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Bird Hazard Management in the German Armed Forces

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Abstract

Bird hazard management in the German Armed Forces is based on distinct regulations given by the German Ministry of Defence, profound experience, intense guiding, continuous exchange of knowledge and training in bird strike prevention. Techniques are developed, Measures instructed and systems are operated by the Biology Branch of the Bundeswehr Geoinformation Office, combining a variety of scientific entities and up-to-date technologies in one organization. A brief overview over the currently operationally used methods and the experiences gained is given.

Key words: Birdstrike Prevention, Habitat Management, Birdstrike Warning, BIRDTAM, Birdstrike Risk Forecast, Bird Avoidance, Radar, Modelling

Introduction

Since the 1960th the German Armed Forces (GAF) got aware of the birdstrike problem. Their first fighter aircraft were single engine aircraft, which were extremely vulnerable to birdstrikes. After a series of damages and losses of F104 "Starfighter" aircraft a biology branch was formed within the German Military Geophysical Service to develop obligatory measures and provide guidance in order to decrease the birdstrike risk. Since then an order was given by the Ministry of Defence to regulate the issue and hand over the overall responsibility to the biology branch in order to take care of the biological aspects of flight safety. The regulations and responsibilities are clearly defined. On this basis the Bundeswehr Geoinformation Office (BGIO) – Biology Branch is responsible for maintaining and further developing a framework of standards and operational measures that are in agreement with international requirements. Staff currently consists of 12 people, including 4 scientists, in the disciplines biology, ornithology, meteorology, hydrology and environmental sciences, programmer, technicians and a laboratory assistant. The biological flight safety program as well as the latest technological achievements will be explained briefly in the following.

1. Birdstrike analysis

The basis of bird strike prevention measures is a scientifically based data collection, analysis and documentation. Birdstrike reporting is mandatory in the GAF. The procedures are standardised and computerized. Feather remains are identified in a BGIO Laboratory by comparison with a feather collection and microscopic analysis. Each year a comprehensive statistical analysis of all the bird strike incidents of the preceding year is conducted. Together with a report on the effectiveness of all the measures and the latest achievements it is presented to the Ministry of Defence and the Headquarters of the GAF. Data are also submitted to the European Military Birdstrike Database, hosted in the Netherlands.

A comparison of the last ten years up to 2007 document that the number of GAF birdstrike incidents dropped significantly from around 400 per year to almost 200 per year. The most reliable birdstrike data are those on damages. Their normalized ratio even dropped to a third, now ranging at around 1 per 10.000 flying hours.

2. Birds on and around airfields

According to birdstrike statistics about one third of the incidents occurred in the landing and take-off phases of flight, one third during enroute flying and another third cannot clearly be grouped as it was not immediately recognised by the pilot. It is obvious that close to the ground the density of birds is generally the highest. Therefore a set of measures is used to actively manage and control the area on and around airfields.

On the long run ecological strategies have proven to be most effective. To find the appropriate management tools in a specific habitat, BGIO conducts regular

monitoring programs and provides management instructions. The field work is supported by GIS-Technology in order to do a synopsis and mapping (supported by aerial photography) of the different field observations, e.g. bird counts, habitat structures, aquatic situation, vegetation cover, nutrients and food availability.

Basic ecological birdstrike prevention measures generally include:

- No agriculture on airfields
- Hydrological mitigation (drainage, removal of ponds and lakes)
- No grazing of sheep or cattle
- No dumping of organic material (waste)
- No hunting of predators (foxes, martin, weasel)
- Long grass management on airfields (max. 2 cuts after migration periods)

Technical harassment techniques are only recommended in order to support ecological strategies. Lethal control is not conducted. Toxic chemicals are only used for controlling rodent populations when necessary.

Falconry and border collies are not used on a routine basis. Experiments proved that they are not continuously effective and turn out to be far too expensive in an operational program.

The flight safety officer of the airfield is in charge of the entire management plan, including birdstrike prevention measures, instructed by BGIO. He also coordinates the tall grass management and other vegetation control measures with the airfield operations section.

3. Bird observation

Additionally to active hazard control on and around the airfield there are passive methods to monitor bird activity in different spatial scales in order to use and supply this information to air staff and flight operations units.

a. Local scale

Within a scale of approximately 5 km the techniques that are used and further developed are based on observations by human eyes, small mobile radar (horizontal and vertical) and video/infrared camera systems combined with laser distance and elevation measurements. Multisensor systems that are available in the GAF are being tested. The goal is to set up a widely automated sensor based local bird activity observation and warning system that focuses on problem areas and gives information online to bird control personal and the tower.

b. Regional scale

Flight safety relevant bird concentrations in the approach and departure area can best be detected by Airport Surveillance Radar (ASR) systems up to approximately 15 – 20 km. A next generation of ASR systems is about to be deployed in the GAF. According to BGIO's requirement a bird channel

was developed to monitor dangerous bird concentrations and flight tracks of big bird flocks and display these to air traffic control personal (tower and ground control approach) on the airfield. There are still calibration and adjustments going on using tracking radar and calibrated small mobile bird radar as references. The effort aims at providing up-to-date bird status information for each airfield environment and to develop and install clear regulations for flight operations in order to avoid severe birdstrike risk situations during approach/landing and take off/climb.

c. Large scale

For a very long time country wide information on bird migration intensities is monitored in real time by a network of long range air defence radar systems, each radar sensor having a 150 km detection range for large bird flocks. In contrast to other radar systems these sensors have a three-dimensional detection capability, so that there is also information on the dangerous altitudinal migration layers. Although being strongly filtered to fulfil the primary task of detecting unfriendly aircraft, there is enough valuable information in the primary data that can be extracted and interpret by experts to alert military and civilian air traffic to bird migration in dangerous intensities over central Europe. The extraction of bird relevant data and their transmission to BGIO is completely automated.

4. Communication networks

BGIO is incorporated into the communication networks of the GAF. For real time data transfer it is essential to have direct access to reliable and fast networks, including protected networks, to be able to address the relevant organisations and pilots. The internet is not always available and often not accepted in military locations because of security reasons.

Protected point-to-point data links are used for the transmission of selected relevant data from radar sensors. For the transmission of messages and reports the World Meteorological Organization's Global Telecommunication Network (GTS) is used as well as the Aeronautical Fixed Telecommunication Network (AFTN). Bird Warnings are communicated via aerial transmission directly into the cockpits of aircraft in affected areas on a high priority frequency.

5. Birdstrike warning (BIRDTAM)

Real time data from the air defence sensor network are analysed by experts at BGIO. An expert system has been developed by own personal and is used to interpret the timely sequence of radar echoes by also taking into account atmospheric parameter and weather phenomena. Wind and precipitation distributions are especially important for the identification of bird migration. The system (Figure 1) also allows for displaying echoes as movie-loops, showing the direction of migration as well as the current warning situation.

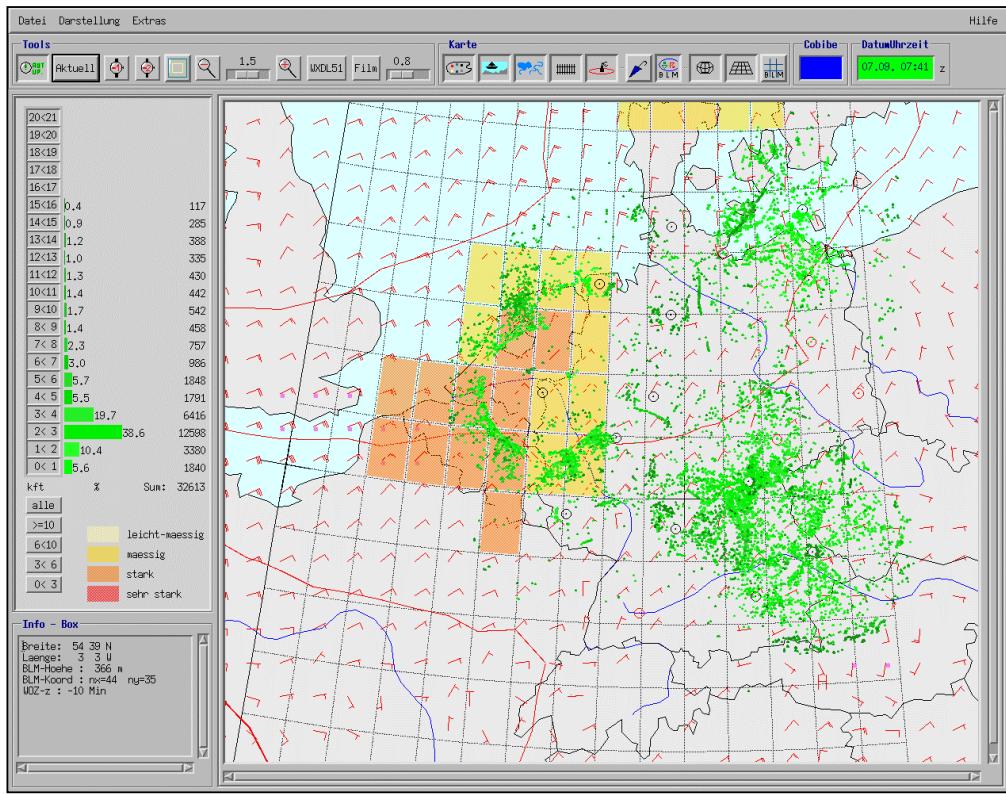


Figure 1: Bird radar echoes and BIRDTAM display on BGIO expert system

Whenever high intensities of bird migration is analysed a message is formed and transferred to a central processing/server unit to automatically create and immediately transmit a birdstrike warning. The so called BIRDTAM (Bird Message to Air Men) have a direct impact on military flight operations. In those areas low level jet-fighter flight missions are prohibited and even instantly aborted in those areas as soon as a BIRDTAM is effective.

Warning areas in BIRDTAM are geographically exactly and legally clearly defined by the GEOREF(Geographic Reference System) 1-degree latitude/longitude squares and from the surface to a given altitude. A BIRDTAM is timely limited up to 4 hours at a maximum, but can be up-dated and extended whenever there is a new information. The intensity-level of the internationally agreed 0 – 8 scale is set by expert judgement, starting at intensity level 5, meaning fairly great birdstrike risk. Always the most recent BIRDTAM-Warning is valid in an area. BIRDTAM situations over Central Europe are also transferred to the US Defense Internet NOTAM service and available via <https://www.notams.jcs.mil> under the European BIRDTAMs button.

6. Birdstrike Risk Forecast

For planning purposes a 24-hour birdstrike risk forecast is evaluated in BGIO's weather forecast center and transmitted via GTS and AFTN every night using a scheme based on the strong correlation between weather parameter (basically: wind, temperature, precipitation) and bird migration (Figure 2). According to the

weather forecasts and the known ornithological dependencies the forecast and an outlook over the following three days is evaluated for specific geographic regions. The birdstrike risk forecast is presented to the pilots during flight mission briefings. During migration periods in spring and autumn an update is given at noon taking the latest BIRDTAM situation, based on real time observations, into account. Birdstrike risk forecasts also provide mission planners with an information on how many flight restrictions are to be expected due to BIRDTAM during the day.

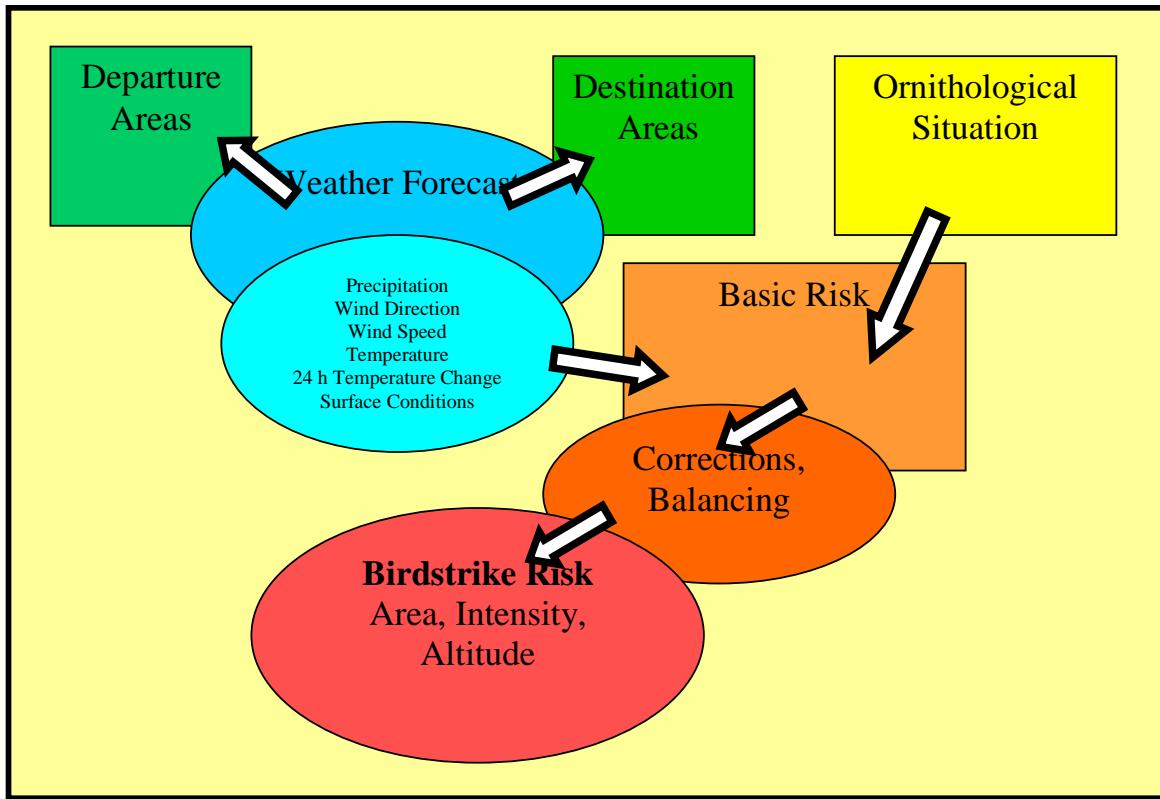


Figure 2: Birdstrike risk evaluation scheme for spring and autumn migration

The presently used manually operated evaluation scheme is further developed by the biology branch towards a computer based model that will automatically take relevant data from a numerical meteorological forecast database. Additionally radar data as well as numerical meteorological model output data are archived and analysed.

7. Nature Protection

Environmental protection is an important issue also for the GAF. Because of Germany, being a densely populated country, there is a lot of concern about the disturbance of endangered bird species. Therefore, besides birdstrike aspects, also nature conservation aspects have to be considered in military planning.

BGIO – Biology Branch provides protective guidance, instructing seasonal and diurnal limitations for relevant areas, so that they must be over flown in a minimum altitude and lateral distance if over flights cannot be avoided.

8. Conclusion

Birdstrike prevention in the German Armed Forces is a seriously taken flight safety topic. Well educated experienced and dedicated staff embedded into an organisation that provides a broad variety of scientific and technological expertise and equipment is available to fulfil the requirements.

Scientific methods, ecological strategies and the use of technological advances are the most important aspects of the GAF long term bird hazard management program. Continues efforts are still required to maintain and improve existing operational techniques. Although focussing on the military specific needs, civilian and military, national and international exchange is vital to keep and improve the biological flight safety standards.