2.13. Radar Observation Methodology and Procedures used by ATC Controllers to Avoid Bird Strikes.

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RADAR OBSERVATION AND AVOIDANCE PROCEDURES

WHICH CAN BE EMPLOYED BY AN AIR TRAFFIC CONTROLLER

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(This paper is based largely on an original study made by Mr LATY, a biologist under contract to Aix en Provence ACC).

1. - GENERAL

1.1 Birds in flight constitute a dangerous hazard which is of growing importance to air navigation. The present characteristics of air navigation make it necessary to locate this hazard accurately in space.

1.2 Radars of 23 cm wave length, used for the surveillance of air traffic, provide the necessary indications which are often sufficient for the detection, under certain conditions, of birds flying either in isolation or in a group.

1.3 If the Controller is properly trained he can, from the image displayed on the radar screen in a control room, identify the echoes caused by birds. He can then transmit this information to crews.

1.4 The information can possibly be supplemented by advice on the appropriate avoiding action to be taken.

2. - RADAR OBSERVATION

2.1 IDENTIFICATION OF BIRD ECHOES ON A RADAR SCREEN

2.1.1 Many luminous signals appear on the surface of a panoramic radar screen and there are no absolute criteria for determining those which correspond to birds.

2.1.2 However, the simultaneous presence of certain data allows the observer to distinguish bird echoes from other phenomena with sufficient accuracy for the information to be transmitted. These are:

- the type of distribution of the echoes and their positions on the surface of the radar screen;
- the persistence of the echoes in time, and their mobility;
- the rate of movement of the echoes across the surface of the screen;
- the effect of MTI in relation to the persistence of echoes during their movement; and,
- the similitude of appearance and disappearance on the screen at a distance which is a characteristic of the altitude of flight.

2.1.3 An echo due to a bird, or birds, will appear on the surface of a radar screen in the form of a luminous spot which is persistent, locally suppressed or not by MTI, and whose slow movement is made along a characteristic path at a speed of less than one hundred kilometres per hour.

2.1.4 It should be noted that the characteristics of radars are not fully understood. Apart from the normal problems associated with the choice of equipment and calibration one may expect two other phenomena, one being saturation at the centre of the screen (Multiplying effect) and the other being differentiated detection, for a same target-antenna thus distorting reality. It has been proved that, in case of saturation, controllers have a tendency to reduce the detection power in order to eliminate echoes other than those caused by aircraft.

2.2 CHARACTERISTIC ECHO FORMS

2.2.1 With the exception of some species whose movements occur as massive flights, whose dimensions exceed that of the radar resolution cell, most birds move either in isolation or in groups of a few individuals.

2.2.2 When the dimensions of the flight exceed that of the radar resolution cell, the echo form may reproduce that of the horizontal section of the flight in its largest dimension. For example, the massive flights of Starlings (Sturnus vulgaris) leaving their dormitory area or those of Rooks (Corvus frugileus) on migration present a characteristic arc of a circle. The size of the echo is proportional to the size of the flock.

2.2.3 When the dimensions of the flight are less than that of the radar resolution cell the form of the echo is independent of that of the bird or group of birds. The echo form is then ovoid and small in size.

2.3 HABITUAL FORMS OF MOVEMENT

2.3.1 Bird movements are marked by seasonal regularity comprising an outward and inward flight (migration) between the mother country of the bird (the breeding area) and the living shelter (wintering area) where they spend that season of the year which would be unfavourable in the breeding area.

2.3.2 In both the wintering area and the breeding area local movements may become established which are geographically well defined although limited in distance.

2.3.3 Local movements are determined in time and space by the position of the source of food, the nest or colony and the dormitories or sheltering areas. They are characteristic of a given species.

2.3.4 As long as the same food source is used and the occupation of day or night dormitories occurs in a regular manner so the traverse of echoes of local flights will follow the same paths from day to day.

2.3.5 The distribution area of a species is constituted by the breeding area and the wintering area between which migratory movements are made.

2.3.6 The characteristics of migratory movements vary from day to day according to the species of the birds, their home territory, their destination, their fitness for flight and the weather conditions.

2.3.7 When migrations are observed the echoes belonging to the same migratory movement travel along tracks which are perceptibly parallel.

2.3.8 The essential difference between local movements and migrations, when observed by radar, lies in the fact that the echoes associated with local movements are located in narrow portions of the screen whereas those connected with migrations are widely distributed over the whole screen surface.

2.4 ALTITUDE OF MOVEMENTS: BANDS OF ALTITUDE DANGEROUS FOR AIR NAVIGATION.

2.4.1 The average altitude at which migrations are observed varies from 300 to 2,500 metres.

2.4.2 The maximum altitude at which local movements have been observed is 400 metres.

2.4.3 However, on local flight certain species may reach higher altitudes. For swifts and certain birds of prey this can be of the order of 1,500 to 3,000 metres.

3. USE OF RADAR BY AIR TRAFFIC CONTROL

3.1 SPECIALISATION OF EQUIPMENT

3.1.1 Control of air navigation and approach control for airports is effected by means of information read off radar screens whose characteristics have been adapted to the needs of the traffic.

3.1.2 With present radars of 23 centimetres wave length the effective range for the detection of bird flights varies from 0 to 50 nautical miles (NM) according to the parameters appropriate to the targets and the radar station.

3.1.3 For en route control the range of the radars is of the order of 200 NM and the controller normally uses the maximum range. This means that any bird phenomena will be found compacted towards the centre of the image.

3.1.4 For terminal control the radar range is of the order of 100 NM and the controller normally uses 40 ± 10 NM, a scale of radar coverage which corresponds to the useful range for bird detection.

3.1.5 The evolution of en route radar towards synthetisation of images, without any special sign to report the presence of birds, entails the risk that the controller will no longer see the hazards presented by birds.

3.1.6 As a synthetic image is not predicted for terminal control the bird phenomena will remain visible to the controller.

3.2 SPECIALISATION OF PERSONNEL

3.2.1 CONTROL EN ROUTE

3.2.1.1 The indifferent display of bird phenomena on en route control radar screens which are set to total radar range does not, however, nullify a controllers interest in the identification of birds. In effect aircraft which by reason of their cruising altitude are, to all intents and purposes, beyond any bird risk will enter the critical altitude band at the moment of descent. This information will then be very useful.

3.2.2 CONTROL IN THE TERMINAL AREA

3.2.2.1 The controller sees a processed (MTI), but not synthetised, image of air traffic and bird movements simultaneously. However, the landing and take-off rate at certain airports eliminates any permanent possibility of the controller being distracted from his surveillance of air traffic for more than a moment.

3.2.2.2 Moreover, there is only a short useful time margin between the moment when the aircraft passes from en route control to terminal control and the moment when it penetrates the dangerous altitude band.

3.2.2.3 When local bird movements in the immediate neighbourhood of an aerodrome have been the subject of special studies the terminal controller must be aware of their characteristics (times, places, altitude, frequency, etc...). If he is fully aware of the danger presented he can then act with much greater efficiency. Despite the short action time available he can transmit the information necessary for a manoeuvre intended for the avoidance, or the reduction of the consequences, of a possible collision as soon as he notices on the radar screen echoes of birds on local flights which could intersect the path of the aircraft.

3.2.2.4 In view of the fact that, for a given radar station, the passage of migrating birds may last several hours, the terminal controller should transmit this information to en route control as soon as he has the time to do so, rather than give it, at short notice, directly to aircraft on descent. Then the en route controller, who does have the necessary time, can advise the various crews concerned and give them adequate notice.

3.2.3 DESIRABLE QUALIFICATION

3.2.3.1 Improvement in air safety in respect of collisions between birds and aircraft can be gained through instructing and training control personnel.

3.2.3.2 This training is necessary since it explains certain radar phenomena which are often attributed to the functioning of the equipment. It is a strange fact that radars are often declared to be unserviceable during major migrations.

3.2.3.3 A controller can acquire a certain skill in the recognition of bird echoes by undergoing a course of instruction such as is given during the courses organised twice each year in France at the Centre Regional de la Navigation Sud-Est, at Aix en Provence.

3.2.3.4 Once bird echoes have been identified by the controller he can transmit (or cause to be transmitted) information on the existing danger to crews concerned.

3.2.3.5 The time required for observation and transmission of the information is relatively short and can perfectly well be incorporated into the data provided by en route control.

3.2.3.6 Where terminal control is concerned observation and transmission of sudden information regarding fully known local bird movements can be made without overloading radio traffic. Information related to migration movements can be the subject of information which is supplementary to that already disseminated by en route control.

4. APPROPRIATE AVOIDANCE PROCEDURES

4.1 The procedures, associated with the type of control, may be put into two general categories: passive procedures or amendments to the flight plan made before or during the flight and active procedures carried out in flight when a hazard is positively identified.

4.2 PASSIVE PROCEDURES

4.2.1 These procedures are quoted for reference. They cover two aspects according to whether the changes are made systematically or as required.

4.2.2 Systematic changes apply particularly to training flights. They concern either limitation of flights at times or altitudes or else a change of route when the information available to the crew shows:

- the presence of a large number of birds in given areas during certain regular periods (local movements), or
- the presence of a large number of birds in a certain altitude band (migration).

4.2.3 Special changes apply either to a cancellation of a flight, such as an interruption of take-off due to the presence of birds on the runway, or to a delay as in the case of an interrupted approach or even a diversion when migrating birds choose a particular airport as a staging point.

4.3 ACTIVE PROCEDURES

4.3.1 These procedures apply above all during the approach phase. They are experimental and have not been the subject of systematic evaluation trials.

4.3.2 Certain procedures concern changes in present flight procedures. For example, a reduction in approach speed would tend to reduce the seriousness of damage in case of impact. Radar guidance can also be used in so far as it is possible to determine the height at which birds are flying, the type of grouping and the real importance of the groups.

4.3.3 Below a certain flight level (FL 100) use of the landing lights can cause birds to change course and so improve safety during the approach phase.

5. CONCLUSIONS

5.1 The fundamental study of bird movements cannot be made by a radar controller who has neither the requisite training nor the necessary time. It calls for a specialist.

5.2 The work of the specialist(s) should lead to a better knowledge of bird movement patterns for the purpose of forecasting movements and setting up a system of daily forecasts.

5.3 All radar controllers could be trained in direct interpretation from an ordinary screen or from any other system stemming from synthetisation of images so as to contribute to much greater efficiency in the prevention of bird strikes.

5.4 The maximum benefit from this training could accrue to terminal control radar which is concerned with the part of the flight where the risk is greatest and whose equipment is best adapted to the observation of birds.

5.5 It will be necessary, by means of basic studies, to seek a better understanding of the variable factors which condition the behaviour of birds. In case of risk the attention of the controller could, without elaborate specialisation, be directed towards surveillance of the phenomena in a situation of potential conflict. These studies will likewise aim at the development of display systems, which will be needed when screens are synthetised, so that the controller, freed from routine tasks by automation, will have the time necessary for the resolution of avoidance problems.

3. Discussion concerning the action taken at the ICAO EUM VI RAN Meeting and subsequently with regard to the Bird Strike Problem.

1. In the initial discussions on this aspect of the bird-strik question it was agreed that, since the BSCE was not recognized by the ICAO Council as a body with which normal contacts are maintained, it would be preferable if any recommendations made by the BSCE were put forward to ICAO by one or more of those States represented at the BSCE which are at the same time Members of ICAO.

2. Mr. Berger from the Paris Regional Office of ICAO informed the Meeting that, with respect to Recommendations 16/14 and 16/15 of the EUM VI RAN Meeting, the Air Navigation Commission of ICAO had instructed its Secretary General to consult States on the matters dealt with by these Recommendations. (The recommendations in question concern Recommendation 16/14 - "Dissemination of Information concerning Bird Migrations" and Recommendation 16/15 - "Inclusion in Annex 15 of Specifications on Publication of Information on Bird Hazards").

3. There was unanimous agreement amongst the Members of the BSCE that they would ensure that their respective administrations would reply to the Secretary General of ICAO as soon as they were consulted on this subject by ICAO, and that the administrations concerned would indicate that they were in full agreement with the intent of the two recommendations. In addition, it was also agreed that those States having already published charts showing migration routes and similar information regarding bird movements in their AIP, would indicate this in their reply to the Secretary General of ICAO.

4. Furthermore, it was agreed that if worldwide adoption of these two recommendations could not be obtained within ICAO, the administrations should propose that, under these circumstances, Recommendations 16/14 and 16/15 should at least be implemented as Regional Supplementary Procedures applicable in the EUM Region.

5. With regard to EUM VI Recommendation 16/16, "Content of Bird Hazard Notam", and Recommendation 16/17, "Distribution of Bird Hazard Notam (BIRDTAM)", it was noted that the Air Navigation Commission (ANC) of ICAO had deferred action on these Recommendations and requested the Secretary General of ICAO to give further examination to their possible implications and to present proposals to the ANC in due course. In view of this situation, the BSCE was unanimous in its views that its Members should ensure that their national administrations inform ICAO of their agreement with these two recommendations at the earliest possible time.

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It was also agreed that national administrations should be requested to propose to ICAO that those States, being able to do so, be encouraged to implement Recommendations 16/16 and 16/17 on a trial basis in order to permit the ANC to make an assessment of their usefulness in the light of practical operating experience. In proposing this action to ICAO, States using the BIRDTAM System already should notify this fact to ICAO.

6. The BSCE noted with surprise that the EUM VI RAN Meeting was not prepared to extend the existing provisions concerning the issuance of advice by air traffic controllers to pilots on the presence of birds. (ICAO PANS-RAC, DOC 4444-RAC/501 refers). In fact, the BSCE regretted that the possibility of detecting bird movements by radar and consequently issuing instructions for avoiding action to pilots were not to be exploited by air traffic controllers.

7. As it was found that some of the States represented in the BSCE were already using radar obtained information on bird movements in order to provide guidance to pilots in avoiding bird strikes and/or were delaying take-offs or approaches of aircraft whenever radar indications showed that a bird hazard existed in the vicinity of the aerodrome in question, it was agreed that the administrations concerned should be encouraged by their Members of the BSCE to approach ICAO on this subject, recommending that radar facilities available to ATS units shoul be used in order to reduce the possibility of bird-strikes. The BSCE was unanimous in its opinion that reporting of bird-strike incidents to ICAO should be made on a regular basis and in a standard manner. It was agreed that a special working group created for this purpose at this meeting should develop proposals to this extent, which should be forwarded to ICAO throug one or more of its member States.

8. Finally, it was believed that it would be useful to propose to ICAO that the question of bird-strikes should not only be considered under its air worthiness aspect, but that it should cover all other technical fields effected by this phenominon (aerodromes, air traffic services, aircraft operations, aeronautical information services). It was also agreed that the Members of the BSCE should request their administrations to approach ICAO in this respect.

4. Other Discussion and Conclusions.

Other Discussion and Conclusions.

1. The report by the chairman included an apology for not distributing, within the time limit, all papers to be presented at the meeting. The reason for this was that the chairman had not received the papers himself as agreed to at the 5th and 6th meeting.

According to the traditional practice, it was agreed that: "Written papers and lectures for future meetings will be sent to all members two months before the intended date of the meeting. The chairman will continue to distribute and reproduce papers as desired".

2. Mr. M.S. Kuhring, Canada, asked the nations receiving funds under the NATO research grant No 460 kindly to send to him specifications for their part of the grant.

3. Dr. V.E. Jacoby, USSR, concluded his presentation by encouraging a closer cooperation between Eastern- and Western Europe in the exchange of information concerning bird migration and weather phenomena.

4. After the presentation by Dr. W. Keil, W-Germany, "Ecological Research in Aerodrome Traffic Zone and its Results", a discussion revealed that the work of the BSCE Working Groups mainly had been concentrated on the "Bird-Strike-En-Route" - problem. To improve the work in preventing Bird-Strike at and around airfields (Aerodrome Traffic Zone) it was decided to form a Working Group to cope with the problems.

5. The paper presented by Mr. J. Thorpe, U.K., revealed in a very clear manner the difficulties in standardization of definitions and statistics.

Members were therefore asked to use definitions concerning phases of flight etc. already defined in ICAO Accident Investigation Manual.

Furthermore it was decided, that Mr. Thorpe should propose a layout for an analysis and circulate it between members of BSCE for approval.

Mr. Thorpe was also called upon to act as Rapporteur for the analysis-work in the future.

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6. After the paper "Radar Observation Methodology and Procedures used by ATC Controllers to Avoid Bird-Strikes" presented by Mr. V.E. Ferry, France, a long discussion took place concerning the use of radar to direct aircraft in order to avoid Bird-Strikes.

During this discussion it was quite clear that ATC-personnel are not able, at the present, to take on the extra work that avoidance of Bird-Strike would create. However the use of radar for preventing collisions between aircraft and birds were found to be so important, that the conclusion was, that ATC should be manned as well as trained in order to cope with the task of avoiding Bird-Strikes.

7. During a discussion about standardization of "Bird-Strike Report Forms", Mr. V.E.Ferry, France, was asked to approach ICAO in order to learn about the proposed form forwarded by him on request of BSCE after the 6th Meeting.

8. With reference to the conclusion from the 6th Meeting about exchange of information about Bird-Strike members were asked to send to BSCE the postal address to whom to send the information.

9. During discussion of "Organization and Future Work of BSCE and Working Groups" Dr. W. Keil, was called upon as the chairman of the

"Bird-Strike Aerodrome Traffic Zone, Working Group"

Dr. Keil accepted the chairmanship.
Mr. Thorpe had already been called upon and had accepted to be Rapporteur for the

"Bird-Strike Analysis Working Group".

The chairman BSCE resigned as the period for his chairmanship had expired. However he was asked to continue, which he accepted, depending upon approval by HQ RDAF, (The approval is obtained).

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10. The BSCE and Working Groups are hereafter organized in the following way:

a. Bird-Strike Committee Europe
Chairman: Lt. Col. E.P. Schneider, Denmark

b. Bird/Radar/Weather Group
Chairman: Dr. V.E.F. Solman, Canada

c. Bird Movement Working Group
Chairman: Dr. J. Hild, W-Germany

d. Transmission Working Group
Chairman: Mr. V.E. Ferry, France

e. Bird/Radar Working Group
Chairman: Mr. E.W. Houghton, U.K.

f. Bird-Strike Aerodrome Traffic Zone Working Group
Chairman: Dr. W. Keil, W-Germany

g. Bird-Strike Analysis Working Group
Chairman: Mr. J. Thorpe, U.K.

11. As many delegates of BSCE are members of several Working Groups, chairmen of Working Groups were asked, as far as possible, to coordinate meetings in such a way that meetings were held in connection with each other, or maybe just prior to the next main meeting.

12. Next meeting of BSCE was planned to be held in Paris sometime in the period 15th May - 15th June 1973.
In order to find the most convenient period, each nation was asked to send a list of national holidays to the chairman.

13. In order to facilitate the arrangement of the meetings it was decided, that hotel accommodation in the future would be arranged by the delegates themselves.

14. The chairman closed the Meeting by giving Mr. M.S. Kuhrin Canada on behalf of BSCE, cordial thanks for the inspiring and unselfish work he had done for the BSCE.
It was the last meeting of BSCE Mr. Kuhring planned to attend, as he probably would retire before the meeting in 1973

E.P. Schneider
Chairman BSCE