

LAND SITE NE COMBATIBLE EUROPE

MILITARY AIRCRAFT
BIRDSTRIKE ANALYSIS

1972

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INTRODUCTION

1. In the past reports on the frequency of bird strikes have been produced by different organizations, each using its own methods, nomenclatures and ornithological terms. The information has been presented in different formats, using wide cut guidelines. These reports have seldom been available to each other, and it is regrettable that the most useful form of analysis has not been developed by any one organization.

2. In order that a common basis for the analysis of bird strikes data could be agreed, a Working Group of the Joint Strike Data Exchange Forum was formed in 1974, led by the representative of the UK. This Group, including the Airfield Safety Division at Heathrow, offered a common format, together with a set of Analysis Tables with explanatory Notes were distributed to all members of the Group together with a request that each country provide an analysis of their Bird Strikes reported during 1974. At the 1975 WJSE Meeting in Paris it was agreed that each country would provide a separate analysis of their Civil, and of their Military Bird Strikes, commencing in 1975.

3. This report contains a brief presentation of the data which has been provided by BSCE Members on strikes to Military aircraft. The strikes to Civil aircraft are reported separately in ICAO Technical Note No 110 dated May 1976.

DATA

4. Unfortunately, much of the usefulness of this Analysis has been lost because of large omissions in the data supplied by Nations. Returns were received from:

Belgium
Canadian Armed Forces Europe
Denmark
France
Netherlands
Spain
Sweden
UK
USAFE

The quality, content, and accuracy of the data varied considerably and in some cases was supplied in a form different to that required by the BSCE. This has made comparative analysis, either difficult or impossible. The data available here is weighted since most of the returns are from France, and especially those of the French Air Force.

MOVEMENTS

5. Only 3 Nations gave all the relevant movement figures. No doubt there are other security implications, but a rate per 10,000 movements is of more significance than simply a number of movements related to frequency. If not stated otherwise, it is still difficult to supply accurate data for this reason, therefore the data is quoted for at least this purpose. A general agreement between the Civil and Military aircraft and between civil and military aircraft movements is not possible.

comparisons might prove to be of considerable interest. However, it must be emphasised that a movement as defined, is in no way related to either sortie or hours, since both of the latter are in fact considerable, and unrelated, numbers of 'movements'. For this reason, it is felt that the security implications are probably minimal for movement data thus used in isolation.

COUNTRIES (See Table 1)

6. Of the 6 Nations supplying movement figures and rates, Spain's is a maximum rate and cannot be used comparatively, and France and UK have comparable rates, as do CAF, Netherlands and Sweden. Possibly the higher rates in the last group can be attributed to a similarity in the aircraft types operated and a geographical position astride bird migration routes.

AIRCRAFT (See Tables 2 and 2A)

7. These tables have the potential for interesting comparisons. With the data as received this is not possible. The following observations are, however, pertinent:-

a. Jet. Rates for some strike aircraft, eg, the French group, and the UK's Phantom, Hunter, Harrier group, are of similar magnitude. The CF104 and Buccaneer rates are greater by a factor of 1. It would have been interesting to compare national rates for the common user aircraft F4, F4C, NF5, Mirage, Hunter and SAAB 35.

b. Other Types. As would be expected, the turboprop rates show similar magnitudes, as also do those of the piston aircraft. No other conclusions are possible.

AIRFIELDS (See Tables 3 and 3A)

8. Of those airfields for which data was received, none, other than those with less than 10,000 movements, have an unusually high rate. The total number of airfield strikes (263) is 54.6% of the total strikes, including 'unknowns'. If the 'unknowns' are disregarded, airfield strikes represent 54.2% of the total (485).

BIRD SPECIES (See Table 4)

9. Of the total known species strikes, gulls (*Larus spp*) account for 34.2%, Lapwings (*Vanellus V*) were 11.3% and pigeons 12.8%, with the swift/swallows, martin group next (8.4%) and then starlings (*starnus vulgaris*) 5.2%. There were 6 strikes involving birds of more than 1.81 Kg. (Cat C and D).

TIME OF STRIKE (Table 5 and 5A)

10. Although the rates in Table 5 were calculated mainly from Franco/UK figures, even the total figures in brackets tend to follow the pattern of peak rates in April, June/August and October. If one were to assume a fairly steady number of movements for each month, and if data had been received from all nations, it is reasonable to deduce that the pattern of rate peaks would have been similar to that shown.

11. Table 5A only tells us that the majority of strikes (88.7%) occur during the day, and undoubtedly if this were further divided we should probably find peaks at mid morning and mid afternoon, which would correspond with peaks of aircraft activity. Unlike the civil figures, which because of a more steady flow of aircraft throughout a greater part of the 24 hour period, tend to show 'bird activity', the military figures undoubtedly tend to show 'aircraft activity'.

AIRSPEED AND ALTITUDE (Tables 6 and 6A)

12. These tables tend to illustrate the low level, high speed nature of military flying in Europe. In table 6A the 46.8% of strikes in the 0-200 feet band are undoubtedly mainly airfield strikes.

FLIGHT STAGE (Table 7)

13. This table, in a more detailed way supports, but does not agree exactly, with the figures in table 3A; ie 46.2% airfield and 53.8% en route strikes. As one might also expect strikes during take off and landing account for 31% of the total strikes and represent 80.3% of the airfield strikes.

PART OF AIRCRAFT STRUCK (Table 8)

14. As might be expected the parts most affected by bird strikes are wings, powerplant and canopy/windscreen. These percentages agree broadly with the civil results.

SIGNIFICANT STRIKES (Table 8A)

15. The number of significant strikes (20%) compares with 4.7% for civil aircraft and reflects the different mode of military operations.

COSTS AND INJURIES (Tables 9 and 10)

16. Very little data was received for these tables. Only Sweden and the Netherlands contributed to Table 9 and only Denmark to Table 10. The figures produced cannot, therefore, be considered representative.

CONCLUSION

17. The data received was unsatisfactory both in accuracy and content. The analysis was, therefore, a difficult and time consuming task, which in the end has produced little significant information. If the BSCE form were to be completed correctly, there would be considerable value in the various comparisons that could be made and data would be available for use by designers, manufacturers and military aviation and aerodrome authorities. The BSCE form may not be ideally suited to the military case and if necessary, at the next EAC meeting in June 1974, ways in which the form can be simplified and improved, may be discussed.

TABLE 1

Country	No of Strikes	No of Movements	Rate per 10,000 movements
(1) Belgium	49	NK	NK
CAF Europe	21	30,311	6.9
(1) Denmark	2	NK	NK
France	89	1,020,688	0.83
Netherlands	114	166,000	6.8
Spain	4	3,800	10.53 (2)
Sweden	180	311,100	5.81
UK	214	1,548,748	1.38
(1) USAFE	47	NK	NK
TOTAL	622 (760 (2))	3,080,647	2.01

- Notes: 1.1 These figures are not included in Total
 1.2 Total number of recorded strikes.
 1.3 Minimum rate.

TABLE 2 - AIRCRAFT TYPE

Type	Aircraft	No of Strikes	No of Movements	Rate per 10,000 Movements	
Jet	<u>BELGIUM</u>				
	F/TF 104G	19	-	-	
	Mirage 5B	18	-	-	
	T33	3	-	-	
	Fouga Magister	2	-	-	
	F84	1	-	-	
	<u>CAF Europe</u>				
	CF104	19	24,979	7.6	
	T33	1	2,180	4.5 (1)	
	<u>DENMARK (2)</u>				
	F/RF 35	6	-	-	
	F100 D/F	9	-	-	
	F/CF 104G	8	-	-	
	Hunter 51/53	7	-	-	
	T33A	5	-	-	
	<u>FRANCE</u>				
	Mirage)			
	Mystere IV A)			
	F100)			
	SMB2) 53	286,336	4.05	
	Vautour B & N)			
	CM 170 Fouga T33	13	342,214	0.37	
	C135F	4	10,440	3.85	
	Mystere 20	3	12,522	2.40	
	MS 760 Paris	2	21,708	0.92	
	<u>NETHERLANDS</u>				
	NF5	44	-	-	
	F104G	61	-	-	
	T33	1	-	-	
	<u>SPAIN</u>				
	NF5	2	2,800	7.3 (1)	
	<u>SWEDEN</u>				
	SAAB J29	82	63,000	12.8	
SAAB 35	72	156,000	6.0		
SAAB 105	20	41,600	4.85		
<u>UNITED KINGDOM</u>					
Buccaneer	10	17,822	5.5		
Canberra	18	52,069	2.9		
Dominie	7	16,136	6.2		

	Grat	12	62,436	1.9
	Barrier	7	56,982	1.7
	Hunter	22	95,818	2.7
	HS125	1	6,366	1.9 (1)
	Jet Provost	39	418,704	0.9
	Lightning	13	79,846	1.6
	Nimrod	15	20,370	2.35
	Phantom	11	43,552	2.7
	Victor	3	15,186	2.0
	Vulcan	2	17,115	1.7
	VC10	4	29,832	1.7
	<u>USAFE (2)</u>			
	F4/RF4	27	-	-
	F111	13	-	-
	C9	1	-	-
	C135	3	-	-
	T39	1	-	-
	Types with NIL Strikes	-	9,578	-
Turboprop	<u>BELGIUM (2)</u>			
	C130H	1	-	-
	<u>FRANCE</u>			
	C160 Transall	6	47,316	1.26
	N262 Fregate	1	10,862	0.92
	<u>NETHERLANDS</u>			
	F27	1	-	-
	<u>UNITED KINGDOM</u>			
	Argosy	3	9,760	3.1 (1)
	Belfast	1	9,516	1.1 (1)
	Britannia	4	24,356	1.6
Hercules	21	88,580	2.3	
	Types with NIL Strikes	-	36,598	-
Piston	<u>BELGIUM (2)</u>			
	SF260 M	2	-	-
	C119G	3	-	-
	<u>DENMARK</u>			
	C54	1	-	-
	<u>FRANCE</u>			
	N2501 Noratlas	6	91,422	0.85
	Cap 10 + 20	1	33,000	0.40
	<u>NETHERLANDS</u>			
	Piper Super CUB	1	-	-
Beaver	1	-	-	

	<u>SPAIN</u>			
	Cessna	2	1,000	20 (1)
	<u>SWEDEN</u>			
	SAAB 91	2	22,100	0.90
	Bullseye	1	13,500	0.74
	<u>UNITED KINGDOM</u>			
	Chipmunk	1	246,815	0.74
	Devon	2	17,440	1.2
	Chackloter	7	7,250	9.3 (1)
	Varsity	3	88,538	0.5
	<u>USAF (2)</u>			
	T29	2	-	-
	Types with NIL Strikes	-	184,035	-
Helicopter	<u>CAF Europe</u>			
	OH130	1	3,152	3.17 (1)
	<u>DENMARK (2)</u>			
	S61A	3	-	-
	Alouette 7	1	-	-
	Hughes 500M	2	-	-
	<u>NETHERLANDS (2)</u>			
	Alouette 7	3	-	-
	<u>SWEDEN (2)</u>			
	Alouette 2	2	-	-
	BV107	1	-	-
	<u>UNITED KINGDOM</u>			
	Puma	2	13,490	1.5
	Sioux	1	11,216	0.9
	Wessex	1	19,006	0.5
	Whirlwind	1	35,490	0.3
	Types with NIL Strikes	-	-	-
UNKNOWN		NIL		

TABLE 2A - SUMMARY OF AIRCRAFT TYPES

Type	Aircraft	No of Strikes (3)	No of Movements	Per Rate 10,000 Movements
Jet	-	437 (666)	1904510	2.29
Turboprop	-	36 (38)	226938	1.53
Piston	-	26 (36)	671101	0.387
Helicopter	-	6 (20)	82048	0.73
Unknown	-	-	-	-
TOTAL (4)	(Including those with NIL strikes)	505 (760)	2,884,647	1.75

- Notes:
- 2.1 Minimum rate
 - 2.2 Not included in the Total.
 - 2.3 Figures in brackets give total recorded strikes.
 - 2.4 These figures do not agree with totals in Table 1 since some nations did not give movement figures for aircraft types, but only for overall totals.

TABLE 3 - AIRFIELD

AIRFIELD		NO OF STRIPS	NO OF MOVEMENTS	RATE OF MOVEMENTS PER HOUR
1. DOMESTIC (data from own country, with known number of movements)				
DENMARK:-	Karup	3	13266	2.7
	Aalborg	7	9028	2.1
	Skaerbaek	7	10902	6.2
FRANCE:-	Vandoeuvre	3	12557	2.1
	Villersotelay	5	28159	4.77
	Strasbourg	5	24706	2.63
	Orleans - Bricey	3	30811	0.98
	Salon de Provence	2	22267	0.66
	Toul - Bellevue	2	140276	0.7
	Clément	2	32227	0.6
NETHERLANDS:-	IJsoordaan	2	64707	0.76
	Twanthe	11	23000	1.6
	Saastenberg	4	19400	2.3
	Deelen	2	18700	2.2
	Elsthooven	2	14400	0.7
	Katwijk	7	11000	2.1
	Gilze Rijen	8	20400	3.2
	De Peel	2	15800	1.2
SPAIN:-	Morón	2	1000	20
	Sevilla	2	2800	7
UK:-	Abingdon	2	1000	20
	Barkston Heath	4	19505	1.2
	Benson	2	31829	0.6
	Brize Norton	3	16835	1.2
	Cottesmore	3	32058	0.9
	Cranwell	3	28469	1.1
	Dishforth	6	30999	0.9
	Elvington	3	21071	1.2
	Fairford	2	28236	0.7
	Finningley	4	4179	4.35
	Houlington	10	28291	2.8
	Keeble	4	21054	1.2
	Kinloss	3	21623	1.4
	Liston-on-Cuse	7	13724	1.1
	Leuchars	4	16377	0.8
	Lynnham	9	10044	1.1
	Oakington	2	18893	0.7
	St Mawgan	2	32908	0.7
	Teruhill	8	12133	1.6
	Thorney Island	2	7961	1.7
Valley	2	57724	0.6	
Waddington	3	34324	0.7	
Wyton	2	13212	1.7	
	3	19659	1.2	

2.	<u>DOMESTIC</u> (Incomplete Data)			
	BELGIUM			
	Beauvechain	9	-	-
	Lecine Broge	4	-	-
	St. Truiden	1	-	-
	Goetsebroek	2	-	-
3.	<u>DOMESTIC AIRFIELDS WITH SINGLE STRIKES</u>	27	-	-
4.	FOREIGN			
	Rhein Main (Germany)	4	-	-
	Incerlik (Turkey)	3	-	-
	New Amsterdam (Netherlands)	2	-	-
	Zweibrücken (Germany)	2	-	-
	Upper Heyford (UK)	5	-	-
5.	<u>FOREIGN AIRFIELDS WITH SINGLE STRIKES</u>	9	-	-
6.	<u>EN ROUTE</u>	222	-	-
7.	<u>UNKNOWN</u>	92	-	-

TABLE 3A - SUMMARY OF LOCATION

Domestic	217	2,105,054	1.03
Domestic (Incomplete Data)	21	-	-
Foreign	25	-	-
En Route	222	-	-
Unknown	92	-	-
TOTAL	577 (2)	-	-

Notes: 3.1 Minimum Rates

3.2 Does not agree with Table 1. With Swedish totals (90 domestic, 90 en route), included this becomes 757.

TABLE 4 - BIRD SPECIES

Common Name	Latin Name	Approx Wt (g)	Category	No of Strikes	% Based on 310
Black-headed Gull	Larus Ridibundus	300	B	10	3.2
Herring Gull	Larus Argentatus	1100	B	5	1.6
(Gull with the Common Gull)	Larus Spp	500-1800	B	91	29.3
<u>COASTAL GULLS</u>					
Lapwing/Beakit	Vanellus Vanellus	200	B	30	11.3
Oyster Catcher	Haematopus ostralegus	550	B	3	0.9
Plover	Pluvialis aprinoria	220	B	1	-
Bitter	Jonasorda collaris	2000	C	1	-
Pink Footed Bean Goose	Anser fabalis	2500	C	1	-
Heron	Ardea cinerea	1800	B	1	-
Feral Pigeon	Columba palumbus	600	B	2	-
Pigeon	Columba livia	250	B	41	13.8
Pheasant	Phasianus	1200	B	8	2.6
Partridge	Perdix perdix	420	B	4	1.3
Buzzard	Buteo Buteo	900	B	6	1.9
Kestrel	Falco tinnunculus	250	B	4	1.3
Falcon (Hobby)	Falco subbuteo	300	B	1	-
Little Bustard	Otis Tetrax	500	B	2	-
Hawk	Accipiter	350	B	1	-
Crow	Corvus Corone	550	B	4	1.3
Rook	Corvus Frugilegus	400	B	6	1.9
Jackdaw	Corvus Monedula	205	B	2	-
Starling	Sturnus Vulgaris	100	A	16	5.2
Swift/Swallow/Martin	-	14-40	A	26	8.4
Thrush	Turdus Philomelus	70	A	2	-
Blackbird	Turdus Merula	100	A	4	1.3
Redwing	Turdus Iliacus	60	A	1	-
Fieldfare	Turdus pilaris	115	B	1	-
Mistle Thrush	Turdus visciorus	150	B	1	-

Chaffinch	<i>Fringilla coerebs</i>	1	1	1	1
Bullfinch	<i>Pyrrhula pyrrhula</i>	12	1	1	1
Wagtail	<i>Motacilla alba</i>	24	1	1	1
Sparrow	<i>Alauda Arvensis</i>	40	1	1	1
Yellow Hammer	<i>Emberiza Citrinella</i>	28	1	1	1
Tern	<i>Sterna Hirundo</i>	100	1	1	1
Puff or Grebe	<i>Phalacrocorax Pagrus</i>	100	1	1	1
Tengmeyer's Owl	<i>Asogellus Funereus</i>	150	1	1	1
Jack Snipe	<i>Plectrophenax Nivalis</i>	25	1	1	1
Starling	<i>Stercoria circoia</i>	1800	1	1	1
Sparrow	<i>Passer Montanus</i>	30	1	1	1.9
Magpie	<i>Picus Picus</i>	100	1	1	1
UNKNOWN				2	
				2	
TOTAL				100	

Notes:-

- 4.1 Bird weights and latin names can be obtained from Canadian Field Note No 51, by C Kaldert, unless there is positive evidence to the contrary. The AVERAGE weight should be assumed.
- 4.2 The Bird Categories based on current CIVIL Aircraftweights requirements are:-
 CAT A below .11 kg ($\frac{1}{4}$ lb) CAT C over 1.31 kg to 3.53 kg ($\frac{1}{4}$ lb to 8 lb)
 CAT B .11 to 1.31 kg ($\frac{1}{4}$ to 4 lb) CAT D over 3.53 kg (8 lb)
- 4.3 Those birds not positively identified should be tabled as Unknown.
- 4.4 Large (CAT C or D) birds are often not positively identified, but the Category these are assumed to be in should be stated.
- 4.5 Percentages should be based on the total of identified birds.
- 4.6 A Flock should be regarded as more than 2 birds.
- 4.7 The percentage in Table 3A should be based on the total of strikes where the number of birds is known.
- 4.8 Table 3 could be repeated restricted to own country only.

TABLE 5 - MONTH OF YEAR - STRIKES IN EUROPE ONLY

Month	Weight Unknown	CAT A & B	CAT C	CAT D	Total	No of (1) Movements	Strikes/10,000 Movements
January	16 (18)	5 (23)	-	-	21 (41)	27700	0.76
February	17 (15)	16 (21)	-	-	33 (36)	25000	1.32
March	30 (33)	7 (17)	1	-	38 (50)	25200	1.51
April	30 (10)	5 (11)	-	-	35 (21)	26700	1.31
May	25 (12)	7 (12)	-	-	32 (24)	27000	1.19
June	41 (26)	20 (41)	-	-	61 (67)	19200	2.08
July	31 (18)	17 (25)	-	-	48 (43)	27000	2.53
August	38 (14)	15 (32)	-	-	54 (46)	23600	2.26
September	21 (13)	13 (31)	1 (2)	-	35 (46)	27400	1.59
October	38 (18)	21 (29)	2	-	61 (48)	25200	2.36
November	22 (28)	14 (19)	-	-	36 (47)	23200	1.55
December	9 (13)	9 (9)	-	-	18 (22)	141807	1.13
UNKNOWN	1	-	-	-	1	-	-
TOTAL	326 (165)	156 (260)	4 (5)	0 (1)	486 (731)	2,901,135	1.67

Note: 5.1 Only 3 nations supplied movement data...
 5.2 Figures in brackets are total figures, but are not used for calculation of strike rate.

TABLE 5A - TIME OF DAY - STRIKES IN EUROPE ONLY

Time	Weight Unknown	Cat A & B	CAT C	CAT D	Total	% based on 557
Dawn						2.15
Day	319	174	4	1	494	88.7
Dusk	5	10			15	2.7
Night	34	15	1		50	9.08
Unknown	58	2			60	
TOTAL	405	200	5	1	611	

Notes: 5.3 Restricted to strikes in Europe

5.4 In the absence of movement data, percentages are used which are dependent on the number of aircraft movements.

5.5 No information for 5A received from CAF or Netherlands.

TABLE 5 - AIRSPEED

Airspeed (Knots IAS)	Weight Unknown	CAT A & B	CAT C	CAT D	Total	% Based on 425
0 - 50	0	0	0	0	0	0.00
51 - 100	0	18	0	0	18	4.24
101 - 150	0	10	0	0	10	2.35
151 - 200	0	45	0	0	45	10.61
201 - 250	0	17	0	0	17	3.99
Over 250	132	57	3	0	192	44.94
Airspeed Unknown	90	36	0	0	126	29.65
TOTAL	298	256	5	0	559	131.53

TABLE 6A - ALTITUDE

Altitude (Feet)	Weight Unknown	CAT A & B	CAT C	CAT D	Total	% Based on 425
0 - 200	123	140	1	0	264	62.12
201 - 800	106	58	4	0	168	39.53
801 - 2500	83	34	0	1	118	27.76
Over 2500	9	4	0	0	13	3.08
Height Unknown	156	20	0	0	176	41.41
TOTAL	477	256	5	1	739	173.89

Notes:-

6.1 Table 6 does not include CAF, or Swedish data.

6.2 Table 6A does not include CAF information.

TABLE 2 - FLIGHT STAGES

Stage	Weight Unknown	CAF A & B	CAF C	CAF D	Total	% Sample on (CAF)
taxiing	2	3	-	-	5	0.74
Take-off	24	80	4	-	108	29.15
Low Alt. Cruise And Attack	221	94	4	-	319	87.77
Climb	4	4	-	-	8	2.21
High Alt. Cruise	3	0	-	-	3	0.84
Holding	0	0	-	-	0	0.00
Descent	4	1	-	-	5	0.14
Final Approach	40	6	-	-	46	12.81
Landing	30	63	4	-	97	26.91
Touch & Go/ Overshoot	5	5	-	-	10	2.75
Unknown	56	11	-	-	67	18.57
TOTAL	499	264	3	0	766	

Notes:-

- 7.1 Data from CAF, and Sweden included as "Weight unknown" and in total.
- 7.2 There is no precise definition of flight stages as altitudes vary between aircraft and types of operation.
- 7.3 Birds struck on the runway are divided equally between take-off and landing.

TABLE 8 - SUMMARY OF AIRCRAFT PARTS

Part	Number Unknown	Def. A & B	Def. C	Def. D	Total
Engine	21	2	0	0	23
Propeller	18	14	0	0	32
Wing	13	20	0	0	33
Porter	1	1	0	0	2
Landing Gear	17	11	0	0	28
Canopy/Windscreen	45	43	0	0	88
Fuselage	34	49	0	0	83
Landing Gear	14	30	0	0	44
Deportage	1	7	0	0	8
Unloading stores and Tanks	22	0	0	0	22
Part Unknown	71	17	0	0	88
TOTAL	451	316	0	1	768

Notes:-

8.1 The totals in Table 8 may not correspond with other tables as they may hit several parts.

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

TABLE 8A - SIGNIFICANT STRIKES

Significant	111	32	0	1	144
Not Significant	424	169	5	0	598
TOTAL	535	207	5	1	748

8.1 The ... of ...
1.1 Geographical ...
1.2 ...
1.3 ...
1.4 ...
1.5 ...

2.1 ...
2.2 ...

3.1 The totals in Exhibit ...

