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TOWARDS A EUROPEAN DATABASE OF MILITARY BIRD STRIKES

A. Dekker and L.S. Buurma
RNLAF Flight Safety Division
P.O. Box 20703
2500 ES The Hague

ABSTRACT

The analysis of bird strike reports will only be a rewarding task when a multifold of biases can be avoided. In statistical terms this means that proper selections should be made. Depending on the questions to be answered the number of data available often is too small to achieve significant results. Therefore there is a strong tendency to lump data as much as possible. But as a result summary reports, such as those used in BSCE military statistics up to now, often cannot serve as comparison between countries. Even worse, they are not suitable for repeated analyses according to different criteria. The only way out is sharing the original bird strike forms while improving and standardizing the format. This report discusses a pilot study on the basis of 1988 data of six European Air Forces and gives some preliminary results.

TOWARDS AN EUROPEAN DATABASE OF MILITARY BIRD STRIKES.

1. INTRODUCTION

1.1. General Introduction

Bird strike statistics are a main source of information on which the prevention of bird strike hazards should be based. Improvement of airworthiness, bird avoidance measurements, and on-airfield bird strike prevention strategies all are served by a sound knowledge about the circumstances under which bird strikes happen and the consequences of certain types of bird strikes. We emphasize three crucial aspects. Firstly, there is the calculation of impact forces. For the development of proper and realistic design criteria, for each part of the aircraft good and detailed information on the relation between bird weight, aircraft speed and damage are of utmost importance (Ref.1,2).
Secondly, adapting flying operations to bird movements should be verifyable with respect to cost effectiveness. En-route bird strikes do make up the greater part of all military strikes. Any system that does warn pilots for high densities of birds has to take into account that with a minimum of operational loss a maximum degree of safety is to be obtained. In other words how many bird strikes are to be prevented at what reduction in flying. Again, good statistics are of vital importance (Ref.3).
Thirdly, bird strike statistics and biological knowledge can only be linked through proper assesment of the bird species involved. Once the problem species are identified one can disclose the true nature of the danger. This was illustrated by Lapwing data from the RNLAF (Ref. 4,5).

However, bird strike statistics traditionally are confined to summary tables which contain different break downs of the number of strikes over bird species, parts struck, type of aircraft etc. etc. (Ref.6,7). Due to shortcomings in the collection of data as well as in the presentation, these summaries do contain only limited information (Ref.8). Furthermore, military BCSE-statistics are very incomplete. It is therefore not surprising that the usefulness of these rudimentary military statistics is questioned (Ref.6).

Once it is acknowledged that bird strike statistics should be collected, it also becomes clear that the collection of such data only makes sense when it is done in a correct and detailed manner. This paper explores the methodological pitfalls on the basis of 1988 data.

1.2. Historic Perspective

Within the Air Forces Flight Safety Committe (Europe) (AFFSC(E)) the USAF(E) has stated that -since BSCE also produces joined statistics- the "bird strikes summaries" as reported by all members to AFFSC(E), should be given up. But the argument that military bird strike statistics already are taken care of by the BSCE is only true to a very limited extend. RNLAF repeatedly draw AFFSC(E)'s attention to the fact that the way in which their own "bird strike summaries" were compiled do result in so much loss of information that they become virtually useless. Mixing up data from fighters, transport aircraft and helicopters obscures all comparability. Loss of information is also caused by the fact that no clear-cut discrimination is made

between strikes with and without damage. In general it is the lack of definitions and of discrimination between different types of bird strikes that reduces the value of these "bird strike summaries". Furthermore there is hardly any knowledge as to what extend the collected data is reliable. These shortcomings in the present way of compiling bird strike summaries were acknowledged by the committee. But also the potential importance of good statistics and their exchange between members was emphasized. Rightly so, good statistics were reckognised as a main tool in the effective understanding of the bird strike problem. It was therefore agreed that member states no longer contribute summaries but instead dump their individual bird strike reports in a joined database. This database then could be used as a commonly owned source of information.

Analysis of a very detailed and complete but relatively small database, as the one of the RNLAF, did show that it is possible to obtain information about airworthiness (Ref.2); altitudinal distribution (Ref.3); temporal distribution (Ref.4) and bird species involved (Ref.9). Since the RNLAF is only a small Air Force, the main problem in any use of the database is the relatively small amount of records. To do sound and proper statements, databases for a large number of years have to be combined to overcome this problem. However,not for all analyses it is possible to lump data from a number of years. For instance, to get some idea about the clustering of bird strikes by day RNLAF data simply are not sufficient in numbers. Another bias resulting from the use of data from only one country is the unballanced use of the airspace. The German plain is the main operational area for the RNLAF. Since all air bases are located within the Netherlands the flying hours are not evenly distributed over the entire operational area. Missions normally begin from, and end at a dutch airbase. Thus, on average the geographical distribution of the flight intensity will be skewed towards more flying time spent near the bases than in perifery of the operational area. Geographical information should therefore be corrected for this phenomenon.

Most of the above raised objections against the use of the database of only one country could be undone by compiling a joined database.
The RNLAF was engaged to compile this joined bird strike database from data provided by the AFFSC(E) forces for the year 1988. Experience gained could then be used to evaluate the reporting requirements and give some idea about the effectiveness of such a database.

1.3. Outline of this Paper

We have chosen a step-by-step approach. Fistly, the data are summarised in the "classical" way , taking several recent BSCE papers as an example (Ref. 6,7,10,11). Then, limitations of the material are illustrated by making very specific selections needed to answer questions concerning the geografical distribution of bird strikes. Thirdly, distributions of bird strikes are made over altitude and time.

It is emphasised that the results only are presented to show what information potentially could be available in the raw material and that on the basis of these preliminary results only a few firm conclusions can be drawn.

2.METHODS AND MATERIAL

2.1. Methods

As a consequence of the decission of AFFSC(E), individual records of 1988 bird strikes were obtained from RDAF, GAF, RAF, USAF(E) and RNLAF. Only USAF(E) and RNLAF records were available on floppy disk, other forces either sent copies of their original forms/telexes or computer output on paper.
From all individual bird strike records the key items were put in a database. By modifying the structue of the RNLAF database it was possible to use standard ways of describing all different aspects of a bird strike. Nevertheless, it took some effort to line up the data to one standard. Very often, usefull information was extracted from the pilots description of the incidentin his own words. While compiling this database, notes were made on problems encountered. These problems mostly concerned the standards used in denotating the different aspects of a bird strike.
All handling of the data was done using the DBase-III database handling package.
The total number of records added up to 1.766 bird strikes during 1988 for the five forces concerned. Apart from all the obvious standard information on each bird strike some extra characteristics were denoted to each strike. These items are:

REGION
Giving some broad idea of geographical location. The main regions used were:
German Plain
>49.00 deg. N and <56.00 deg. N
>02.00 deg. E and <11.00 deg. E
United Kingdom
Rest of Europe
Other regions like parts of the american continents and Africa were used infrequent and were left out from the present analysis.

TYPE OF AIRCRAFT
In order to make proper use of the database, distinction is needed between (at least) three types of aircraft:
JETS.....All types of fighter/trainer jet aircraft
HELI.....All types of helicopters
OTHER.All cargo aircraft, wether it be prop or jet engined. Also smal prop or turboprop aircraft. In fact all a/c not denoted as JET or HELI.

STAGE OF FLIGHT
For the right selections to be made, it is neccesary to know wether the bird strike occurred en-route or during the presence of the aircraft on or near an airbase. Using a number of criteria every record was attributed as en-route, local or unknown. The most useful criterium is aircraft speed (Ref.3). Other information used to attribute birdstrikes to these selections sometimes were:
-altitude
-parts struck (landing gear)
-phase of flight
-remarks like "dead bird found on runway"

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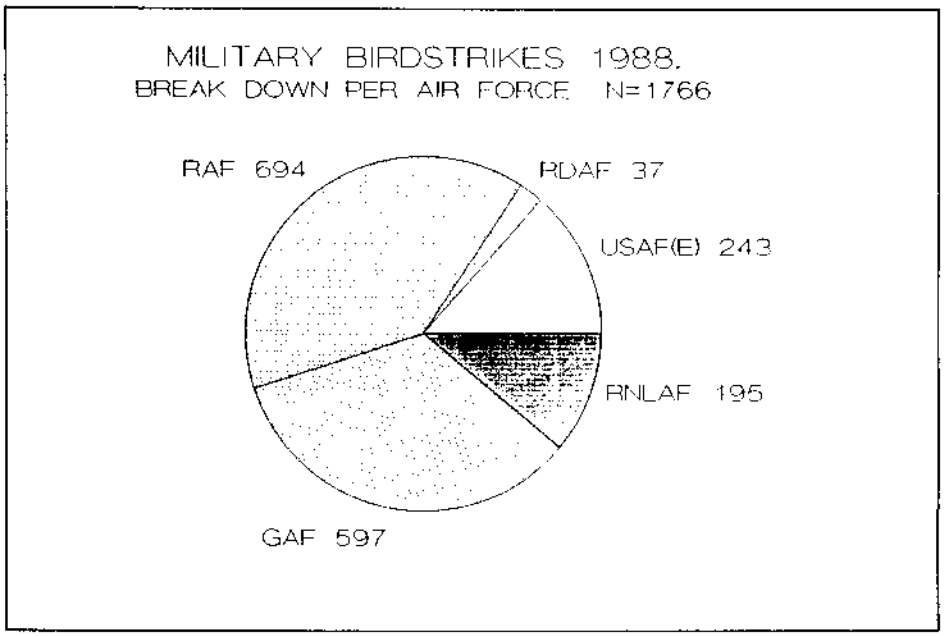
2.2. General Information on the Available Material

2.2.1. Available Bird Strikes from the Different Air Forces

The number of strikes for each contributing air force is given in figure 1. The fact that the RAF clearly is top scorer does by no means imply that this air force is really running a greater risk of bird strikes than for instance the GAF or RNLAF.

FIGURE 1.



Apart from the obvious differences in fleet size, differences between the forces concerning the following factors may have contributed to the final results presented in figure 1.

- Reporting standards. Reporting of bird strikes can be organised in a number of different ways. It will be clear that differences in reporting system may result in different standards of reporting. For instance, the inclusion of crew chiefs in the reporting system means that far more strikes without damage will be reported then when only pilot reports are included (Ref.2). In addition, the attitude of pilots towards bird strikes and their consequences will irrevocably have influence on the willingness to report all bird strikes.

- Composition and activity of the air fleet. Apart from the obvious distinction between slow moving helicopters and propeller aircraft on the one hand and fast flying turbo-prop and jet aircraft on the other hand, it is clear that -if only because they cover a larger distance- (high speed) jet fighters do have per flying hour a greater chance to encounter birds than any other kind of aircraft. Another important fact is the relation between aircraft size (frontal area) and the number of bird strikes. Thus, the distribution of flying hours over the different aircraft is a major factor determining the total number of bird strikes an air force will suffer.

- Type of operations. Since the distribution of bird movements is extremely skewed towards lower altitudes (Ref.12), operational tasks which include low level missions of long duration and/or extreme low altitude will have a relatively high score of bird strikes (Ref.1). The importance of altitude is clearly demonstrated by the fact that a special subgroup within the BSCE was formed, called "Bird Hazard to Military Aircraft at Low Level" (Ref.13)

- Geographical location of the arena. Birds are not evenly distributed over a region. It is well known that for instance arid areas do only hold a fraction of the number of birds that are frequently present in wet, fertile and lush areas. The bird movement working group of BSCE has therefore been active in drawing up maps of bird concentrations. The cooperation in this working group even resulted in a NW European map of bird concentrations (Ref.14). It is clear that air forces in whose arena vast bird concentration areas are located do run a more than average risk to encounter birds during missions.

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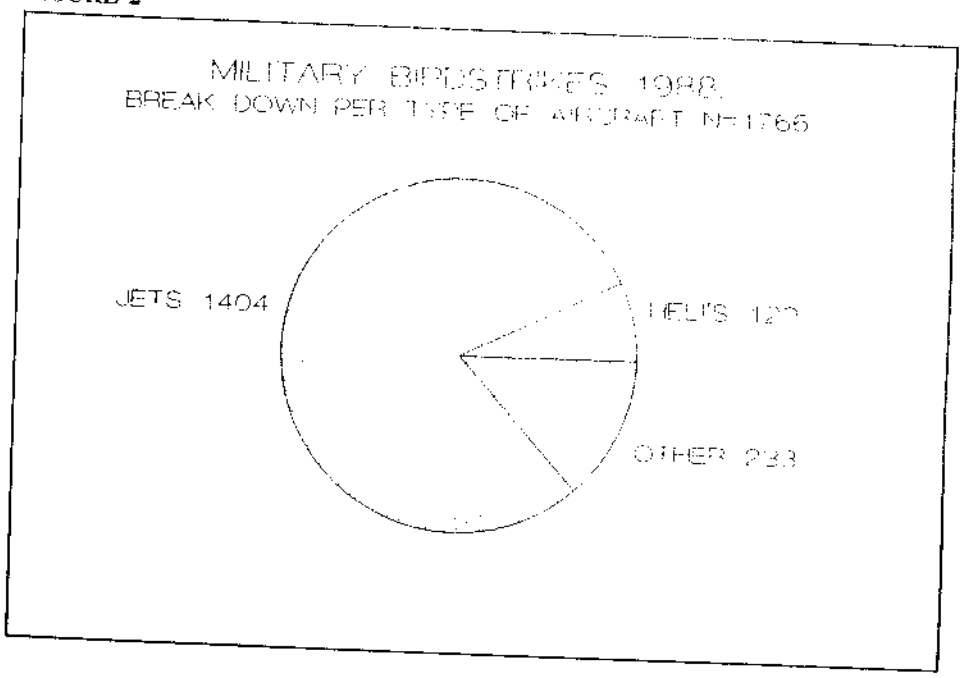
FIGURE 2

2.2.2. Distribution of the Bird Strikes over Aircraft Type

Only three categories of aircraft were reckognised, JETS, HELI and OTHER. The number of strikes for each category is given in figure 2. Detailed information about the break down per air force is given in appendix A. As is apparent from figure 2, the majority of bird strikes are encountered by jet aircraft. Since no information was available on the number of flying hours these results have to be looked at with some reserve. From RNLAF statistics it is known that the difference in ratio (number of bird strikes corrected for the number of flying hours) between jet aircraft and both other categories roughly amounts to a factor 10. If this is also valid for the other forces it means that a realistic comparison between the aircraft types based on ratios will reveal that the susceptibility for bird strikes of jets is far more overwhelming than is shown in figure 2.
Since the number of bird strikes with non-jet aircraft is quite low and very unevenly distributed among the forces, for reasons of comparibility only jet aircraft are considered in the majority of the following presentations.

FIGURE 2



2.2.3. Bird Species Involved in Bird Strikes

As is clear from figure 3, in relatively few cases information is available on the bird species involved (25.9%). In only 56 cases it was completely [illegible] bird remains were found. The break down over the [illegible] bird species is known is rather [illegible] the proportion one would [illegible] figure 1). Most striking is the [illegible] RNLAF is extremely [illegible]

[illegible] different types of birds [illegible] figure 4. Less pheasants [illegible] indicated in figure 3. The [illegible] species does [illegible] RNLAF. Furthermore, [illegible] less than bird groups. In [illegible] insignificant since this [illegible] RNLAF stated 10% damage [illegible] earlier analysis of the RNLAF [illegible] aircraft flying at speeds of more than 300 knots does not result in damage in about 3% percent of the cases (Ref 2).

From figures 3 and 4 it will be clear that firm and solid conclusions as to the bird species involved in bird strikes cannot be made. The discrepancy between the forces in the amount of information on bird species simply still is to large.

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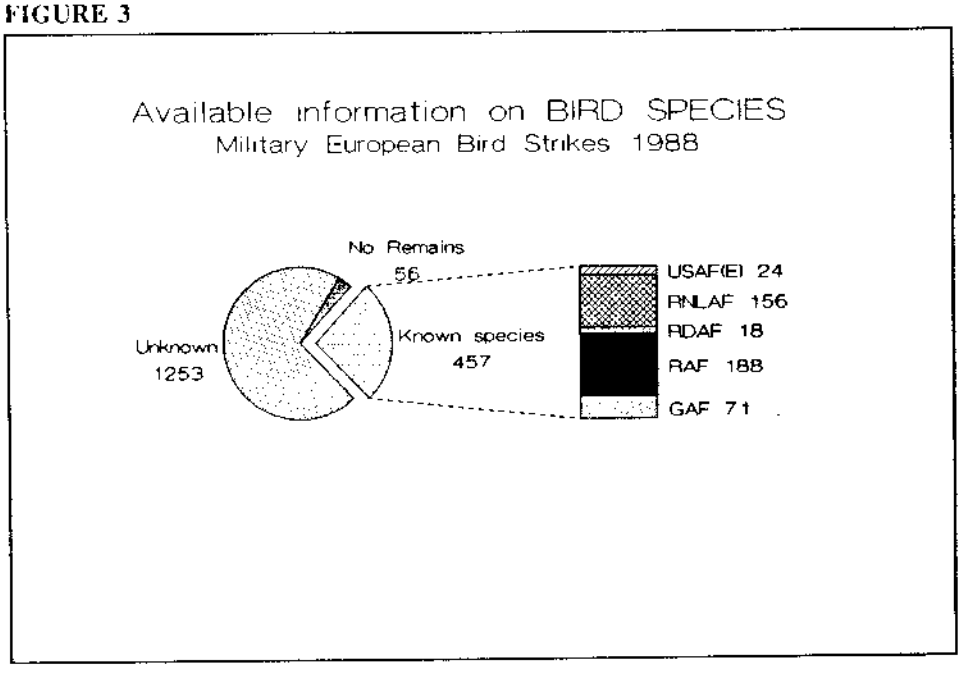

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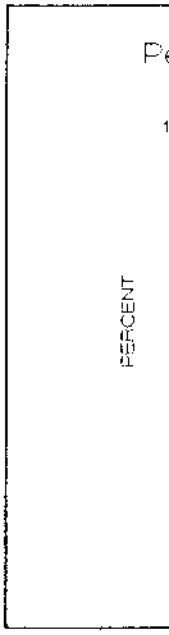

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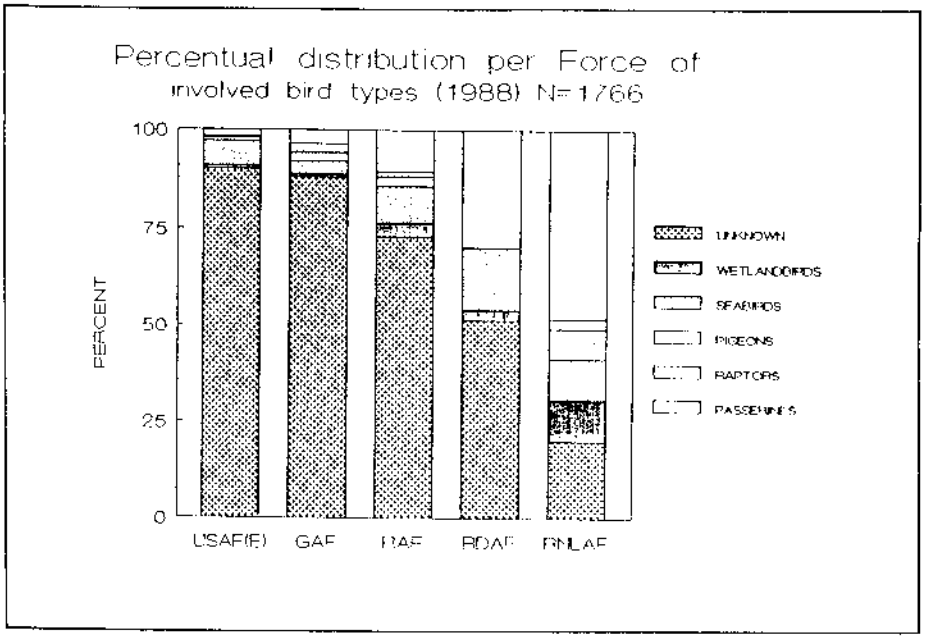
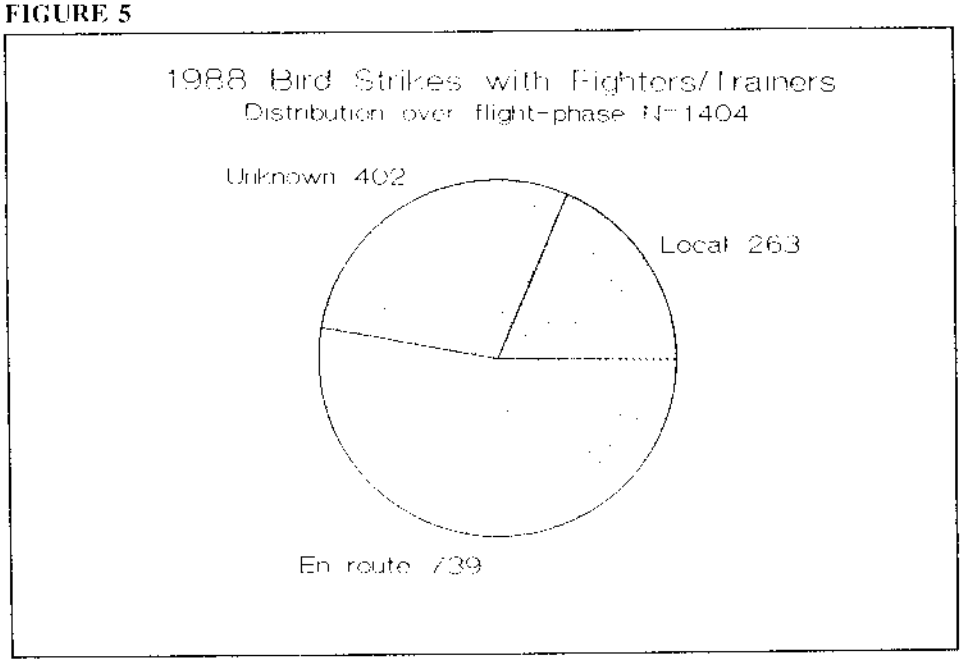


2.2.4. The Distribution of Bird Strikes over the Stages of Flight

As is mentioned under section 2.1. each bird strike was earmarked as being of local, en-route or of unknown stage of flight. The distribution of all strikes with jet fighters/trainers over these three categories is given in figure 5. Clearly the majority of bird strikes do occur en-route. From over a quarter of all strikes it is not known at what stage of flight they happened.
Detailed information per Air Force about this topic is given in figure 6. There is a marked difference to be noticed in the proportion of en-route strikes between GAF and RNLAF on one hand and RAF and USAF(E) on the other hand. This could well mean that the reporting discipline of RNLAF and GAF is higher. Detailed analysis of RNLAF data in the past (Ref. 2) has revealed that in both the typical en-route bird strikes as well as the "unknowns" more or less the same bird species are involved. These strikes with mainly small passerines and Swifts are often unnoticed by the pilot and, for a greater part, are reported thanks to the attentiveness of the crew chief.

FIGURE 5



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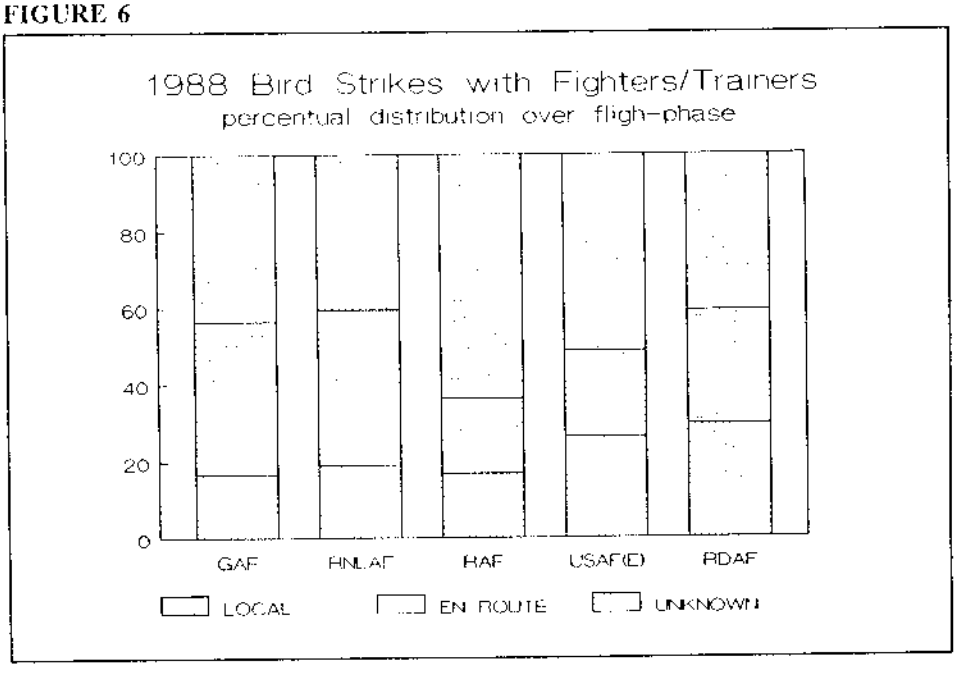

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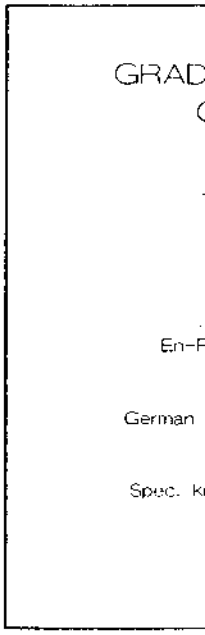

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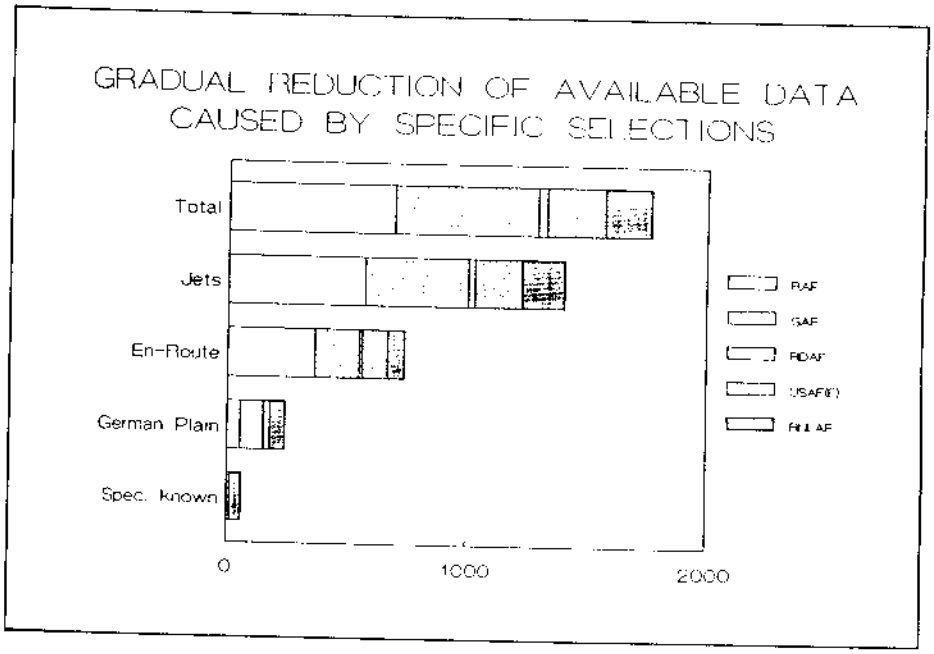
2.3. Suitability of the Material for Detailed Analysis

The data presented so far raised more questions than that they provided answers. In order to understand this, one has to realise that for specific questions to be dealt with, different selections of the database need to be consulted. Quite often, within these selections different break downs are needed as well. This does mean that the original available number of bird strikes drastically diminishes once detailed and specific analysis are to be made. This effect is shown in figure 7 (based upon data from appendix A). If the geographical distribution of bird strikes with en-route jet aircraft over the German Plain is to be analysed from the original available 1766 strikes only 61 strikes remain from which the bird species involved is known. To look for differences between the geographical distribution of the species involved therefore is rather an unpromising job. Numbers of bird strikes with sufficiently detailed information within the 1988 joined database still are to low to make sound statements. Hence, analysis of the geographical distribution of the strikes within the German Plain are limited to the overall distribution, regardless of the bird species.

FIGURE 7



However, even interpretation of these maps showing locations of bird strikes is very difficult. A number of factors certainly will have influenced the final result. To mention only the main reasons:

a. As emphasized in 1.2, flying activity is not evenly distributed. To make balanced maps which are corrected for this fact one needs geographical information on the overall average flying activity per geographical unit.

b. Bird strike warnings have been issued in certain regions. This will mean that -as a consequence- accents are shifted.

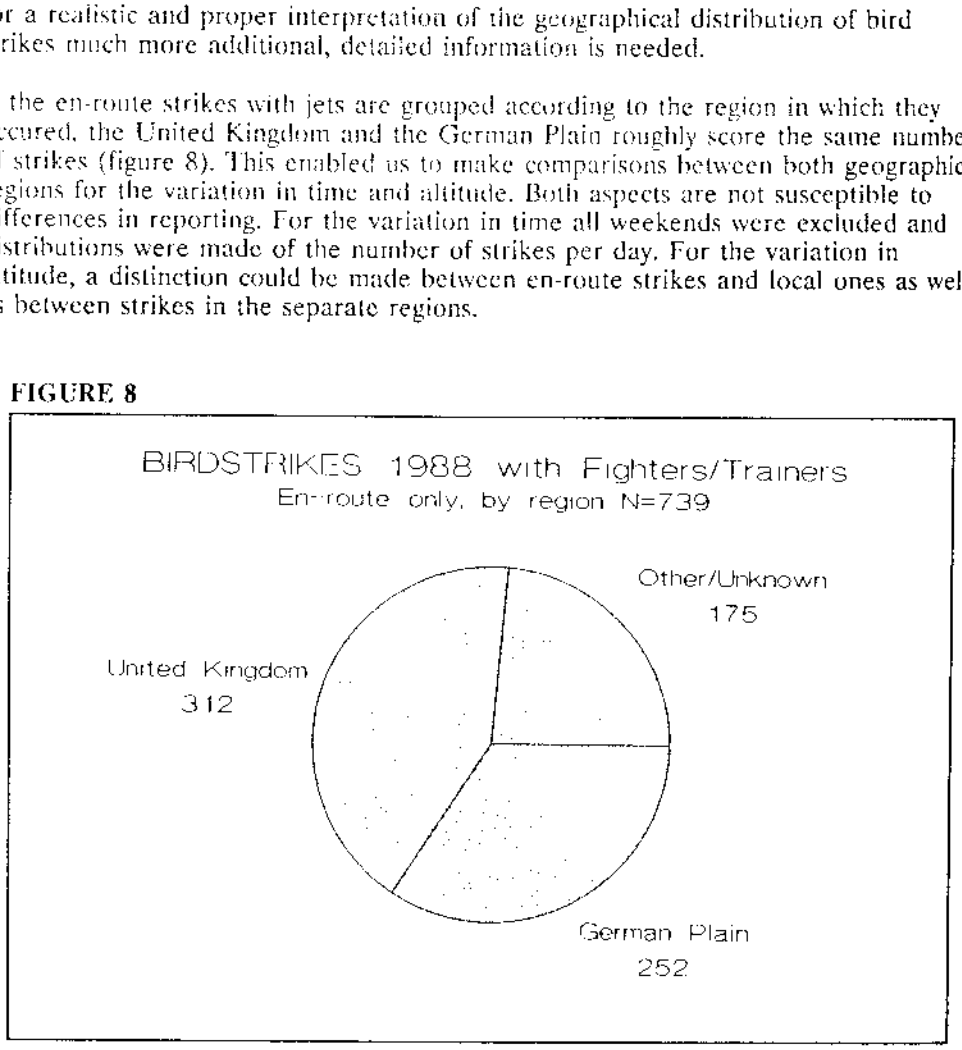
c. In reporting, pilots tend to remember the location as it is related to generally used landmarks. Some heavy dots on the map may in fact mean that the exact location was in the broad surroundings of that specific location.

d. The time aircraft spend at different altitude levels also is of great importance. Bird densities generally are concentrated in the lower airlayers. Knowledge as to the altitude layers in which the majority of bird activities are concentrated and the circumstances (wheather, landscape,season) with which these vary are only scarcely known (Ref.12).

About the role each factor plays, little is knowledge is available. The total effect of all influences is that for different areas different correction factors are needed. About the range of these corrections no information is available. It has to be stressed that for a realistic and proper interpretation of the geographical distribution of bird strikes much more additional, detailed information is needed.

If the en-route strikes with jets are grouped according to the region in which they occured, the United Kingdom and the German Plain roughly score the same number of strikes (figure 8). This enabled us to make comparisons between both geographical regions for the variation in time and altitude. Both aspects are not susceptible to differences in reporting. For the variation in time all weekends were excluded and distributions were made of the number of strikes per day. For the variation in altitude, a distinction could be made between en-route strikes and local ones as well as between strikes in the separate regions.

FIGURE 8



3. RESULTS

Since in fact nothing news was added to the existing (BSCE) literature, the data presented so far were ranked as "material" and not as "results". We only used the 1988 joined miltary data set to expose the unbalanced and confusing picture one gets when looking at bird strike statistics sorted out only superficially. In this chapter we try to make one step further. The results are still preliminary.

3.1. Geographical Distribution of Bird Strikes

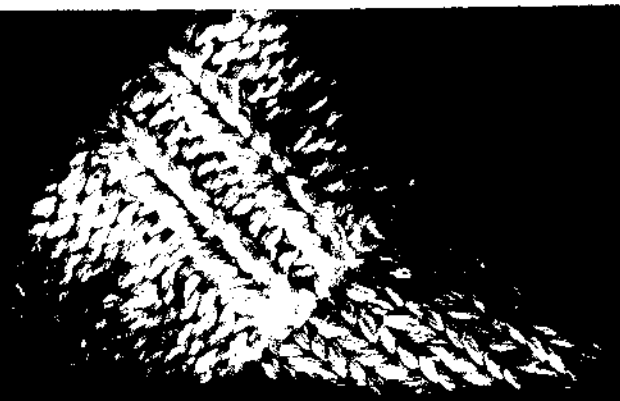
All contributing Air Forces do operate to a lesser or greater extend within the German Plain; each Air Force therefore only has limited knowledge about the total geographical distribution of bird strikes within this region. In the United Kingdom as a contrast, hardly any non-RAF operations do occur apart from those from USAF(E). Figure 9 pictures the distribution of all en-route bird strikes with known location in the Geman Plain; low flying areas are also indicated. No distinct concentrations of bird strikes within these low flying areas is apparent.

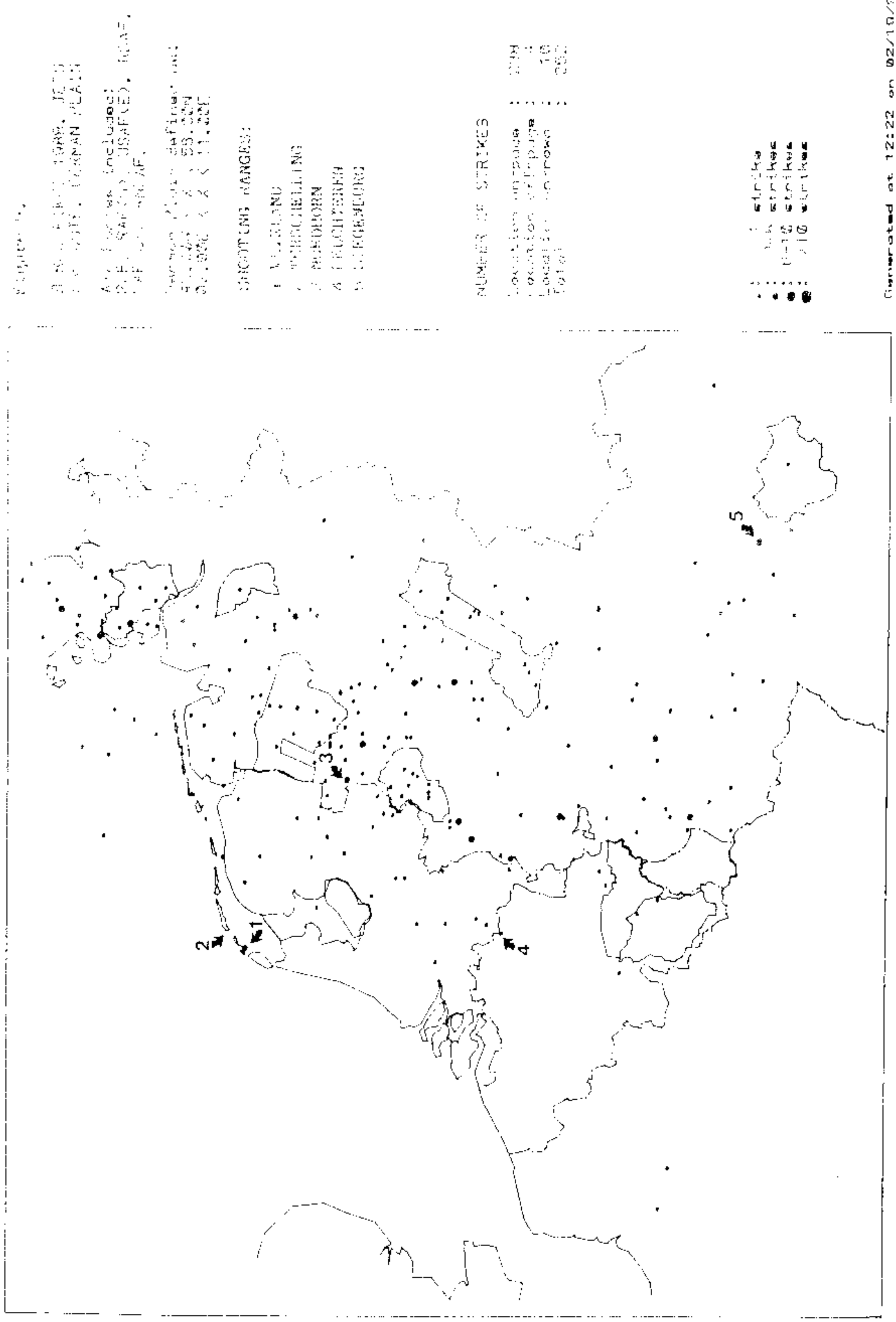
Realising the difficulties in interpretation as mentioned in section 2.3, from figure 9 still some conclusions can be drawn.
First of all a concentration of bird strikes is to be noticed in the north west part of Germany and in Schleswig-Holstein. The heavily populated Ruhr area stands out as an area completely devoid from bird strikes. Both facts clearly are related to flying activity of aircraft. The relative shortage of strikes in Belgium of course is mainly due to the missing of BAF data.
If looked upon in detail, concentrations of bird strikes can be reckognised at the shooting ranges. Vlieland range stands out markedly, as do Siegenburg range and Nordhorn range. Helchteren range is not as prominently represented as one would expect; the fact that no data from BAF is included might well be responsible for this. No bird strikes were reported from Terschelling range. At first sight this may be surprising since Vlieland range nearby stands out so markedly and the resemblance in use of both ranges. The difference in bird strikes between these two ranges probably can be explained by marked differences in the immediate surroundings. Vlieland range is located near a very densely populated (year-round) bird sanctuary which also acts as a high tide roost and twice a day accumulates numerous birds from vast areas of the Waddensea. Terschelling range on the other hand is located at a bare sandbank and no mudflats are situated near the range; in fact the immediate surroundings of Terschelling range are rather poor in birds.

The results justify the conclusion that for all species considered together, no clear geographical clusters of bird strikes do emerge from the material.

3.2. The Distribution of Bird Strikes over Time

Generally the distribution of bird strikes over time is given as a monthly frequency of all strikes. In this way day-to-day variations are obscured and all flight phases are lumped. In the latter case distinctly different seasonal patterns for local and en-route bird strikes are mixed up (Ref.4). Here, the analysis is restricted to the en-route data from jet fighters/trainers. On a day-to-day basis a comparison is made between the bird strike frequency in the German Plain and in the United Kingdom.





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To get a better and more detailed idea about the amount of clustering in time, for each day (excluding weekends) the number of bird strikes per region is given in figure 10a and 10b. In order to indicate the real deflections in these figures also the mean number of strikes per day and the single as well as the double Standard Deviation is shown. If only the real deviating days (with a number of strikes that exceeds the two times SD line) are taken into account, the two regions differ in a very distinct way. The extreme days in the United Kingdom are more or less evenly distributed over the year with only a slight concentration in late summer. In the German Plain a concentration of strikes did occur in spring and during autumn migration, when there was one day with an extreem high score. While reading figure 10A (German Plain) one should keep in mind that bird strike warnings are issued in this area and consequently this will have lowered the potential number of strikes during both spring and autumn migration (Ref.15). Therefore, figure 10A,(German Plain) does not reflect the amount of bird activity, as is the case in figure 10B (United Kingdom).

Thus, despite the fact that birdtams are issued for the German Plain, in both regions concentrations of bird strikes in time evidently are existing. This does mean that by avoiding only days with more than average bird strike risk, a substantial gain in flight safety can be achieved without reducing the flying program correspondingly.

FIGURE 10A

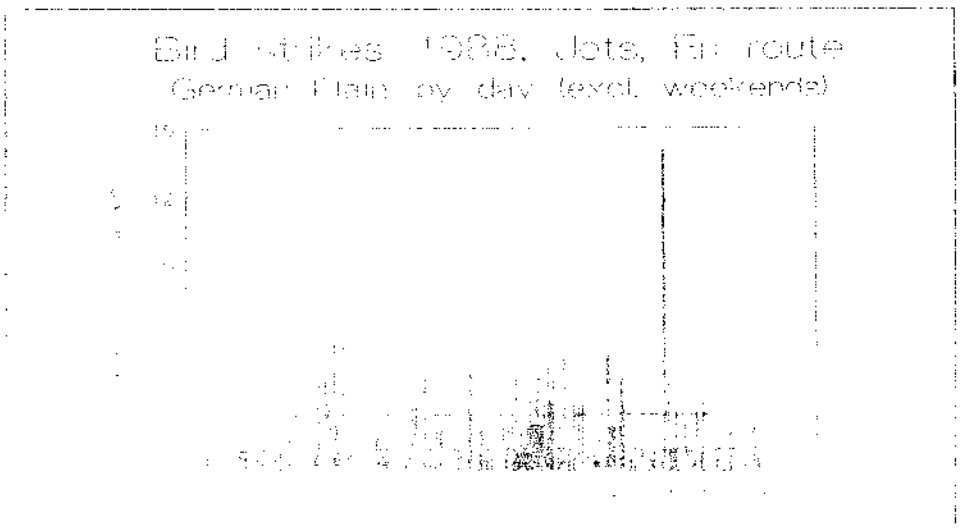
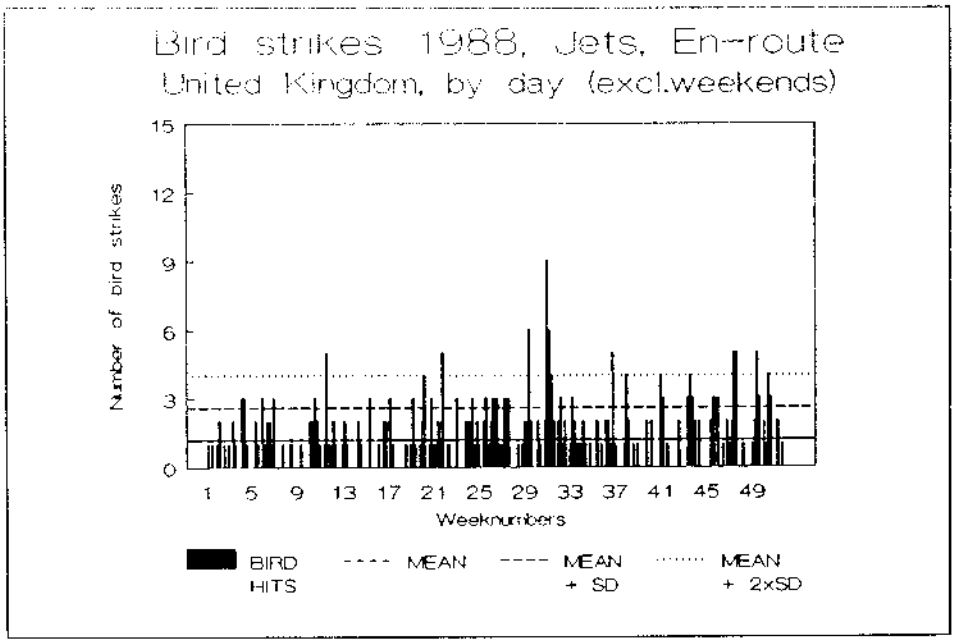


FIGURE 10b



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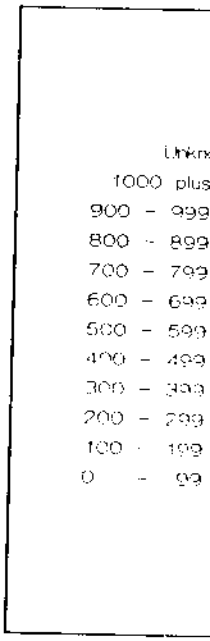


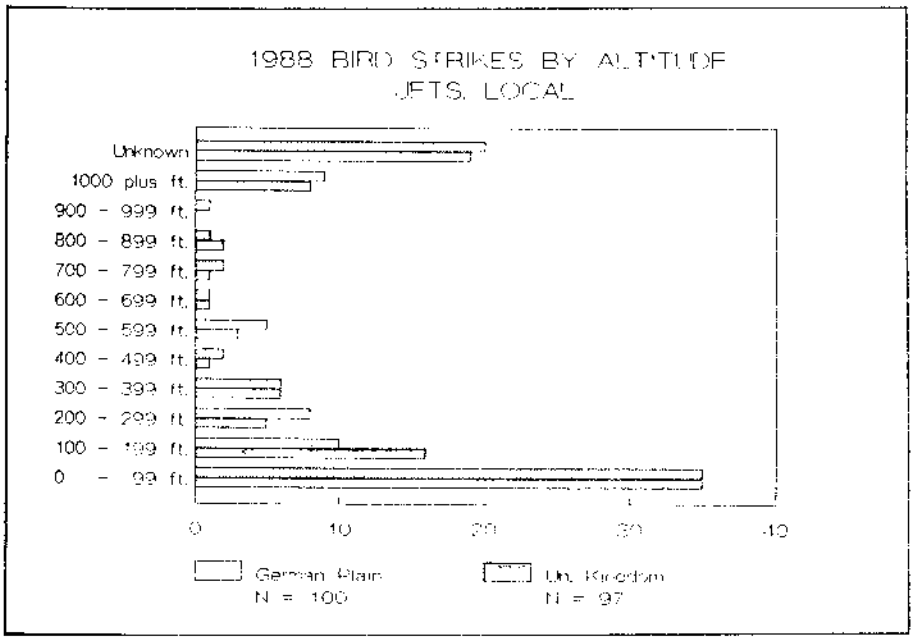
3. The Distribution of Bird Strikes over Altitude

Since there are distinct differences in the characteristics of local bird strikes and strikes en-route (Ref.2) the analysis of the distribution of birdstrikes over altitude was done for both situations seperately.

3.1 Altitude Distribution of Local Bird Strikes

The distribution over altitude from local bird strikes with jet fighters/trainers is given in figure 11. As is known from detailed studies using small scale radars combined with visual observations from highly skilled bird watchers, the majority of bird movements in Western Europe does take place in the lowest air layers (Ref.12). Aircraft taking off or landing normally cover all altitudes below 1000ft. under fixed angles with the earth and therefore have an equal chance of hitting birds in each 100 ft. layer. The risk of encountering a local bird strike therefore is to a great extend dependent on the number of birds in each air layer. This means that the altitude distribution of local bird strikes does reflect the distribution of birds over altitude (Ref.2,3). As is clear from figure 11 there are no distinct differences in the distribution of local bird strikes over altitude for the different regions. In both cases the majority of strikes occured below 200 ft. This result may surprise those who think that, since the United Kingdom is situated at the end of migratory flyways, the altitudinal distribution of birds in the United Kingdom will differ from that in the German Plain.

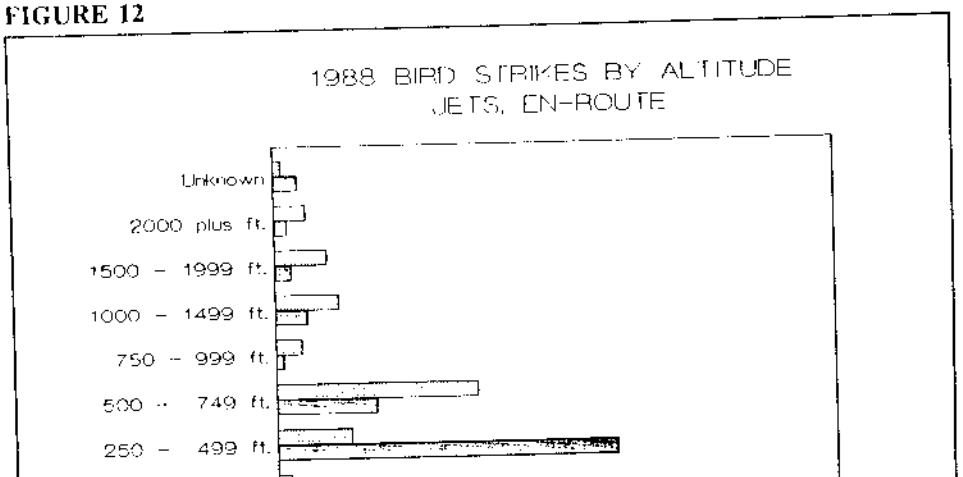
FIGURE 11



3.3.2. Altitude Distribution of En-Route Bird Strikes

In contrast to the local situation the distribution of en-route bird strikes does not represent the altitude distribution of birds but rather resembles the time spent by aircraft at different altitudes (Ref.2,3). For the German Plain as well as the United Kingdom the altitude distribution of en-route bird strikes of jet fighters/trainers is given in figure 12. Knowing that the majority of aircraft movements do take place at low levels it is not surprising that in both regions more than half of all strikes occured below 750 ft. Nevertheless there is a difference between both regions. The distribution of bird strikes is more skewed towards lower altitudes in the United Kingdom than in the German Plain. Flying at lower altitudes in the United Kingdom than in the German Plain by birds, aircraft or both may be the reason for this. We suggest that RAF operations in the United Kingdom do involve more hours of extreem low flying than all forces together do over the German Plain operations in the German Plain.

FIGURE 12



4. CONCLUSIONS AND DISCUSION

The feasability of a joined European Military Database is the main topic of this paper; the presented arrangements of data only serve as examples as to what kind of analysis and monitoring is possible, using such a database . Therefore, this section only deals with methodological aspects, putting emphasis on the weak points.

4.1. General Conclusions

4.1.1. Implementation of a joined database

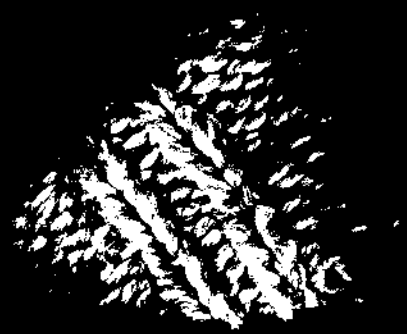
The first preliminary results of this analysis do offer such good prospects that it is more than worthwile to pursuit a joined European Military Bird Strike Database. Already now , with still limited material, it proved very well possible to do the kind of analysis that provides new information and offers better insight into the bird strike problem. For instance, the temporal distibution of bird strikes both in the United Kingdom and in the German Plain holds clues to an improvement in the prevention of en-route bird strikes.
Standardisation, added to just a slight improvement in the reporting standards of the plainer items should not be considered impossible and would substantially improve the results. This implies that with all contributing Air Forces reporting a limited number of items in a consequent and complete way, a reliable set of data can be achieved which is very well suited for analyses in broad terms.

A number of items are not easily put in a general joined database. These items for instance concern information that is difficult to acquire since expert knowledge is needed (i.e. identification of feather remains). Information on effects from bird strikes on operations is another item that needs very consistent and solicitous reporting. Not all Air Forces might be willing or able to go in such detail in reporting bird strikes. This does not need to be considered an insuperable barrier for the set up of a common European military database. Having available very detailed information on some items from only a limited number of Air Forces could well mean that the value of the whole database can be upgraded. Provided that all Forces do contribute to the database their basic information in a standardised an consistent way it is very well possible to extrapolate in-depth analyses done on the detailed material of just part of the contributors. But first of all, emphasis should be put on the improvement of the contributed basic information.

4.1.2. Problems Encountered

The difficilties that arose in this first attempt to set up a joined European bird strike database can be classified as belonging to three main categories which will be dealt with below:

Absence of standardisation in the reports.
For a number of questions less detailed information is sufficient and only a broad idea about specifics items is needed. Such rough indications could serve as a basis for selection. To illustrate this point we consider the break down of the material over the regions as it is presented in figure 7. The majority of the strikes that had to be attributed to the "unknowns" certainly could be avoided. Bird strikes that are not



noticed by the pilot during the mission and are reported on the basis of evidence of a strike during post flight inspection can in almost all cases be said to have happened during the last mission. Since it is known where this mission took place the rough geographical region can be registered.
The same can be said about the time of the bird strike, the least that is known is the time the mission begin and ended. Records in which the time of the event is marked as "unknown" can in most cases be avoided.

Reliability of the material.
For a number of items it is neccesary to have information on the extend to which the information is reliable. This is best illustrated using the "bird species involved". For only a minor part of the bird strikes it is known with what species the aircraft collided. And even from these relatively few records it is often not clear how the given bird species was identified. It is obvious that identification of feather remains by an expert will be of better quality than information from pilots who saw a glimps of the bird prior to the impact. In the last case there will be a tendency to call light coloured birds "gull" and darker ones "crow"; likewise small birds will be called "sparrow" or swallow", if they are seen at all. To what extend these abberations are present in the material is not clear. That they are present is nicely illustrated by the pilot that claimed that the bird strike he encountered during a mission in the Falklands involved a Robin. Wether this has to be judged as a joke or as an indication that a small bird was involved it not clear. Certainly Robins do not live in the Falkland area.

The distinction between "definite no" and "not reported".
A major source of concern is the fact that from the bird strike reports, for a number of items the discrimination between "definite no" and "not reported" cannot always be made. This kind of uncertainties do for instance emerge when insight is to be acquired on all the consequences of bird strikes. Apart from financial losses also the loss of operations has to be included. Information on aborted missions then becomes vital. Quite often it is not mentioned on bird strike forms, wether or not the mission was aborted and a precautionary landing was made. In evaluating the bird strike form one then has to assume that no such actions were taken, but onbe cannot be completely positive about the decision. These kind of problems mostly arose for items that were not treated separately on the forms and where the information had to be extracted from the pilots description. It is clear that these uncertainties only can be avoided if very clear bird strikes forms are used on which each seperate item has to be dealt with. Even more important, it should be the possibility for each item to tick at as being really "unknown".

Handling the above mentioned imperfections might at first sight seem a considerable task. However, the use of a not to extensive but standardised bird strike form in a disciplined way wil surmount most of the problems. In this way it is possible to score a considerable increase in extractable information and improve the quality of this information without much effort.

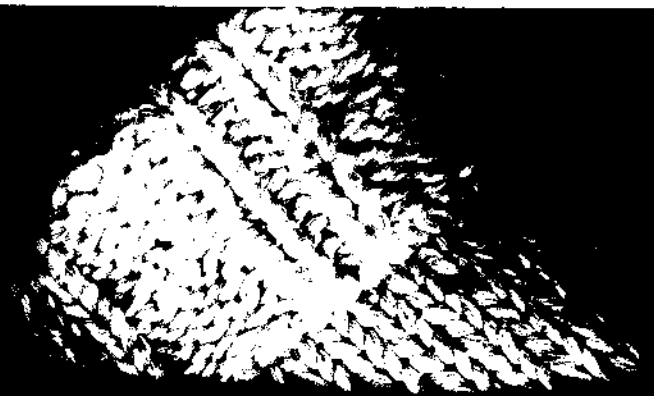
4.2. Discussion

In setting up a joined database, in which the records consist of information on the individual bird strikes, an important extra dimension is given to the traditional joined summaries in BSCE as well as in AFFSC(E). Not only more detailed analyses now are possible, the same data will be available for future analyses as well. Of course all individual Air Forces had (and will have) their own databases. But, as in all statistics, the reliability of the analyses is strongly dependent on the numbers included in these databases; for detailed analyses numbers of national databases will often be to small to do draw sound conclusions. It is therefore surprising that former initiatives to set up a joined database of European military bird strikes did not succeed. As to the reasons why it took so long before the importance of such a joined database was reckognised one can only guess. Certainly confidentiallity, differences between Air Forces, tradition, but also disbelief in the potention of such a database may have played a role. Taken into account the promising results described in this paper all of these objections seem superficial. A slight effort of each contributing Air Force will be sufficient to create the optimal circumstances for the succesfull set-up of a European military bird strike database.

Despite the optimistic views displayed above, some legitimate problems remain to be solved. First of all it is very important to convince pilots of the benefit to be drawn from good basic information on bird strikes. Acording to experiences in the RNLAF this almost certainly will improve the willingness to make proper reports of bird strikes and improve the reliability. Realising that in order to collect the data one needs the cooperation of the pilot the introduction of straight forward and simple bird strike forms, that are easily filled in, seems a sensible and obvious thing to do. In order to develop such a form it has to be decided which items are to be considered as the minimal basic aspects of a bird strike and which items have to be considered as being of more importance in relation to very specific and country dependent aspects. Once these decisions are made, the adoption of a (partly) standardised bird strike report form (cq. data base structure) becomes feasable. Such a form could well consist of one part containing aspects that will be fed in the joined database and another part containing country specific information that may differentiate with respect of criteria and degree of detail.

Once agreement is reached on the above mentioned matters a decision can be made as to the final database structure. It then seems fair to share the burden of feeding data in computer files. This could best be realised if a standard and straight forward program is available to accomplish this in an efficient way. RNLAF is willing and able to develop such a program and make this available to contributing Forces.

Another substantial problem is illustrated in figure 3. For most Air Forces, in only very few cases, information is available on the bird species involved in bird strikes. Even when species are mentioned it is often not clear how reliable this information is (see allso section 4.1.2.). It has to be stressed that collecting and professional identification of feather remains considerably increases the value of reported bird strikes, especially those strikes that resulted in damage of the aircraft.



5. ACKNOWLEDGEMENTS

The realisation of this first attempt to set up a joined bird strike database was only possible thanks to the cooperation of the contributing AFFSC(E) members. Flight safety departments of the air forces of Denmark, Germany, United Kingdom, France, United States of America (Europe) and the Netherlands made available their individual bird strike records. Secretarial facilities were provided by the RNLAF. The time consuming job of feeding data, that only were available on paper, into computerfiles could only be done thanks to the help of Mrs. W.A.C. Wakker. The computerised mapping of bird strikes in the German Plain was done with a custom-made program developed by Mr. M.A. Strobbe who spent part of his conscription on this project. Other people who, each in their own way, made contributions to this paper are: Lt.Col. W.H.J. Christiaans, Mr. G.H. Kamphuis, Mr. J.R. van Gasteren and the student pilots J. Post, E. Murer and M. Bakker.

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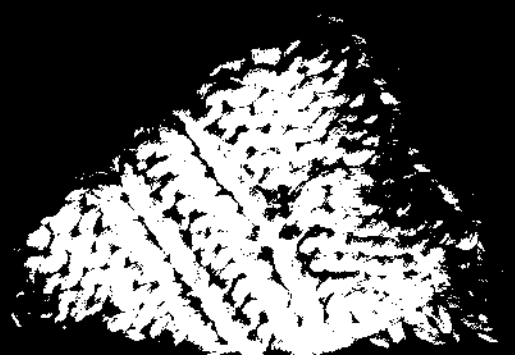

APPENDIX A

	GAF	RAF	RDAF	USAFE	RNLAF	TOTAL
Total number of bird strikes	597	694	37	243	195	1.766
Of which were with JETS	429	573	27	197	178	1.404
From JETS:						
Local	72	97	8	52	34	263
Unknown	170	112	8	40	72	402
En route	187	364	11	105	72	739
From the en route:						
location elsewhere/unknown	93	20	6	50	6	175
location in the United Kingdom	0	285	0	26	1	312
location in the German Plain	94	59	5	29	65	252
From the German Plain:						
coordinates known	94	55	5	24	64	242
Of which bird species known	11	1	0	1	48	61

Bird Species:						
Unknown	479	460	19	217	34	1.209
No bird remains	36	15	0	0	5	56
Remains sent for ID, yet unknown	11	31	0	2	0	44
Known bird species	71	188	18	24	156	457

Type of Aircraft:						
Carriers, props etc.	56	120	8	45	4	233
Heli's	112	1	2	1	13	129
Jet fighters/trainers	429	573	27	197	178	1.404

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Emphasis is put on
the starling.

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Second author : US