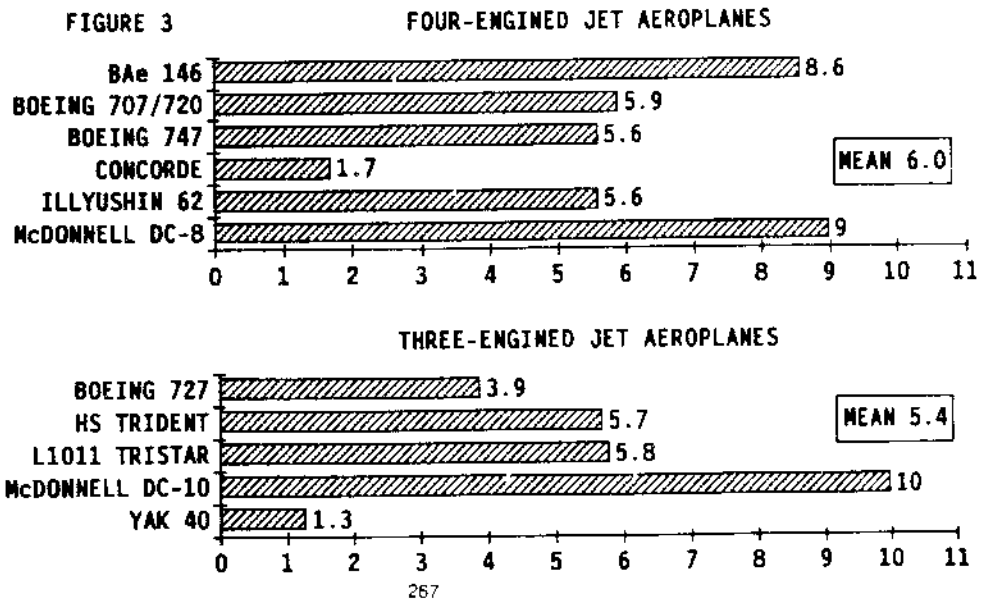
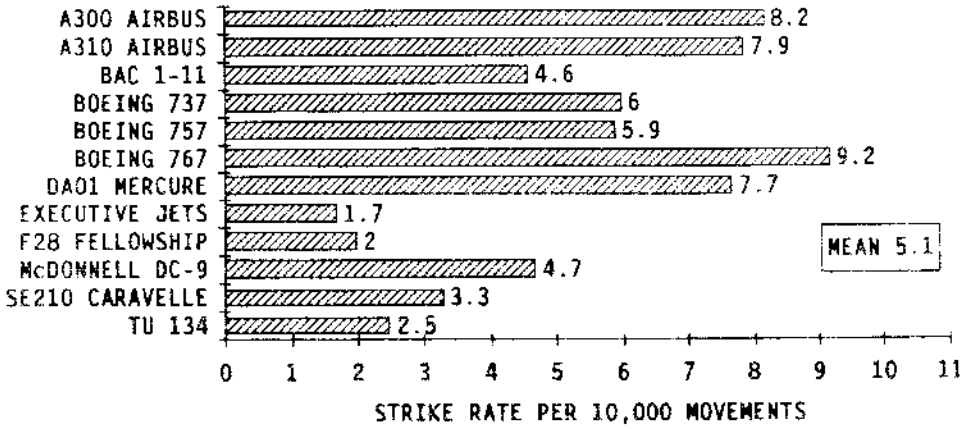


FIGURE 3 Cont'd TWIN-ENGINED JET AEROPLANES



ii) **Table 2** shows that there is considerable variation in the damage rate for each aircraft type, factors such as frontal area, vulnerability and position of engines are likely to influence the results.

The DC10, A300, A310 and TU134 have damage rates that are greater than average, whilst the Trident (now out of service), BAC1-11, DC9, F28 and HS125 have below average rates. The latter are all rear engined aircraft and it demonstrates the protection from the most frequent type of engine damage that this layout provides.

b) Turboprop and Piston Aeroplanes

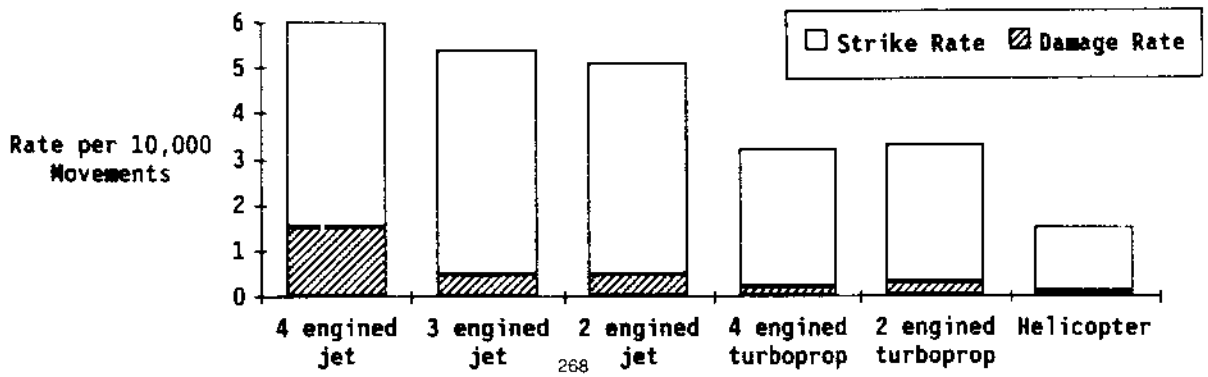
About 15% of movements are by turboprop aeroplanes, which have an overall strike rate of 3.5. The damage rate of 0.3 is lower than that for jets possibly because the operating speeds are lower. The number of piston engined aeroplanes in use is so small that they can be ignored.

c) Helicopters

Because helicopters mainly fly at low altitude where birds are most frequently found, they are continuously exposed to the risk of a strike, thus rates have been based on flying hours. The rate for the 500,000 hours is 1.5 per 10,000 hours. This low rate may be due to the comparatively low speed, high forward noise levels and protection provided by the main rotor. The damage rate at 0.1 per 10,000 hours is very low.

d) **FIGURE 4** summarises the strike rate and damage rate for each group of aircraft.

FIGURE 4 RATES FOR TYPES OF AIRCRAFT - 1981 to 1985



3.3 **Aerodromes** (See Table 3)

a) Aerodrome data is of particular importance as it may indicate where bird control measures need to be taken. Some countries were able to provide aerodrome movement data for their nationally registered aircraft, so that a national rate has been quoted. For others only the total number of strikes at each aerodrome, reported by all European sources is available in the absence of movement data.

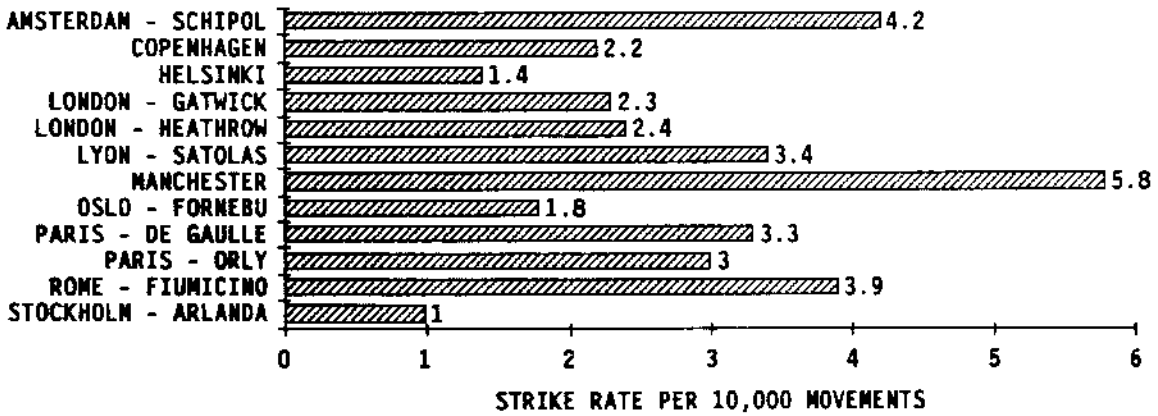
b) Strikes reported on aerodromes are influenced by one or more of the following:

- reporting standards,
- a large bird population, perhaps due to the aerodrome's geographic location,
- the number of aircraft movements,
- the effectiveness of bird control measures,
- a difficult problem in spite of use of correct bird scaring methods,
- local factors perhaps beyond the control of the aerodrome e.g a garbage dump or bird roost site in the vicinity.

Because of the factors listed above , direct comparison of the reported strike rates for different aerdromes could be misleading.

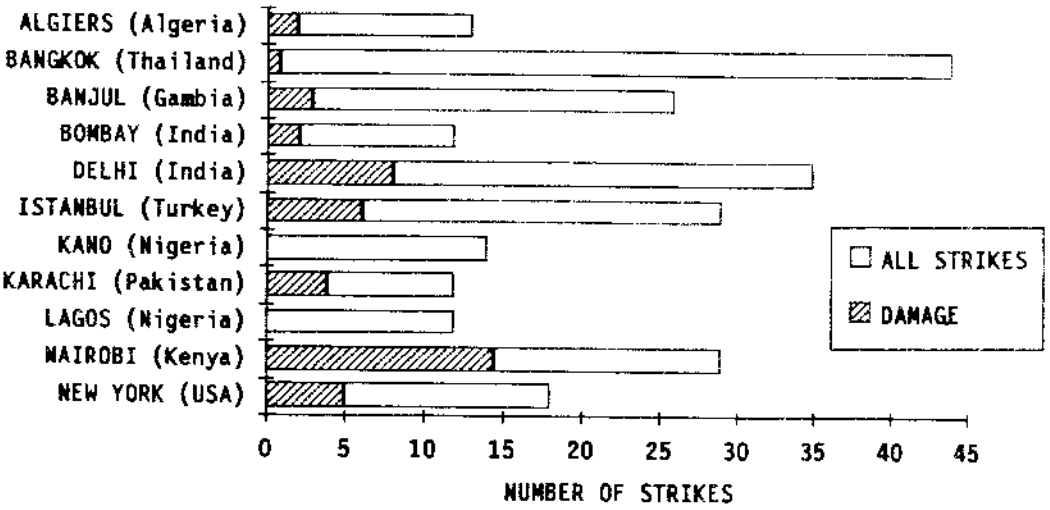
c) **FIGURE 5** shows, where available, the strike rate of each countries busiest airport. It is unfortunate that a number of countries were unable to provide movement data in order to calculate rates.

FIGURE 5 STRIKE RATE (NATIONAL AIRLINES) AT SELECTED MAJOR EUROPEAN AIRPORTS - 1981 to 1985



d) **FIGURE 6** shows the non-European airports with the highest total of strikes reported by European Operators. Some of these airports are extensively used by European airlines. There is considerable variation in the percentage of damaging strikes at each airport, Bangkok being very low and Nairobi being very high.

FIGURE 6 NON-EUROPEAN AIRPORTS, TOTAL STRIKES TO EUROPEAN AIRLINES - 1981 to 1985



e) A major problem has been defining what is meant by an airport bird strike. It has been agreed that up to 500ft in the climb and 200ft and below on the approach are ON an airport.

f) Strikes NEAR an airport are between 501 ft and 1500 ft on the climb and between 1000 ft and 201 ft on the approach. Table 4 contains the data collected for strikes near airports for the year 1985.

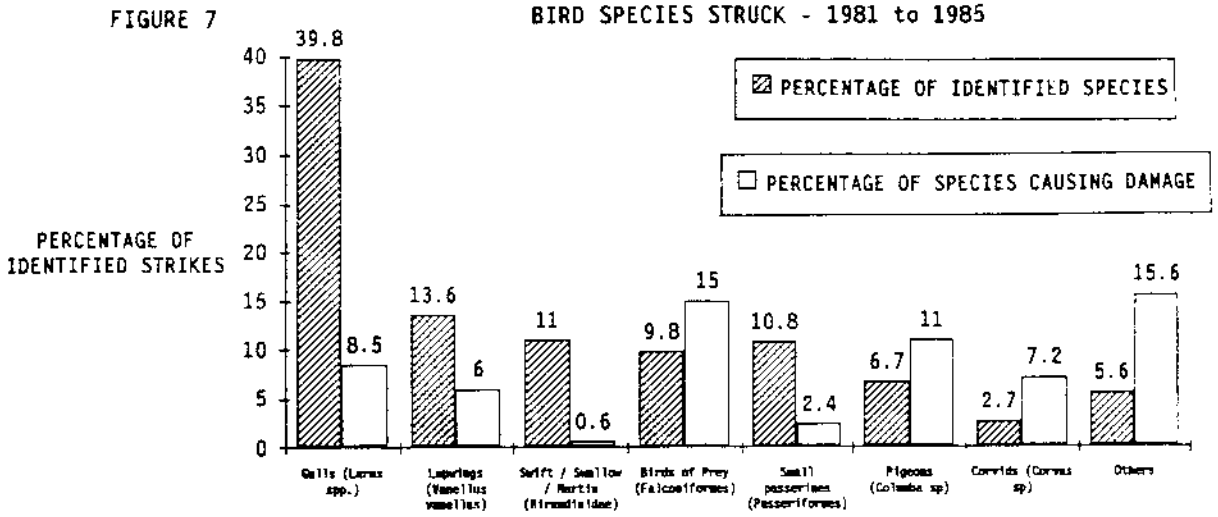
3.4 Birds (see Table 5)

a) Some knowledge of the bird species involved was available in 59% of incidents. The identification standard ranged from examination of bird remains by a trained ornithologist, to the fleeting glance of a pilot.

b) FIGURE 7 shows that Gulls (Larus spp) were involved in 40% of incidents where the birds have been identified. Of these the Black-headed gull comprised 7%. There has been a decrease in gull strikes from 53% to 41.5% in the previous 5 year period. This may indicate the increasing effectiveness of the well known measures for dealing with these birds. The next most frequently struck bird was the Lapwing (Vanellus vanellus) with 13.6%, followed by Swifts, Swallows and Martins at 11.4% and Pigeons at 6.7%. The decrease in Gull strikes from the previous period was offset by an increase in Birds of Prey and in Swifts, Swallows and Martins.

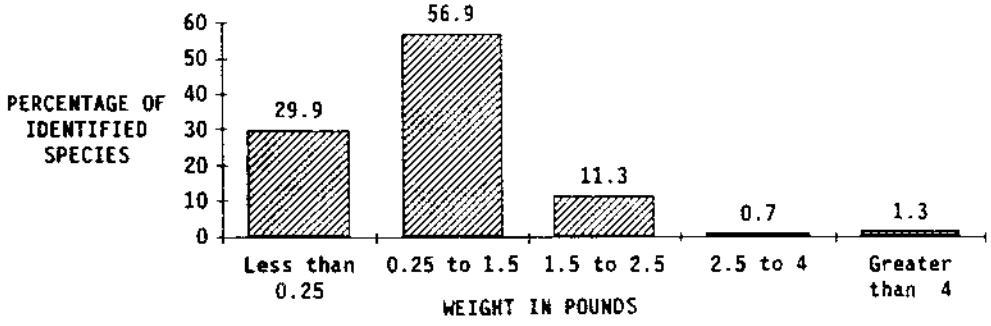
c) Birds of Prey, Pigeons and "other identified birds" are the most damaging as they cause the largest percentage of damage.

FIGURE 7 BIRD SPECIES STRUCK - 1981 to 1985



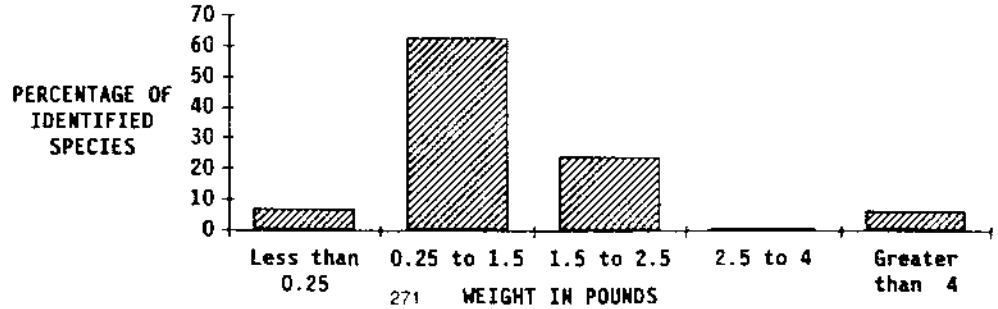
d) From an airworthiness point of view the breakdown of bird weights is a most important feature. Unfortunately Gulls span a weight range from 300 gm to 1.8 kg and fall into three weight categories and have therefore been excluded unless the exact Gull type was known. **FIGURE 8** shows that 30% of birds struck weigh less than 110 gm (¼ lb), 57% lie between 110 and 680 gm (¼ to 1½ lb) 11% lie between 681gm and 1.13 kg (1½ and 2½ lb). Just over 1% of incidents were known to involve birds of greater than 1.81 kg (4 lb)

FIGURE 8 WEIGHT DISTRIBUTION OF IDENTIFIED BIRDS - 1981 to 1985



e) From **Figure 9** it can be seen that in the smaller weight group 29.9% of strikes only result in 8% of the damage, whilst in the ¼ lb to 1½ lb group 62% of the damage results from 56.9% of the strikes. The 1½ to 2½ lb weight group has 23% of the damage from only 11.3% of the strikes, showing aircraft to be vulnerable to this weight category of birds. Over 2½ lb 6.9% of the damage results from 2% of the strikes.

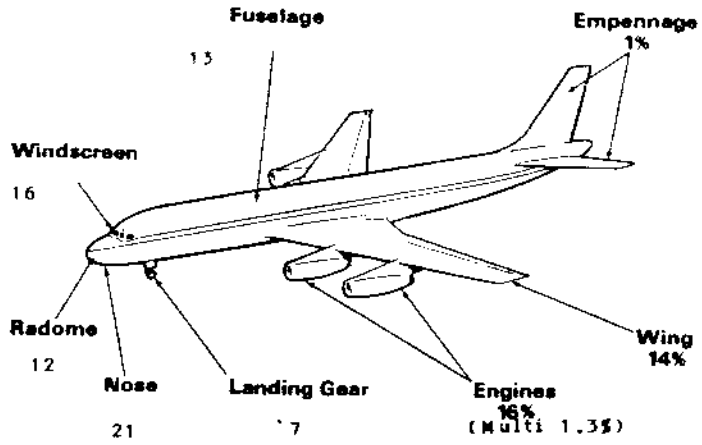
FIGURE 9 WEIGHT DISTRIBUTION OF BIRDS CAUSING DAMAGE - 1981 to 1985



3.5 **PART STRUCK** (See Table 6)

FIGURE 10 shows the nose, radome and windshield were struck in 48.7% of incidents. Engine strikes accounted for 17.2% of strikes, in which 1.3%, a total of 102 incidents, affected more than one engine and in 59 cases struck all engines. The multiple engine strike rate is about 1 per 75,000 flights. The tail area was very rarely struck. These percentages are influenced by the size of bird involved, since small birds (below ½ lb) are rarely reported as striking the engines, wing or landing gear, but are more frequently reported on the nose, radome and windshield. By comparison, birds between 110 gm and 1.8 kg most frequently strike propellers, wing, landing gear and multiple engine strikes. The over 1.8 kg birds mostly affect wing, landing gear and one engine.

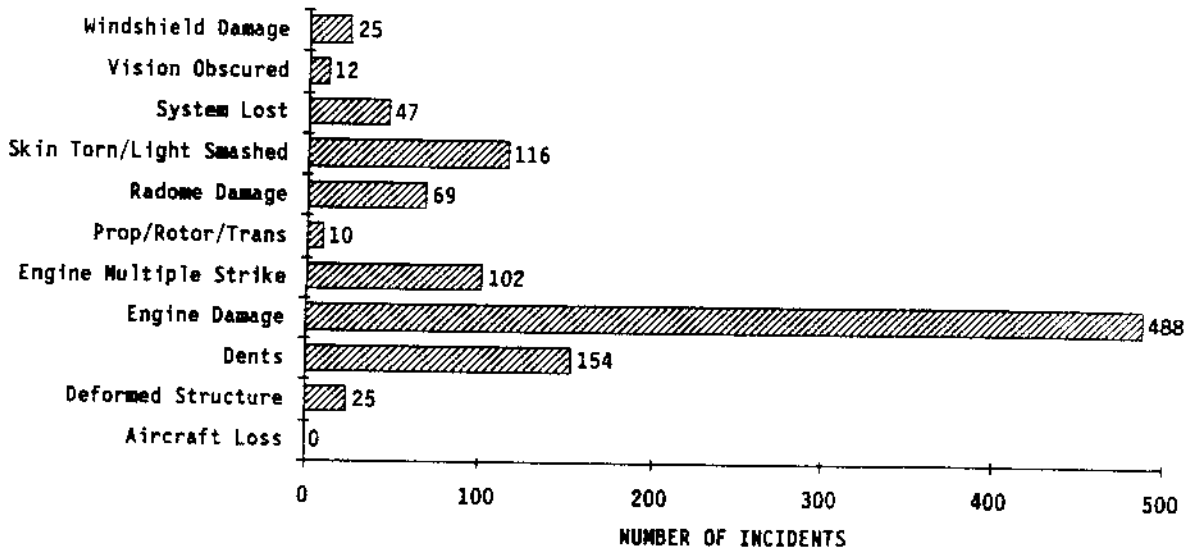
FIGURE 10 PART STRUCK - 1981 TO 1985



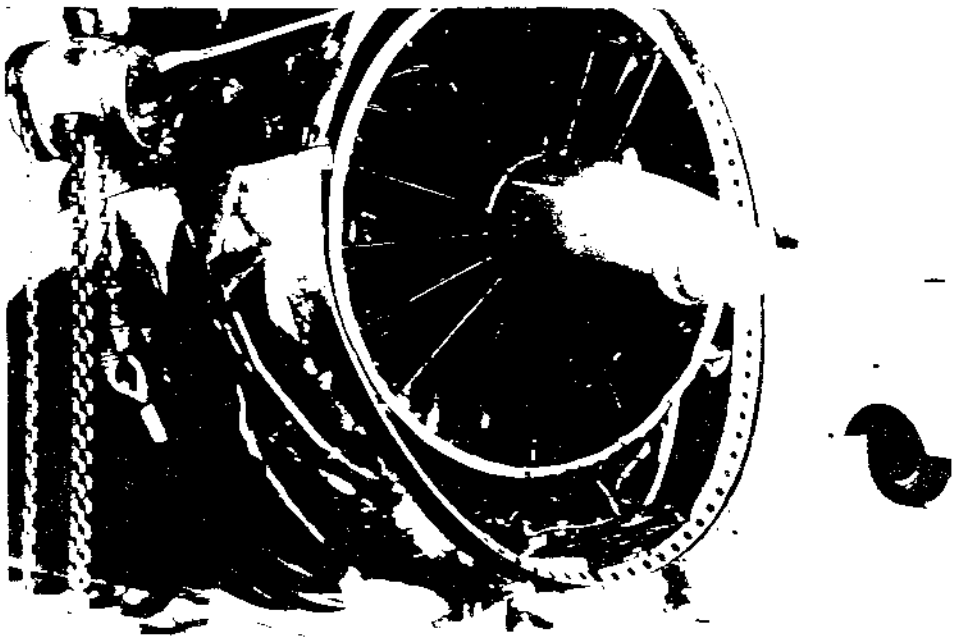
3.6 **EFFECT** (see Table 7)

a) From **FIGURE 11** it can be seen that there were no deaths, injuries or aircraft losses during this period.

FIGURE 11 EFFECT OF STRIKE - 1981 to 1985



One Lancaster Airliner (BA damage, saw two
3 ark-headed gu l s serious engine damage).



b) A total of 488 engines were damaged such that repair or replacement was necessary (damage which has been dressed out has not been counted). Of the 488 cases, 266 were in twin engined aircraft. It appears that 37% of engine strikes involves damage.

c) Twenty five windshields needed to be replaced, (only 2% of the 1225 windshield strikes). None of these involved windshield penetration.

d) There were 69 cases of radome damage, out of 893 radome strikes (8%). The radome was in most cases only delaminated, some cases are known where it was shattered. The radome strength is usually determined by the dielectric properties necessary for satisfactory operation of the weather radar.

e) Examination of the bird weights shows, not surprisingly, that only 3% of small birds (below 110 gm) caused damage, whereas 38% of strikes with birds over 1.81 kg caused damage (16% for birds between 110 gm and 1.81 Kg).

3.7 COST

Unfortunately, there was insufficient data available to estimate the cost of birdstrikes to European airlines. If the cost of engine repair is conservatively estimated at say, $50,000 US per incident (ranging from one replaced blade to a written off large fan engine , which can cost $8 million), the cost for this alone would be over $24 million US Dollars during the 5 year period. Further information on costs is highly desirable.

3.8 OPERATOR REPORTING (See Table 8)

This table provides a guide to the reporting efficiency and problems of individual airlines (since birds can not read !). It is probable that it is considerably affected by the airport(s) at which the airline has its main base(s).

4. CONCLUSIONS

a) The overall strike rate for the 7544 strikes reported by European Operators from 1981 to 1985 is 5.7% strikes per 10,000 movements. This is somewhat higher than the rate from previous five year periods.

b) There does not appear to be any close correlation between the strike rate and the aeroplane type; however, the strike rate for the group comprising wide-bodied aeroplanes does appear to be slightly above average.

c) The damage rate of rear engined aircraft is 0.25 per 10,000 movements whereas the rate for wing and mixed wing/rear engined is 0.88. This shows the protection from engine damage that the rear engine layout provides.

d) Helicopters have a low strike rate at 1.5 per 10,000 hours, with damage at 0.1 per 10,000 hours.

e) At certain airports there is a high proportion of damage.

f) Gulls were struck more frequently than other birds, being involved in 40% of incidents, somewhat lower than in previous periods which may indicate the effectiveness of measures to deal with these birds.

g) Only 1.3% of strikes were believed to involve birds of greater than 1.8kg (4 lb)

h) 23.7% of the damage was caused by the 11.3% of birds in the 1½ - 2½ lb weight group. Similarly 6.4% of the damage is caused by the 1.3% of birds over 4lb in weight. Small birds cause little damage.

i) The nose area including radome and windshield were struck in 48.7% of incidents, followed by engines with 17.2%.

j) About 1.3% of incidents (102) involved multiple engine strikes, a rate of about 1 in every 75,000 flights.

k) There was no deaths, injuries or aircraft losses during this period.

l) The major consequence was damage to 488 engines, slightly worse than one in every three engine strikes . There was little windshield damage.

m) There is no accurate information on the cost of bird strikes.

n) There is considerable variation in operators reporting standards.

BIRD STRIKE ANALYSIS

EUROPEAN OPERATORS 1981 - 1985

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

Notes:

0.1 The following are excluded from this Analysis:

(a) aircraft of maximum weight 5700 kg (12,500 lb) and under, except for those few executive jets, which have been included, eg Lear and Citation.

(b) all military type and operated aircraft.

0.2 All Tables are for strikes reported world-wide.

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.

0.4 There are two movements per flight.

0.5 Where the number of incidents, or number of movements are small, and particularly where they are both small, the derived rate should be treated with caution.

TABLE 1 ANNUAL RATE FOR EACH COUNTRY

(A high rate may be due to efficient reporting)

Reporting Nation	Rate per 10,000 Movements					Total Incidents	Damaging Incidents	Total Movements	Rate per 10,000 Movements	
	1981	1982	1983	1984	1985				All Strike	Damaging Strikes
Austria	-	-	4.6	3.7	3.6	67 (2)	3	154,092	5.5	0.2
Belgium	7.1	7.1	7.7	7.4	7.1	368	25	561,422	2.7	0.41
Czechoslovakia	-	2.2	3.6	3.7	6.5	85	21	186,116	1.8	1.12
Denmark	3.1	3.9	2.8	2.7	2.8	248	8	991,561	2.5	0.13
Finland	2.3	3.6	2.1	4.1	5.7	231	18	665,884	3.5	1.27
France	3.2	3.5	4.8	5.1	4.6	1,048 (67)	227 (17)	2,515,097	4.2	0.90
Germany	5.6	3.0	8.3	-	-	1,375(375)	133(140)	1,464,858	9.4	0.91
Ireland	7.7	9.7	10.7	7.7	9.5	287 (19)	N/A	322,592	8.9	N/A
Italy	-	-	9.2	14.1	4.8	457	15	458,088	10.0	0.33
Netherlands	6.2	4.9	4.1	5.1	4.4	460 (6)	77 (1)	925,952	5.0	0.83
Norway	-	-	-	-	-	N/A (273)	(9)	N/A	N/A	N/A
Sweden	3.3	5.0	3.8	3.1	3.5	378	29	1,032,994	3.7	0.28
Switzerland	-	-	9.1	-	8.8	330(153)	13 (6)	371,298	8.9	0.35
United Kingdom	4.4	4.6	4.9	4.8	4.7	2,404(121)	165	5,124,554	4.7	0.32
Total/Mean	4.2	3.9	5.5	5.1	5.0	7,544(1016)	733(173)	14,775,005	5.1	0.5

Notes:

1.1 There are two movements per flight.
1.2 Helicopters are excluded from this Table.
1.3 The figures in brackets are strikes for which no movement data is available.
1.4 * Movement data for Austria, Czechoslovakia, Ireland Italy, Netherlands and Switzerland is from ICAO sources.
1.5 Data from Switzerland is for Swissair jet aircraft only.

TABLE 2

Aircraft
JET
McDonnell 3
BAe 146
Boeing 707/
Boeing 747
Ilyushin 62
Concorde
BAC VC10
All 4 Engin
McDonnel' D
Lockheed 10
HS Trident
Boeing 727
Yak 40
All 3 Engine
Boeing 767
A300 Airbus
A310 Airbus
DA01 Mercure
Boeing 737
Boeing 757
McDonell Dou
BAC 1-11
Tupolev 134
Cessna 500/5
SE 210/212 C
Fokker F28
Learjet
HS125
DA20 Falcon
Gulfstream 1
SN 601 Corve
Mitsubishi M
HFB 320 Hans
VFW 614
All 2 Engine
All Jets
TURBOPROP
Short Belfast
Ilyushin I8
BAC Viscount
BAC Merchantm
DHC Dash 7
BAC Britannia
Canadair CL44
HS Argosy
L188 Electra
All 4 Engine

TABLE 2

AIRCRAFT TYPE - 1981 to 1985 Data

Aircraft	Number of Countries Reporting	Number of Strikes		Number of Movements	Rate per 10,000 Movements	
		Damage	All		All Strikes	Damage
JET						
McDonnell Douglas DC-8	8	16 (1)	110	122,193	9.0	1.3
BAe 146	1	1	32	37,392	8.6	-
Boeing 707/720	6	18 (2)	104 (2)	175,546	5.9	1.0
Boeing 747	11	133 (10)	456 (9)	813,413	5.6	1.6
Ilyushin 62	1	6	21	37,432	5.6	1.6
Concorde	2	4 (1)	5 (8)	29,289	1.7	1.4
BAC VC10	1	1	1	410	-	-
All 4 Engined Jets	-	179 (13)	729 (19)	1,215,675	6.0	1.5
McDonnell Douglas DC10	11	58 (5)	463 (57)	464,835	10.0	1.2
Lockheed 1011 Tristar	2	13 (5)	128 (5)	220,804	5.8	0.6
HS Trident	1	3	212	368,760	5.7	0.1
Boeing 727	6	45 (15)	551 (15)	1,407,211	3.9	0.3
Yak 40	1	-	3	22,622	1.3	-
All 3 Engined Jets	-	123 (25)	1,365 (77)	2,509,858	5.4	0.5
Boeing 767	1	-	13	14,064	9.2	-
A300 Airbus	8	85 (3)	657 (8)	805,296	8.2	1.0
A310 Airbus	6	15 (6)	100 (21)	126,766	7.9	1.2
DA01 Mercure	1	30	183	239,082	7.7	1.2
Boeing 737	9	159 (29)	1,641 (68)	2,736,494	6.0	0.6
Boeing 757	2	4	7	120,214	0.3	0.3
McDonell Douglas DC-9	11	53 (5)	1,093(258)	2,343,329	4.7	0.2
BAC 1-11	2	11	437	943,366	4.6	0.1
Tupolev 134	1	14	40	160,566	2.5	0.9
Cessna 500/550 Citation	3	2	7	19,276	3.6	1.0
SE 210/212 Caravelle	4	19	119	362,664	3.3	0.5
Fokker F28	4	13	178 (9)	871,469	2.0	0.1
Learjet	6	2 (3)	5 (12)	27,942	1.8	0.7
HS125	3	6	44 (1)	255,390	1.7	0.2
DA20 Falcon	6	1 (11)	1 (17)	11,868	-	-
Gulfstream II	1	-	-	1,978	-	-
SN 601 Corvette	3	- (1)	- (6)	15,914	-	-
Mitsubishi Mu 300	1	-	-	300	-	-
HFB 320 Hansa	1	-	- (3)	-	-	-
VFW 614	1	-	- (1)	-	-	-
All 2 Engined Jets	-	414 (58)	4,589(404)	9,001,978	5.1	0.5
All Jets	-	716 (96)	6,683(500)	12,727,511	5.2	0.6
TURBOPROP						
Short Belfast	1	-	5	5,522	9.1	-
Ilyushin 18	1	-	13	18,884	6.9	-
BAC Viscount	1	8	80 (3)	222,922	3.6	0.4
BAC Merchantman	1	1	4	16,538	2.4	-
DHC Dash 7	4	-	28 (5)	138,288	2.0	-
BAC Britannia	1	-	-	382		-
Canadair CL44	2	-	- (1)	942	-	-
HS Argosy	1	-	-	9,290	-	-
L188 Electra	1	-	- (2)	-	-	-
All 4 Engine Turboprops	-	9	131 (11)	412,768	3.2	0.2

Cont'd.....

BAE Jetstream [illegible]	3	[illegible]	[illegible] (5)	137,234	[illegible]	[illegible]
Short [illegible] 330 [illegible]	[illegible]	-	[illegible] (9)	394,174	[illegible]	[illegible]
HS [illegible]	[illegible]	[illegible]	[illegible] (3)	329,4[illegible]	[illegible]	
Fokker F27 [illegible]	[illegible]	2[illegible]	[illegible] (1)	321,912	[illegible]	[illegible]
HP Herald [illegible]	-	[illegible]	[illegible] (1)	153,850	[illegible]	[illegible]
[illegible] 360	2	[illegible]	[illegible] (9)	41,98[illegible]	[illegible]	-
ATR 42	[illegible]	-	-	6,[illegible]	-	-
[illegible]	1	- [illegible]	- (3)	-	-	-
[illegible]		-	- (2)	-	-	-
ALL 2 Engine Turboprops	-	6[illegible] ([illegible])	[illegible] (37)	1,854,073	[illegible]	0.[illegible]
ALL TURBOPROPS	-	[illegible]	77[illegible] (48)	2,306,841	[illegible]	0.5
PISTON						
Douglas DC3 Dakota	1	1	2	20,868	0	-
Bristol 170 Freighter	1	-	-	1,918	-	-
ALL PISTON	-	1	2	22,786	0.0	-
UNKNOWN	-	-(240)	-	-	-	-
TOTAL	-	786(109)	7,455(548)	15,057,138	4.9	0.5
HELICOPTERS						
Westland WG 30	1	-	3	7,741	3.9	-
Boeing 234 Chinook	1	-	8	30,671	2.6	-
Sikorsky S61	4	1	57 (11)	317,789	1.8	-
Bell 212/214	2	2	5	43,978	1.1	0.4
AS332L Puma	2	2	8	112,261	0.7	0.2
Westland Wessex	1	-	-	4,008	-	-
ALL HELICOPTERS	-	5	81 (12)	526,448	1.5	0.1

Notes:

2.1 Because of the low altitude of operation, and difficulty in collection of movement data, helicopter operations are quoted in hours.

2.2 The figures in brackets are for aircraft for which movement data is unavailable.

2.3 Where the number of incidents, or the number of movements is small and particularly where they are both small any derived rate should be treated with caution.

TABLE 3 A

(A

De

Country/Aerodr
AUSTRIA
Klagenfurt
Linz
Salzburg
Vienna
Graz
BELGIUM
Antwerp
Brussels
Ostend
CZECHOSLOVAKIA
Bratislava
Prague
DENMARK
Aalborg
Billund
Copenhagen
Esbjerg
Karup
Odense
Ronne
Stauning
FINLAND
Helsinki - Vant
Jyvaskyla
Kajaani
Kemi
Kuopio
Mariehamn
Oulu
Pori
Savonlinna
Tampere
Turku
Vaasa
Varkaus
FRANCE
Ajaccio
Basle Mulhouse
Bastia
Beauvais - Tille
Biarritz
Bordeaux
Brest
Calvi
Clermont Ferrand
Hyenes - Le Octe
Grenoble - St Ge
Lille

TABLE 3 AERODROMES - 1981 to 1985 Data

(A high rate may be due to efficient reporting)

Definition - up to 500ft on climb
- 200ft and below on approach

Country/Aerodrome	Incidents	Movements	Rate per 10,000 Movements	Incidents to Other European Aircraft	Total	
					Damage	All
AUSTRIA						
Klagenfurt	6	-	-	-	-	6
Linz	4	-	-	3	-	7
Salzburg	5	-	-	7	-	12
Vienna	46	-	-	22	4	68
Graz	3	-	-	-	2	3
BELGIUM						
Antwerp	4	-	-	-	-	4
Brussels	52	-	-	35	14	81
Ostend	4	-	-	1	1	5
CZECHOSLOVAKIA						
Bratislava	10	15,561	6.4	2	4	12
Prague	29	39,106	7.4	-	6	29
DENMARK						
Aalborg	5	2,370	-	11	1	16
Billund	8	-	-	-	1	8
Copenhagen	67	301,089	2.2	96	8	163
Esbjerg	19	-	-	2	-	21
Karup	-	-	-	1	-	1
Odense	7	2,164	-	-	-	7
Ronne	9	-	-	3	-	12
Stauning	3	-	-	-	-	3
FINLAND						
Helsinki - Vantaa	53	389,962	1.4	2	2	55
Jyvaskyla	4	23,304	1.7	-	-	4
Kajaani	6	14,352	4.2	-	-	6
Kemi	12	39,370	3.0	-	-	12
Kuopio	13	154,412	0.8	-	1	13
Mariehamn	41	31,096	13.1	-	-	2
Oulu	12	72,094	1.7	-	-	12
Pori	10	77,486	1.3	-	1	10
Savomlinna	3	7,164	4.2	-	-	3
Tampere	6	56,520	1.1	-	-	6
Turku	7	129,020	0.5	-	1	7
Vaasa	9	51,060	1.8	-	1	7
Varkaus	3	5,426	5.5	-	-	3
FRANCE						
Ajaccio	6	7,686	7.8	-	-	6
Basle Mulhouse	7	22,263	3.1	3	2	10
Bastia	12	25,880	4.6	-	3	12
Beauvais - Tille	3	103	-	6	1	9
Biarritz	10	5,485	18.2	1	1	11
Bordeaux	24	60,573	3.4	-	1	24
Brest	18	19,182	9.4	1	2	19
Calvi	9	7,413	-	-	-	9
Clermont Ferrand	4	14,921	2.7	-	1	4
Hyenes - Le Octeville	3	2,743	10.9	-	-	3
Grenoble - St Geoirs	7	11,689	6.0	-	-	7
Lille	11 (279)	22,372	4.9	-	-	11

Cont'd.....

Le Harve	5	959	-	-	-	5
Lorient - Lan Bihoe	5	1,967	-	-	-	5
Lourdes	29	7,285	39.8	14	4	43
Lyon - Satolas	68	183,825	3.4	1	2	69
Marseilles	40	144,751	2.8	7	1	47
Montpellier	26	39,278	6.6	-	2	26
Nice - Cote d'Azur	30	148,405	2.0	8	3	38
Nimes - Garons	9	10,307	8.7	-	3	9
Paris-Chas de Gaulle	106	317,390	3.3	47	16	153
Paris - Le Bourget	17	19,518	-	3	6	20
Paris - Orly	162	546,856	3.0	15	16	177
Pau/Pont	9	11,984	7.5	-	1	9
Perpignan	17	13,382	12.7	-	-	17
St Nazaire	3	1,189	-	-	-	3
St Yan	20	46,620	-	-	-	20
Strasbourg	15	41,514	3.6	-	1	15
Toulouse - Blagnac	96	81,601	11.8	6	12	102
GERMANY						
Berlin	11	-	-	11	1	11
Bremen	22	-	-	2	3	24
Cologne - Bonn	48	-	-	9	5	57
Dusseldorf	137	-	-	17	18	154
Francfurt A M	157	-	-	10	23	167
Hamburg	68	-	-	11	22	79
Hannover	32	-	-	1	4	33
Munchen	4	-	-	2	4	6
Munich	104	-	-	8	10	114
Munster	4	-	-	-	2	4
Nurnberg	12	-	-	-	1	12
Stuttgart	38	-	-	3	14	41
IRELAND						
Cork	32	-	-	4	-	36
Dublin	126	-	-	6	1	131
Shannon	26	-	-	2	1	28
GREECE						
Athens	-	-	-	7	-	7
Corfu	-	-	-	29	-	31
Rhodes	-	-	-	6	-	6
Thessalonika	-	-	-	4	-	4
ITALY						
Bari	3	5,398	5.5	-	-	3
Cagliary	6	12,718	4.7	-	-	6
Catania	7	4,093	17.1	4	-	3
Genoa	8	2,617	-	9	1	17
Milan - Linate	67	111,238	6.0	34	5	101
Milan - Malpensa	8	18,409	4.3	4	2	12
Naples	3	19,016	4.2	6	2	9
Olbia	7	6,784	1.0	2	1	9
Rome - Fiumicino	72	182,216	3.9	22	1	94
Ronchi	4	5,586	-	-	-	4
Turin	-	-	-	4	2	4
Venice	35	23,324	15.0	19	3	54

NETHERLANDS

Amsterdam
Eindhoven
Mastericht
Rotterdam

NORWAY

Allesund
Alta
Bergen
Bodo
Honningsvag
Kristiansond
Molde
Oil Rigs
Oslo - Fornebu
Stavanger
Tromso
Trondheim

PORTUGAL

Faro
Porto

SPAIN

Alicante
Barcelona
Gerona
Ibeza
Madrid
Mahon
Malaga
Minorca
Palma
Reus

SWEDEN

Angelholm
Gothenburg - Landvetter
Halmstad
Kalmar
Karlstad
Kristianstad
Lulea
Malmo - Sturup
Norrkoping
Stockholm - Arlan
Stockholm - Broma
Umea
Vasteras Hasslo
Visby

SWITZERLAND

Beale - Mulhouse
Geneva
Zurich

Cont'd.....

NETHERLANDS						
Amsterdam	147	351,134	4.2	53	39	198
Eindhoven	2	-	-	2	-	-
Mastericht	3	7,334	4.1	-	-	1
Rotterdam	10	18,821	5.3	3	4	13
NORWAY						
Allesund	3	12,225	2.4	-	-	3
Alta	4	13,654	2.9	3	-	7
Bergen	18	74,294	2.4	15	1	40
Bodo	24	105,525	2.3	11	2	35
Honningsvag	6	9,218	6.5	-	-	6
Kristiansond	9	49,947	1.9	-	-	9
Molde	7	18,873	3.7	-	-	7
Oil Rigs	7	-	-	-	-	7
Oslo - Fornebu	46	259,446	1.8	26	-	72
Stavanger	22	129,376	1.7	6	-	27
Tromso	15	72,796	2.1	11	-	26
Trondheim	10	34,875	2.9	2	-	12
PORTUGAL						
Faro	-	-	-	10	-	10
Porto	-	-	-	4	2	4
SPAIN						
Alicante	-	-	-	15	1	15
Barcelona	-	-	-	15	1	15
Gerona	-	-	-	6	1	6
Ibeza	-	-	-	31	3	31
Madrid	-	-	-	11	-	11
Mahon	-	-	-	10	1	10
Malaga	-	-	-	39	4	39
Minorca	-	-	-	7	-	7
Palma	-	-	-	44	5	44
Reus	-	-	-	7	-	7
SWEDEN						
Angelholm	22	25,028	8.0	-	3	20
Gothenburg - Landvetter	13	125,238	1.0	7	2	19
Halmstad	13	16,390	7.9	-	-	13
Kalmar	5	6,494	7.7	1	1	6
Karlstad	6	7,480	8.0	-	-	6
Kristianstad	7	8,152	8.6	-	-	7
Lulea	2	14,218	1	-	3	3
Malmo - Sturup	24	66,834	3.6	8	3	32
Norrkoping	2	1,800	-	1	1	3
Stockholm - Arlanda	51	536,004	1.0	24	1	75
Stockholm - Broma	20	118,700	1.7	-	-	20
Umea	17	42,910	4.0	1	2	18
Vasteras Hasslo	5	4,002	12.5	2	-	7
Visby	13	26,622	4.9	-	-	13
SWITZERLAND						
Beale - Mulhouse	7	31,386	2.2	-	-	7
Geneva	43	74,208	5.8	11	2	54
Zurich	113	128,230	8.8	28	5	141

Cont'd.....

UNITED KINGDOM						
Aberdeen	54	345,515	1.6	-	2	46
Belfast Aldergrove	98	118,380	8.3	3	5	101
Belfast Harbour	11	17,028	6.5	-	2	11
Birmingham	94	118,631	7.9	11	6	105
Blackpool	13	42,246	3.1	2	-	15
Bournemouth - Hurn	22	49,155	4.5	-	4	22
Bristol - Filton	5	-	-	-	-	5
Bristol - Lulsgate	19	30,694	6.2	8	1	27
Cambridge	3	3,461	-	-	-	3
Cardiff - Wales	29	35,136	8.3	1	1	30
Dundee	7	3.142	-	-	-	7
East Midlands	42	95,570	4.4	1	-	43
Edinburgh	72	119,701	6.0	9	3	81
Glasgow	99	201,190	4.9	5	5	104
Guernsey	36	-	-	-	-	5
Hatfield	19	-	-	-	-	19
Humberside	4	7,708	-	-	-	4
Inverness	5	26,022	1.9	-	-	5
Jersey	23	-	-	-	-	4
Kirkwall	11	25,603	-	-	-	11
Leeds - Bradford	32	49,387	6.5	1	1	33
Liverpool	28	86,342	3.2	5	-	33
London - Gatwick	90	383,215	2.3	1	6	91
London - Heathrow	164	671,818	2.4	69	12	233
London - Stansted	35	63,276	5.5	5	-	40
Luton	81	109,109	7.4	-	8	81
Lydd	8	6,791	11.8	-	-	8
Manchester	131	225,190	5.8	8	4	139
Newcastle	76	72,920	10.4	-	2	76
Norwich	35	61,967	5.6	-	-	35
Oil Rigs	33	-	-	-	-	33
Prestwick	6	13.905	4.3	1	2	7
Ronaldsway I of M	60	60,331	9.9	2	-	62
Scatsa	4	9,159	4.4	-	-	4
Southend	5	14,508	3.4	-	-	5
Stornoway	3	2,865	-	-	1	3
Sumburgh	22	77,967	2.8	-	-	22
Tees-side	28	43,879	6.4	-	-	28
USSR						
Moscow-Shera	4	-	-	-	9	9

Lis
Accra
Agadai
Algier
Arusha
Bamako
Bangko
Banjul
Bombay
Budape
Burgas
Casabl
Changi
Colomb
Dakar
Dalama
Delhi
Doula
Dar-es
Doha (
Freeto
Hong K
Istanb
En-Rout
Unknown

Notes: 3.1

3.2

3.3

3.4

3.5

Cont'd.....

List of Non European Aerodromes where at least two strikes have been reported by European Airlines

Accra (Ghana)	9	(1)	Johannesbourg (South Africa)	3	(1)
Agadair	4		Kano (Nigeria)	14	
Algiers (Algeria)	13	(2)	Khartoum (Sudan)	5	(2)
Arusha (Tanzania)	10		Karachi (Pakistan)	12	(4)
Bamako (Mali)	4		Kilimanjaro (Tanzania)	4	(1)
Bangkok (Thailand)	44	(1)	Kuala Lumpur (Malaysia)	4	
Banjul (Gambia)	26	(3)	Kigali (Rwanda)	3	(1)
Bombay (India)	12	(2)	Larnaca (Cyprus)	3	(1)
Budapest	3		Las Palmas (Canaries)	7	(2)
Burgas (Bulgaria)	4	(3)	Lagos (Nigeria)	12	
Casablanca (Morocco)	6	(1)	Libreville (Gabon)	3	
Changi (Singapore)	3	(1)	Lome (Togo)	5	
Colombo (Sri Lanka)	10		Malta (Malta)	11	
Dakar (Senegal)	7	(4)	Monrovia (Liberia)	5	(3)
Dalaman	35	(8)	Mombasa (Kenya)	11	(1)
Delhi (India)	35	(8)	Monastir (Tunisia	5	(1)
Doula (Cameroun)	4		Montevideo (Uruguay)	3	(2)
Dar-es Salaam (Tanzania)	6	(2)	Melbourne (Australia)	3	(1)
Doha (Qatar)	3	(3)	Nairobi (Kenya)	30	(15)
Freetown (Sierra Leone)	6	(1)	New York JFKennedy (USA)	18	(5)
Hong Kong (Hong Kong)	4		Panama (Panama)	3	(1)
Istanbul (Turkey)	29	(6)	Rio de Janeiro (Brazil)	6	(2)
			Tangier (Morocco)	5	(1)
			Tel Aviv (Israel)	8	
			Tunis (Tunisia)	10	(3)
			Tripoli (Lebanon)	3	(1)

En-Route Strikes	199 (34)
Unknown	139 (13)

Notes:

3.1 Because of the variability in reporting, bird population, aircraft movememt pattern, control measures and features beyond control, any comparison between rates calculated for different aerodromes can be misleading.

3.2 German non-damaging strikes for 1985 NOT included.

3.3 Data on Damaging Strikes NOT supplied by the following

1982 - France
1983 - Austria, Denmark, France, Ireland, Norway.
1984 - Denmark, Ireland, Norway.

3.4 Carcasses found on aerodromes in UK NOT included.

3.5 Aerodromes with 2 strikes or less excluded.

TABLE 4 **INCIDENTS NEAR AERODROMES - 1985 Data**

Definition - Between 501 ft and 1500 ft on climb
- Between 1000ft and 201ft on approach

Country/Aerodrome	Incidents	Movements	Rate per 10,000 Movements	Incidents to Other European Aircraft	Total Damage	Total All
AUSTRIA						
Salzburg	-	-	-	1	1	1
BELGIUM						
Brussels	3	-	-	-	-	3
BULGARIA						
Burgas	-	-	-	1	-	1
CYPRUS						
Larnaca	-	-	-	1	-	1
CZECHOSLOVAKIA						
Bratislava	4	15,561	2.6	-	-	4
Ostrava	1	4,197	-	-	1	1
Prague	11	39,106	3.1	1	3	12
DENMARK						
Aalborg	1	-	-	-	-	1
Copenhagen	3	61,674	0.6	1	1	4
FINLAND						
Helsinki - Vantaa	2	61,138	0.3	-	-	2
Joesuu	1	3,124	-	-	-	1
Turku	1	10,672	-	-	-	1
FRANCE						
Bastia - Poretta	1	7,323	-	-	-	1
Marseille	1	37,567	-	-	-	1
Paris - Charles de Gaulle	5	64,606	1.4	4	2	9
Paris - Orly	3	118,898	0.3	-	1	3
St Yan	1	-	-	-	1	1
Toulouse - Blagnac	1	17,865	-	-	-	1
GERMANY						
Cologne - Bonn	-	-	-	1	-	1
Dusseldorf	1	-	-	-	1	1
Frankfurt	7	-	-	-	7	7
Hambourg	4	-	-	-	4	4
Munchen	2	-	-	-	2	2
Nurnberg	1	-	-	-	2	2
Stuttgart	1	-	-	-	1	1
IRELAND						
Dublin	-	-	-	1	-	1
ITALY						
Milan - Linate	2	-	-	2	-	4
Milan - Malpensa	1	-	-	-	-	1
Rome - Fiumicino	3	-	-	-	-	3
Venice	3	-	-	-	-	3
SPAIN						
Ibiza						
Malaga						
Palma						
SWEDEN						
Gotenborg - Landv						
Stockholm - Arlar						
Kalmar						
UNITED KINGDOM						
Aberdeen						
E. Midlands						
Glasgow						
London - Gatwick						
London - Heathrow						
Luton						
Manchester						
U.S.A.						
New York - J.F.K						

Cont'd.....

SPAIN						
Ibiza	-	-	-	1	-	1
Malaga	-	-	-	2	-	2
Palma	-	-	-	1	-	1
SWEDEN						
Gotenborg - Landvetter	-	37,038	-	1	-	1
Stockholm - Arlanda	-	162,800	-	1	-	1
Kalmar	-	6,494	-	1	-	1
UNITED KINGDOM						
Aberdeen	1	68,773	-	-	-	1
E. Midlands	1	21,001	-	-	-	1
Glasgow	4	39,253	1.0	-	1	4
London - Gatwick	1	93,535	-	-	-	1
London - Heathrow	7	145,987	0.5	-	-	7
Luton	1	22,041	-	-	1	1
Manchester	1	49,570	-	1	-	2
U.S.A.						
New York - J.F.K	-	-	-	2	-	2

TABLE 5 BIRD SPECIES - 1981 to 1985 DATA

Scientific Name	English Name	Weight	Weight/ Category	Number of Incidents		% based on 4620
				Damage	Total	
PODICIPEDIFORMES						
Podicipedidae	Grebe	150 g - 990 g	B	-	1	-
		Total		-	1	-
PROCELLARIIFORMES						
Fulmarus glacialis	Fulmar	750 g	B	-	1	-
PELICANIFORMES						
Pelecanidae	Pelican	up to 6 kg	D	-	2	-
Phalacrocorax sp.	Cormorant	1.7 kg - 2.7 kg	C	1	1	-
Frigata magnificens	Frigate bird	1.4 kg	B	1	1	-
		Total		2	4	-
CICONIIFORMES						
Botaurus stellaris	Bittern	1190	B	-	1	-
Bubulcus ibis	Cattle egret	345 g	B	2	10	-
Ardea sp.	Heron	500 g - 4.5 kg	B	4	12	0.3
Ardea cinerea	Grey heron	up to 1.5 kg	B	2	9	-
Ciconia sp.	Stork	up to 3 kg	C	2	2	-
Ciconia ciconia	White stork	3.4 kg	C	1	3	-
Eudocimus albus	White ibis	830 g	B	-	1	-
		Total		11	38	-
ANSERIFORMES						
Anser sp.	Goose	1.8 kg - 4 kg	C	5	8	-
Cygnus sp.	Swan	4.7 kg - 12 kg	D	-	3	-
Cygnus olor	Mute swan	10 kg	D	-	1	-
Cygnus cygnus	Whooper swan	10 kg	D	-	1	-
Anas sp.	Duck	250 g - 1.3 kg	B	2	25	0.5
Anas platyrhynchos	Mallard	1.1 kg	B	3	14	0.3
		Total		10	52	1.1
ACCIPITRIFORMES						
Milvus sp.	Kite	780 g - 1.0 kg	B	7	20	0.4
Pernis apivorus	Honey buzzard	785 g	B	-	1	-
Milvus migrans	Black kite	780 g	B	9	40	0.9
Neophron percnopterus	Egyptian vulture	2.1 kg	D	1	1	-
Gyps sp.	Vulture	up to 10 kg	C	2	2	-
Gyps bengalensis	Whitebacked vulture	5.3 kg	D	1	1	-
Circus aeroginosus	Marsh harrier	630 g	B	-	3	-
Accipiter sp.	Hawk	up to 1 kg	B	6	46	1.0
Accipiter gentilis	Goshawk	1.0 kg	B	1	7	-
Accipiter nisus	Sparrow hawk	190 g	B	-	13	0.3
Buteo sp.	Buzzard	260 g - 1.3 kg	B	15	72	1.6
Buteo buteo	Common buzzard	800 g	B	9	57	1.2
Aquila sp.	Eagle	1.1 kg - 4.2 kg	C	2	5	-
Aquila chrysaetos	Golden eagle	4.2 kg	D	-	1	-
		Total		53	269	5.9
FALCONIFORMES						
Falconiformes	Bird of Prey	105 g - 1.3 kg	B	1	29	0.6
Falco sp.	Falcon	105 g - 1.3 kg	B	7	54	1.2
Falco tinnunculus	Kestrel	200 g	B	6	94	2.0
Falco columbarius	Merlin	195 g	B	-	2	-
		Total		14	179	3.9

Cont'd.....

GALLIFORMES

Tetrao tetrix
Alectoris rufa

Perdix perdix
Phasianus colchi

GRUIFORMES

Grus grus
Tetrax tetrax

CHARADRIIFORMES

Haematopus ostral
Charadrius hiatic
Pluvialis apricar
Vanellus vanellus
Vanellus senegall
Calidris alpina
Philomachus pugna
Gallinago gallina
Gallinago megala
Scolopax rusticol
Numenius arquata
Larus sp.
Larus melancephal

Larus minutus
Larus ridibundus

Larus delawarensis

Larus canus
Larus fuscus

Larus argentatus
Larus marinus

Rissa tridactyla
Sterna sp.
Chlidonias leucopt

COLUMBIFORMES

Columba sp.
Columba livia
Columba livia var.
Columba oneas
Columba palumbus
Streptopelia turtur

CUCULIFORMES
Cuculus canorus

STRIGIFORMES

Strix sp.
Tyto alba
Bubo bubo
Athene noctua
Strix aluco
Asio otus
Asio flammeus

CAPRIMULGIFORMES

Caprimulgus europaeu

GALLIFORMES						
Tetrao tetrix	Black grouse	1.1 kg	B	-	17	0.3
Alectoris rufa	Red-legged partridge	450 g	C	-	2	-
Perdix perdix	Grey partridge	400 g	B	7	40	0.9
Phasianus colchicus	Pheasant	1.1 kg	B	6	18	0.4
		Total		13	77	1.7
GRUIFORMES						
Grus grus	Crane	5.0 kg	D	1	2	-
Tetrax tetrax	Little bustard	180 g	B	-	1	-
		Total		1	3	-
CHARADRIIFORMES						
Haematopus ostralegus	Oystercatcher	500 g	B	2	18	0.3
Charadrius hiaticula	Ringed plover	54 g	A	-	1	-
Pluvialis apricaria	Golden plover	185 g	B	2	17	0.4
Vanellus vanellus	Lapwing	215 g	B	36	625	13.6
Vanellus senegallus	Wattled plover	220 g	B	-	1	-
Calidris alpina	Dunlin	50 g	A	-	1	-
Philomachus pugnax	Ruff	140 g	B	1	3	-
Gallinago gallinago	Common snipe	125 g	B	-	9	-
Gallinago megala	Swinhoe's snipe	150 g	B	-	1	-
Scolopax rusticola	Woodcock	300 g	B	1	3	-
Numenius arquata	Curlew	770 g	B	1	21	0.5
Larus sp.	Gull	280 g	B	109	1186	25.4
Larus melancephalus	Mediterranean gull	280 g	B	-	1	-
Larus minutus	Little gull	120 g	B	-	1	-
Larus ridibundus	Black-headed gull	275 g	B	25	360	7.8
Larus delawarensis	Ring-billed gull	485 g	B	-	1	-
Larus canus	Common gull	420 g	B	3	83	1.8
Larus fuscus	Lesser black backed gull	820 g	B	2	22	0.5
Larus argentatus	Herring gull	1.0 kg	B	12	119	2.5
Larus marinus	Great black backed gull	1.7 kg	B	-	9	-
Rissa tridactyla	Kittiwake	390 g	B	-	1	-
Sterna sp.	Tern	45 g - 570 g	B	3	42	0.9
Chlidonias leucoptera	White winged black tern	57 g	A	-	1	-
		Total		200	2526	54.7
COLUMBIFORMES						
Columba sp.	Pigeon	up to 465 g	B	18	172	3.7
Columba livia	Rock dove	395 g	B	7	19	0.4
Columba livia var.	Homing pigeon	400 g	B	-	7	-
Columba oneas	Stock dove	345 g	B	-	6	-
Columba palumbus	Woodpigeon	465 g	B	10	103	2.2
Streptopelia turtur	Turtle dove	145 g	B	-	1	-
		Total		35	308	6.6
CUCULIFORMES						
Cuculus canorus	Cuckoo	105 g	A	-	1	-
		Total		-	1	-
STRIGIFORMES						
Strix sp.	Owl	160 g - 380 g	B	1	20	0.4
Tyto alba	Barn owl	315 g	B	1	12	0.3
Bubo bubo	Eagle owl	2.8 kg	C	-	4	-
Athene noctua	Little owl	164 g	B	-	1	-
Strix aluco	Tawny owl	480 g	B	-	4	-
Asio otus	Long-eared owl	275 g	B	-	1	-
Asio flammeus	Short eared owl	355 g	B	-	8	-
		Total		2	50	1.1
CAPRIMULGIFORMES						
Caprimulgus europaeus	Nightjar	70 g	A	-	5	-
		Total		-	5	-

Cont'd.....

APODIFORMES						
Apus apus	Swift	40 g	A	1	143	3.1
		Total		1	143	3.1
PASSERIFORMES						
Passeriformes	Perching birds	20 g	A	6	202	4.4
Galerida cristata	Crested lark	40 g	A	-	1	-
Alauda arvensis	Skylark	40 g	A	-	58	1.2
Lullula arborea	Woodlark	27 g	A	-	1	-
Riparia riparia	Sand martin	13 g	A	-	5	-
Hirundo noexena	Welcome swallow	14g	A	-	1	-
Hirundo rustica	Swallow	19 g	A	2	328	7.1
Delichon urbica	House martin	17 g	A	-	27	0.6
Anthus pratenses	Meadow pipit	18 g	A	-	2	-
Motacilla sp.	Wagtail	20 g	A	-	2	-
Motacilla alba	Pied wagtail	23 g	A	-	2	-
Turdus sp	Thrush	60 g - 125 g	A	1	13	0.3
Turdus merula	Blackbird	100 g	A	1	18	0.4
Turdus pilaris	Fieldfare	98 g	A	-	2	-
Turdus philomelos	Song thrush	73 g	B	-	4	-
Turdus iliacus	Redwing	70 g	A	-	2	-
Pica pica	Magpie	220 g	B	-	10	-
Corvus sp.	Crow	up to 530 g	B	4	82	1.7
Corvus frugilegus	Rook	430 g	B	5	27	0.6
Corvus corone corone	Carrion crow	530 g	B	-	5	-
Corvus corax	Raven	1.1 kg	B	-	2	-
Sturnus vulgaris	Starling	80 g	A	4	78	1.7
Passer sp.	Sparrow	18 g - 40 g	A	-	72	1.5
Passer domesticus	House sparrow	40 g	A	-	13	0.3
Fringilla coelebs	Chaffinch	23 g	A	-	3	-
Carduelis chloris	Greenfinch	29 g	A	-	1	-
Carduelis spinus	Siskin	-	-	-	1	-
Carduelis cannabina	Linnet	18 g	A	-	9	-
Plectrophenax nivalis	Snow bunting	35 g	A	-	3	-
Emberiza citinella	Yellow hammer	27 g	A	-	2	-
Molothrus ater	Brown headed cowbird	45g	A	-	1	-
		Total		23	382	21.2
CHIROPTERA						
Chiroptera sp.	Bat	-	-	-	3	-
		Total		-	3	-
UNKNOWN				232	3172	
TOTAL				599		7792

Notes:

5.1. Bird weights and Scientific Names are based on 'Average Weights of Birds' by T Brough of Aviation Bird Unit, Worplesdon Laboratory, Agricultural Science Service, MAFF, Worplesdon, England. The average weight has been assumed.

5.2 The bird categories based on current Civil Airworthiness requirements are:

A below 110 g (¼ lb)
B 110 g to 1.81 g (¼ lb to 4 lb)
C over 1.81 kg to 3.63 g (4 lb to 8 lb)
D over 3.63 kg (8 lb)

5.3 Those birds not positively identified are tabled as Unkown. Except where there is evidence that they are large (C or D).

5.4 Percentages are based on incidents where birds are identified.

TABLE 6 PAR

PART STRUCK	INCIDENT
Fuselage	
Nose (excluding and windshie	
Radome	
Windscreen	
Propeller	
1 engine struck	
out of 3 struck	
2 or more of 4 s	
all engines stru	
Wing/Rotor	
Landing Gear	
Empenage	
Part unknown	
TOTAL	

Notes:

6.1 T b
6.2 T
6.3 W r
6.4 1
6.5 N

TABLE 6 PART OF AIRCRAFT STRUCK - 1981 to 1985 DATA

INCIDENTS / PART STRUCK	BIRD WEIGHTS				TOTAL	% BASED ON 7579
	unknown	below 110 g	100 g to 1.81 kg	over 1.81 kg		
Fuselage	325	169	483	14	991	13.1
Nose (excluding radome and windshield)	601	345	611	12	1,569	20.7
Radome	345	195	344	9	893	11.8
Windscreen	435	300	478	12	1,225	16.2
Propeller	7	3	92	2	10	1.4
1 engine struck	410	147	623	25	1,205	15.5
out of 3 struck	-	2	8	-	10	0.1
2 or more of 4 struck	13	2	18	-	33	0.4
all engines struck	10	5	44	-	59	0.8
Wing/Rotor	305	101	641	16	1,063	14.0
Landing Gear	93	52	373	14	532	7.0
Empenage	27	6	42	-	75	1.0
Part unknown	249	129	628	7	1,013	-
TOTAL	2,820	1,456	4,385	111	8,772	100.0

Notes:

6.1 The totals in Table 6 are higher than other tables as several parts can be struck in one incident.

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

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

6.4 110 g = ¼ lb, 1.81 kg = 4 lb. 3.63 kg = 8 lb.

6.5 No data on parts struck available from Netherlands.

TABLE 7 EFFECT OF STRIKE - 1981 to 1985 Data

Bird Weight / Effect	BIRD WEIGHTS: Unknown	Below 110 gm	110 gm to 1.81 kg	1.81 kg to	Over 1.81 kg	Total	% Based on 5879
Loss of life/aircraft	-	-	-	-	-	-	-
Flight crew injured	-	-	-	-	-	-	-
Engine repairs on:							
2 engined aircraft	78	8	176	4	-	266	4.5
Others	102	10	97	9	4	222	3.8
Windscreen cracked or broken	11	1	12	1	-	25	0.4
Vision obscured*	7	-	5	-	-	12	0.2
Radome Changed	24	1	40	3	1	69	1.2
Deformed structure	6	-	18	1	-	25	0.4
Skin torn/light glass broken	38	6	65	7	-	116	2.0
Skin dented*	61	8	80	5	-	154	2.6
Propeller/Rotor/ transmission damaged	1	-	9	-	-	10	0.2
Aircraft system lost	11	4	30	1	1	47	0.8
Take off abandoned*	14	2	50	1	-	67	1.1
Nil damage	2,196	703	1,931	31	5	4,866	82.8
Unknown	374	116	267	9	1	767	-
TOTAL	2,923	859	2,780	72	12	6,646	100.0

Notes:

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

7.2 The percentages are based on known effects.

7.3* Not counted as damage.

7.4 No data on strike effect available from Netherlands.

7.5 Aircraft Systems lost includes hydraulics, pilot and de-icing.

TABLE 8

A high str

OPERATOR
AUSTRIA
Austrian A
Tyrolean A
BELGIUM
Air Belgiu
Delta Air
Sabena
Sobelair
T.E.A.
CZECHOSLOVA
CSA
SLI
DENMARK
Cimber Air
Conair
Gronslandsf
Maersk Air
SAS
Sterling Ai
Other
FINLAND
Finnair Oy
FRANCE
Air Alsace
Air France
Air Inter
Eiat
Prive
U.T.A.
T.A.T.
Taxis
Others

TABLE 8 AIRCRAFT OPERATORS - 1981 to 1985 Data

A high strike rate may demonstate thorough reporting.

OPERATOR	NUMBER OF INCIDENTS	NUMBER OF MOVEMENTS	RATE PER 10,000 MOVEMENTS
AUSTRIA			
Austrian Airlines	87	146,806	5.9
Tyrolean Airways	2	-	-
BELGIUM			
Air Belgium	-	2,282	-
Delta Air Transport	-	8,294	-
Sabena	109	370,772	2.9
Sobelair	4	26,572	1.5
T.E.A.	13	60,358	2.2
CZECHOSLOVAKIA			
CSA	76 (9)	145,994	-
SLI	2	612	-
DENMARK			
Cimber Air	2	64,620	0.3
Conair	22	35,178	6.2
Gronslandsfly	-	63,022	-
Maersk Air	58	161,118	3.6
SAS	126	432,798	2.9
Sterling Airways	18	165,350	1.1
Other	14	41,176	3.4
FINLAND			
Finnair Oy	245	673,976	3.6
FRANCE			
Air Alsace	2	-	-
Air France	413	1,248,865	3.3
Air Inter	550	929,047	5.9
Eiat	15	-	-
Prive	5	-	-
U.T.A.	49	98,742	5.0
T.A.T.	28	401,736	0.7
Taxis	22	-	-
Others	26	-	-

Cont'd.....

IRELAND			
Aer Lingus	227	-	-
Air Turas	1	-	-
Aviar	10	-	-
ITALY			
Aer Mediterranea	-	43,453	-
Alitalia	224	221,218	10.1
NETHERLANDS			
KLM	313	519,503	6.0
Martinair	7	29,863	2.3
NLM	38	176,760	2.1
Transavia	20 (6)	23,621	8.5
NORWAY			
A/S Morefly	2	-	-
Braathen Safe	42	-	-
Busy Bee	2	-	-
Fred Olsen	2	-	-
Helicopter Service	13	-	-
SAS	192	-	-
Scanair	1	-	-
Wideroe	16	-	-
Others	9	-	-
SWEDEN			
Linjeflyg AB (LIN)	139	465,000	3.0
Ostermans Aero AB	1	7,189	-
Rikspolisstyrelsen (National Board of Police Dep.)	2	11,639	1.7
SAS	234	464,432	5.0
Swedair	4	7, 586	5.3
SWITZERLAND			
Alisarda	3	-	-
Balair	24	-	-
Omo	2	-	-
Swissair	457	-	-

Cont'd.....

UNITED KING
Air Atlanti
Air Bridge
Air Ecosse
Air Europe
Air UK
Airways Int
Birmingham E
Bristow Heli
Britannia Ai
British Aero
British Air
British Airw
British Airw
British Cale
British Cale
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British Midl
Brymon Airway
Channel Expre
Dan-Air Servi
Euroair Trans
Express Air S
Ford
Guernsey Airl
Heavy Lift Ca
Inter City Ai
Janus
Jersey Europea
Lease Air (Ger
Logan Air
Manx Airlines
McAlpine
Metropolitan A
Monarch Airlin
North Scottish
Helicopters
Orion Airways
Peregrine
Spaceground
Tradewinds Airw
Virgin Atlantic
Other Operators
Unknown

Note 8.1

UNITED KINGDOM			
Air Atlantique	3	10,526	2.9
Air Bridge Carriers	5	24,978	2.0
Air Ecosse	12	38,134	3.1
Air Europe	51	95,432	5.3
Air UK	105	378,212	2.8
Airways Int (Cymru)	4	7,500	5.3
Birmingham Executive	3	19,556	1.5
Bristow Helicopters	21	184,752 hrs	1.1
Britannia Airways	377	356,312	10.6
British Aerospace	31	-	-
British Air Ferries	19	97,078	2.0
British Airways	736	1,907 406	3.9
British Airways Helicopters	38	160,806 hrs	2.4
British Caledonian Airways	237	363,188	6.5
British Caledonian Charter	2	3,663	5.5
British Caledonian Helicopters	5	38,351 hrs	1.3
British Island Airways	2	30,184	0.7
British Midland Airways	139	340,204	4.1
Brymon Airways	7	64,324	1.1
Channel Express	2	18,396	1.1
Dan-Air Services	221	553,394	4.0
Euroair Transport	2	4,160	4.8
Express Air Services	4	12,270	3.3
Ford	8	-	-
Guernsey Airlines	9	20,144	4.5
Heavy Lift Cargo	4	5,522	7.2
Inter City Airlines	4	13,510	3.0
Janus	12	N/A	-
Jersey European	4	10,842	3.7
Lease Air (Genair)	17	44,078	3.9
Logan Air	24	43,372	5.5
Manx Airlines	65	55,614	11.7
McAlpine	4	-	-
Metropolitan Airways	4	12,148	3.3
Monarch Airlines	45	101,562	4.4
North Scottish Helicopters	-	24,191 hrs	-
Orion Airways	57	96,246	5.9
Peregrine	5	1,626	-
Spaceground	5	-	-
Tradewinds Airways	4	12,206	3.3
Virgin Atlantic	-	1,872	-
Other Operators	48	-	-
Unknown	101	-	-

Note 8.1 Leased aircraft are included against the operator.

WORLD-WIDE BIRD STRIKE INCIDENTS INVOLVING CRASH/FATALITY 1960-1989

APPENDIX 7

DATE	AIRCRAFT	LOCATION	PART STRUCK	BIRDS/WEIGHT	OCCUPANTS	DEATHS	OTHER
8.10.60	Lockheed L188 Electra (Allison 501) Flock ingested into 3 engines, aircraft stalled and crashed in harbour	Boston, USA	Engines	Starlings-80gm (Sturnus vulgaris)	72	62	9 serious injuries
15.07.62	Douglas DC3 Co-pilot killed when vulture penetrated windscreen during cruise	Lahore, Pakistan	Windscreen	Vulture-up to 10kg (Accipitriformes)	3	1	
23.11.62	Vickers Viscount (Dart) At 5000ft whistling swan struck and removed left tailplane, aircraft crashed	Maryland, USA	Tailplane	Whistling Swan-6kg (Cygnus columbianus)	17	17	-
28.07.68	Falcon 20 (CF700) Gulls ingested into both engines on takeoff causing severe damage, ditching in lake	Lake Erie, USA	Engines	Gulls-280gm to 1.7kg (Larus sp.)	3	-	-
23.07.69	Douglas DC3 Cranes blocked carb intakes on both engines, ditched in sea.	Khar, Ambadu, India	Engines	Cranes - up to 6kg (Grus sp.)	4	-	-
26.02.73	Lear 24 (CJ610) On take off severe power loss on both engines. Aircraft crashed into buildings.	Atlanta, USA	Engines	Cowbirds-44gm (Molothrus ater)	7	1	1 third party serious injury
12.12.73	Falcon 20 (CF700) Gull's* caused severe damage to both engines on take off, crash landed	Norwich, UK	Engines	Gulls* (see note 4)	9	-	1 minor
14.06.75	NA265 Sabreliner (JT12A) Ingestion in both engines on take off, crash landed	Watertown, USA	Engines	Franklin's gull-260gm (Larus pipixcan)	6	-	3 serious injuries
12.11.75	DC10 (CF6) Gulls+ ingested in Eng 3 which exploded, causing severe wing fire, abandoned take off, aircraft burnt out	Kennedy NY,USA	Engine	Gulls+ (see note 5)	139	-	2 serious injuries
20.11.75	HS125 (Viper) Lapwings ingested in both engines on take off, power loss, crash landed destroying car	Dunsfold, UK	Engines	Lapwings-215gm (Vanellus vanellus)	8	-	6 third party deaths
06.02.76	Lear 24 (CJ610) Gulls ingested in both engines, power lost and crashed in field	Bari, Italy	Engines	Gulls-280gm to 1.7kg (Larus sp.)	3	-	-
12.11.76	Falcon 20 Both engines failed just after lift-off, causing aircraft to crash	Naples Florida USA	Engines	Ring-billed gulls-485gm (Larus delawarensis)	11	-	11 serious injuries
04.04.78	B737 (JT8D) Wood pigeon ingested during training touch and go, abandoned take off beyond V_1 and over-ran. Burnt out	Gosselies, Belgium	Engine	Woodpigeon-465gm (Columba palumbus)	3	-	-
25.07.78	Convair 580 (Allison 501) Sparrowhawk ingested in one engine on take off, auto feathered, crashed in field	Kalamazoo, USA	Engine	Sparrowhawk-105gm (Falco sparverius)	43	-	3 serious injuries
07.04.81	Lear 23 (CJ610) At 4000 ft loon penetrated right windscreen killing co-pilot and injuring pilot. Windscreen debris damaged Engine 2 and was shutdown	Lunken, Cincinnati, USA	Windscreen	Loon-3.7kg (Gavia immer)	2	1	1 serious injury
06.12.82	Lear 35 (TFE731) Abandoned take off after V1 after striking gulls. Over-ran, ILS installation injured co-pilot. Engines were not damaged	Le Bourget Paris	-	Black-headed gulls-275gm (Larus ridibundus)	-	-	1 serious injury
17.08.83	Lear 25 (CJ610) At 500 ft passed through starling flock. Both engines failed. Force landed after striking trees in industrial area	Wilmington, USA	Engines	Starlings-80gm (Sturnus vulgaris)	2	-	-
15.09.88	Boeing 737 (JT8D) Ingestion in both engines at lift off, surging, loss of power. Attempted return, both engines failed. Crashed 10Km from airport during attempted landing in open country but struck river bank and burned. Airport is 5,800ft amsl.	Bahar Dar, Ethiopia	Engines	Speckled pigeon-320gm (Columba guinea)	104	35	21 serious injuries

Notes:

1. Civil register aircraft of 5700kg (12,500lb) and over, together with executive Jet aeroplanes.
2. The part struck relates to the part which was the primary cause of the accident
3. Cases included where aircraft in flight suffered total engine power disruption resulting in a crash
4. Common gulls (Larus canus 420g) and Black-headed gulls (Larus ridibundus 275g)
5. Great black-blacked gulls (Larus marinus 1.7kg), Ring-billed gulls (Larus delawarensis 485g) and Herring gulls (Larus argentatus 1.0kg)

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- Helicopt

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The author
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