BIRD STRIKE COMMITTEE EUROPE

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BIRD STRIKES DURING 1976 TO EUROPEAN REGISTERED CIVIL AIRCRAFT
(Aircraft over 5700 kg Maximum Weight)

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Summary

The strikes, reported throughout the World in 1976 by operators from ten European countries have been analysed. The analysis includes rates for countries' aircraft types and aerodromes based on aircraft movements. Italso covers bird species, part of aircraft struck, effect of strike, cost and airlines affected.

The strike rate in 1976 was significantly greater than in previous years. Gulls (Larus spp.) were involved in nearly half the incidents. The major effect was the crash of an executive jet aircraft, and damage to 57 engines. During the year bird strikes were estimated to have cost European airlines at least 3.7 million US dollars in engineering repairs.

CONTENTS

1. INTRODUCTION

1.1 Prior to 1972 reports containing data on bird strikes were produced by different organisations, such as airlines, aviation authorities and ornithologists. The information was presented in various forms, using different guidelines. These reports seldom contained data on aircraft movements, such that the most useful form of comparison, strike rate, could 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 on their bird strikes. These analyses were consolidated to form an annual report on Bird Strikes to European Registered Civil Aircraft, and reports covering the individual years 1972, 1973 and 1974 and 1975 have been presented to annual BSCE meetings. This paper presents the 1976 analysis.

1.3 Appendix 1 contains the Tables of data relating to this paper.

1.4 Appendix 2 provides brief details of serious world-wide bird strike incidents.

2. SCOPE

For the following reasons, the detailed analysis includes only civil aircraft of over 5700 kg (12 500 lb) maximum weight, except that all executive jets including those of weight less than 5700 kg have been included:

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

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

(c) 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 a total of 10 European countries. A few of these were not able to provide full information, and their data, therefore, appears in some tables and not in others.

(b) The overall strike rate for the 1428 incidents contained in this analysis is 5.2 per 10,000 movements (two movements per flight). This is considerably higher than the average of 3.5 during the past four years.

(c) The strike rate reported by each country is dependent upon two major factors -

- reporting standard

- the bird strike problem at airports within that country, since, although each country is reporting world-wide strikes, a high proportion of its aircraft movements are within its own borders.

(d) The country with the worst strike rate is the Netherlands with 12.1 per 10,000 movements, followed by Germany with 11.2. France has consistently reported a rate well below average at 1.3, however this is thought to be a reporting problem. The reasons for the differences between countries is not clear, but it is almost certainly a combination of the above two factors.

3.2 AIRCRAFT TYPES (See Table 2)

(a) General

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

(b) Jet Aeroplanes

(i). There appears to be no consistent correlation, possibly for the reasons suggested above. The results obtained this year, in general, show close similarity between aircraft of similar design eg DC8 and B707, Trident and B727, BAC 1-11 and DC9. This was not so in the previous paper based on four years data.

(ii) The group of wide-bodied aircraft comprising B747, L1011 Tristar, DC10 and A300B Airbus, has a much above average rate of 8.3, whereas the four executive jets, with a comparatively low total of movements have a slightly below average rate of 4.3. The group comprising the rest of the jets has a rate of 5.2.

(c) Turboprop Aeroplanes

The extent to which turboprop aeroplanes are used has declined considerably, and the average strike rate for all turboprops is considerably less than that for jets. This could be expected as a result of the lower take-off and landing speeds.

(d) Piston Aeroplanes

Very few strikes were recorded to piston engined aeroplanes, except for the Convair 440, for which movement data is not available.

(e) Helicopters

The number of strikes reported to helicopters is very low, only 5. Because helicopters fly mainly at low altitude where birds are most frequently found, they are continuously exposed to the risk of a strike. Therefore flying hours have been used to determine a strike rate. The rate is very low at 0.6 per 10,000 hours, possibly due to their modest operating speed.

3.3 AERODROMES (See Table 3)

(a) The 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 could be quoted.

However the total number of strikes at each aerodrome, reported by all European sources has been included.

(b) Aerodromes which have a high number of strikes or a high strike rate may be influenced by some of the following:

(i) a very good standard of reporting

(ii) a large bird population (perhaps due to the airport's geographical location)

(iii) a large number of aircraft movements

(iv) inadequate bird control measures

(v) a local problem which may be beyond the control of the aerodrome, eg a garbage dump in the vicinity of the aerodrome.

(c) Of the aerodromes with more than 10,000 movements and where the rate is known, Bremen, Hamburg, Cologne, Luton, Belfast and Glasgow have much above average rates.

(d) The aerodromes with high numbers of strikes are Copenhagen-Kastrup, Frankfurt, Amsterdam and London-Heathrow. However several of these airports are known to have a high number of aircraft movements and a difficult bird problem but, through effective use of bird control measures, have managed to maintain a commendably low strike rate. This demonstrates what can be achieved.

(e) Significant numbers of strikes have been reported at some aerodromes outside the boundaries of the ten reporting countries. New York, Kennedy Airport has 9, but is frequently used by many European airlines. However the numbers at Athens and Nairobi (6 each) and Madrid and Bombay (5 each) appear to be rather high considering the relatively few European operators' movements at these airports.

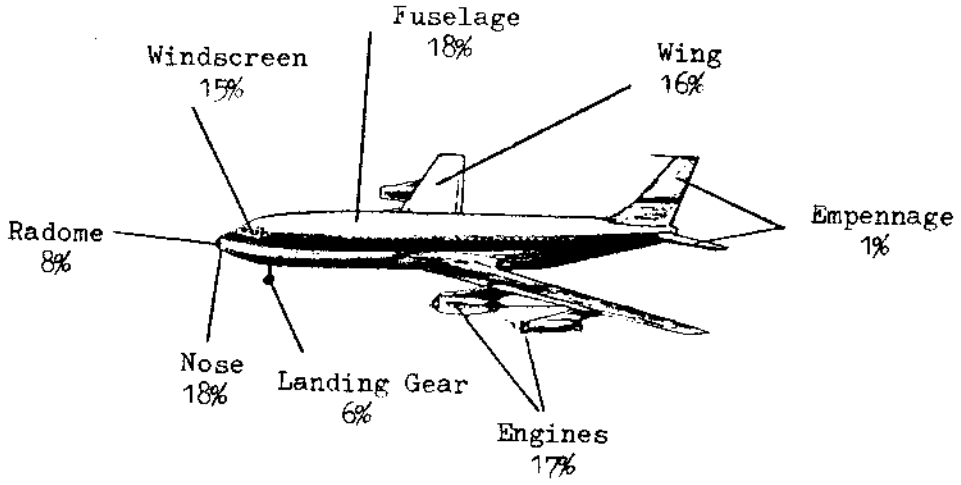
(f) There were 54 incidents where the aircraft was considered to be en-route.

3.4 BIRD SPECIES (See Table 4)

The bird species involved were identified in 684 incidents. The identification standard ranged from examination of bird remains by a trained ornithologist, to the fleeting glance of a pilot. From Figure 2 it can be seen that overall 44% of strikes involved gulls (Larus sp), of which the black-headed gull (Larus ridibundus) and Common gull (Larus canus) were the most frequently identified. Next on the list were Lapwings (Vanellus vanellus) with 13.9%, followed by the combination of swifts, swallows and martins with 11% and pigeons (Columba sp) with 7%. The percentage of gull strikes was 10% lower than in the previous 4 year period, but lapwing strikes were 2% higher. Less than 1% of incidents were known to involve birds of greater than 1.81 kg (4 lb).

3.5 PART OF AIRCRAFT STRUCK (See Table 5)

(a) From Figure 7 it can be seen that the parts most frequently reported as being struck were the nose and fuselage with 18% each, followed by the engines with 17%. The windscreen was struck in 15% of the incidents. It should be noted that there were 17 incidents where more than one engine was struck, of which seven struck all engines.



3.6 EFFECTS OF STRIKES (See Table 6)

(a) During the period covered by this paper a European registered executive jet aircraft crashed due to both engines ingesting gulls on take-off, without injury to the two occupants.

(b) 57 engines were damaged such as to require repair or replacement. Of these 28 were on twin-engined aircraft. It appears that 22% of engine strikes involve engine damage.

(c) Only 2 windscreens were changes, a small number when compared with 222 windscreen strikes (1%). It is thought that none of these incidents involved penetration of the windscreen.

(d) There were 13 cases of radome damage, out of 116 radome strikes, a rather high percentage (11%). In most cases the radome was only delaminated, but in a few cases it was shattered. The radome strength is usually determined by the dielectric properties necessary for satisfactory operation of the weather radar.

3.7 EFFECT VERSUS AIRSPEED VERSUS WEIGHT OF BIRD (See Table 7)

The number of incidents where damage is caused, and the airspeed and bird weight are known, are comparatively few. However it appears that the greatest risk of damage lies in the 101-150 knot speed range, from birds of weight up to 1.8 kg (4 lb).

3.8 COST (See Table 8)

Much more information on costs has been provided this year by seven countries, the engineering cost of bird strikes totalling 2,800,000 US dollars. From this it is estimated that the cost to all European operators is at least 3.7 million US dollars. The accident to the Italian Lear Jet is not included in this total.

3.9 WEATHER AND TIME OF DAY (See Table 9)

(a) It can be seen that 26.1% of strikes were at night, when aircraft movements are low. In addition 13.4% were during the comparatively short periods of twilight.

(b) The data about weather is as yet limited, and in any case the pattern of weather, irrespective of strikes, is not easily quantified. However it can be seen that very few strikes are associated with mist, fog and precipitation.

3.10 AIRCRAFT OPERATORS (See Table 10)

This table provides a guide to the reporting rates of individual airlines. It is probable that it is considerably affected by the airport(s) at which the airline has its main base.

4. CONCLUSIONS

4.1 The overall rate for the 1428 strikes reported during this period by European operators is 5.2 strikes per 10,000 movements. This rate is considerably higher than the average of 3.2 for the previous four years. The Netherlands and Germany have the highest rates, possibly due to a good standard of reporting.

4.2 There does not appear, from the available data, to be any close correlation between the strike rate and the aeroplane type, in terms of speed, engine type, etc. However the strike rate for the group comprising wide-bodied aeroplanes does appear to be above average, indicating that frontal area may have an effect. There is no evidence that the strike rate of executive jet aeroplanes is above that which would be expected for their size.

4.3 Certain of the airports where movement data was available have an above average strike rate. There are also some airports outside Europe where the number of bird strikes reported by European operators is high, but the movements by European registered aircraft are low.

4.4 Gulls (Larus sp) were struck more frequently than other birds, being involved in 44% of incidents. Less than 1% of strikes were known to involve birds of greater than 1.8 kg (4 lb).

4.5 Although the majority of strikes occurred during daylight, 26% were at night when the number of aircraft movements was lower.

4.6 The nose section and fuselage were each struck in 18% of the incidents, followed by engines with 17%. Approximately 1% of all strikes involved more than one engine.

4.7 Apart from the crash of one aircraft, due to ingestion in both engines, the major effect was damage to 57 engines, approximately 1 in 5 of the engine strikes. There were also 13 cases of radome damage, approximately 1 in 9 radome strikes.

4.8 Based on information provided by seven countries the estimated minimum cost of bird strikes to European airlines was at least 3.7 million US dollars in the year.

APPENDIX 1

BIRD STRIKE ANALYSIS

EUROPEAN OPERATORS 1976

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 executive jets, which have been included;

(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.

Table 1 Country 1976

Country	Number of Incidents	Number of Movements	Rate per 10,000 Movements
Austria	6	54,000	1.1
Belgium	40	119,717	3.3
Denmark	58	172,832	3.4
France	75 (3)	569,341	1.3
Germany	447	399,780	11.2
Italy	23 (2)	212,200	1.1
Netherlands	150	123,714	12.1
Sweden	(68)	-	-
Switzerland	119	182,104	6.5
United Kingdom	510 (3)	900,994	5.7
Total	1,428 (76)	2,734,682	5.2

Notes:

1.1 There are two movements per flight.

1.2 Movement data for Italy and Austria is based on ICAO sources.

1.3 Austria reported damaging strikes only.

1.4 Helicopters are excluded from this table.

1.5 Data from Switzerland is for Swissair only.

1.6 The figures in brackets are strikes for which no movement data is available.

Table 2 Aircraft Type - 1975

Type	Aircraft	Number of Countries Reporting	Number of Incidents	Number of Movements	Rate per 10,000 Movements
JET					
4 engined	McDonnell Douglas DC8	6	71 (4)	112,319	6.3
	Boeing 707/720	6	116	186,976	6.20
	Boeing 747	8	44	82,183	5.3
	BAC VC10	1	12	27,916	4.30
	Concorde	2	1	2,536	3.9 *
	HS Comet 4	1	2	18,262	1.10
3 engined	McDonnell Douglas DC10	8	92	74,003	12.4
	HS Trident	1	104	135,558	7.7
	Boeing 727	4	163 (1)	233,564	7.0
	Lockheed 1011 Tristar	2	11	17,246	6.4
2 engined	Cessna 500 Citation	1	1	1,036	9.6 *
	Boeing 737	4	211	265,582	7.9
	A300B Airbus	4	24	31,314	7.7
	Lear Jet	4	3	4,408	6.8 *
	BAC 1-11	2	110	241,336	4.6
	HS 125	3	14	30,914	4.5
	McDonnell Douglas DC9	5	189 (35)	452,703	4.2
	DA01 Mercure	1	14	40,954	3.4
	Fokker F28 Fellowship	2	2 (3)	7,622	2.6 *
	Falcon 20	3	2	10,538	1.9
	SE210 Caravelle	6	36	230,690	1.6
	VFW 614	3	1	8,366	1.2 *
TURBOPROP					
4 engined	Canadair CL44	1	8	9,488	8.4
	BAC Merchantman	1	11	13,084	8.4
	BAC Viscount	1	78 (2)	120,042	6.50
	BAC Britannia 253	2	1	4,180	2.4 *
	HS Argosy	1	1	5,460	1.8 *
2 engined	HS 748	1	19	34,718	5.5
	HP Herald	1	17	64,168	2.6
	Fokker F27	5	23	126,316	1.8
	Nord 262	2	2	51,069	0.4
	DHC6 Twin Otter	2	1	25,000	0.4
	Beech 99	1	1	30,000	0.3 *

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Table 2 (Continued)

Type	Aircraft	Number of Countries Reporting	Number of Incidents	Number of Movements	Rate per 10,000 Movements
PISTON					
	DH114 Heron	1	3	2,558	11.7 *
	ATL 98 Carvair	1	1	6,784	1.5 *
	Douglas DC6	2	0	1,982	0 *
	Convair 440	2	0 (23)	8,865	0 *
	Douglas DC3 Dakota	1	0	14,946	0
UNKNOWN			39	-	-
HELICOPTERS					
	Sikorsky S61	1	4	39,688	1.0
	Others	2	1	46,120	-
TOTAL			1,433	-	-

Table 2A Summary of Aeroplane Types

	Number of Incidents	Number of Movements	Rates per 10,000 Movements
Jet	1,223 (43)	2,216,022	5.5
Turboprop	162 (2)	483,525	3.3
Piston	4 (23)	35,135	1.1
Unknown	39		
TOTAL	1,428 (68)	2,734,682	5.2

Notes:
2.1 There are two movements per flight.
*2.2 Rates for aircraft types with less than 10,000 movements are included in the Table, but are subject to greater error.
2.3 Rates for types where ICAO data has been used are only approximate (ICAO data on Charter Operators is not comprehensive).
2.4 The figures in brackets are from Sweden, which was unable to supply movement data.

Table 3 Aerodromes - 1976

Aerodrome/Country	Incidents	Movements	Rate per 10,000 Movements	Incidents to other European Aircraft	Total Incidents
EUROPEAN AERODROMES					
Austria					
Vienna	1			8	9
Linz	1				1
Graz	1				1
Belgium					
Brussels	25	57,471	4.35	11	36
Antwerp	3	5,726	5.24 *		3
Charleroi	1	2,130	4.69 *		1
Denmark					
Copenhagen	35	150,630	2.32	22	57
Rønne	4	3,458	11.57 *	4	8
Billund	4	8,355	4.79		4
Aalborg	3	6,643	4.52 *		3
Esbjerg	3	5,062	5.93 *		3
Karup	1	3,006	3.33 *		1
Odense	2	3,368	5.94 *		2
Sønderborg	1	3,708	2.70 *		1
Thisted	2	1,417	14.11 *		2
Thirstrup	1	4,992	2.00 *		1
Vagar	1	1,299	7.70 *		1
France					
Paris-Orly	17	144,732	1.17	11	28
Paris-Charles de Gaulle	7	92,879	0.75	7	14
Paris Le Bourget	4	38,116	1.05	7	11
Lyon-Satolas	9	93,456	2.07		9
Nice	7	41,289	1.69	2	9
Marseille Marignane	4	46,688	0.86		4
Tarbes Ossun Lourdes	3	4,272	7.02 *		3
Bastia Poreta	2	8,853	2.26 *		2
Biarritz Bayonne	2	3,164	6.32 *		2
Montpellier	2	6,423	3.11 *		2
Metz Frescaty	2	5,189	3.86 *		2
Germany					
Frankfurt	66	-	6.87	5	71
Hamburg	40	-	12.03	3	43
Dusseldorf	35	-	9.38	5	40
Munich	36	-	8.28	4	40
Cologne	20	-	11.5	3	23
Bremen	10	-	19.97	4	14
Berlin Tegel	-	-	-	9	9
Hanover	8	-	3.65	1	9
Nuremburg	8	-	11.39		8
Westerland	-	-	-	3	3
Stuttgart	2	-	1.17	1	3

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Table 3 (Continued)

Aerodrome/Country	Incidents	Movements	Rate per 10,000 Movements	Incidents to other European Aircract	Total Incident
Italy					
Rome Fuimicino	8			5	13
Venice	4				4
Milan Linate	4				4
Naples	2			2	4
Trieste	2				2
Alghero	-			2	2
Rome Ciampino	1				1
Bari	1				1
Milan Malpensa	1				1
Catania	1				1
Caglia	1				1
Netherlands					
Amsterdam	44	61,401	7.17	19	63
Rotterdam	4	3,267 *	12.24	2	6
Eindhoven	1				1
Sweden					
Stockholm Arlanda	8	66,100	1.2	4	12
Norrkoping	9	4,400 *	20.5		9
Stockholm Bromma	8	30,400	2.6		8
Gothenburg/Torslanda	5	29,900	1.7	3	8
Halmstad	3	4,300 *	7.0		3
Angelholm	3	3,700 *	8.1		3
Malmo/Sturup	3	15,900	1.9		3
Jonkoping	2	7,400 *	2.7		2
Visby	2	7,900 *	2.5		2
Switzerland					
Zurich	34	53,886	6.3	6	42
Geneva	15	31,769	4.7	8	23
Basle	10	31,385	3.2		10
United Kingdom					
London Heathrow	48	131,239	3.7	19	67
Glasgow	35	32,489	10.8		35
Luton	33	17,474	18.9	1	34
Belfast (Aldergrove)	33	20,387	16.2		33
Prestwick	27	29,832	9.0		27
Edinburgh	21	22,469	9.3		21
London Gatwick	20	68,877	2.9		20
Birmingham	13	20,539	6.3		13
Aberdeen	13	45,981	2.8		13
Ronaldsway I of M	10	12,894	7.7		10
East Midlands	9	15,576	5.8		9

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Table 3 (Continued)

Aerodrome/Country	Incidents	Movements	Rate per 10,000 Movements	Incidents to other European Aircraft	Total Incidents
United Kingdom (Contd.)					
Newcastle	9	15,818	5.7		9
Manchester	9	36,491	2.5		9
Glamorgan/Rhoose	8	6,770	11.8		8
Liverpool	6	11,162	5.4		6
Tees-side	4	8,334	4.8		4
Belfast Harbour	4				4
Bristol Filton	4				4
Inverness	3	10,493	2.8		3
Southampton	3	10,367	2.8		3
Macrihanish	3				3
Stansted	2				2
Hatfield	2				2
Leeds/Bradford	2				2
Warton	2				2

Table 3 (Continued)

OTHER AERODROMES

List of aerodromes where more than one strike has been reported by European operators.

Guernsey	(UK)	9	Freetown	(Sierra Leone)	3
New York	(US)	9	Merida	(Mexico)	3
Nairobi	(Kenya)	6	Entebbe	(Uganda)	3
Athens	(Greece)	6	Kinshasa	(Zaire)	2
Bombay	(India)	5	Oujda	(Morocco)	2
Madrid	(Spain)	5	Istanbul	(Turkey)	2
Monrovia	(Liberia)	4	Mailand		2
Jersey	(UK)	4	Palma	(Spain)	2
Freeport	(Bahamas)	4	Addis Abbaba	(Ethiopia)	2
Lisbon	(Portugal)	4	Gibraltar	(Gibraltar)	2
Tenerife	(Canary Isles)	4	Alghero	(Italy)	2
Lima	(Peru)	4	Accra	(Ghana)	2
Bangkok	(Thailand)	4	Fornebu	(Norway)	2
N'Djamena	(Tchad)	3	New Dehli	(India)	2
Dakar	(Senegal)	3	Los Angeles	(US)	2
Douala	(Cameroon)	3	La Paz	(Bolivia)	2
Abidjan	(Ivory Coast)	3	Roswell	(US)	2
Boston	(US)	3	Santiago	(Chile)	2
Lagos	(Nigeria)	3	Malaga	(Spain)	2
Hong Kong	(Hong Kong)	3	Prague	(Czechoslovakia)	2
Barcelona	(Spain)	3	Toronto	(Canada)	2
Bergen	(Norway)	3	Panama	(Panama)	2

Other Aerodromes with single incidents	88
En-Route	54
Unknown	96
TOTAL	1,504

Notes: * 3.1 Rates with less than 10,000 movements are included, but are subject to greater error.

Table 4 Bird Species - 1976

English Name	Scientific Name	Weight	Weight Category	Number of Incidents	% Based on 688
Ciconiiformes					
Stork	Ciconiidae	up to 3 kg	C	2	0.3
Heron	Ardea sp.	up to 1.8 kg	B	3	0.4
Anseriformes					
Mallard	Anas Platyrhynchos	900 g	B	2	0.3
Duck	Anas sp.	300-1.5 kg	B	1	-
Goose	Anser sp.	up to 2.5 kg	C	1	-
Falconiformes					
Kite	Milvus sp.	1	B	5	0.7
Black Kite	Milvus migrans	1 kg	B	2	0.3
Vulture		up to 5 kg	C	1	-
Sparrowhawk	Accipter Aisus	200 g	B	1	-
Falcon	Falco sp.	up to 800 g	B	19	2.8
Common buzzard	Buteo buteo	880 g	B	6	0.9
Kestrel	Falco tinnunculus	200 g	B	5	0.7
Buzzard	Buteo sp.	up to 880 g	B	14	2.0
Hen harrier	Circus cyaneus	400 g	B	1	-
Montagues harrier	Circus pygargus	300 g	B	4	0.6
Galliformes					
Partridge	Perdix perdix	300-400 g	B	16	2.3
Pheasant	Phaslanus Colchicus	1.2 kg	B	6	0.9
Charadriiformes					
Oyster catcher	Haematopus ostralegus	550 g	B	8	1.2
Lapwing	Vanellus vanellus	250 g	B	95	13.8
Golden Plover	Pluvialis apricaria	200 g	B	2	0.3
Curlew	Numenius arquata	800 g	B	1	-
Greenshank	Tringa nebularia	160 g	B	1	-

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Table 4 (Continued)

English Name	Scientific Name	Weight	Weight Category	Number of Incidents	% Based on 688
Charadriiformes Contd.					
Great black-backed gull	Larus marinus	1.8 kg	B	6	0.9
Lesser black-backed gull	Larus fuscus	800 g	B	6	0.9
Herring gull	Larus argentatus	1.1 kg	B	21	3.1
Common gull	Larus canus	400 g	B	5	0.7
Black-headed gull	Larus ridibundus	300 g	B	49	7.2
Gull	Larus sp.	300-1.8 kg	B	214	31.1
		Total	Gulls	301	43.7
Columbiformes					
Pigeon	Columba sp.	450 g	B	48	7.0
Strigiformes					
Owl	-	170-380 g	B	3	0.4
Long-eared owl	Asio otus	260	B	4	0.6
Short-eared owl	Asio flammeus	380 g	B	1	-
Apodiformes					
Swift	Apus apus	30 g	A	13	1.9
Passeriformes					
Sky lark	Alauda arvensis	40 g	A	3	0.4
Swallow	Hirundo rustica	15 g	A	62	9.1
House martin	Delichon urbica	15 g	A	1	-
Carrion crow	Corvus corone	550 g	B	11	1.6
Jackdaw	Corvus monedula	230 g	B	2	0.3
Raven	Corvus corax	1.2 kg	B	1	-
Rook	Corvus frugilegus	400-550 g	B	1	-

Continued overleaf

Table 4 (Continued)

English Name	Scientific Name	Weight	Weight Category	Number of Incidents	% Based on 688
Passeriformes Contd.					
Magpie	Pica pica	220 g	B	1	-
Redwing	Turdus iliacus	85 g	A	3	0.4
Starling	Sturnus vulgaris	85 g	A	13	1.9
Green finch	Carduelis chloris	30 g	A	1	-
Sparrow	Small passeriform	18-40 g	A	22	3.2
Corn bunting	Plectrophenax nivalis	25 g	A	1	-
Unknown				813	
TOTAL				1,501	

Notes: 4.1 Bird weights and Scientific Names are based on information supplied by Pest Infestation Control Laboratory, MAFF, Worplesdon, England, and the average weight has been assumed.

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

A below 110 g ($\frac{1}{4}$ lb)
B 110 g to 1.81 kg ($\frac{1}{4}$ lb to 4 lb)
C over 1.81 kg to 3.63 kg (4 lb to 8 lb)
D over 3.63 kg (8 lb)

4.3 Those birds not positively identified are tabled as Unknown, except where there is evidence that they are Large (C or D).

4.4 Percentages are based on incidents where birds are identified.

Table 5 Part of Aircraft Struck - 1976

Part Struck	No. of Strikes by Bird Weight Category					% Based on 1488
	Unknown	A	B	C & D	Total	
Fuselage	150	29	97	-	276	18.5
Nose (excluding radome and windscreen)	154	27	91	1	273	18.3
Radome	58	14	44	-	116	7.8
Windscreen	114	44	64	-	222	14.9
Engine:-						
1 engine struck	124	9	104	1	238	16.0
2 out of 3 struck	1	-	1	-	2	0.1
2 or more of 4 struck	1	-	7	-	8	0.5
all engines struck	-	1	6	-	7	0.5
Wing/Rotor	108	16	117	-	241	16.2
Landing Gear	34	9	46	1	90	6.0
Empennage	3	1	11	-	15	1.0
Part Unknown	79	14	116	-	209	-
TOTAL	826	164	704	3	1,697	100.0%

Notes: 5.1 The totals in Table 5 are higher than others, as one bird can strike several parts.

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

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

Table 6 Effect of Strike - 1976

Effect	No. of Strikes by Bird Weight Category						% Based on 536
	Unknown	A	B	C	D	Total	
Loss of Life/ Aircraft	-	-	1	-	-	1	-
Flight Crew Injured	-	-	-	-	-	-	-
Engine Damage Requiring Repair							
2 Engined Aircraft	9	-	20	-	-	29	5.4
Others	18	-	10	-	-	28	5.2
Windscreen Cracked or Broken	-	-	2	-	-	2	0.4
Radome Changed	2	-	11	-	-	13	2.4
Deformed Structure	2	1	4	-	-	7	1.3
Skin Torn/Light Glass Broken	10	1	10	-	-	21	3.9
Skin Dented	11	9	34	1	-	46	8.6
Propeller/Rotor/ Transmission Damaged	-	1	2	-	-	3	0.6
Aircraft System Lost	5	1	5	-	-	11	2.0
Nil Damage	187	62	126	-	-	375	
Unknown	59	1	20	-	-	80	-
TOTAL	303	69	243	1	-	616	100%

Notes: 6.1 If, for example, skin is torn in two places, or both windscreens are broken, two incidents are recorded.

6.2 The percentages are based on known effects.

Table 7 Effect-Airspeed-Weight of Bird-1976 Data

Effect	Airspeed	0-80	81-100	101-150	151-200	201-250	over 250
	Weight	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							
Engine Prematurely Changed			2	13	2		
Windscreen Cracked/ Broken				2			
Radome Changed					1		
Deformed Structure				5 1			
Skin Torn/Light Glass Broken				2	2	1	
Skin Dented			2	10 1	1		1
Propellor/Rotor Damaged							
Aircraft System Lost			1	1			
Total			5	33 2	6	1	1

Notes: 7.1 The totals are very low as the table includes only damaging strikes where bird weight and airspeed are known.

7.2 Airspeed is in knots.

Table 8 Cost-1976

	Aircraft Movements	Cost US Dollars
Where cost is known	2,068,702	2.80 million
Where cost is not known	665,980	
LIKELY TOTAL COST	2,734,682	3.70 million

Notes: 8.1 Engineering costs only.

8.2 Cost data supplied by Belgium, Denmark, France, Netherlands, Sweden, Switzerland and the UK.

Table 9 Weather-Strikes On or Near Aerodrome and Time of Day

Weather / Time of Condition/ Day	Dawn	Day	Dusk	Night
Precepitation	2	3	1	5
Mist / Fog *	1	1		2
Cloud Coverage	< ½ | > ½	< ½ | > ½	< ½ | > ½	< ½ | > ½
Base Below 1000 ft	1	2 | 9	1	2
Base 1000-5000 ft	3	7 | 6	1 | 4	2 | 8
Above 5000 ft		4 | 6		
Clear	4	57	3	22
Total in Each Time Band	11	95	10	41
% In Each Time Band	7.0	60.5	6.4	26.1

Notes: 9.1 Visibility less than 1000 metres.

9.2 Clear includes CAVOK.

Table 10 Aircraft Operator's Reported Strikes

Operator	Number of Incidents	Number of Movements	Rate per 10,000 Movements
Austria			
Austrian Airlines	6	54,000 +	1.1
Belgium			
Sabena	37	87,102	4.2
Trans European Airways	2	5,462	3.7 *
Young Cargo	1	2,302	4.3 *
Denmark			
SAS	26	89,896	2.9
Sterling Airways	11	36,074	3.0
Maersk Air	8	21,738	3.7
Conair	8	6,884	11.6 *
Cimber Air	1	17,888	0.6
Others	4	2,440	16.4 *
France			
Air Inter	36	144,344	2.5
Air France	19	339,014	0.5
UTA	15	29,276	5.1
Air Alpes	2	65,000 +	0.3
Uni Air	1	13,000 +	0.8
Others	5	-	-
Germany			
Various	449	-	-
Italy			
Alitalia	22	-	-
Others	3	-	-
Netherlands			
KLM/NLM/Martinair	139	117,990	11.8
Transavia	11	5,724	19.2 *
Sweden			
SAS	39	-	-
Linjeflyg AB	26	-	-
Others	3	-	-
Switzerland			
Swissair	119	182,104	6.5

Continued overleaf

Table 10 (Continued)

Operator	Number of Incidents	Number of Movements	Rate per 10,000 Movements
UK			
Transmeridian	5	5,520	9.1 *
Tradewinds	3	3,690	8.1 *
Laker	12	17,100	7.0
British Airways			
Overseas Division	46	67,600	6.8
Remainder	254	357,400	7.1
British Caledonian	44	77,500	5.7
British Midland	21	41,700	5.0
McAlpine	3	6,200	4.8 *
Britannia Airways	18	40,400	4.5
Alidair	4	9,800	4.1
Monarch	5	14,100	3.5
British Island Airways	13	46,800	2.8
Air Anglia	6	27,000	2.2
Dan-Air	17	86,200	2.0
British Air Ferries	2	16,600	1.2
Others/Unknown	65	-	-

Notes: 10.1 The aircraft movements of operators who did not report any strikes are not included.

10.2 Leased aircraft are included against the operator.

+10.3 Estimated movements.

*10.4 Rate subject to error.

SERIOUS BIRD STRIKE INCIDENTS WORLD-WIDE 1976

(Executive Jets and Aircraft over 5,700 Kg)

1.1.76 SAS DC10-30, LN-RKA, at Copenhagen

During a night take-off with 13 on board from runway 22L when aircraft was at 100 ft and 175 kts it struck flock of gulls. Pilot heard loud bang and No 1 engine lost power. Aircraft returned safely. A total of 28 black-headed gulls (Larus ridibundus) were found on runway. It is believed that between 9 and 15 birds went through No 1 and 3 engines. The weight of the birds was between 240 and 340 grams. There was severe damage to No 1 engine, including failure of the casing which had started to open up. There was also minor damage to No 3 engine and the left wing. The weather conditions were 7/8 cloud, base 500 ft, slight rain, and due to aerial damage two ILS approaches were made. The cost of repairs are estimated to be approx $1\frac{1}{2}$ million US dollars.
(Source Bird Strike Committee Denmark and ICAO Subsequent Notification)

23.1.76 Pan American Boeing 747 at Istanbul

During take-off birds were ingested into No 3 and 4 engines, aircraft returned but neither engine was shutdown. Birds struck were gulls and "hawks", and a dead bird was found in No 8 canoe fairing. Seven fan blades were replaced on No 3 engine and six on No 4, and there were cuts in cowlings.
(Source Aviation Week, February 2, 1976 - not confirmed by other sources)

6.2.76 Executive Lear 24, I-AMME, Bari, Italy

Just before lift-off aircraft encountered a flock of gulls. Both engines failed and aircraft veeered off the runway and came to rest in a small field. The 2 occupants were uninjured.
(Source - Lloyds List and Sillages)

13 February 1976 Air France B747 at Paris Orly

During the take off run at 165 kts struck flock of black headed gulls (Larus ridibundus). Fifty three tonnes of fuel were jettisoned before landing. It was found that engine 1 was badly damaged, and engine 4 required some new fan blades.
(Source - French Reporting System)

10.3.76 British Airways Boeing 747, G-AWNI, at Prestwick, UK

At approx 110 kts during the take-off on runway 13 aircraft struck flock of birds, engine 4 had high vibration and ran down, and take-off was abandoned. All fan blades were damaged, nose cowl extensively damaged with 2 holes in outer case, fan blade tips missing. The weather was 8/8 cloud at 1,300 ft with rain.

14.4.76 British Airways Boeing 747, G-AWNK, at Prestwick, UK

At 50 ft, 160 kts during take-off on a training flight the aircraft struck a flock of gulls (believed Herring gulls - Larus agentatus or Lesser black backed gulls - Larus fuscus). There was loud bang, power loss, fire warning and tower reported 200 ft long flame and pieces falling. Engine was shutdown and fire bottles fired. Vibration with engine shutdown even at 165 kts. Inspection showed 2 fan blades broken and all other blades damaged, one foot square hole right through nose cowl outer skin. Cowlings displaced, pylon panels and exhaust cone missing, reverser sleeve displaced, leading and trailing edge flaps holed. Weather was 3/8 at 4,000 ft, visibility greater than 10 Km. There were 6 crew on board.
(Source: UK Reporting System)

27 August 1976 British Airways B747 at Hong Kong

At 400ft after take off two large birds seen to go under right wing. Found 13 x 6 inch hole in flap canoe fairing outboard of engine 3. Remains of small hawk (Falconiformes) removed.
(Source - UK Reporting System)

12 November 1976 Private Falcon 20 N27R at Naples, Florida, US

Before the accident airport employees had dispersed a flock of gulls from the runway. Most of the gulls departed but about 30 returned. The radio normally carried by the bird scaring team was unserviceable. By this time (8.55 local, daylight) the aircraft had started its take off run. Shortly after becoming airborne it passed through the flock, both engines failed and the aircraft crashed. The fuselage was severely damaged, a wing separated and all eleven occupants were seriously injured. The gulls were ring-billed gulls (Larus delawarensis).
(Source - ICAO Subsequent Notifications and US Sources)

BSCE/A/2

Revised
June 1976

BIRD STRIKE COMMITTEE EUROPE

MILITARY AIRCRAFT

BIRD STRIKE ANALYSIS

1976

Prepared by: Squadron Leader T S Austin RAF
MOD (Inspectorate of Flight Safety (RAF)) - UK

ANALYSIS OF MILITARY BIRDSTRIKES - 1976

INTRODUCTION

1. Data used in this analysis was supplied by the following air forces:

Royal Netherlands Air Force
Royal Norwegian Air Force
Royal Air Force
Swedish Air Force

2. The United States Air Force (Europe) also supplied data and although the information was not suitable for inclusion in the tables, points of interest are included in this analysis.

STRIKE RATES

3. Table 1 shows the strike rates for aircraft by their main role. Strike and Recce aircraft, operating mainly in the low level role showed up, once again, with the highest strike rate. Within nations the strike rate varied quite considerably, probably reflecting the different operating speeds and heights of the different aircraft. In the United Kingdom, for instance, there are 3 aircraft operating in the same speed and height range. Two, the Harrier and Jaguar, operate mainly over the land whilst the third, the Buccaneer, operates largely over the sea. The Buccaneer's strike rate is at least twice that of the other aircraft.

AIRFIELD BIRDSTRIKES

4. Table 2 lists the number of strikes against airfields and, in the case of domestic airfields only, strike rates. The Netherlands, in particular, appear to have a problem with two airfields, Leeuwarden and Twenthe, showing well above the average strike rates. It will be interesting to see what effect bird control teams, which have been formed since 1976, will have on these rates.

5. Excluding the strikes which are listed as "unknown" in table 2, 58% occurred on and around the airfield whilst 42% occurred en route. This is a complete reversal of 1975 when 45% occurred "on airfield" and 55% occurred "en route".

BIRD SPECIES

6. Table 3 shows the bird species involved in strikes. Gulls of all types featured in 40% of occasions when the bird was identified against 30% in 1975 whilst the second most common type of bird struck, the Lapwing (Vanellus vanellus) again featured in 15% of occasions. However, of the total number of recorded birdstrikes (665) only in 39% of occasions was the bird identified.

PARTS OF THE AIRCRAFT STRUCK AND THE EFFECT

7. Tables 4, 4A and 5 show the parts of the aircraft struck, the effect of the strike and the effect against airspeed and weight of the bird. The distribution of strikes about the aircraft remains substantially the same as that for 1975. The effect of the strikes also follows the same pattern for 1975 with 58% causing no damage. However 2 aircraft were destroyed against one in 1975. Where the bird was identified, 55% of the strikes occurred when the aircraft were flying at 250 knots and higher.

TABLE 1 AIRCRAFT ROLE

ROLE	AIRCRAFT TYPE		STRIKES PER 10,000 MOVEMENTS
STRIKE AND RECCE	Netherlands		
	F 104G		28.3
	RF 104G		14.5
	NF 5A		16.2
	Sweden		
	AJ 37		20.3
	SH 37		5.0
	S 35		7.7
	A 32		14.7
	S 32		13.4
	United Kingdom		
	Buccaneer		16.70
	Harrier		5.15
	Jaguar		8.51
	Vulcan		6.38
AIR DEFENCE	Netherlands		
	F 104,		20.1
	Norway		
	F - 5	(13)	NK
	F - 104	(9)	NK
	Sweden		
	J 35		3.8
	J 32		1.7

TABLE 1 AIRCRAFT ROLE

ROLE	AIRCRAFT TYPE		STRIKES PER 10,000 MOVEMENTS
	United Kingdom		
	Lightning		2.32
	Phantom		1.31
TRANSPORT	Netherlands		
	F 27		4.2
	PSC		3.2
	Norway		
	Falcon 20c	(1)	NK
	DHc - 6	(1)	NK
	United Kingdom		
	Andover		3.55
	Argosy		11.61
	Belfast		9.38
	Devon		1.00
	Hercules		5.91
	HS 125		4.64
	VC 10		2.51
MARITIME	Norway		
	P 3	(4)	NK
	United Kingdom		
	Nimrod		16.91

TABLE 1 AIRCRAFT ROLE

ROLE	AIRCRAFT TYPE	STRIKES PER 10,000 MOVEMENTS
TRAINING	Netherlands	
	NF - 5B	17.4
	TF - 104G	14.9
	Sweden	
	Sk 60	9.3
	Sk 61	2.4
	United Kingdom	
	Bulldog	0.26
	Dominie	7.67
	Gnat	0.91
	Hunter	2.08
	JP	1.77
HELICOPTERS	Netherlands	PER 10,000 HOURS
	Alouette 111	1.2
	Bo 105c	4.4
	Norway	
	Sea King (1)	NK
	Sweden	
	H kp 4)	4.7
	H kp 6)	

TABLE 1 AIRCRAFT ROLE

ROLE	AIRCRAFT TYPE	STRIKES PER 10,000 MOVEMENTS
	United Kingdom	
	Puma	7.66
	Whirlwind	1.27
	Wessex	0.68

1.1 There is a minimum of 2 movements per flight.

1.2 Countries are not listed where they do not have aircraft operating in the particular role.

1.3 Aircraft with no recorded birdstrikes are not listed.

1.4 Where the strike rate is not known the number of strikes is in brackets after the aircraft type.

TABLE 2 AIRFIELD

AIRFIELD	NUMBER OF INCIDENTS	NUMBER OF MOVEMENTS	STRIKES PER 10,000 MOVEMENTS
1. DOMESTIC (data from own country with known no of movements).			
NETHERLANDS			
Leeuwarden	30	16,700	18.0
Volkel	10	24,348	4.1
Twenthe	20	15,078	13.3
Eindhoven	2	8,708	2.3
Gilze Rijen	6	11,212	5.4
Soesterberg	12	25,484	4.7
Deelen	5	28,994	1.7
SWEDEN			
F1 Vasteras	7	18,344	3.8
F/13M Malmslatt	7	16,144	4.3
F4 Ostersund	4	20,894	1.9
F5 Ljungbyhed	13	37,644	3.5
F6 Karlsborg	2	11,118	1.8
F7 Satenas	14	16,570	8.4
F10 Angelholn	5	24,182	2.1
F11 Nykoping	9	18,396	4.9
F12 Kalmar	7	14,652	4.8
F13 Norrkoping	4	16,834	2.4
F15 Soderham	4	11,576	3.5
F16 Uppsala	9	26,230	3.4
F21 Lulea	5	22,232	2.2

TABLE 2 AIRFIELD

AIRFIELD	NUMBER OF INCIDENTS	NUMBER OF MOVEMENTS	STRIKES PER 10,000 MOVEMENTS
UNITED KINGDOM			
Kinloss	6	6,789	8.8
Fairford	5	9,572	5.2
Brize Norton	15	31,022	4.8
Wyton	7	25,016	2.8
Lossiemouth	15	54,599	2.7
Macrihanish	2	7,282	2.7
Scampton	6	23,565	2.5
Lyneham	9	38,502	2.3
Finningley	9	39,376	2.3
Northolt	3	14,307	2.1
Benson	5	25,903	1.9
Marham	5	30,263	1.7
Church Fenton	4	31,769	1.3
Leuchars	4	31,996	1.3
Waddington	3	26,552	1.1
Leconfield	2	20,144	1.0
Honington	3	31,740	0.9
Coltishall	2	25,269	0.8
Cranwell	6	79,902	0.8
Coningsby	3	42,541	0.7
St Mawgan	2	29,280	0.7
Shawbury	4	59,445	0.7
Wittering	2	32,834	0.6
Valley	6	101,692	0.6
Odiham	2	46,041	0.4
Linton upon Ouse	3	78,180	0.4
Leeming	2	69.087	0.3

TABLE 2 AIRFIELD

AIRFIELD	NUMBER OF INCIDENTS	NUMBER OF MOVEMENTS	STRIKES PER 10,000 MOVEMENTS
2. DOMESTIC (incomplete data)			
NORWAY			
Bodo	6	-	-
Rygge	4	-	-
Gardemoen	3	-	-
Sola	3	-	-
Orland	3	-	-
3. DOMESTIC AIRFIELDS WITH SINGLE STRIKES	16	-	-
4. FOREIGN AIRFIELDS		-	-
5. FOREIGN AIRFIELDS WITH SINGLE STRIKES	-	-	-
6. EN ROUTE	259	-	-
7. UNKNOWN	77	-	-
TOTAL	690	-	-

TABLE 3 BIRD SPECIES

COMMON NAME	LATIN NAME	APPROX WEIGHT	CATEGORY	NUMBER OF STRIKES	% BASED ON 261
Gull (various)	Larus sp	400-1800	B	48	18.4
Lapwing	Vanellus vanellus	200	B	39	14.9
Blackheaded Gull	Larus ridibundus	400	B	32	12.3
Swift	Apus apus	40	A	20	7.7
Wood Pigeon	Columba palumbus	500	B	17	6.5
Common Gull	Larus canus	400	B	14	5.4
Skylark	Alauda arvensis	40	A	11	4.2
Herring Gull	Larus argentatus	1000	B	8	3.1
Golden Plover	Pluvialis apricaras	170	B	6	2.3
Oyster Catcher	Haemotopus ostralegus	550	B	6	2.3
Starling	Sturnus vulgaris	100	A	6	2.3
Kestrel	Falco tinnunculus	200	B	5	1.9
Passerine	Passeriformes	20-110	A	5	1.9
Feral Pigeon	Columba livia var	400	B	4	1.5
Magpie	Pica pica	250	B	4	1.5
Partridge	Perdix perdix	400	B	4	1.5
Buzzard	Buteo buteo	1000	B	3	1.2
Fieldfare	Turdus pilaris	100	A	3	1.2
Sparrow	Passer spp	40	A	3	1.2
Swallow	Hirundo rustica	18	A	3	1.2
Thrush	Turdus philomelus	70	A	3	1.2
Corvid	Corvus sp	250-550	B	2	0.8
Curlew	Numenius arquata	800	B	2	0.8
House Martin	Delichon urbica	18	A	2	0.8
Mallard	Anas platyrhrynchos	1000	B	2	0.8
Pheasant	Phasianus colchicus	1000	B	2	0.8
Snow Bunting	Plectrophenax nivalis	35	A	2	0.8
Auk	Alcidae indet	900	B	1	0.4
Black throated Diver	Gavia artica	2500	C	1	0.4
Chaffinch	Fringilla spp	23	A	1	0.4
Crow	Corvus corone	550	B	1	0.4
Great Blackbacked Gull	Larus marinus	1800	B	1	0.4

TABLE 3 BIRD SPECIES

COMMON NAME	LATIN NAME	APPROX WEIGHT	CATEGORY	NUMBER OF STRIKES	% BASED ON 261
Great Tit	Parus major	20	A	1	0.4
Lesser Blackbacked Gull	Larus fuscus	800	B	1	0.4
Linnet	Acanthis cannabina	30	A	1	0.4
Meadow Pipit	Anthus pratensis	30	A	1	0.4
Redwing	Turdus iliacus	70	A	1	0.4
Ringed Plover	Charadrius Liaticula	50	A	1	0.4
Rook	Corvus frugilegus	400	B	1	0.4
Siskin	Carduelis spinus	18	A	1	0.4
Tern	Sterna Lirundo	100	A	1	0.4
Unknown	-	-	-	404	-
TOTAL		-	-	665	-

Notes:

3.1 The bird Categories based on current Civil Airworthiness requirements are:

CAT A below .11 kg ($\frac{1}{4}$ lb)
CAT B .11 kg to 1.81 kg ($\frac{1}{4}$ to 4 lb)
CAT C over 1.81 kg to 3.63 kg (4 lb to 8 lb)
CAT D over 3.63 kg (8 lb)

3.2 Those birds not positively identified are tabled as Unknown.

3.3 Percentages are based on the total of identified birds.

TABLE 4 PART OF AIRCRAFT STRUCK

PART	WEIGHT UNKNOWN	CAT A	CAT B	CAT C & D	TOTAL	% Based on .698...
Nose (excluding radome and windscreen)	55	25	35	-	115	16.5
Radome	25	2	14	-	41	5.9
Windscreen	74	16	18	-	108	15.5
Fuselage (excluding the above)	52	9	31	1	93	13.3
Engine:-						
1 engine struck	49	18	28	-	95	13.6
2 out of 3 struck	-	-	-	-	-	
2 out of 4 struck	1	-	2	-	- 3	0.4
3 out of 4 struck	-	-	-	-	-	
all struck (on multi-engined aircraft)	-	-	1	-	1	0.1
Wing	42	12	46	-	100	14.3
Rotor / Propeller	6	1	6	-	13	1.9
Landing Gear	20	3	33	-	56	8.0
Empennage	8	1	9	-	18	2.6
Underwing Stores / Tanks	33	5	17	-	55	7.9
Part Unknown	53	11	19	-	83	-
TOTAL	418	103	259	1	781	-

Notes:

4.1 **The Total in Table 4 and 4A may be higher than other tables, as one bird can strike several parts.**

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

4.3 Multiple strikes are counted as one strike, unless for example both wings or both landing gears are struck, when two incidents should be recorded.

4.4. Data obtained from 4 Nations.

TABLE 4A EFFECT OF STRIKE

EFFECT	Weight Unknown	CAT A	CAT B	CAT C	CAT D	TOTAL	% Based on 550
Loss of Aircraft	2					2	0.4
Flight Crew Injury							
Major							
Minor							
Slight			1			1	0.2
Engine damage requiring repair:-							
on single engined aircraft	4	2	8			14	2.6
1 on a 2 engined "	17	4	11			32	5.8
1 " 3 " "	-	-	-			-	
1 " 4 " "	-	-	4			4	0.8
2 " 3 " "							
2 " 4 " "	1	-	3			4	0.8
3 " 4 " "	-	-	-			-	
all engines on a multi	-	-	1			1	0.2
Windscreen Cracked / Broken	8	2	3			13	2.5
Radome Changed	5	1	4			10	1.8
Deformed Structure	13	-	7			20	3.6
Skin Torn/light glass broken	18	1	12			31	5.6
Skin Dented	30	6	25			61	11.1
Propeller/Rotor Damaged †	3	1	2			6	1.1
Aircraft System Lost	-	-	-			-	
Underwing Stores / Tanks damaged	10	1	9			20	3.6
Miscellaneous	3	-	9			12	2.2
Nil Damage	182	60	77			319	58.0
Unknown	24	5	11			40	-
TOTAL	320	83	187	-	-	590	

Notes:

4A.1 † Includes helicopter transmissions.

4A.2 Data obtained from 4 Nations.

TABLE 5 EFFECT - AIRSPEED - WEIGHT OF BIRD

EFFECT	AIRSPEED	0-80		81-100		101-150		151-200		201-250		over 250	
	WEIGHT	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						1							
Engine Prematurely Changed		1				2		4		1		7	
Windscreen Cracked/Broken												4	
Radome Changed												2	
Deformed Structure								1					
Skin Torn/light glass broken										1		5	1
Skin Dented				3		2		3		1		12	
Propeller/Rotor Damaged						1				1			
Aircraft System Lost													
Underwing Stores/Tanks Damaged												4	
TOTAL		1		3		6		8		4		34	1

Notes:

5.1 The TOTAL in Table 5B is very small, as those incidents where the airspeed or the bird weight are unknown, together with the non damaging strikes, have been omitted.

5.2 Data obtained from 4 Nations.