2.12 Analysis of Bird Strikes.

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PAPER TO BE PRESENTED AT THE 7TH MEETING OF THE
BIRD STRIKE COMMITTEE EUROPE, HELD IN LONDON ON 6TH AND 7TH JUNE 1972

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(The views expressed in this paper are the Authors' own, and do not necessarily reflect those of the Airworthiness Division of the CAA.)

ANALYSIS OF BIRD STRIKES

1 INTRODUCTION

1.1 As a member of the United Kingdom Bird Committee, representing the Airworthiness Division of the Civil Aviation Authority, formerly the Air Registration Board, I undertake the analysis of the bird strikes reported, involving U.K. civil aircraft. Bird strike data has been collected in the U.K. on a systematic basis since 1966, and in 1970 it was decided to attempt to relate these data to aircraft and airfield utilization so as to attempt to draw some meaningful conclusions.

1.2 Appendix A is the result of this comprehensive analysis of the strikes reported during 1970, and I would like to mention a few of the details and problems that have arisen during this work. The most important objective in any analysis of this sort is to arrange that the results provide the various interested parties with the information that they each want, the Airports require the rate for their airport, the ornithologist the type of bird most troublesome, the Airworthiness Authority the part of the aircraft most frequently struck, etc., and it is for this reason that I have used the main headings Aircraft Type, Airfield, Type of Bird, Single or Flock, Time of Year, Time of Day, Altitude, Flight Stage, Part of Aircraft Struck, Significant/Not Significant and finally Airline or Operator Reporting.

2 METHODS IN DETAIL

2.1 I feel it is essential to divide the statistics into aeroplanes of over 12,500 lb (5700 kg), and 12,500 lb and under, for the following reasons:-

(a) the airworthiness requirements of both the U.K. and U.S. are different for these two classes of aeroplane, e.g. in British Civil Airworthiness Requirements (BCAR) the larger class of aeroplane has to withstand a 4 lb. bird, whereas the smaller class only has to meet a 2 lb. bird on the windscreen,

(b) we know much more about the reporting methods and standards of operators of transport types than the air-taxi operator or private owner,

(c) the 12,500 lb. and under classification is in general a much slower aircraft, requiring less airspace and thus a noticeably different strike rate would be expected.

For these reasons the main analysis is of aircraft of over 12,500 lb., with the few strikes reported to the smaller class briefly detailed in an Appendix to the main analysis (see Appendix A page 10).

2.2 Needless to say when analysing strikes to civil aircraft all military type aircraft, even if civilian operated should not be included, owing to their very different operational environment and the fact that the utilization data would not then correspond. The converse could be true of course if an analysis is made of military strikes.

2.3 Aircraft which are not on the States own National Register should not be included, for the same reason, and because it is most probable that the majority of strikes will be reported on arrival in their own country. The strikes by Foreign registered aircraft could if desired be shown on a separate sheet as an Appendix. (This could serve as a useful cross-check for the other Countries.) The table of Aircraft types should include the number of movements by each type, so that the rate for each aircraft type can be used to give the rate for piston, turboprop and jet, and for wide bodied and normal. The figures for Aircraft types for which no strikes have been reported should also be included, so that an overall rate may be obtained. It is odd that in 1970 the Boeing 707 rate is double that of the VC10, for which there is no obvious explanation, but it may be a good demonstration of the danger of basing conclusions on too small a sample, perhaps over a 5 year period the rates will be similar.

2.4 The table of airfields where strikes are reported is only really of use if the appropriate corresponding number of movements is available, because the airfield with the highest number of strikes reported may be very much busier than one with a smaller number of strikes, but with very few movements, and in reality a very high rate. It is interesting to note that in the U.K. the eight worst airfields are close to the sea, and that the two airfields with the highest number of movements - Heathrow and Gatwick do in fact have a very low rate. It is very difficult to obtain this movement data since it has to exclude Foreign registered, military and 12,500 lb. and under aircraft; but must include scheduled and charter, positioning, test and training flights. For some airfields the latter can be a significant proportion of total movements! In order to arrive at a figure inspired guesses may have to be made, and it is worth detailing these at the back of the document so that other people may be able to follow and if necessary make comments, and also so that next year you can remember the basis you used last time! (see Appendix A page 8). Where the airfield is unknown, or the strike is encountered en-route the Not Stated column should be used. It may also be necessary to regard islands a long way off-shore as Foreign, for example the Channel Islands are very much closer to France than England. Again such decisions should be included at the back of the document.

2.5 The next phase of the analysis must be the Bird Species, as the weight category of the bird struck is necessary in the tables which follow. The bird weights should be obtained from Canadian Field Note 51 by G. Kaiser. Those birds not positively identified should be included as Not Stated. The results show that of the identified birds 56% were gulls, a similar figure to many other European countries, and that less than 1% were birds of over 4 lbs. weight.

2.6 Single or flock can be conveniently included at this time, and it may seem slightly odd but I decided that a Flook was more than 2 birds, therefore in fact a single bird can be 2 birds!

2.7 The next few tables are categorised into weight of bird as follows, Not Stated, below $\frac{1}{4}$ lb., $\frac{1}{4}$ lb. to 4 lb., over 4 lb. to 8 lb., and over 8 lb. These are based on the existing weights used in civil aircraft airworthiness requirements.

2.8 The Month of Year table has been restricted to Domestic movements only, since world wide data would tend to confuse the results, as well as make it very difficult to obtain the number of movements each month. In 1970 the worst rate was experienced during January, but I think this may be an isolated freak figure, as the real peak is during August, September, October and November. Many analyses which quote numbers of strikes, as opposed to the strike rate, show the worst month to be August, which is of course the holiday season, with an above average number of aircraft movements. Examination of this data over several years will show the months when extra effort in bird control is required.

2.9 The Time of Day has also been restricted to Domestic movements only, but will only give a guide to the problem area, as dawn and dusk from the birds' point of view is very dependent upon the weather. It must be noted that the majority of movements are during the day, and thus most of the strikes are also, but there may well be a particular problem around dawn.

2.10 The Altitude has been divided 0 to 200 ft., 200-800 ft., 800-2,500 ft. and over 2,500 ft. When the altitude is not specifically stated, but the flight stage is quoted as take-off or landing, the altitude can be assumed to be in the 0 to 200 ft. bracket. Where incidents of dead birds being found on the runway are reported, they should be included in the 0 to 200 ft. bracket and divided equally between take-off and landing. The 1970 figures show that 83% of strikes were in the 0 to 200 ft. bracket, with only 4% above 2,500 ft.

2.11 The Flight Stage can be conveniently broken down into Taxying, Take-off, Climb, Cruise, Holding, Let-down, Approach and Landing. It appears that the Take-off with 40% is slightly worse than the Landing (33·5%).

2.12 The Part of Aircraft Struck is of particular interest, and the totals will be higher than the other tables, since one incident can result in strikes on several parts of the aircraft. The divisions are Nose Section, Wing, Power-plant, Windscreen, Fuselage, Landing Gear and Empennage. It could be expected that the frequency of strikes

should be in direct proportion to the frontal area of the parts of the aircraft, but as it is very difficult to obtain these areas from drawings etc., and as the effective area varies with aircraft attitude it is not possible to correlate. Nevertheless it can be seen that the nose section accounts for 28·5% of the strikes, and the power-plant 20·5%, whereas the Tail and Empennage accounted for less than 1%.

2.13 A table of Significant/Not Significant strikes will show what percentage of strikes could have serious consequences. The definition of Significant is based on ICAO Working Paper No. 294 as follows:-

(a) Catastrophic - loss of life or destruction of aircraft.

(b) (i) Torn metal skinning on any part of aircraft.

(ii) Deformed secondary structure.

(iii) Cracked or shattered windscreen.

(iv) Damage to engines sufficient to cause shut-down or unrecoverable loss of power.

In 1970 only 5% of strikes were Significant, and more than half of these were caused by birds of less than 4 lbs.

2.14 Finally a table of Airlines reporting the strikes, together with their total movements, will show which have the worst bird strike rate, or the best reporting standard! It seems that BOAC have the worst problem of the U.K. airlines, while some airlines have no problem at all!

3 TIMESCALE

3.1 In the U.K. the reports are sent to the Directorate of Flight Safety (SFB3) and are then passed to me quarterly in the form of a large Summary with all the data in columns which I use as the basis for the attached comprehensive breakdown. I use blanks of each of the individual tables and put a small tick in the appropriate box, the only trouble is that after an interruption it is difficult to remember whether you did put a tick in the $\frac{1}{4}$ to 4 lb. column against 0-200 ft. or not? The time taken to analyse the U.K's fairly high total of 280 strikes is approximately 35 hours, with a little bit extra if any problems arise. The data on aircraft movements is not usually available until the June of the following year, and it is therefore not possible to be completely up to date.

4 LONG-TERM COLLECTION OF STATISTICS

4.1 In 1966 all States reporting to the International Civil Aviation Organisation were asked to send their Civil bird strike data to the ICAO Airworthiness Committee in Montreal, in order that this large quantity of data could be assessed to show the real extent of the problem, from the operational as well as airworthiness aspect.

4.2 Appendix B is three pages from ICAO Working Paper AIR C-WP/431 which summarises the data received by ICAO from various countries between 1967-1969 inclusive. I would like to draw to the attention of this European Bird Strike Committee that only 4 European countries, that are members of the European Bird Committee, France, Ireland, Holland and the U.K. have reported to ICAO in all three of the years. It is a pity that three countries Germany, Italy and Switzerland, which are interested enough to be members of the European Committee did not report at all to ICAO during the three year period. If in fact no Bird strikes were reported in your countries during this period, then I apologise, and I do appreciate that many of you within the European Committee are Military personnel to whom ICAO is of no direct interest.

4.3 However, I am sure that you will agree that it is only with the long term collection of data from many countries that any trends can be seen, or conclusions can be accurately reached, and I would ask all of you to use your influence to obtain the best possible standard of reporting in each country, and to see that the data is sent to ICAO in Montreal.

5 CONCLUSIONS

5.1 I hope that some help has been given with problems that can occur during analysis work, much of which can be applied to Military as well as Civil data, or possibly I have convinced you all to keep well away from it!

5.2 It is very important to attempt to combine the results with movements, so that rates can be used for comparison purposes, rather than numbers.

5.3 The results when broken down, particularly when combined with movements to give rates, can be of benefit to Airfield Authorities, Ornithologists, Ecologists, Airworthiness Authorities and Operators. If the strike reports merely find their way into a dusty file in a cupboard then they are of little use to anybody.

5.4 It is important to obtain the best possible standard of reporting, the insignificant strikes are just as important as the few significant ones.

5.5 Care must be taken not to draw conclusions from insufficient evidence, data from several years is much more reliable than from one year.

5.6 Summaries of strike reports should be sent to the ICAO Airworthiness Committee in Montreal to increase the data available, and hopefully, in time, to enable World-Wide data to be made available.

APPENDIX A

SUMMARY OF BIRD STRIKE DATA RECORDED BY U.K. OPERATORS

YEAR 1970

CIVIL AIRCRAFT OVER 12,500 LB. MAXIMUM WEIGHT

1. AIRCRAFT TYPE

TYPE	AIRCRAFT	NO. OF STRIKES	NO. OF MOVEMENTS	STRIKES PER 10,000 MOVEMENTS
JET	Boeing 707	48	65,620	7·30
	VC 10	29	65,060	4·45
	H.S. Trident	32	115,900	2·76
	BAC 1-11	53	200,270	2·61
	Boeing 737	4	16,610	2·40
	Comet 4	5	33,350	1·50
	Boeing 747	1	-	-
TURBOPROP	Nord 262	2	2,200	9·10
	Vanguard/Merchantman	20	47,150	4·24
	Viscount	58	155,660	3·72
	Herald	11	30,440	3·61
	H.S. 748	2	16,440	1·22
PISTON	DC 3	4	9,960	4·00
	Heron	1	5,500	1·82
	Ambassador	1	1,750	5·71
	Bristol 170	1	15,040	0·66
HELICOPTER	S61N	1	18,660	0·53
	Unknown	7	-	-
TOTAL	(Including those with NIL strikes)	280	841,900	3·32

1.A SUMMARY OF TYPES (Including those Types with NIL strikes)

Piston	7	47,400	1·48
Turboprop	93	278,290	3·34
Jet	172	497,550	3·46
Helicopter	1	18,660	0·53
Not Stated	7	-	-

1.B FRONTAL AREA

Wide Bodied*	1	-	-
Normal	279	841,900	3·31

*Boeing 747

2. AIRFIELD

AIRFIELD	NO. OF STRIKES	NO. OF MOVEMENTS	STRIKES PER 10,000 MOVEMENTS
U.K.			-
Wick	4	2,520	15·9
Blackpool	7	4,440	15·8
Belfast	25	20,340	12·3
Edinburgh	13	11,710	11·1
Prestwick	30	29,560	10·2
Glasgow	24	30,260	7·9
Cardiff	3	5,090	5·9
Aberdeen	3	5,730	5·2
Birmingham	6	11,800	5·1
Liverpool	7	14,550	4·8
Luton	8	22,370	3·6
Manchester	10	29,850	3·3
Heathrow	14	129,500	1·1
East Midlands	2	20,600	1·0
Gatwick	4	42,020	0·9
Other U.K. Aerodromes with Single Strikes	13	-	-
FOREIGN			
Jersey	5		
Berlin	5		
Guernsey	4		
Rome	4		
Bremen	3		
Nairobi	3		
Dusseldorf	3		
Lagos	3		
Delhi, Lisbon, Kingston,) Shannon, Malta, Paris,) Tel Aviv, Lusaka, Darwin)	2		
Other Foreign Aerodromes with Single Strikes	40		
Not Stated	19		
TOTAL	280	-	-

2.A DOMESTIC/FOREIGN

	NO. OF STRIKES	NO. OF MOVEMENTS	STRIKES PER 10,000 MOVEMENTS
Domestic	173	577,500	3·00
Foreign	88	264,500	3·30
Not Stated	19	-	-
TOTAL	280	842,000	3·32

3. TYPE OF BIRD

SPECIES	APPROX* WEIGHT	NO. OF STRIKES	% BASED ON 180
Gulls	½-3½ lb	102	56·5
Plover/Lapwing/Peewit	½ lb	21	11·5
Swift/Swallow/Martin	<1/16 lb	13	7·2
Pigeon	¼-1⅛ lb	8	4·5
Oystercatcher	1⅛ lb	6	3·5
Sparrow	1/16 lb	4	2·0
Crow	1-1¼ lb	4	2·0
Kite	½ lb	4	2·0
Skylark	1/16 lb	2	1·0
Starling	⅛-3/16 lb	2	1·0
Hawk	-	1	-
Turkey Vulture	3 lb	1	-
Curlew	1½ lb	1	-
Finch Type	1/16 lb	1	-
Tern	⅛-½ lb	1	-
Linnet	1/16 lb	1	-
Vulture	3-12 lb	1	-
Magpie	½ lb	1	-
Duck	¾-3 lb	1	-
White Owl	-	1	-
Owl	⅜-1⅛ lb	1	-
Blackbird	3/16 lb	1	-
Corbeau	-	1	-
Kite/Vulture	assumed 4-8 lbs	1	-
Not Stated	-	106	-
TOTAL	-	286	-

*from Field Note 51

4. SINGLE OR FLOCK

	STRIKES	% BASED ON 239
Flock (more than 2)	100	42
Single (1 or 2 birds)	139	58
Not Stated	43	-
TOTAL	282	-

5. TIME OF YEAR - DOMESTIC MOVEMENTS ONLY

MONTH	WEIGHT NOT STATED	UP TO 4 LB	OVER 4 LB-8 LB	OVER 8 LB	TOTAL	NO. OF MOVEMENTS	STRIKES PER 10,000 MOVEMENTS
January	9	15	0	0	24	33,100	7·25
February	1	4	0	0	5	37,500	1·33
March	1	13	0	0	14	44,100	3·18
April	1	4	0	0	5	47,400	1·05
May	1	6	0	0	7	56,100	1·25
June	0	9	0	0	9	55,800	1·61
July	3	12	0	0	15	60,100	2·50
August	6	20	0	0	26	58,900	4·41
September	4	19	0	0	23	57,800	4·00
October	7	14	0	0	21	47,500	4·42
November	5	12	0	0	17	40,600	4·20
December	4	6	0	0	10	38,600	2·60
Not Stated	0	0	0	0	0	-	-
TOTAL	42	134	0	0	176	577,500	3·00

6. TIME OF DAY - DOMESTIC MOVEMENTS ONLY

TIME	WEIGHT NOT STATED	UP TO 4 LB	OVER 4 LB-8 LB	OVER 8 LB	TOTAL	% BASED ON 167
Dawn	7	30	0	0	37	22
Day	19	86	0	0	105	63
Dusk	3	2	0	0	5	3
Night	7	13	0	0	20	12
Not Stated	6	3	0	0	9	-
TOTAL	42	134	0	0	176	-

7. ALTITUDE

ALTITUDE (feet)	WEIGHT NOT STATED	BELOW ¼ LB	¼ LB TO 4 LB	OVER 4 LB-8 LB	OVER 8 LB	TOTAL	% BASED ON 238
0 - 200	54	21	122	0	0	197	83
200 - 800	10	0	13	1	0	24	10
800 - 2500	2	1	4	0	0	7	3
Over 2500	9	0	0	1	0	10	4
Not Stated	31	1	10	0	0	42	-
TOTAL	106	23	149	2	0	280	-

8. FLIGHT STAGE

STAGE	WEIGHT NOT STATED	BELOW ¼ LB	¼ LB TO 4 LB	OVER 4 LB-8 LB	OVER 8 LB	TOTAL	% BASED ON 251
Taxying	0	0	0	0	0	0	-
Take-off	30	8	62	0	0	100	40
Climb	9	0	6	2	0	17	7
Cruise	2	0	2	0	0	4	1·5
Holding	0	0	0	0	0	0	-
Let Down	4	0	0	0	0	4	1·5
Approach	21	5	16	0	0	42	17
Landing	22	9	53	0	0	84	33·5
Not Stated	18	1	10	0	0	29	-
TOTAL	106	23	149	2	0	280	-

9. [illegible] OF AIRCRAFT DAMAGE

PART	WEIGHT NOT STATED	BELOW ¼ LB	¼ LB TO 4 LB	OVER 4 LB-8 LB	OVER 8 LB	TOTAL	% BASED ON 273
Nose Section	34	10	34	0	0	78	28·5
Wing	23	2	35	1	0	61	22
Powerplant	20	4	30	2	0	56	20·5
Windscreen	11	7	19	0	0	37	13·5
Fuselage	12	7	11	0	0	30	11
Landing Gear	0	1	9	0	0	10	3·5
Empennage	1	0	0	0	0	1	-
Not Stated	17	4	46	0	0	67	-
TOTAL	118	35	184	3	0	340	-

10. SIGNIFICANT/NOT SIGNIFICANT*

	WEIGHT NOT STATED	BELOW 4 LB	OVER 4 LB-8 LB	OVER 8 LBS	TOTAL	%
Significant	5	8	1	0	14	5%
Not Significant	101	164	1	0	266	95%
TOTAL	106	172	2	0	280	-

*see Appendix 1

11. AIRLINE OPERATORS

OPERATOR	NO. OF STRIKES	NO. OF MOVEMENTS	STRIKES PER 10,000 MOVEMENTS
BEA	116	337,100	3·44
BOAC	74	111,740	6·30
Cambrian	16	46,220	3·46
BUA	14	59,170	2·37
BIA	10	32,812	3·04
Court Lines	9	16,800	5·35
Dan Air	7	23,780	2·95
British Midland	7	21,534	3·25
Britannia	4	19,326	2·07
BKS/Northeast	2	21,462	0·93
Skyways	2	19,188	1·04
Laker	2	9,654	2·08
Caledonian	2	18,960	1·05
British Air Ferries	1	37,970	0·26
Channel	1	19,400	0·51
Air Anglia	1	-	-
BEA Helicopters	1	18,660	0·53
Donaldson, Invicta, Lloyd, Monarch, Tradewinds, Trans-Meridian	0	28,100	-
Others	2	-	-
Not Stated	9	-	-
TOTAL	280	841,900	3·32

APPENDIX 1

EXPLANATORY NOTES

1. Analysis is designed to highlight Operational as well as Airworthiness aspects.

2. The following aircraft are excluded from the analysis:-

   (a) Non U.K. registered aircraft.

   (b) Aircraft of 12,500 lb. and under.

   (c) Military aircraft.

3. The total number of movements (2 per flight) includes those aircraft types for which no strikes have been reported.

4. Table 1B - The Wide Bodied aircraft constitute the Boeing 747 (Lockheed 1011 and DC 10).

5. Table 2 and 2A - Where the airfield is unknown, or the strike is en-route the Not-Stated column was used. By reason of geographic location the Channel Isles have been included as Foreign, but the Isle of Man and Ulster are regarded as U.K.

   The movements at each airport have been compiled from information in Business Monitor Civil Aviation Series CA1 - Airport Activity and CA5 - Airline Operations. The major difficulty was to isolate the movements of UK registered aircraft only of over 12,500 lb.

   A. From CA5 Table 6.1 the total movements of all aircraft types over 12,500 lb. was obtained, and compared with the total movements to show that 79% were aircraft over 12,500 lb. (excluding the Corporations) and 89% when the Corporations were included.

   B. From CA1 at each airport the following percentages in the appropriate columns were used:-

(i)	Scheduled Services UK Operators - Corporations	100%
(ii)	" " " " - Others	79%
(iii)	Charter Flights UK Operators - Corporations	100%
(iv)	" " " " - Others	79%
(v)	Empty charter positioning*	50%
(vi)	Other Commercial Movements*	50%
(vii)	Other Flights by air transport operators*	50%
	*(as some movements by non-UK Operators are included)	
(viii)	Test and Training (which includes Corporations)	89%

6. Table 5 and 6 - In these tables only strikes within the U.K. have been used.

7. Table 7 - Where the altitude is not given but the Flight Stage is stated to be Take-off or Landing the altitude was assumed to be 0-200 ft.

8. Table 8 - Dead birds found on the runway should be divided equally between take-off and landing.

9. Table 9 - One incident can give rise to strikes on several parts of the aircraft.

10. Table 10 - Significant Strikes are based on ICAO Working Paper 294 as follows:-

(1) Catastrophic - loss of life or destruction of aircraft.

(2) (a) Torn metal skinning on any part of the aircraft.

(b) Deformed secondary structure.

(c) Cracked or shattered windscreen.

(d) Damage to engines sufficient to cause shut down or unrecoverable loss of power.

11. Appendix 2 contains details of strikes to aircraft of 12,500 lb. and under.

APPENDIX 2 - STRIKES TO U.K. REGISTERED AIRCRAFT OF 12,500 LB. AND UNDER

	AIRCRAFT	DATE	TIME	LOCATION	ALTITUDE	IAS	PHASE	BIRD	NUMBER	PART STRUCK	DAMAGE
1.	BN2 Islander	13.1.70	dusk	Guernsey	2-300'	50	Approach	Lapwing	Single	N/S	Nil
2.	Cessna	19.1.70	day	Denham	250'	70	Take-off	Gull	Flock	Wing	Nil
3.	Cessna 150	25.1.70	day	Glasgow	50'	55	Landing	Gull	Single	Wing	Nil
4.	Cessna 310	28.1.70	day	Aberdeen	2000'	130	Letdown	-	Single	Nose & Prop.	U/S for 24 hrs.
5.	B65 Queen Air 80	9.2.70	day	Shoreham	30'	60	Take-off	Pigeon	Single	Propeller	Nil
6.	Cessna 150	10.2.70	day	Norwich	400'	90	Take-off	Starlings	Flock	Landing gear	Nil
7.	Cessna 150	24.2.70	day	Thruxton	10'	60	Take-off	Plover	Single	Wing	Nil
8.	Cessna 172	25.2.70	day	Thruxton	20'	70	Take-off	Plover/Pigeon	Flock	Wing	Nil
9.	Cessna 150	6.3.70	day	Thruxton	5'	55	Take-off	Pigeon	Flock	Prop. & Cowling	Nil
10.	Piper PA 28	7.3.70	day	Guernsey	0	45	Landing	Gull	Single	Wing	Nil
11.	Cessna 150	11.3.70	day	-	6'	-	Take-off	Gull	Single	Propeller	Nil
12.	Piper Aztec	12.3.70	day	Ipswich	145'	-	Landing	Pigeon	Flock	Port Engine Intake	Nil
13.	Cessna 150	23.3.70	dusk	Norwich	20'	50	Take-off	Gull	Flock	Windscreen	Nil
14.	Cessna 150	2.4.70	day	Luton	0	60	Overshoot	Pigeon	Single	Wing	U/S for 24 hrs.
15.	Dove	15.4.70	day	-	40'	100	Take-off	Oyster Catcher	Flock	Engine	Nil
16.	BN2 Islander	2.6.70	day	Cardiff	200'	-	Take-off	Pigeon	Flock	-	Nil
17.	Cessna 170	26.7.70	day	Edinburgh	50'	-	-	Pigeon	Single	-	Nil
18.	Apache	3.8.70	day	Staverton	0	60	Landing	Gull	Flock	Wing	Nil
19.	Piper PA 28	18.8.70	day	Leeds/ Bradford	0	55	Landing	Gull	Single	Undercarriage	Nil
20.	Cherokee	18.8.70	day	-	300'	80	Take-off	-	Single	Prop, wing, fin	Nil
21.	BN2 Islander	19.8.70	day	Guernsey	0	60	Take-off	Swallow	Single	Windscreen	Nil
22.	Piper PA 31	20.8.70	day	Woodford	20'	100	Approach	Gull	Flock	Wing	U/S for 5 days
23.	BN2 Islander	9.10.70	day	Unst (Shetland)	30'	75	Landing	Greylag Goose	Flock	see below	

The birds (average weight 7 lbs.) flew up from flood water, too low to take evasive action and struck Stbd. Wing and undercarriage causing wrinkling of wing skin, deformation of wing and nacelle structure, and fractured engine foot mount - repair cost £3,000 plus out-of-service for 4 weeks.

24.	Bell 206A Jet Ranger	9.10.70	day	West London Heliport	25'	20	Take-off	Gull	Single	Engine cowl	Nil
25.	Cessna 421	30.10.70	day	Hunstanton	0	75	Take-off	Pheasant	Single	Propeller	Nil
26.	Piper PA22	3.12.70	day	Liverpool	50'	-	Take-off	Gull	-	-	Nil
27.	Piper PA23	19.11.70	day	Rochester	200'	140	Climb	Gull	Single	Wing	Nil

1967

COUNTRY	CONFIRMED STRIKES TOTAL	AIRCRAFT DAMAGE SIG.	AIRCRAFT DAMAGE INSIG.	AIRCRAFT DAMAGE CAT.	WEIGHTS OF BIRDS STRUCK No. of confirmed strikes in each weight group 0-4 lb.	4-8 lb.	8 lb.+	WINDSHIELD STRIKES TOTAL	No. of laterals broken in each weight group 0-4 lb.	4-8 lb.	8 lb.+	INTRUSION STRIKES TOTAL	No. which caused either injury or total damage 0-4 lb.	4-8 lb.	8 lb.+	RETAIL COST	DOWN TIME
Belgium	5	2	3	0	4	1	0	1	-	-	-	0	0	0	0		20 min
Canada	206	5	201	0	204	2	0	38	0	0	0	1	0	0	0	$74,530	
Chad	1	0	1	0	0	1	0	-	-	-	0	0	0	0	0		
E'African Community	4	0	4	0	2	2	0	-	-	-	-	0	0	0	0	3000	
France	29	10	19	0	26	1	2	5	3	-	-	0	0	0	0	9670Fr	
H'Kong	1	0	1	0	1	1	0	-	-	-	-	0	0	0	0		
Ireland	16	3	13	0	15	1	0	2	1	0	0	0	0	0	0	£50	
Israel	1	1	0	0	1	0	0	-	-	-	-	0	0	0	0	$3000	
Mexico	2	0	2	0	1	1	0	-	-	-	-	0	0	0	0		
N'thlds	34	1	33	0	32	2	0	-	-	-	-	0	0	0	0		
Norway	16	2	14	0	16	0	0	3	2	0	0	0	0	0	0	[illegible]	
Portugal	7	1	6	0	7	0	0	1	0	0	0	0	0	0	0	$3000	17 hrs
S'Africa	30	1	29	0	18	12	0	2	-	-	-	1	0	1	0	£9613	
U.K.	239	8	231	0	237	2	0	22	2	-	-	5	0	1	0	£1513	9 hrs
TOTAL STRIKES	591	34	557	0	563	26	2	74	8	0	0	7	0	2	0		
		5.75%	94.2%		95.25%	4.39%	.3%										
Flying Hrs.	2080090																

1. The catastrophe that occurred in 1969 concerned a DC-3 which ditched and sank following a bird or multi bird strikes - no details were given, bird species unknown. The accident occurred near Djibouti. There were some injuries but, so far as is known, no loss of life.

2. The catastrophe tabled for 1968 concerned USA report serial 237 which stated that a Dassault Jet Falcon struck a flock of Gulls, lost power on both engines, had ditched and sank. No injuries to persons were reported, but 334 dead Gulls, by actual count, were involved in the accident.

1967 Strike Rate 3519 Flying Hours per strike

1 9 6 8

COUNTRY	CONFIRMED STRIKES TOTAL	AIRCRAFT DAMAGE			WEIGHTS OF BIRDS STRUCK No. of confirmed strikes in each weight group			WINDSHIELD STRIKES	No. of windshields broken in each weight group			ENGINE STRIKES	No. which caused either 'sig.' or 'insig.' damage			REMARKS	
		SIG.	INSIG.	CAT.	0-4 lb.	4-8 lb.	8 lb.+	TOTAL	0-4 lb.	4-8 lb.	8 lb.+	TOTAL	0-4 lb.	4-8 lb.	8 lb.+	COST	DOWN TIME
Australia	87	11	76	0	80	2	5	20	0	0	0	1	–	1	–	$922.	
Belgium	7	0	7	0	6	1	0	–	0	–	–	0	0	0	0	–	
Canada	229	5	224	0	225	3	1	53	0	0	0	4	4	0	0	$213,000	
Denmark	14	1	13	0	12	1	1	2	0	0	0	0	0	0	0	Kr2600	
Dakar	1	0	1	0	0	0	1	–	–	–	–	–	–	–	–	–	
E'African Community	21	3	18	0	18	2	1	1	1	0	0	0	0	0	0	£50	
Finland	7	0	7	0	5	2	0	–	–	–	–	0	0	0	0	–	
France	46	10	36	0	44	1	1	8	1	0	0	1	1	0	0	100 Fr	
Hong Kong	6	2	4	0	5	0	1	–	–	–	–	0	0	0	0	$17,500	
India	25	8	17	0	13	8	4	–	–	–	–	1	0	1	0	[illegible]51120	
Ireland	3	0	3	0	3	0	0	0	0	0	0	0	0	0	0	–	
Israel	15	0	15	0	–	–	–	1	–	–	–	0	0	0	0	–	
Ivory Coast	1	0	1	0	0	1	0	–	–	–	–	0	0	0	0	£200	
Japan	12	3	9	0	12	0	0	2	1	0	0	1	1	0	0	$2750.	
Malawi	4	1	3	0	2	0	2	–	–	–	–	0	0	0	0	–	
N'th'lds	159	4	155	0	157	2	0	33	1	0	0	2	1	1	0	–	
N. Zealand	89	1	88	0	87	2	0	1	1	0	0	0	0	0	0	–	
Niger	3	2	1	0	3	0	0	–	–	–	–	0	0	0	0	CFA 250,000	
Norway	12	1	11	0	12	0	0	1	0	0	0	0	0	0	0	$5.	
Poland	1	1	0	0	1	0	0	–	–	–	–	0	0	0	0	–	
S.Africa	15	1	14	0	14	1	0	3	0	0	0	0	0	0	0	R32,900	
Sweden	19	2	17	0	18	0	1	3	0	0	0	0	0	0	0	[illegible]	
Spain	2	1	1	0	2	0	0	–	–	–	–	0	0	0	0	[illegible]	
U.K.	231	11	220	0	230	1	0	29	3	0	0	1	1	0	0	£11,167	
U.S.A.	504	31	472	1	483	12	9	93	7	3	1	9	6	2	1	$30[illegible],78[illegible]	118 days
TOTAL STRIKES	1513	99 6.5%	1413 93%	1 .06%	1432 94.5%	39 2.6%	27 1.8%	255	15	3	1	20	14	5	1		

FLYING HRS. 9575044

Strike Rate 6328 Flying Hours per Strike

1 9 6 9

COUNTRY	CONFIRMED STRIKES TOTAL	AIRCRAFT DAMAGE			WEIGHTS OF BIRDS STRUCK No. of confirmed strikes in each weight group			WINDSHIELD STRIKES				EMPENNAGE STRIKES				REPAIRS	
									No. of shields broken in each weight group				No. which caused either [illegible] damage				
		SIG.	INSIG.	CAT.	0-4 lb.	4-8 lb.	8 lb.+	TOTAL	0-4 lb.	4-8 lb.	8 lb.+	TOTAL	0-4 lb.	4-8 lb.	8 lb.+	COST	[illegible]
Canada	219	3	216	0	213	3	3	34	0	0	0	1	1	0	0	$35,700	2 hrs.
Cent'l African Republic	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0		
E'African Community	28	3	25	0	20	4	4	2	0	0	0	1	0	0	1		
Finland	8	0	8	0	7	1	0	0	0	0	0	0	0	0	0		50 min
France	66	3	62	1	62	3	1	4	3	0	0	0	0	0	0	$59,720	
Hong Kong	12	3	9	0	12	0	0	2	0	0	0	0	0	0	0	$21,000	12 hrs
India	27	6	21	0	19	7	1	5	0	0	0	2	0	1	0	$180511	34 days
Ireland	9	0	9	0	8	1	0	1	0	0	0	1	1	0	0		
Israel	16	0	16	0	15	1	0	3	0	0	0	0	0	0	0		
Japan	40	2	38	0	36	4	0	3	0	0	0	1	0	0	0	$607.	
Malawi	6	0	6	0	4	1	1	1	0	1	0	0	0	0	0		
N'th'lds	153	1	152	0	151	0	2	18	0	0	0	2	0	0	0		
N.Zealand	64	1	63	0	64	0	0	2	1	0	0	0	0	0	0		
Niger	2	2	0	0	0	0	2	0	0	0	0	0	0	0	0		1 day
S. Africa	30	1	29	0	29	1	0	3	0	0	0	0	0	0	0	R2832	
Sweden	32	2	30	0	32	0	0	6	0	0	0	0	0	0	0	$900.	
U.K.	211	3	208	0	206	4	1	23	1	0	0	5	1		0	£720	2days 4 1/2 hrs.
TOTAL STRIKES	944	30 3.1%	893 96.6%	1 .1%	878 95%	30 3.24%	16 1.7%	107	5	1	0	13	3	1	1		

FLYING HRS. 2705513

Strike Rate 2866 Flying Hours per Strike

Data from Denmark arrived too late for inclusion in this Table.

D N E