EURBASE, PROGRESS REPORT AND FIRST IMPRESSIONS ON BIRD SPECIES

Arie Dekker[1], Hans van Gasteren[1] & Judy Shamoun-Baranes[2]
[1]Royal Netherlands Air Force, TL/AOO/SNEB
PO Box 20703; 2500 ES The Hague; Netherlands
Tel: +31 70 339 6348, Fax: +31 70 339 6347
Email: sneb@stl.af.dnet.mindef.nl
[2]University of Amsterdam
Nieuwe Achtergracht 166, 1018 WV Amsterdam; Netherlands
Tel: +31 20 525 7595, Fax +31 20 525 7431
Email: shamoun@science.uva.nl

Abstract

After years of contributing bird strike summaries to the Air Forces Flight Safety Committee Europe (AFFSC(E)) it was recognised in the late nineteeneighties that collecting the actual details of bird strikes in one combined European Military Bird Strike Database (EURBASE) would yield much more information. At the 20th IBSC meeting in 1990 a preliminary study on the bird strike reports over the year 1988 of six Air Forces was presented. From then on the database increased rapidly, not in the least because along with new data also data from previous years was contributed. Standardisation of data was encouraged by the introduction of the European Military Bird Strike Form (EURFORM). Over the years progress reports on the EURBASE project were presented for AFFSC(E) and IBSC. The Military Agency for Standardisation (MAS) adopted EURFORM as an annex to the Standard NATO agreement 3879 FS. At the 24th IBSC meeting in 1998 an extensive inventory of quantity and completeness of the then available database of 34,564 bird strikes was presented.

This paper is to be considered a progress report in that it gives an overview of the 40640 contributions, as per January 2003, specified per Air Force and per year. The database is also used to make preliminary statements about bird species involved in bird strikes. Therefore the 30% of cases in which the bird species was known is dealt with in more detail. These details show that with all the limitations of the mixed set of data it is possible to reveal facts that cast a better light on the nature of bird strikes.

Another useful application for EURBASE data is demonstrated in a pilot study in which EURBASE information on individual bird strikes and data from the Flycatcher tracking radar will be used to analyse the altitudes of bird flight in relation to meteorological conditions. More specifically, soaring and gliding birds such as birds of prey and swifts, two groups either responsible for extensive damage to aircraft or numerous bird strikes, will be studied. Flight altitudes of soaring birds are strongly influenced by thermal updrafts and other forms of lift. It is still unclear, however, what influences the flight altitudes of swifts. The EURBASE will be used as a data source for locations and altitudes of flight of these species, which will then be analysed in relation to local meteorological conditions such as thermal depth, temperature and humidity. This pilot study is a small part of the Bird Avoidance Model presently being developed at the University of Amsterdam in co-operation with the Royal Netherlands Air Force and the Dutch Centre for Field Ornithology SOVON.

Key words: military statistics, Eurbase, bird species, identification, Bird Avoidance Model

1. Introduction

1.1 Background

After years of contributing bird strike summaries to the Air Forces Flight Safety Committee Europe (AFFSC(E)) it was recognised in the late 1980's that collecting the actual details of bird strikes in one combined European Military Bird Strike Database (EURBASE) would yield much more information. At the 20th IBSC meeting in 1990 a preliminary study on the bird strike reports over the year 1988 of six Air Forces was presented (DEKKER & BUURMA 1990). From then on the database increased rapidly, not in the least because along with new data also data from previous years was contributed. Standardisation of data was encouraged by the introduction of EURFORM, the European Military Bird Strike Form (DEKKER & BUURMA 1992). Over the years progress reports on the EURBASE project were presented for AFFSC(E) and IBSC (DEKKER 1994, BUURMA 1995 and 1996; BUURMA & DEKKER 1992 and 1996). The Military Agency for Standardisation (MAS) adopted EURFORM as an annex to the Standard NATO agreement 3879 FS. In most of the progress reports some results from analyses of EURBASE data was included. At the 24th IBSC meeting in 1998 an extensive inventory of quantity and completeness of the then available database of 34,564 bird strikes was presented (DEKKER 1998).

1.2. This report

Per January 2003 the total number of contributed bird strikes amounts to 40,640. It is hoped that this progress report motivates all contributors to send in their data and complete EURBASE. This paper is first of all meant to be a progress report that informs all the contributors on the current state status of EURBASE. In the extensive report on the quality and completeness of the database at the 24th IBSC meeting (DEKKER, 1998) emphasis was put on the limitations of EURBASE. This lead to the conclusion that the full set of heterogeneous material may be used for superficial analyses which then may lead to more in-depth studies of carefully chosen selections.

Although information on bird species involved in bird strikes is –on average- only available in 30% of the records we feel that this lack of completeness is counterbalanced by the enormous quantity of records in the database. We therefore use this report to unveil some details on bird species as they were reported in 11,917 bird strikes. In the interpretation of the figures it should be kept in mind that we worked with the complete set of data and that reporting standards and identification levels vary considerably between contributing nations.

2. Contributions so far

An overview per Air Force and per year is given in *Annex A*. It is encouraging that for six Air Forces the data set is complete up to 2001. Unfortunately, another nine Air Forces have contributed in the past but have failed to do so in recent years. If looked at the development of EURBASE through the years [*Figure 1*] it is clear that up to 1995 the number of contributing Air Forces was growing, while after that the database is dominated by only six Air Forces.

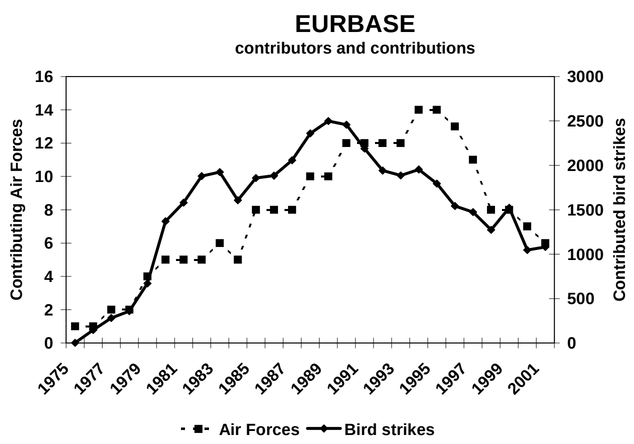

Figure 1. *EURBASE contributors and contributions per year*

3. Bird strike numbers in time

3.1. Bird strikes through the years

Apart from the number of contributing Air Forces, *figure 1* also shows the yearly total number of contributed bird strikes. It is clear that since 1991 the numbers decrease. This decrease is only partly a consequence of the decrease in contributing Air Forces, which became apparent since 1997. If looked at the contents of *Annex A* it is noticed that nearly all Air Forces show a decrease in reported bird strikes through the years. If we look at the three Air Forces with the longest complete series of yearly contributions (GAF, RAF and RNLAF) the average number of bird strikes per year in the latest 6 years (1996-2001) is considerably lower than in the first 6-year period 1984-1989. The numbers in the last period are 72%, 61% and 41% respectively of that in the first period. There are a number of factors, which all attributes to a certain extend to this decrease. Firstly, as a consequence of the peace dividend, Air Forces realise considerably less flying hours in recent years. The numbers are not corrected for this decrease in flying hours. Another factor of importance is the change in operations, which means less flying at extreme low altitudes where bird density generally is higher. Also, for the RNLAF, the ever better distribution of increasingly accurate birdtams undoubtedly has contributed to the decrease.

3.2 Seasonal pattern of bird strikes (in relation to flight phase of the aircraft)

Civil aviation is characterised by take-off and climb to generally high cruising altitudes that are used until descent and landing. Military flight operations are only comparable to this as far as the beginning and end of the flight is concerned. The nature of the actual flight is very variable, depending of the operations. In *figure 2 and 3* therefore the seasonal variation in bird strikes is given for the local (on and near airfields) and en-route situation respectively. The criteria which are used to attribute a bird strike local or en-route are given in *Annex C.* As expected on the basis of flight operations, the seasonal pattern of local military aviation, as derived from EURBASE [*Figure 2*] resembles that of civil aviation (ANONYMOUS, 2001; MACKINNON, 2001). Relatively few bird strikes in the winter months while the late summer months (July-October) score high.

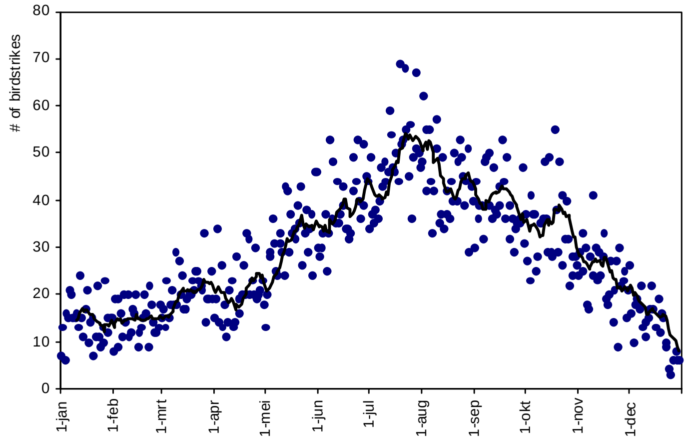

Figure 2. *Seasonal pattern of local bird strikes. N=10,513*

In *figure 3* the seasonal pattern of en-route military bird strikes from EURBASE are given. Opposed to the local situation, the en-route bird strikes show a considerable peak in March. Apparently the flight operations of military aircraft intervene with the spring bird migration. With prevailing southerly winds in Western Europe, diurnal migration takes place at rather high altitudes (usually up to 2 Km) where birds have a higher risk of meeting military aircraft while the majority of civil en-route aircraft operate at altitudes of around 10 Km. Although autumn migration involves a manifold of birds, an autumn peak in bird strikes statistics is only just discernible in *figure 3*. The fact that autumn migration in Europe often involves flying against the wind makes that the altitude at which the majority of birds fly (up to 0,5 Km) is generally lower than in spring. Apparently the birds are therefore less prone to meet military aircraft.

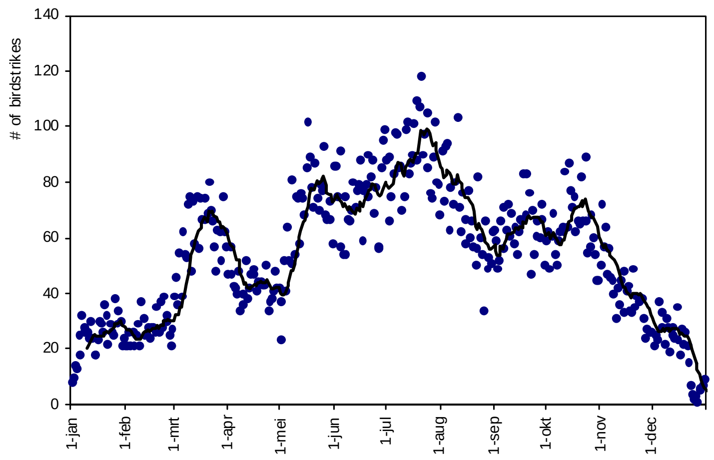

Figure 3. *Seasonal pattern of en-route bird strikes. N=19,710*

Another striking difference between the seasonal patterns of local and en-route military bird strikes is the duration of the summer peak. For local bird strikes the summer peak very gradually decreases from July onwards towards November. For the en-route bird strikes the peak quickly decreases from July towards September, while it then stays stable to November. On and around airfields, the local and staging migrating birds are responsible for the permanent presence of only slowly decreasing number of birds, resulting in only gradually decreasing numbers of local bird strikes through late summer and autumn [*Figure 2*]. En-route military aircraft mainly meet birds that are actually on migration. Thus, the situation in September and October [*Figure 3*] reflects mainly migrating activity of birds.

4. Bird species involved in military bird strikes

The information on bird species or species groups given below is based on the 30% of the records of which this information is available. This percentage greatly varies between Air Forces and between years [*Figures 4 and 5*]. Also the certainty of identification (% identified by Bird Control Unit (BCU) or laboratory) varies between Air Forces and years [*Figures 4 and 5*]. It is with this in mind that the following results have to be judged.

4.1. Identification of bird remains

The percentage of identification of bird remains to species level varies greatly between bird families as shown in *Annex B*. Several factors affect the level of identification within or between bird groups. Some groups are easy to identify to species level either due to unique characteristics or only a few species within a family or order such as Swifts (family Apodidae) and Starlings (family Sturnidae). Other groups like the order Passeriformes (songbirds) are more problematic; when only minute remains are available many cases can only be identified to the order level, even using microscopic techniques. Identification of more substantial bird remains by bird control units should generally be to the species level since they would send the more difficult cases to experts from a laboratory.

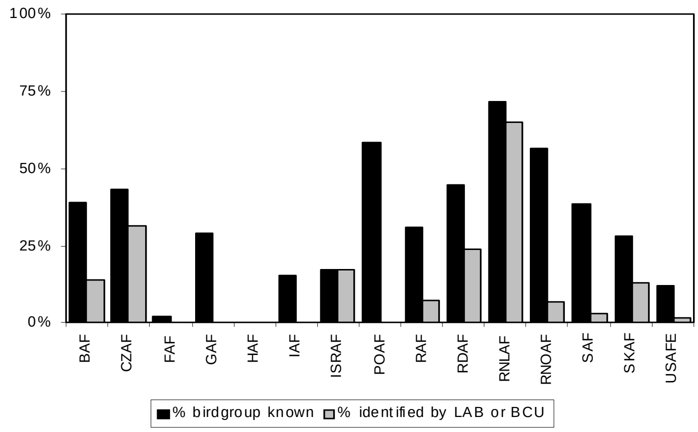

Figure 4. *EURBASE data, information per Air Force on bird species and identification*

Not only does the proportion of bird strikes of which the bird is identified to species level vary between bird families, there is also considerable variation between the flight phase of the aircraft. Gulls [Lariidae], Pigeons [Columbidae] and Swallows [Hirundinidae] involved in en-route bird strikes are identified to species level considerably less often than in local bird strikes. This probably is caused by the fact that pilots have attributed en-route bird strikes to these families

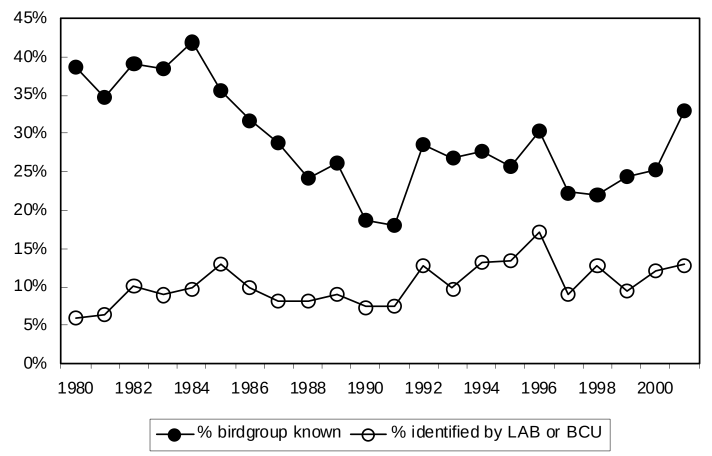

Figure 5. *EURBASE data, information over the years on bird species and identification*

more easily (but possibly incorrectly) than to other, less easily recognisable bird families.

4.2 Most frequently struck bird species

Bird remains from collisions with aircraft are identified to species level if possible, this provides the most accurate information on the type of bird (weight, behaviour etc.). If identification at species level proves to be impossible it often is still feasible to ascertain the family or order (Passeriformes) it belongs to. Although this type of information is more variable, it is still possible to say something on bird weight and behaviour.

Table 1. *Top ten of bird families involved in European Military Bird Strikes*

Ranking	Bird family		Number
1	Lariidae	Gulls	2751
2	Apodidae	Swifts	1195
3	Columbidae	Pigeons + Doves	1165
4	Hirundinidae	Swallows + Martins	1115
5	Passeriformes	Songbirds	891
6	Charadriidae	Waders + Plovers	835
7	Accipitridae	Hawks + Buzzards etc.	695
8	Alaudidae	Larks	443
9	Falconidae	Falcons	377
10	Turdidae	Thrushes	329

In *Table 1* the overall top ten bird families that were involved in bird strikes is given. More details are given in *Annex B* which contains the top 15 bird families that were involved in bird strikes and information on the proportion that was identified to species level, not only for the overall total but also specified for the flight phase of the aircraft. The overall ranking in *table 1* shows expected high rankings for the Gull family (Lariidae) at no. 1 and Pigeons (Columbidae) at no.3. Rather surprising are the high rankings of Swifts (Apodidae) at no. 2 and Swallows and Martins (Hirundinidae) at no. 4. The high ranking of gulls and pigeons is in line with the civil UK bird strike statistics (MILSOM & HORTON, 1995), in which they are also ranked 1 and 3 (see *Table 2*). The relative low position of Waders (Charadriidae) at no. 6 is surprising, especially since they rank 2 in the UK Civil statistics.

4.3 Bird species in relation to flight phase of the aircraft

If the results are broken down to the flight phase of the aircraft during the impact, a rather different picture arises for the LOCAL bird strikes (bird strikes that happened on or in the vicinity of the airfield). Gulls (Lariidae), Waders (Charadriidae), Swallows and Martins (Hirundinidae) and Pigeons (Columbidae) form the top 4. Apart from the Swallows and Swifts this is in line with UK civil statistics. The most common species group involved in European military local bird strikes are compared with civil statistics from various sources MILSOM & HORTON 1995; BRIOT & EUDOT 1992; MCKINNON et al. 2001) in *table 2*. The top 3 bird groups in EURBASE are identical to that in UK civil statistics. It seems safe to state that local military bird strike statistics are comparable to civil ones, both are related to the airfields and their immediate surroundings. However, French civil statistics (only two years) are surprisingly dominated by raptors, followed again by the top 3 of both UK civil and EURBASE local statistics. The situation in North America is similar to that of Europe: Gulls are the top group of birds involved in bird strikes. On the other hand, the much lower ranking of Waders / Plovers and the prominent ranking of Geese and Duck on the other side of the Atlantic deviates from the European situation.

***Table 2**. Ranking of bird groups involved in bird strikes on or around airfields. (UK Civil data from MILSOM & HORTON 1995, France civil data from BRIOT & EUDOT 1992, USA and Canada civil data from MCKINNON et al. 2001).*

Rankings	EURBASE local up to 2001	UK civil 1976-1990	France civil 1990-1991	USA civil 1991-1999	CAN civil 1991-1999
Gulls	1	1	2	1	1
Waders / Plovers	2	2	3	5	3
Pigeons / Doves	3	3	4	2	5
Raptors	4	-	1	4	2
Waterfowl	(14)	-		3	4

A comparison of the ranking of species involved in local and en-route bird strikes [*Annex B*] shows two striking features. Charadriidae score only low in the en-route strikes but score a dominant second place in the local bird strikes. Since the Lapwing is by far the most dominant species of this group its reputation as a typical airfield problem species is apparent from EURBASE. The same applies for the Falconidae (almost all Kestrels), scoring a 6th position in local statistics and only a 14th position in the en-route figures.

4.4 Bird species through the year per flight phase of the aircraft

As is apparent from *figures 2 and 3* the seasonal distribution of local bird strikes differs from that of the en-route strikes. Also, as is shown in paragraph 4.3, the species composition of local bird strikes deviates from that of en-route bird strikes. In *figures 6 and 7* these phenomena are combined: per month the distribution of bird strikes over bird groups is given for both the local and en-route situation.
From *figures 6 and 7* a number of conclusions can be drawn, to mention a few:

- Accipitridae (Hawks etc.) are relatively often involved in en-route bird strikes in spring. This is mostly caused by display flights of Buzzards that occur at altitudes that intervene with en-route military aircraft.
- Falconidae (Falcons) are mainly a local problem, concentrated in late summer when there is an influx of juvenile, inexperienced Kestrels on the grassland of airfields.
- Charadriidae (Waders) are both in local and en-route bird strikes less of a problem in early summer (breeding season). Overall they form a considerable part of local bird strikes while they only constitute a minority of en-route bird strikes. Their preference for the steppe-like runway environment and their (flocking) behaviour apparently make that they are over-represented in local bird strikes compared to the en-route ones.
- Lariidae (Gulls) are both local and en-route a major problem, in both cases particularly so during the winter months.
- Columbidae (Pigeons) show near complementary seasonal patterns for local and en-route bird strikes. In spring and early summer (April to June) they are well represented in local bird strikes while for en-route they mainly are a winter problem. This suggests that they are attracted to the runway environment during the seeding season. As the runway environment should not be exploited, it could be that the agricultural activities in the airport vicinity are responsible.
- The patterns for Apodidae (Swifts) and Hirundinidae (Swallows) taken together, show that these species are responsible for a considerable part of the bird strikes in summer, especially en-route. After the Swifts have left NW Europe, Swallows still are present in high numbers. Airborne insects in the runway environment probably attract them, as they are well present in local bird strikes.
- Both local and en-route the proportion of “other families” is largest during spring and autumn migration when apparently a greater variety of species is struck.

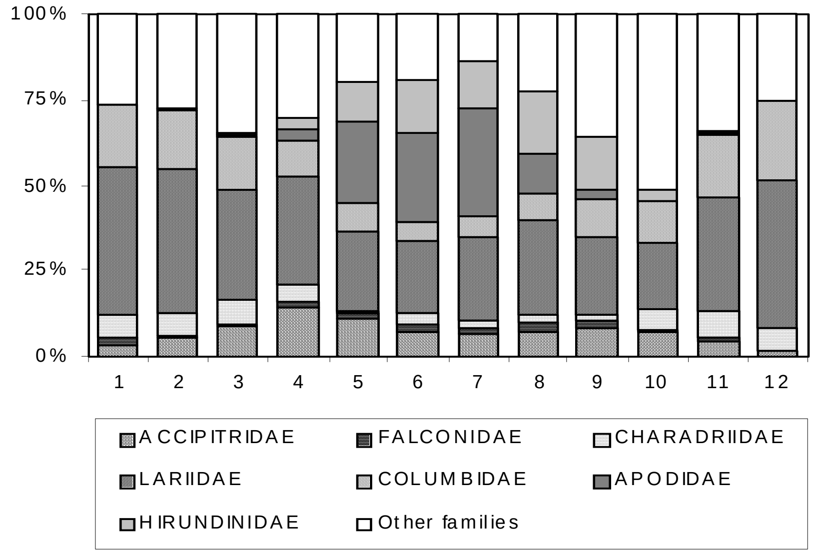

Figure 6. *Monthly percentual distribution of en-route bird strikes over bird species groups*

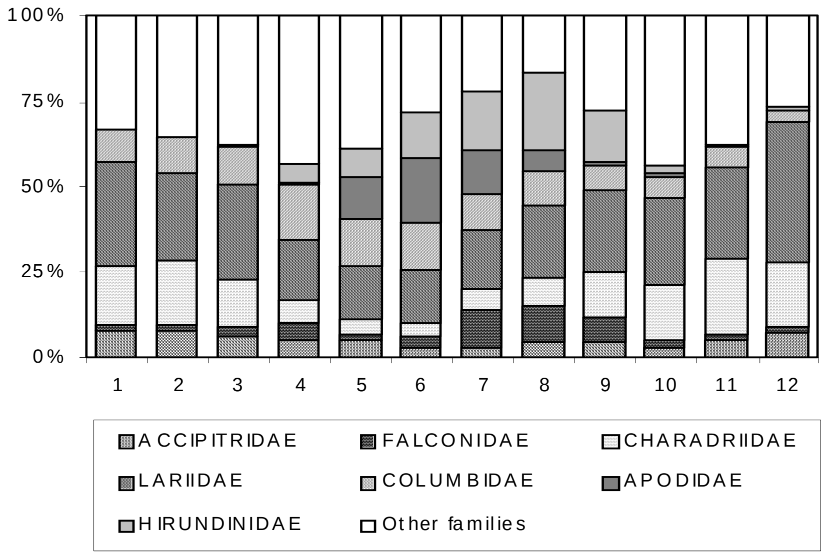

Figure 7. *Monthly percentual distribution of local bird strikes over bird species groups*

4.5 Bird species and damage

The overall picture from *Annex B* of damage per bird group can be summarised as follows:

- 1 order and 4 families of smaller birds score damage in up to 20% of the strikes (Passeriformes, Hirundinidae, Alaudidae, Fringillidae and Motacillidae)
- 6 families of birds have damage reported in 20-40% of the strikes. Apart from the Apodidae these are intermediate sized birds (Charadriidae, Falconidae, Turdidae, Corvidae, Sturnidae,Apodidae)
- 3 families of large birds (Lariidae, Accipitridae and Columbidae) cause damage in 40-60% of the bird strikes they are involved in.
- 1 family of heavy birds (Anatidae) scores damage in more than 60% of the strikes.

This is consistent with the general law of $E=MC^2$. In bird strikes with heavier birds more energy is released, therefore there is a higher risk of damage in these bird strikes. As expected on the basis of higher aircraft speed (which is squared in the formula), en-route bird strikes generally result in damage more often than local bird strikes. As is clear from *Annex B* the difference is considerable: for most families the proportion of strikes resulting in damage is in the en-route situation up to three times as high as in the local situation. So, whereas 22,6% of local gull strikes result in damage, this is true in 67,8% of the en-route strikes with gulls. Other bird groups show comparable differences.

A complicating factor in the interpretation of these fact is that in the en-route situation the chance of finding bird remains is higher for those bird strikes that cause damage. In the local situation this might be reversed (even slipstream victims that did not even hit the aircraft may result in a reported bird strike).

6. Using EURBASE data for analysis of bird flight altitudes, as part of a Bird Avoidance Model

Part of the recently started development of a Bird Avoidance Model (BAM) by RNLAF and the University of Amsterdam is the study of the predictability of flight altitudes of birds. This study is focussed on the local movements of several species of gliding and soaring birds and the influence of environmental factors such as thermal depth and intensity, surface temperature and humidity on flight altitudes. Flight altitudes of swifts, gulls and birds of prey, will be collected using the RNLAF flycatcher tracking radar and EURBASE bird strike data (when species, altitude and location are known). Diverse meteorological data is available through the Internet. Thermal depth will be estimated from radiosonde data (for example: http://www.fsl.noaa.gov/fsl/docs/data/fsl-data.html). Relation to surface temperature and humidity will also be analysed from ground stations closest to the bird observations (www.knmi.nl), mesoscale model outputs or reanalysis data sets (www.cdc.noaa.gov/cdc/data.nmc.reanalysis.html). Numerical models predicting the development, depth and intensity of the thermal boundary layer have been developed. Two of these models have been tested in relation to soaring bird migration altitudes (SHANNON et al. 2002, SHAMOUN-BARANES et al. 2003).

Following statistical analysis, a model will be developed predicting flight altitudes of soaring and gliding birds in relation to local meteorological conditions as part of the Bird Avoidance Model currently being developed at the University of Amsterdam (for more details see BOUTEN et al. in these proceedings).

7. Acknowledgements

This paper could only have been written thanks to the dutiful reporting of all the pilots, the bird controllers who collected bird remains, and of course all Air Force Head Quarters which contributed their databases to EURBASE. Furthermore we thank the Royal Netherlands Air Force which, as custodian of EURBASE, provided time and means. Luit Buurma read an earlier draft of the paper.

8. References

ANONYMOUS 2001. 1999 Bird Strike Analyses (IBIS). ICAO state letter A/N 4/9.1.1-01/95; 18 October 2001.

BRIOT J.L. & A. EUDOT (1992) Etude statistique des collisions oiseaux-aeronefs survenues en France durant les annees 1990 et 1991.

BUURMA L.S. (1995). Sharing facts and figures on an open market: Bird Strike Committee Europe. Presentation for the Air Forces Flight Safety Committe (Europe), Toronto, Augustus 1995.

BUURMA L.S. (1996). Bird movements around airports: a critical issue in the specification of avoidance systems. Proc. of 23st Meeting International Bird Strike Committee, London, May 1996.

BUURMA L.S. & A. DEKKER (1992). Bird Strike Hazards to Helicopters. Paper nr 19 at the 18th European Rotorcraft Forum, Avignon, September 1992.

BUURMA L.S. & A. DEKKER (1996). EURBASE: Potential lessons from military bird strike statistics. Proc. of 22rd Meeting International Bird Strike Committee, London, May 1996.

DEKKER A. (1994). The European Military Bird Strike Database. Progress Report. Proc. of 22st Meeting International Bird Strike Committee, Vienna, September 1994.

DEKKER A. (1998). EURBASE, limitations and opportunities. Proc. of 24th Meeting International Bird Strike Committee, Stara Lesna, September 1998.

DEKKER A. & L.S. BUURMA (1990). Towards a European Database of Military Bird Strikes. Proc. of 20st Meeting International Bird Strike Committee, Helsinki, September 1990.

DEKKER A. & L.S. BUURMA (1992). The European Database of Military Bird Strikes, from proposal to reality. Proc. of 21st Meeting International Bird Strike Committee, Jerusalem, March 1992.

MACKINNON B, editor (2001) Sharing the Skies. Report issued by Transport Canada

MILSOM, TP & N. HORTON (1995). Birdstrike, An assessment of the hazard on UK civil aerodromes 1976-1990. Report by the Central Science Laboratory UK.

SHANNON, H., YOUNG, G., YATES, M., FULLER, M. AND W. SEEGAR. (2002). American White pelican soaring flight and altitudes relative to changes in thermal depth and intensity. Condor 104: 679-683.

SHAMOUN-BARANES, J., LIECHTI, O., YOM-TOV, Y. AND Y. LESHEM. (2003). Differential use of thermal convection by soaring birds over central Israel. Condor. In press.

Annex A *Total number of contributions to EURBASE per Air Force and per year*

Year	Air Forces	Bird strikes	BAF	CZAF	FAF	GAF	HAF	IAF	ISRAF	POAF	RAF	RDAF	RNLAF	RNOAF	SAF	SKAF	USAFE
1975	1	3													3		
1976	1	145											145				
1977	2	281			93								188				
1978	2	359			179								180				
1979	4	670			155	378							136		1		
1980	5	1370			188	429					621		131		1		
1981	5	1580			206	503					693		175		3		
1982	5	1879			196	615					785		281		2		
1983	6	1924			170	655			104		768		224		3		
1984	5	1608			126	505			23		778		176				
1985	8	1858			70	474			112		743		151	25	1		282
1986	8	1884			70	415			125		710		154	14	22		374
1987	8	2058			180	580			138		679		181	13	9		278
1988	10	2360	112		189	604			167		746	38	196	38	6		264
1989	10	2499	115		180	623			262		638	45	243	37	20		336
1990	12	2458	95	41	122	602		66	238		638	66	183	36	10		361
1991	12	2189	75	25	221	497		101	247		589	51	92	26	11		254
1992	12	1941	64	38	183	443		84	218		613	40	107	29	7		115
1993	12	1887	70	23	211	489		184	170		533	46	93	36	13	19	
1994	14	1954	85	30	249	425	7	174	221	2	555	26	100	53	10	17	
1995	14	1794	67	33	156	367	15	186	194	9	506	32	108	33	65	23	
1996	13	1542	80	25	65	406	5	155	247	8	367	16	93		49	26	
1997	11	1473		12	289	383	50	153		10	434	28	77		23	14	
1998	8	1274		35	216	355		134			434	24	75				1
1999	8	1522		35	345	418		123			458	33	81		29		
2000	7	1046		28		371		118			435	5	74		15		
2001	6	1082		19		371		117			499		58		18		
Total	15	40640	763	344	4059	10908	77	1595	2466	29	13222	450	3702	340	321	99	2265

ANNEX B *Top 15 of bird groups from EURBASE per January 2003*

Rank Overall	Family	Total number	%Damage	% identified species level	**Flight phase LOCAL** Rank	% Damage	% identified species level	**Flight phase EN-ROUTE** Rank	% Damage	% identified species level	**Flight phase UNKNOWN** Rank	% Damage	% identified species level
1	Lariidae	2751	48,7	36,1	1	22,6	47,9	1	67,8	28,7	2	48,0	31,6
2	Apodidae	1195	22,2	98,5	5	11,9	99,3	3	27,9	97,8	1	21,7	98,4
3	Columbidae	1165	45,4	41,7	4	24,6	51,2	2	62,8	35,5	5	45,4	36,7
4	Hirundinidae	1115	10,6	53,9	3	7,6	53,6	4	14,8	41,2	4	9,2	75,1
5	Passeriformes*	891	13,8	0,0	9	9,0	0,0	5	18,2	0,0	3	10,9	0,0
6	Charadriidae	835	29,5	90,3	2	18,0	95,1	7	55,5	83,5	9	31,4	81,0
7	Acciptridae	695	55,7	89,1	8	28,6	90,1	6	71,6	89,1	8	51,3	87,0
8	Alaudidae	443	11,3	93,0	7	5,5	90,8	12	20,2	93,6	6	14,5	96,2
9	Falconidae	377	25,7	91,5	6	16,0	94,3	14	50,0	83,3	11	36,1	90,2
10	Turdidae	329	19,1	80,5	13	14,9	92,6	10	21,0	76,1	10	20,6	85,6
11	Corvidae	328	38,1	60,4	10	17,5	68,5	8	58,0	54,7	14	37,1	51,4
12	Sturnidae	278	30,9	100,0	11	16,4	100,0	11	46,5	100,0	13	34,5	100,0
13	Fringillidae	266	8,3	97,0	>15	10,5	94,7	13	9,0	94,4	7	6,7	100,0
14	Anatidae	251	64,1	57,8	14	43,1	66,7	9	78,1	52,7	15	48,5	60,6
15	Motacillidae	166	9,6	66,3	15	4,3	65,7	15	15,0	67,5	12	12,5	66,1

* Songbirds, which could not be identified to family or species level.

ANNEX C Hierarchical system used to designate bird strikes as being “local” or “en-route”.

In this scheme field names from EURBASE are printed italic, attributed field contents are printed upper-cast and the result is printed bold upper-cast . A key to the abbreviations is added at the end.

1. If LAN is among the *impact points* the bird strike is considered being **LOCAL**, else:

2. If *flight phase* is UNK the bird strike is considered **UNK**, else:

3. If *flight phase* is TAX, TOF or LAN the bird strike is considered **LOCAL**, else:

4. If *flight phase* is CRU or LLE the bird strike is considered **ENR**, else:

5. If *actype* unequals JET
    - 5a. and *flight phase* is HOL, TGO or FAP the bird strike is considered **LOCAL**, else:
    - 5b. and *flight phase* is CLI or DES:
        - 5b1. and *altitude* is 2000ft or less the bird strike is considered **LOCAL**, else:
        - 5b2. and *altitude* is over 2000ft the bird strike is considered **ENR**, else:

6. If *actype* is JET and *flight phase* is HOL or TGO or FAP or CLI or DES
    - 6a. and *speed* equals 300 kts or more the bird strike is considered **ENR**, else:
    - 6b. and *speed* is less than 300 kts the bird strike is considered **LOCAL**.

Abbreviations used:

UNK = Unknown
LAN = Landing gear (*impact point*) or Landing (*flight phase*)
TAX = Taxiing (*flight phase*)
TOF = Take-Off (*flight phase*)
CRU = Cruise (*flight phase*)
LLE = Low level, En-route (*flight phase*)
JET = Jet fighter aircraft (*actype*)
HOL = Holding (*flight phase*)
TGO = Touch and Go, Overshoot (*flight phase*)
CLI = Climb (*flight phase*)
DES = Descent (*flight phase*)
FAP = Final Approach (*flight phase*)

LOCAL bird strike occurred on an airfield or in the vicinity of it
EN-ROUTE bird strike occurred off airfield while aircraft was en-route
UNK unknown whether the bird strike was local or en-route