
Near-miss between a DHC-8-311, LN-WFR, and Boeing 737-800.

Micro-summary: A cascading series of errors results in a near-miss.

Event Date: 2004-11-29 at 1219 and 1223

Investigative Body: Accident Investigation Board Norway (AIB), Norway

Investigative Body's Web Site: <http://www.aibn.no/>

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REPORT

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This report is written in English to facilitate access by international readers. This investigation is limited in its extent. For this reason, the AIBN has chosen to use a simplified report format. The report format indicated in the ICAO annex 13 is only used when the scope of the investigation makes it necessary.

All times given in this report is local time (UTC + 1 hr), if not otherwise stated.

Aircraft:

- Type and reg.:	Bombardier Aerospace DHC-8-311, LN-WFR	Boeing 737-800, Reg. not reported
Operator:	Widerøes Flyveselskap	Eurocypria Airlines
Radio callsign.:	WIF408	ECA978
Date and time:	Monday 29 November 2004 at 1219 and 1223 hrs.	
Location:	Bergen Flesland Airport, Norway (ENBR)	
Type of occurrence:	Air traffic incident, loss of separation	
Type of flight:	Commercial, scheduled / Commercial, non-scheduled	
Weather conditions:	ENBR METAR 1220 hrs.: 13005KT 110V170 9999 SCT025 BKN080 02/M00 Q1014 NOSIG	
Light conditions:	Daylight	
Flight conditions:	IMC	
Flight plan:	IFR (both)	
No. of persons onboard:	3+40 / Not reported	
Injuries:	None	
Aircraft damage:	None	
Other damage:	None	
Commander:	WIF408	ECA978
- Sex and age:	Male, 51 years	Male, age not reported
- Licence:	ATPL-A	Not reported
- Flying experience:	10 000 hr total, 5 000 hr on type	Not reported
Air traffic controller:		
- Sex and age:	Male, 34 years	
- Licence:	June 1996	
- Authorization:	December 2000	
- Ratings:	TWR/ADI/RAD, APS/RAD	

Information sources: Report from Flesland TWR/APP, e-mail with report of flight to ENBR from the Commander of ECA978, Air Traffic Incident Reporting Form (NF-0148) from the Commander of WIF408 and investigations by AIBN.

FACTUAL INFORMATION

ECA978 was arriving ENBR from Larnaka International Airport, Cyprus (LCLK) on a non-scheduled flight and was cleared the Standard Instrument Arrival (STAR) SOXUS 1E and descent to 6 000 ft for a later ILS approach to runway 17. WIF408 was a scheduled airline flight from Sandefjord Torp Airport, Norway (ENTO) to ENBR. The air traffic controller at Flesland Approach (APP) evaluated the approach sequence and decided that WIF408 was number 1 for the approach.

By mistake the air traffic controller cleared WIF408 direct to OKITO, a reporting point on extended centreline of RWY 35. This made WIF408 turn onto a southwesterly heading. When the air traffic controller observed the turn on the radar screen he corrected this by reclearing WIF408 direct INTEL, a point on the extended centreline of RWY 17. Sequencing was no longer favouring WIF408 due to the unintended delaying “dog leg” turn. The air traffic controller decided to keep the sequence with WIF408 as number 1 by giving WIF408 the opportunity to track direct to the field for a later visual approach. At 12:17:00 WIF408 was cleared by Flesland APP to fly heading 270° and to descend to altitude 5 000 ft, anticipating to get visual with the field in sight. Heading was adjusted to 280° one minute afterwards. Tracks of the aircraft are shown on a cut from the AIP Norway STAR Chart AD2 ENBR 4-18 in the Appendix (based on radar recording).

Both aircraft were descending when the air traffic controller of Flesland APP at 12:18:30 noticed that vertical separation between the two aircraft was decreasing. Their tracks were crossing east of ENBR and separation was based on minimum 1 000 ft difference in altitude observed by ATC radar from SSR-transponder altitude information read-out (Mode C). The radar display system, Norwegian Air Traffic Control System (NATCON), can show rate of climb/descent of aircraft on the radar label. This function of the radar display was not used during the incident.

The air traffic controller instructed at 12:18:45 WIF408 to increase descent rate. WIF408 did not respond to this transmission and the instruction was repeated. The flight crew then responded that they were unable to comply due to the fact that they were descending at idle power and maximum speed (IAS equal V_{mo}). The aircraft approached each other fast on crossing tracks and the air traffic controller instructed ECA978 to stop the descent. ECA978 complied and levelled off at FL83.

Instructions were not timely to avoid a loss of separation between the two aircraft. A radar recording from the Air Navigation Service Provider (ANSP), Avinor, shows that Mode C read-out was less than 1 000 ft during 30 seconds. Minimum vertical distance shown by Mode C was 700 ft while lateral separation was less than 5 NM, 1 NM at minimum. Both flight crew received Traffic Advisory from their TCAS. The radar display system of Flesland APP showed a Short Term Conflict Alert (STCA) warning on the labels of both aircraft for 1 minute.

After the two aircraft had passed each other WIF408 was still IMC and received a radar vector to heading 350° for a downwind for later visual approach. Weather conditions prevented the flight crew of WIF408 from getting the field in sight. The air traffic controllers at TWR and APP had a short telephone coordination and decided that the weather no longer favoured visual approaches

from the east. WIF408 received a descent clearance to 4 000 ft and a new vector to heading 020° in sequence behind ECA798 for the ILS-17.

At 12:23:00 WIF408 asked Flesland APP to confirm that an aircraft ahead was 4 NM away and descending to the same altitude. Flesland APP replied that radar showed 5 NM to the aircraft on base leg, descending through 3 600 ft for 3 000 ft. This was ECA978. A short discussion followed between WIF408 and Flesland APP on the radio frequency whether this was “the second airmiss with the same aircraft”. The flight crew of WIF408 stated that TCAS showed the aircraft ahead at a distance of 3 NM. The flight crew of ECA798 overheard the discussion and monitored WIF408 on their TCAS, but saw no reason to react to the situation.

Radar recording shows the two aircraft in sequence on downwind and base leg in a radar circuit for ILS-17. Minimum lateral distance was observed to be 4.6 NM by AIBN based on use of the Vector function on the radar display system (NATCON). Minimum vertical distance was 700 ft. Separation was lost during 30 seconds before vertical separation was re-established. AIBN has not found support for the flight crew claim of 3 NM minimum distance. The aircraft ahead was descending away from the altitude of WIF408.

ICAO Doc 4444 PANS-ATM is translated into Norwegian regulations “RFL I” and prescribes separation methods and minima. Flesland TMA is class D airspace and IFR flights shall be separated by ATC. Separation shall be maintained by giving clearances and instructions that ensure either a lateral or vertical separation. In Flesland TMA, ATC may use a radar separation minima of 5 NM. Vertical separation is maintained with minimum 1 000 ft difference in cleared altitude. When using Mode C altitude information an aircraft is considered to have left an altitude when Mode C read-out shows more than 300 ft difference in the right direction. When two aircraft are changing level, vertical speed control can be imposed to ensure that vertical separation is maintained.

Radar recordings of the incident were impounded by the CNS-department of ENBR. AIBN received print out of radar images from their Radar and ADS Display System (RaADS), a radar display system that AIBN has playback software for. When AIBN requested the RaADS recording files from the incident, Flesland TWR could not forward them. The RaADS-files had been deleted during routine maintenance of the recording facility. Avinor at Bergen Flesland Airport has subsequently changed procedures regarding impound and storage of RaADS-files.

AIBN used radar recordings of the Norwegian Air Traffic Control System (NATCON) to analyse this incident. AIBN does not have equipment to playback such recordings. Recordings were analysed by AIBN at Flesland together with the chief air traffic controller of Flesland TWR/APP and the air traffic controller on duty during the incident and by assistance of the CNS-department.

Playback of radar and communication recordings revealed that the different recording facilities at Flesland are not synchronized. Time stamping of the recorded events were not adjusted to show coordinated universal time, and this makes comparison and time-event plotting more difficult.

COMMENTS FROM THE ACCIDENT BOARD

The Accident Investigation Board Norway (AIBN) considers that there was no danger of collision between the aircraft during two losses of separation. Both flight crews had knowledge of the other aircraft via TCAS and by radar derived information from ATC.

AIBN considers that a loss of separation occurred in Flesland TMA at 1219 hrs which lasted 30 seconds. Separation was lost due to descent clearances without rate restrictions. The descent profile of WIF408 was not like the air traffic controller assumed from previous experience and a change in descent rate led to less than minimum prescribed vertical distance to ECA798 during 30 seconds. The air traffic controller was not able to correct the reduction of vertical distance by alternate clearances.

A function of the NATCON radar display that would have showed descent rates of the two involved aircraft was not used by the air traffic controller on duty. He stated that this information made radar labels too big so that the display would become cluttered with information. There is no policy or local regulations at Flesland APP about the use of the climb/descend-rate function of the radar display. AIBN considers that such information enables air traffic controllers to better monitor vertical separation during climb and descent of aircraft and issues a recommendation concerning this.

AIBN considers that a loss of separation occurred at 1223 hrs. which lasted 30 seconds. Separation was lost during the subsequent vectoring of the two aircraft to ILS-17 due to the 90° turn of the first of two trailing aircraft that were close to radar separation minimum (5 NM). After ECA798 made the turn to base leg, distance to WIF408 was reduced to a minimum of 4.6 NM before vertical separation was re-established.

The use of radar separation minima for aircraft with crossing tracks require attention to the fact that distance between them will decrease after the first has crossed ahead of the other. The same applies in this case where aircraft number 1 was given a 90° turn ahead of the other. The trailing distance immediately started to decrease until aircraft number 2 had number 1 in a position 45° away from its own track. From there on, distance started to increase.

A geometrical analysis of this situation is shown in the Appendix, depicting two aircraft. To simplify the example, both aircraft are considered to have same ground speed and follow a right angled (square pattern) radar circuit. Two aircraft with 5 NM trailing distance will have a minimum of 3.54 NM between them after a 90° turn of the first aircraft. To ensure 5 NM distance at their nearest point, trailing distance must be at least 7.1 NM at the beginning of the turn.

In the incident in Flesland TMA the aircraft types involved may have given the air traffic controller the impression that ECA798 would advance on WIF408 so that radar separation minima would be maintained during vectoring to ILS-17. Air traffic controllers need to add margin for speed changes when aircraft approach their intercept point for the localizer, as the aircraft will reduce speed during transition to landing configuration. In this incident a Boeing 737 followed by a DHC-8 had same ground speed along different segments in the radar circuit and separation was lost after a 90° turn of the first aircraft.

Radar recordings are valuable information for the investigation authority. An air navigation service provider shall have in place procedures that ensure safekeeping of impounded recordings until they are released in a proper way. AIBN issues a safety recommendation concerning this.

NATCON playback software does not allow user input during replay. This makes analysis of radar data difficult, as normal radar tools like Range and Bearing Line and selection of alternate display modes is not available. AIBN issues a safety recommendation to Avinor regarding improvement of the radar recording playback software for NATCON.

Recording facilities at Bergen Flesland Airport are not synchronized and events are not time stamped according to the same useful reference (preferably co-ordinated universal time, UTC). Correct time stamps on such recordings are valuable information for the investigation authority. AIBN issues a safety recommendation concerning this.

SAFETY RECOMMENDATIONS

AIBN recommends that Avinor evaluates the use of climb/descent-rate function on radar displays and describes the operational use of this function for air traffic controllers in ATC-units using radar displays that provide this function. (Recommendation 46/2005)

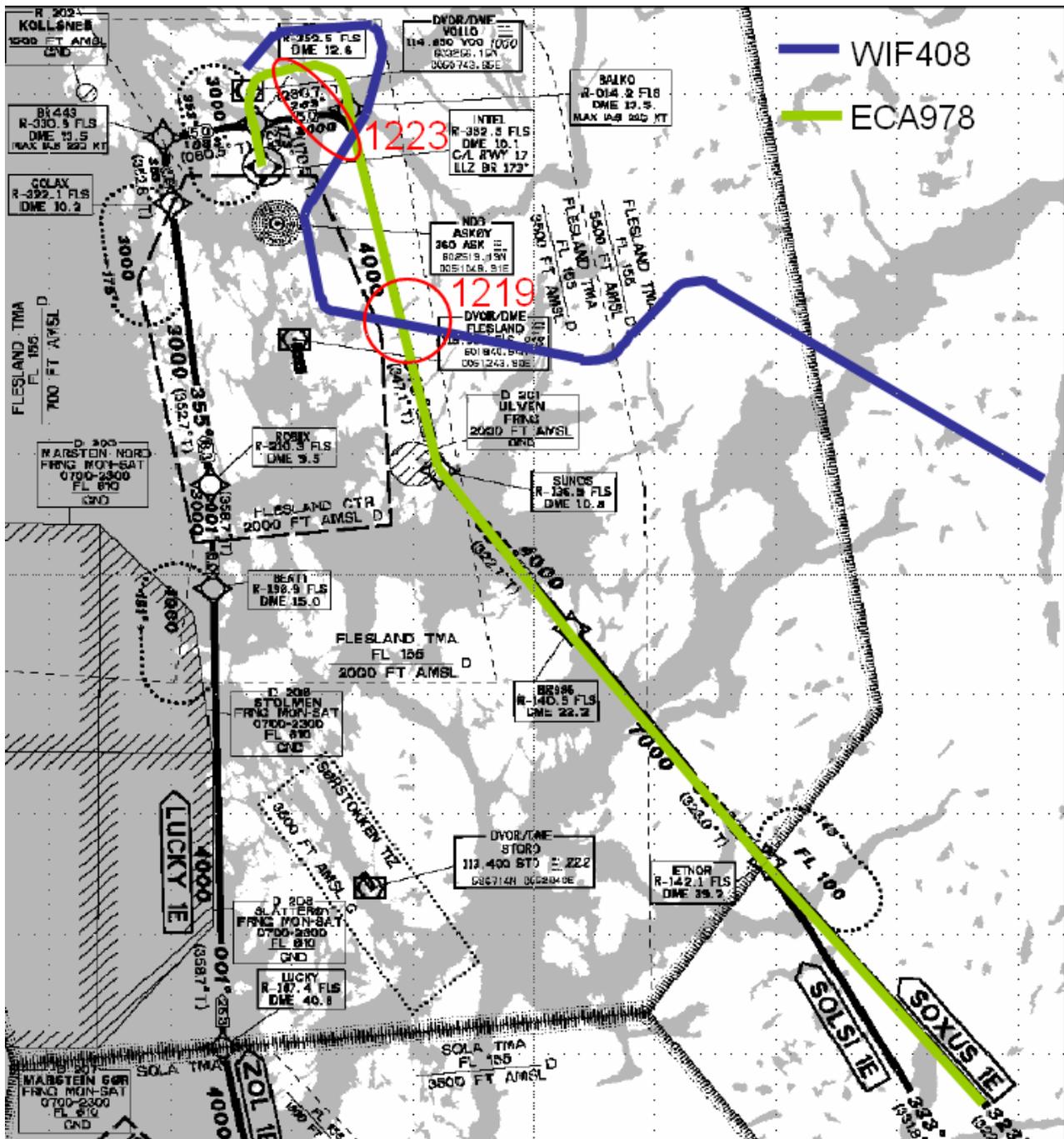
AIBN recommends that Civil Aviation Authority Norway verifies Avinor procedures regarding radar recording and storage with RaADS at ATS units using this system, to ensure that impounded recording files are kept until their proper release. (Recommendation 47/2005)

AIBN recommends that Avinor develops the playback function of NATCON to improve the possibilities for analysis of radar recordings. (Recommendation 48/2005)

AIBN recommends that the CNS-department at Bergen Flesland Airport reviews its recording equipment and ensures that time stamps on recorded events are made with reference to co-ordinated universal time (UTC). (Recommendation 49/2005)

APPENDIX

A cut from AIP Norway AD 2 ENBR 4-18 “Standard Arrival Chart Instrument (P-RNAV STAR based on VOR/DME FLS or GNSS except Class A GPS) Arrival from S” with tracks of WIF408 and ECA978 marked, based on ATC radar recorded by Avinor.



Reduction of distance during turn to base leg:

Aircraft A is trailing aircraft B with distance y when B is turned 90° left.

