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THE SIGNIFICANCE OF BIRDTAMS/BIRDSTRIKE WARNINGS FOR MILITARY AND CIVIL AVIATION

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ABSTRACT

The Paper describes the fundamental principles of bird strike warnings introduced by several air forces and standardised in the NATO document STANAG 38 79 FS, it gives a short survey of the observation systems, and compares the number and intensities of warnings issued by different countries as well as the flight restrictions to military aviation. Moreover the Paper discusses the possibilities of using the existing warnings for the requirements of civil aviation.

Keywords: Warning Systems, Birdtam/Notam, En-route Aspects, Inflight Avoidance, Bird Detection, Military Aviation, Civil Aviation.

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1. INTRODUCTION

The birdstrike hazard is directly correlated to the number of birds within the flight path of the aircaft. As this number varies considerably in space and time, the assessment of the birdstrike risk requires a sufficient knowledge of the pattern of birds' flight activity. It is impossible to get these data countrywide by visual observation of bird movements, for the human eye even with binoculars has a very limited range. The most suitable tool for the observation of large-scale bird movements also at high altitudes and during night are still radar systems, even if the equipment cannot detect all birds due to their size, altitude and flocking behaviour. The fundamental principles of radar ornithology and the application of radar for birdstrike reduction are presented at BSCE20/WP36, and must not be repeated.

The primary observation data must be assessed and calibrated if they should be the basis for birdstrike warnings. The following points of view should be taken into consideration:

1. It is generally impossible to detect all flight movements of birds even if a dense network of observation sites would be existing.

2. The annual mean risk caused by bird movements cannot be reason for birdstrike warnings, for the inevitable large number of warnings cannot be taken into account by the pilot.

3. All efforts must be concentrated on the detection of bird intensities very much above the annual mean risk. These intensities are usually restricted to the migration periods in spring and fall. Bird movements with high intensities usually continue for many hours. Therefore the delay between observation and warning time can be accepted.

4. The content and format of birdstrike warnings must be adjusted to the requirements of the Air Traffic Control Units respectively the pilots.

2. FUNDAMENTAL PRINCIPLES

As the altitudes mainly used by migrating birds are particularly important for military training flights, the interest in exact warnings of high bird intensities was first of all a military one. Therefore the detection of bird movements by radar, the assessment of the birdstrike risk, and the distribution of "bird notices to airmen" (BIRDTAM) were promoted and organized by military sections. The internationally used exponential 0 to 8 scale of bird intensities was developed by the Royal Netherlands Air Force on the basis of theoretical calculations and practical experience of the radar observation of bird movements. This scale is also used in the NATO Standardization Agreement (STANAG) 3879 FS "Birdstrike Risk/Warning Procedures (Europe)" with regard to the density of birds and the birdstrike risk involved.

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The STANAG 3879 FS recommends the following content and format for birdstrike warnings:

Heading: "BIRDSTRIKE WARNING" and serial number
a. Issuing station
b. Begin of validity (DTG-ZULU)
c. End of validity (DTG-ZULU)
d. Intensity of bird migration
e. Geographic reference
f. Lower altitude limit of the hazard (AGL)
g. Upper altitude limit of the hazard (AGL)

The issuing station may be the observation site itself or an evaluation center. The validity is normally limited to a maximum of 4 hours, a period in which large-scale bird migration will normally continue. The intensity of bird migration refers to the exponential 0-8 scale. As absolute figures (kilos of birds per cubic kilometre) are normally missing, the intensity will be often calculated or estimated in relation to the maximum number of bird echoes observed during the migration periods. The geographic reference is mostly based on the GEOREF-system (1-degree-areas) which is an artificial one and does not correspond exactly with the areas covered by bird migration. But the system is very useful for pilots as it is unambiguous. The lower altitude limit of the hazard is mostly unknown, for surveillance radar systems cannot detect targets at very low altitude. Therefore this item will be always indicated as 0 or sfc (surface). The upper altitude limit is first a question of definition for the bird density is decreasing in relation to the altitude. The limit will be set normally at 80 - 90 % of the bird migration, and can be determined only by use of a tracking radar or a real 3D-pencil beam surveillance radar. Otherwise the upper limit of the altitude can only be roughly estimated.

The STANAG 3879 FS has been ratified by 8 countries: Belgium, Denmark, Germany, Greece, Italy, the Netherlands, Norway, and the United States. The ratification does not mean that all these countries are able to issue birdstrike warnings, but they agree with the principles. Birdstrike warnings based on regular radar observations are issued only in Belgium, Denmark, Germany, and the Netherlands.

3. SITUATION OF THE BIRDSTRIKE WARNING SYSTEM

Surveys of the birdstrike warning system were presented at BSCE20/WP34 and BSCE21/WP18. As the warning system is completely depending on the regular and continuous observation of bird movements the actual situation in the countries issuing birdstrike warnings shows as follows:

- The Belgian Bird Observation System Semmerzake (BOSS) has been improved during the years 1990 - 91 (see BSCE18/WP16 and BSCE21/WP 14) shifting the bird observation program from the operational ATC computer to a standard PC. The new system is able to observe and quantify bird migration by use of 4 area radars and 3 airfield radars. Two of the area radars are 3-dimensional and inform roughly about the height of bird migration. The calculation of a bird intensity is based on a specially adapted tracking program, and considers the number of hits counted in all tracks as well as the maximum number of hits ever counted in each single GEOREF.

- The Danish electronic counting system FAUST (see BSCE8/WP8-2) is operating at 3 radar stations for 20 years. Since the system has not been developed any further it shall be replaced as soon as new 3D-radars will be operational.

- The Dutch ROBIN-System (see BSCE20/WP36) is in operation at one air defence radar station for some years. The bird intensities are calculated in relation to the number of echoes per square km. Since September 1993 a motion analysis is running automatically and makes it possible to separate bird echoes and rain drops, but problems may be caused by high echo densities. The experience of the previous years will be used to develop a new ROBIN-system by autumn 1994.

- The German Bird Observation System is based on visual and radar observations (8 air defence radars and about 15 ASR units, see BSCE18/WP5). The air defence radar stations identify bird echoes still by polaroid photos. The installation of video cameras and PCs has started in 1994. The possibility of using the new 3D-pencil beam air defence radars for bird observation was tested in spring 1994. The results are encouraging, but the operational realization will need some years.

The comparison of birdstrike warnings from different countries gains an insight into the observation and warning standards, and shows where a calibration is absolutely necessary. The results of the period January to June 1991 were presented at BSCE21/WP18. In spring 1993 (15 Feb - 16 Apr) a total number of 293 German Birdtam (40,6 % with intensities 6 - 8), 120 Dutch bird migration warnings (36,7 % with intensities 6 -8), 99 Danish Birdtams (50 % with intensities 6 - 8), and 26 Belgian Birdtams (65,4 % with intensities 6 - 8) were distributed. Whereas the Belgian, Danish and Dutch systems are exclusively based on radar observations, the German system also considers visual observations as indicators for bird migration. As visual observations are not calibrated with radar observations, warnings based on these observation data will not exceed intensity 5. If we assume, that the Dutch system gives a rather realistic account of bird movements, the other systems seem to overestimate the high intensities, or do not record all migratory movements with medium intensity. But the discrepancies can also be caused by general differences in bird density (e.g. the long coast lines of the Danish isles) as well as the different detection of bird movements with regard to altitude (inclusion of ASR in Belgium and Germany). In spite of the lack of calibration which is still a necessary requirement, the general pattern of bird migration, especially the busiest days, was detected very well even if the intensities differ to some extent. The results are very similar to those of spring 1991. The main problems are still the gaps in the continuous and complete surveillance of bird movements, and as a result of that an uncomplete coverage of Central Europe by warnings.

4. OPERATIONAL USE OF BIRDSTRIKE WARNINGS

As mentioned above the birdstrike warnings were introduced by military authorities with the purpose to reduce the number of enroute birdstrikes. As a fighter aircraft has a mean speed of 200 m/sec it is nearly impossible for the pilot to avoid a collision if a bird is crossing his flight path. If in certain areas the birdstrike risk is much higher than normal these areas will be restricted to military training flights.

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For the Belgian Air Force flight restrictions to jet aircraft are in force if a bird intensity of 5 and greater is present. Flight performances are allowed from 1000 ft above the upper altitude limit and 1000 ft below the lower limit respectively above 5000 ft AGL if no altitude has been specified. Gunnery ranges are closed at an intensity of 5 or greater.

The German Air Force has the following regulations:

- areas with bird intensities 6 - 8 are completely restricted to jet aircraft within the altitudes specified.

- areas with bird intensities 4 - 5 are restricted to jet aircraft except national and NATO exercises as well as take off/landing/touch and go approaches if ATC does not observe any birds. The approach to gunnery ranges is permitted if the bird activity is low above the range area.

The Royal Netherlands Air Force has flight restrictions to jet aircraft at bird intensities 7 - 8 and advisory regulations at intensities 5 - 6 northwest of a line Boulogne-Venlo-Hannover-Hamburg. Regulations concerning the flyways through the Wadden Sea are also existing. The speed of helicopter aircraft flying below 600 ft AGL should not exceed 80 kts if flight restrictions to jet aircraft are in force.

All these restrictions can be accepted by military authorities because military training flights can be temporarily stopped or can use alternate routes or altitudes. The success of birdstrike warnings causing flight restrictions can only be estimated roughly from birdstrike statistics because too many factors must be considered. But the decrease of birdstrikes in the Netherlands parallel to the introduction of the ROBIN-system, and the results of the UK radar trial in 1991 (see BSCE21/WP23) show the close connection between bird migration and birdstrikes.

As birdstrike warnings are primarily fit to the requirements of military aviation, up to now civil aviation does not take notice of them or uses them at the most as general information. The reasons for this attitude are obvious, if we imagine the different flight procedures. Whereas military training flights cross large areas at altitudes in which migratory flights of birds are very common, this hazard does mainly concentrate on civil aviation in the vicinity of airfields and aerodromes. Moreover migrating birds cross quickly the relatively small airfield areas during periods with optimal flight conditions and do not rest on the airfield. A considerable birdstrike hazard caused by bird migration mainly exists for civil aviation at final approach and initial climb. Even if the pilot has knowledge of dangerous bird flocks crossing his flight path the possibility to avoid a collision is very small because the pilot cannot deviate from his flight schedule.

If birdstrike warnings should be useful for civil aviation the following items should be considered:

1. The existing military birdstrike warnings can only be considered if the birdstrike risk is very much above the annual mean risk (= bird intensities 7 and 8). Elsewhere they would burden the pilot with insignificant information.

2. The birdstrike warnings must use a reference system familiar to the pilot, e.g. location indicator of aerodromes or flight information regions (FIR), so that the pilot can easily recognize the warnings relevant to him.

3. The selection and transformation of birdstrike warnings into a "civil language" must be carried out automatically by a computer program.

Since 1992 the German Air Traffic Control Ltd. has started a trial using the criteria mentioned, but there are no statistics on it yet to which extent the information will be used by pilots.

It must always be taken into account that birdstrike warnings based on data from a surveillance radar cannot consider low intensities or indicate exact flight altitudes. Exact warnings of bird flocks crossing the flight path of an aircraft in the vicinity of aerodromes are only possible by use of a tracking radar, scanning the approach area, and reporting automatically the position, speed, and direction of bird flocks causing a birdstrike hazard.

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