

- 4.5. THE BIRDSTRIKE PROBLEM IN GERMAN AIR FORCE.
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The Birdstrike Problem in German Air Force (background analysis and instruction)

by Dr. Jochen Hill

Since 1966, the first European Birdstrike Committee Meeting was held in Frankfurt by incitement of German Air Force/Flight Safety, a lot of work, investigation and biological experiment has been done to reduce the increasing number of birdstrikes.

I should like to give you a short summary report about our birdstrike problem on airfields as well as methods of investigation and research, types of provisions and efficiency but also about publication and instruction service as to the birdstrike problem in German Forces.

Special results and problems have been published and discussed in reports given during meetings since the last 7 years; it is recommended to study these reports of the various countries before beginning any work and inducing any provisions or procedures. I have to confirm that, for also during this meeting some subjects of discussion - f.i. national regulations or long grass experience - should be well-known out of the BSCE - Minutes and publications of the last years.

1. Birdstrikes at take off and landing

The number of birdstrikes on airfields decreased from 62 in 1967 - beginning of provisions against birds - to 25 in 1973 (included are strikes on other GAF-airfields = nearly 15-20 %). That is a rate for every 10000 movements of 0.71 for 1967 and 0.25 for 1973.

Table No.1 : Birdstrikes GAF on airfields 1967 - 1973.

	1967	1968	1969	1970	1971	1972	1973
GAF airfields	53	41	36	36	33	32	20
other airfields	9	6	12	7	8	3	5
Total number	62	47	48	43	41	35	25
Rate/10000 movements	0.71	0.53	0.36	0.36	0.32	0.32	0.25

The type and dimension of damage changed during the same time from 17 birdstrikes with damage in 1969 to 9 birdstrikes with damage in 1973.

The most birdstrikes occurred with gulls (51 x), small birds which increased as "striker" since 1970 (45 x), crows (30 x), lapwings (14 x), pigeons (8 x), starlings (7 x), buzzards (7 x), partridges (6 x), ducks (6 x) and falcon, pheasant, swift, owl, goshawk, kite and sparrow hawk.

Airfields in northern Germany had been more endangered than airfields in the middle highlands and in southern Germany. As to the daytime there was no relevant period which seemed especially rich in birdstrikes. The most strikes occurred with jet-aircraft.

Ecological research

The decreasing number and rate of birdstrikes on German Forces airfields can only be possible by basic air provisions against birds. Ecological research and experiments before beginning, so each German airfield was investigated as to climatic, edaphic, vegetational, hydrological and ornithological conditions. Every two years all jet-airfields are visited by a biologist to get special informations about the newest status of the airfield, about problems and to give special advisories. This biologist must be informed about all agricultural, farming, forestal and infrastructural measures in the airfield and the surrounding. During the last years more than 15 detailed ecological opinions were published for the most endangered airfields, more than 200 short-reports about visit-results on airfields and more than 150 ecological attitudes were worked up as to garbage dumps, artificial lakes, planting trees, planning drainage, building shelters, grassland use in airfields and the surrounding.

These advisories and ecological statements were based on experiments and investigations in 18 airfields and airports since 1966, and that:

- a) Grassland experiments, grass-length and birds (compare minutes 1967-1975)
- b) Rate of grass growth within one year regarding soil and humidity
- c) Grassland experiments with growth prohibiting substances (compare minutes 1970/71)
- d) Effect of mowing grass on bird appearance (compare minutes 1968-1973)
- e) Experiments with chemical substances scaring birds (compare minutes 1969-1971)
- f) Investigations about correlation between sheep-grazing and birds (compare minutes 1969/1970)
- g) Laboratory experiments with chemical substances possibly dangerous for water and soil.
- h) Testing grass species and sorts as to the growth length (compare minutes 1970)
- i) Experiments with various electroacoustical and phonocoustical installations (compare minutes 1968-1972)
- k) Experiments with traps for crows, gulls and hawks (compare minutes 1960-1971)
- l) Entomological investigations to find out relationships between soil, humidity, vegetation, season, chemical substances and bird appearance (compare minutes 1971)

At the moment there is going on a third bird observation series for some years on all airfields; a first visual series was carried out from 1966-1967, the second radar-series from 1968 - 1969.

5. Procedures and provisions on airfields

On each airfield German Forces have a so-called "bird-man" who is responsible for coordination of all provisions; he can induce experiments and special investigations and is responsible that all provisions ordered by the Ministry of Defense and by the ecological attitudes are carried out in agreement with natural protection and conservation authorities.

The best success - scaring birds on airfields - was reached by

- Mowing grass as rare as possible, but regarding Flight Safety demands and depending on type of aircraft which is training on the airfield (compare minutes 1972-1973) -
- Grass-length between 15 and 30 cm depending on bird species, soil, humidity and grass-seed mixtures (compare all minutes)
- Using growth prohibiting substances depending on soil and vegetational state (compare minutes 1973) -
- Avoiding sheep-grazing, any type of agricultural use and garbage dumps (compare minutes 1968-1970) -
- Hunting in combination with pyroacoustical methods -
- Trapping crows (compare minutes since 1967) -
- Controlling arthropods and small mammals (compare minutes 1967-1973) -
- Controlling birds visual and by radar (compare minutes 1967-1973) -
- Draining swampy areas (compare minutes since 1968) -
- Reforestation of grassland outside the 150 m safety areas along the runways under consideration of tree-species, largeness of wood areas, effect of boundary lines, density of wood, darkness and humidity within the woods. In each case it seems better to have such type of wood than too large grassland areas which are mowed every 14 days -

4. Instruction service

It is impossible to give general and standardized recommendations for all airfields; recommendations can only be given on the basis of long years observation and ecological research. Provisions are only rich in meaning if on the airfield one man is responsible for this subject, but this man has to work in a narrow contact with Flight Safety, with the responsible scientific advisory authorities as well as with the Air Traffic Control on the airfields. In IAF all this people is trained regularly, and that

- every two years "birdmen" of all airfields for 3 days according a special program with demonstrations on an airfield -
- Flight Safety people during their vocational training in a special academy -
- Operational people of radar stations every two years in a special instruction course. Moreover all radar stations are visited every two years in order to come into contact with all controllers and to learn something about special problems -
- Air Traffic Control people of the airfields during their vocational training in a special school, and

- weather people during their vocational training in a special school, too
All instruction meetings are in strong contact with the civil aviation authorities which can participate.

Moreover it is necessary to give sufficient informations and publications to all people which is engaged in the birdstrike problem. So GAF/Flight Safety publishes monthly informations not only for the birdstrike problem and a special series, named "Flight Safety", every two months; these two publications are open for special birdstrike-informations, too. Besides this since one year we have a very good publication series edited by the Luftfahrtbundesamt in which special and scientific informations can be published.

And finally GAF has a special publication series edited by the German Military Geophysical Office which is, in the main, responsible for all problems which have to do with birdstrike and ecological research, and that:

- Advisory orders; at the moment three orders or directions are valid :

Advisory for visual observation of birds on airfield or of migratory birds and the corresponding reporting system.

Advisory for handling birdtam and forecasts, and

Advisory for radar observation of birds and the corresponding reporting system.

- Other types of information-publications exist in form of advisory books ,f.i.

Field-book "Birds on Airfields" published in 1969

Birdstrike statistic books, published every 3 or 4 years

Advisory book " Bird Movements and Concentration Areas in Europe", published in 1973

Expert information book "The Birdstrike Problem in the Flight Safety" which serves for collecting the most actual informations by exchange of pages; published 1974, and

Expert evidences to special projects mostly in form of ecological studies.

Birdstrikes German Air Force, Part II

(Actual advisory procedures)

by Dr. Juergen Becker

1. Birdstrikes en route and in the control zones of airfields

In 1973, the German Air Force suffered 239 birdstrikes. 148 birdstrikes happened en route, 47 in the control zones of airfields, 28 on air fields at take off/landing, and 16 during unknown flight phase. Compared to 1972 (276 birdstrikes) this was a decrease of 13 %. The total number of en route/control zone birdstrikes decreased insignificantly since 1971.

Table No. 1: Birdstrikes GAF en route/control zones 1967-1973

	1967	1968	1969	1970	1971	1972	1973
en route	152	147	144	184	170	126	148
control zones	23	32	22	40	28	70	47
total number	175	179	166	224	198	196	195
rate/10.000 flight hours	4,57	4,61	3,84	4,96	4,95	4,86	4,74

In 1973, only 164 en route/control zone birdstrikes happened within the Federal Republic of Germany. These birdstrikes shall be discussed in this paper, because they happened in areas and heights which would have been restricted to aircraft if adequate informations about bird migration would have been in hand.

The number of birdstrikes per month was less than 10 in November-February and in June, between 10 and 20 in March-May and July-August, but more than 20 in September and October. In 1972, a rate of 20 or more birdstrikes even happened in 5 months (March, June, August-October). In 1973, on the other hand the number of birdstrikes in October was extremely high (44). An analysis of these birdstrikes shows clearly the forecast problems.

On October 2nd there happened 5 birdstrikes, whereas the Office of Military Geophysics got only 4 bird movement messages from a weather radar station in southern Germany. From October 11th to 12th there happened 11 birdstrikes without having obtained any radar informations of bird migration. Various visual observations of cranes, geese, lapwings, and gulls did not justify any bird warning message. The most part of fall migration happened from October 24th to 26th. There were 11 birdstrikes on October 24th, though 6 birdtam were issued. The first information about bird migration was reported to the Office of Military Geophysics at 9.30 (Z) from a radar station in northern Germany. The first radar observation of bird migration in southern Germany took place at 12.30 (Z). Till this time the most part of the birdstrikes yet had occurred. On October, the 25th and 26th, the bird migration continued, and 13 birdtam were spread without any birdstrikes.

The specification of the height of the bird migration is often difficult because of a lack of hight finder measurements. In 1973 26 birdstrikes (= 15,8 % of the 164 discussed ones) happened at unknown heights. Among the birdstrikes with height specification 32 (= 23,2 %) happened below 500 ft (GND), 90 (= 65,2 %) between 500 and 1500 ft (GND), and only 16 (= 11,6 %) above 1500 ft (GND). The greatest height reported was 5500 ft (GND) near Lake Constance in October.

2. Observation system of bird migratory movements

The basis for all kind of bird movement warnings is an effective observation system. In the FRG the meteorological personnel of 40 military airfields is briefed to perform visual observations of bird movements. In 1973 there was a total number of only 250 observations mostly referring to short-scale movements of crows, gulls, starlings, and lapwings.

Because of the insufficient visual observations the most important informations about bird migration are obtained by radar observations. These are performed by 15 radar stations of different wave-lengths.

They have been ordered to take polaroid pictures every 3 hours, and in case of migration observed every hour. In 1973 there were taken nearly 10.000 polaroid pictures. 491 pictures contained echos of bird movements. 449 radar observations were reported directly to the Office of Military Geophysics in Porz-Wahn.

The registered bird intensity is not uniform for all stations because of the different radar parameters, and cannot be compared mutually without any correction factors considering the type of radar, the distance of the target, and the geographic position of the station. The best conditions for bird observation are given by narrow radar beams, high pulse power, high pulse repetition frequency, big pulse length, and horizontal polarisation. In the FRG good results are obtained by the older radar equipments, whereas the modern ones registrate only a small part of the total migratory movements. In this case the intensity observed has to be multiplied with a factor 3 at least.

An electronic system for counting birds has to consider the correction factors, too. If they are known for a special type of radar, they also can be used for the photographic registration and interpretation. The advantage of the photographic method consists in the detailed informations about small areas, the direction, and the speed of bird migratory movements.

3. Actual bird warning messages

All visual and radar observations of bird movements are reported by teleprinter or telephone to the Office of Military Geophysics. It is necessary to have the disposal of data concerning bird migration very quickly after the

observation with details about the geographical areas (georef), the direction, the speed, the height, and the intensity for limiting low level flight restrictions only to such areas which will include a considerable birdstrike risk to aircraft.

If a radar intensity of "3 increasing" or more respectively a fixed number of birds observed visually is reported, a bird warning message ("birdtam") is transmitted by weather network and AFTN. The birdtam contains informations about the area in georef indications, the height, and the validity. During the Flight Safety Meeting in October 1973 several NATO countries demanded a specification of the birdtam with regard to intensities. In spite of the German objections the intensities were added since Oct. 15th, 1973. The intensities don't have any significance for the GAF, because they don't give any measure for the real birdstrike risk. In near future GAF will be use a corrected system of intensities regarding the factors mentioned above.

In 1973, 141 birdtam were reported to military and civilian airfields in Germany and to foreign countries. 77 % of the birdtam were issued in March (30 birdtam), July (21 birdtam), October (42 birdtam), and November (16 birdtam). These are correlated to the spring and fall migration as well as to the short-scale movements of young birds in summer. Highlights of the bird migration were on March 22nd (7 birdtam) and from October 24th to 26th (19 birdtam). Most of the birdtam related to areas in the northwestern lowlands of Germany and to Bavaria, wherever the radar observations of bird movements were especially good. The georef JJ (mouth of Elbe and Weser) was the most frequently restricted area (232 hours in 1973).

4. Long term bird movement warnings

Moreover the Office of Military Geophysics issued 243 so called birdstrike risk forecasts in 1973. The risk forecasts consider the actual bird migratory movements, and the

biological conditions for bird movements within the following 24 hours using the large scale weather types and single meteorological parameters. In 1973 a medium bird-strike risk was forecast 48 times for the whole FRG, and 39 times for partial areas of the FRG. The maximum was in March/April and October/November. In case no birdtem is issued the forecasts serve as general informations without responsibility and flight restrictions.

In 1973, 13 bird movement forecasts were issued monthly (December to February and June to August) or every 14 days (March to May and September to November). These forecasts serve as general informations for the flying units. Bird movement maps have the same aim. They exist for the most European countries specified for the different seasons, and contain informations about bird concentration areas as well as narrow and broad migration routes.

5. Data processing of bird observations

It is a need to investigate whether it will be possible to make a forecast based on statistically determined relations between bird migration and weather data. In 1973, 11.793 bird observations obtained from 1966 to 1973, and each containing up to 25 single informations have been transferred to punch cards. The observations contain the following parameters:

- country (referring to the international meteorological code)
- georef (areas of 1 degree of longitude and latitude)
- geographic areas (referring to the Geophysical Service code)
- year, month, day and time (whole hours GMT)
- large scale weather type Europe (30 types)
- large scale weather type Germany (11 types)
- actual weather during and 1 hour before the observation
- wind speed and direction

- ceiling (cloud cover and type of clouds)
- temperature and air pressure
- species or genus of birds (only visual)
- intensity
- tendency (increasing, constant or decreasing)
- direction, height and speed of the birds

The single weather parameters are added by the computer from data being obtained by GAF weather observations. The evaluation program has been developed only with practical aspects for warning the flying units. Therefore it is important to analyze those factors which are mostly constant during 24 hours. At first the correlation between the bird migratory movements and the large scale weather types have been analyzed and printed in lists containing only the weather type and the seasonal period as variables. Thus the forecast can be based on 8 years of bird observation, and only has to consider the weather forecast. In the future the number of data has to be enlarged considerably, as well as the possible correlations between weather and bird migration have to be analyzed in order to give the same meaning to the birdstrike risk as to the birdtam.