FINAL REPORT

HCL 70/99	**Incident**		
Aircraft Type:	Boeing 737-500	Aircraft Registration:	G-MSKB
Engines:	2 CFM-56	Type of Flight:	Scheduled, IFR
Crew:	2/5 no injuries	Passengers:	54 no injuries
Place:	Billund Airport, EKBI	Date and Time:	3 December 1999, 1911 UTC

Notification

The Danish AAIB received the information concerning the incident from the Air Traffic Service at Billund Airport 6 December 1999.

Synopsis

All times in this report are UTC.

The flight was scheduled from Birmingham (EGBB) to Copenhagen (EKCH) with a scheduled time of departure at 1600 hrs, and a scheduled time of arrival at 1800 hrs. When the flight arrived at Copenhagen TMA, the crew were informed that they should expect a delay of approximately 10 minutes before they could start arrival from point 'LUGAS'. The crew received an expected approach time of 1732 hrs. The aircraft entered the holding pattern at reporting point 'LUGAS' at 1722 hrs. A new expected approach time (1743 hrs) was issued at 1734 hrs. The flight was cleared for the Standard Terminal Arrival Route, STAR, at 1737 hrs and the approach was initiated to runway 22 left. The flight was on approach at 3000 feet at1804 hrs. During the approach the weather got worse with wind gusts up to 70 knots. On short final the crew made a go-around at 1808 hrs. As the wind information for the destination alternate aerodrome, Malmo was missing the crew decided to divert to Billund (EKBI). During the approach to Billund runway 27 the weather got worse and on the final approach the crew received a 'cockpit wind shear warning'. Consequently, the crew made a go-around at 1853 hrs. The crew advised Billund ATC that they had to declare an emergency, as the expected remaining fuel during the following approach would be less than the Final Reserve Fuel. On the second approach to Billund the crew had to disregard wind shear warnings. The aircraft landed without any further incidents at 1911 hrs.

1. Factual information

1.1 History of the flight

The flight was planned from Birmingham to Copenhagen on 3 December 1999.

The Ground Operations staff planned the ATS Flight Plan, the Operational Flight Plan, and the Load Information.

The crew reported at the crew room at Birmingham Airport at approximately 1500 hrs and received a briefing package containing a Meteorological Briefing and an AIS Briefing.

Additional information was available to the crew through the Operator's system.

The AIS Briefing was printed at 1451 hrs on 3 December 1999.

The AIS Briefing included airports: Birmingham (EGBB), East Midlands (EGNX), Manchester (EGCC), Liverpool (EGGP), Leeds (EGNM), London Gatwick (EGKK), Bristol (EGGD), Amsterdam (EHAM), Copenhagen Kastrup (EKCH), Stockholm (ESSA), Hamburg (EDDH), Oslo (ENGM), Malmo (ESMS),

Goteborg (ESGG) and Copenhagen Roskilde (EKRK).

The Meteorological Briefing consisted of weather charts, TAFs and METARs covering the same airports as the airports covered in the AIS Briefing. The Meteorological Briefing was printed at approximately the same time as the AIS Briefing, but it has not been possible to recover this briefing for investigation purposes.

The route was planned via TNT VOR, airway A2, reporting point DENBY, airway UB1, OTR VOR, airway UL975 to VES VOR. An approach was planned from VES VOR to destination, Copenhagen Airport (EKCH). Malmo Airport (ESMS), was planned as the destination alternate aerodrome.
The aircraft had an underload of approximately 5500 kg, and was carrying 7 crew and 54 passengers. The commander had added approximately 1788 kg of extra fuel bringing the planned total amount of fuel onboard up to 7600 kg.

At 1520 hrs an aircraft landed at Billund Airport (EKBI), and exited the runway coming to rest on the grass surface south of the runway. Consequently at that time Billund Airport was closed.

The flight had an estimated time of departure from Birmingham (EGBB) at 1600 hrs.
After a minor ATC delay, the aircraft departed from the gate just 10 minutes after the estimated time of departure, ETD. Before engine start (at 1608 hrs) the actual fuel onboard was 17080 lb (7747 kg). The aircraft started to taxi out for take-off at 1610 hrs and was airborne at 1616 hrs carrying 16920 lb (7675 kg) of actual take-off fuel.
On this day, a low-pressure area was moving east towards the northern part of Denmark. A storm was developing with wind gusts of more than 90 knots in some parts of the southern and central part of Denmark.

The flight passed over the OTR VOR at 1633 hrs carrying approximately 6075 kg of fuel, or approximately 1975 kg more than the required fuel according to flight plan. The flight continued towards the North Sea and the Copenhagen FIR border.

The crew established radio contact with Copenhagen Control on 134.675 MHz at 1649 hrs.

At 1650 hrs a NOTAM was issued regarding Esbjerg Airport (EKEB). The airport was closed due to a massive destruction of buildings and debris from the buildings covering the runway.

Copenhagen Control established radar contact with the flight at 1654 hrs when it was over the North Sea cruising at FL 370. The aircraft had approximately 5425 kg of remaining fuel. At this time, the flight was cleared direct to VES VOR (located on the Danish west coast).

The EKDK SIGMET 2 valid for Copenhagen FIR was issued at 1545 hrs, but the information was not transmitted to the flight crew.

At 1700 hrs, and while flying over the North Sea, the flight was cleared direct to the reporting point

TUDLO (located approximately 71 nm and 253° from Copenhagen Airport). The remaining fuel was 5245 kg.

The crew requested descent from FL 370 at 1713 hrs, but was instructed to contact Copenhagen Control on 128.150 MHz. At this time the remaining fuel was 4970 kg.
Copenhagen Control cleared the flight to FL 330 and instructed the crew to turn left by 15° (to heading 080°). Shortly hereafter, Copenhagen Control instructed the crew to turn further left heading 060°. At 1716 hrs the flight was cleared for descend to FL 250.
The crew were then instructed to contact Copenhagen Control on 133.150 MHz.

The crew made radio contact with Copenhagen Control on 133.150 MHz at 1717 hrs.
Copenhagen Control cleared the flight to FL 150 and to fly direct to the reporting point LUGAS. Furthermore the crew were instructed to reduce the speed to 250 knots in order to adjust the estimated time over-head the reporting point LUGAS. The crew were informed that the expected approach time was 1732 hrs (from LUGAS holding pattern).

According to the operational flight plan the estimated time over LUGAS was 1725 hrs, however the flight arrived over LUGAS at 1722 hrs and entered the holding pattern descending through FL 200 with 4750 kg of remaining fuel.
Copenhagen Control cleared the flight to FL 120 at 1724 hrs and, on request from the crew, approved a delay of the descent for two minutes.

At 1733 hrs Copenhagen Control transmitted to all aircraft in the approach holding that the expected approach times would be postponed, due to the weather conditions at Copenhagen Airport.

At 1734 hrs Copenhagen Control issued a new expected approach time for the flight. The new expected approach time was 1743 hrs. The remaining fuel was now 4625 kg.

Copenhagen Control cleared the flight at 1737 hrs to turn left and fly direct to KORSA VOR and to follow the Standard Terminal Arrival Route, STAR, 'Lugas One Charlie'. The flight was then cleared for descent to FL 80 and later, at 1740 hrs, the crew was instructed to contact Copenhagen Approach on frequency 119.800 MHz. The remaining fuel was at this moment 4375 kg.

The crew made contact with Copenhagen Approach at 1741 hrs. At 1743 hrs the crew requested a heading correction to the left in order to avoid some clouds containing freezing moisture. Copenhagen Approach accepted and cleared the flight to FL 70.

At 1746 hrs Copenhagen Approach instructed the crew to reduce speed to a 'minimum clean speed'.
At 1747 hrs the crew asked if they could be turned right 10° or 15°, as the worse weather was to the left of them.
Copenhagen Approach could not accept the turn to the right, as there was traffic in that area, and added that it would not be possible for them to make the right turn for the next approximately 10 miles.

At 1748 hrs the flight was cleared to 5000 feet on QNH 970, and at 1749 hrs the flight was instructed to turn right heading 180°. Copenhagen Approach explained that this turn was required in order to reduce the ground speed of the aircraft. The flight was then cleared to 4000 feet (at 1750 hrs).

Both units of the wind measuring equipment at Malmo Airport were struck by lightning at 1750 hrs and was subsequently out of service.

Copenhagen Approach instructed the crew at 1752 hrs to turn left heading 040° for downwind.
The crew were then instructed to contact Kastrup Final on 119.100 MHz.

The crew made contact with Kastrup Final at 1753 hrs and were instructed to reduce speed to 180 knots.

Kastrup Final instructed the crew at 1755 to descend to 3000 feet and to turn right heading 090°.
A minute later, the crew were instructed to turn right heading 120° for base leg, shortly followed by the instruction to turn further right heading 160°.

At 1757 hrs the crew were instructed to turn right heading 190°, followed by a clearance for the ILS approach to runway 22 left. At this time, the remaining fuel was 3830 kg.

Kastrup Final instructed the crew at 1800 hrs to turn right heading 200° and to intercept the localizer, followed by the instruction to reduce speed to 170 knots and to maintain this speed until 5 miles final. The crew were furthermore instructed to contact Kastrup Tower on 118.100 MHz.

The crew made contact with Kastrup Tower at 1801 hrs and were informed that their flight was number four to land. The crew were informed that the surface wind direction was 210° and the wind velocity was 38 knots gusting 56 knots.

On the final approach, and while flying in turbulence, the CAS increased (for a few seconds) to 197 knots resulting in an overspeed of the maximum flaps / slats speed of 7 knots. To reduce the speed the crew momentarily used the speed brakes.

Kastrup Tower issued the landing clearance at 1808 hrs and informed the crew that the surface wind direction was 210° and the wind velocity was 45 knots gusting 70 knots. The landing clearance was issued when the aircraft was on less than a three mile final.

Few seconds later, due to the weather conditions and the wind information just received, the crew initiated a go-around procedure and was instructed by Kastrup Tower to climb straight ahead to 2000 feet. The remaining fuel was 3320 kg.
During the go-around the aircraft climbed into severe turbulence.

The succeeding aircraft requested a wind check, and the Tower informed them that the wind direction was 210°, the velocity 48 knots gusting to 70 knots.

Having received this information the succeeding aircraft also initiated a go-around.

At 1809 hrs the crew were instructed to climb to 3000 feet and to contact Kastrup Arrival on 118.450 MHz, but they missed to switch over to the new frequency. At 1811 hrs, and still in contact with the Kastrup Tower, the crew requested radar guidance to avoid the worst weather.

The crew were again instructed to contact Kastrup Arrival on 118.450 MHz.

The crew made contact with Kastrup Arrival at 1811 hrs and were instructed to turn left heading 120°. The Arrival then asked the crew to confirm that they would make a new approach to Copenhagen.

The crew responded that they were considering diverting to Malmo and they requested the actual weather report for Malmo Airport.

At this time, it was not possible for the crew to receive the wind information from Malmo ATIS.

Kastrup Arrival instructed the crew to turn right heading 180° (at 1815hrs), and the crew asked Kastrup Arrival if they could inform the crew about the actual weather conditions in Malmo. The remaining fuel was at this time 3030 kg. Kastrup Arrival replied that the actual weather report for the airport was on request.

Kastrup Arrival informed the crew at 1816 hrs that it was impossible to obtain any wind information from Malmo, as a thunderstorm was passing Malmo Airport. The crew were then instructed to turn right heading 220°. The crew informed Kastrup Arrival that they were seriously considering diverting to Billund Airport and that they requested the actual weather report from Billund. Kastrup Arrival informed the crew that Billund had had an accident and that the airport was closed, or at least it had been one hour ago, and that it was not known at this time if the airport was reopened.

At 1817 hrs the crew were instructed to turn right heading 270°, and the crew were informed that Kastrup Arrival would try to find the actual weather report for Billund. The crew were then asked if they wanted to climb, and the crew replied that they would like to have a higher FL. The remaining fuel was now 2975 kg.

At 1818 hrs the flight was cleared to FL 80, and the actual weather report for Billund Airport was transmitted to the crew: wind direction 270°, wind velocity 29 knots with gusts of 41 knots, with showers of rain-scattered clouds at 1200 feet, broken CB clouds at 1600 feet, temperature 6°C, dew point 6°C, and QNH 960 hPa.

The crew requested to divert to Billund immediately and also requested a climb to FL 200 at 1820 hrs with 2815 kg remaining fuel. At this moment, the aircraft was approximately 17 nm south of Copenhagen Airport and the direct distance to Billund Airport was approximately 122 nm.

Kastrup Arrival cleared the flight initially to climb to FL 200 direct to Billund Airport, but seconds later the flight was re-cleared, first to FL 160, then seconds later to FL 140.

The flight reached FL 140 at 1822 hrs on a position approximately 16 nm south of Copenhagen Airport.

At 1824 hrs Kastrup Arrival instructed the crew to contact Copenhagen Control on frequency 133.150 MHz. The crew contacted Copenhagen Control and were informed that Copenhagen Control had radar contact. At this moment, the remaining fuel was 2470 kg.

During the flight to Billund, it was necessary to use engine anti-icing and frequently also airframe anti-icing.

The crew requested descent at 1836 hrs and were cleared to descend to FL 90. The remaining fuel was now 2000 kg.

The crew were instructed to contact Billund Approach on frequency 127.575 MHz, and they made contact with Approach at 1839 hrs. Billund Approach cleared the flight to descend to FL 60 and to fly direct to the reporting point 'Loksa' (located on the centre line 11.5 nm east of threshold runway 27).

At 1840 hrs Billund Approach informed the crew of the latest weather report for Billund: wind direction at threshold runway 27 290°, wind velocity 42 knots, maximum velocity 73 knots, minimum 27 knots, visibility 7 kilometres in light rain showers, broken clouds at 1200 feet, broken CB clouds at 1500 feet, temperature and dew point 4°C, and QNH 965 hPa. Furthermore, Billund Approach informed the crew that severe turbulence on final runway 27 was reported one hour ago.
Billund Approach informed the crew to expect straight-in ILS approach to runway 27, and that the runway was wet with some standing water up to 4 millimetres on the southern side of the runway.

Billund Approach cleared the flight to descend to 3000 feet on QNH 965 hPa at 1842 hrs. At this moment, the remaining fuel was 1835 kg. A few seconds later, Billund Approach informed the crew that the new QNH was 966 hPa.

Billund Approach cleared the flight for the ILS approach to runway 27, and the crew reported that they were established on the localizer to runway 27. They were then instructed to contact Billund Tower on frequency 119.000 MHz.

The crew made contact with Billund Tower at 1847 hrs and were informed that they were 'number one' for the approach, and that the wind direction was 280°, wind velocity 50 knots gusting 76 knots, minimum 24 knots. They were also informed that they would receive continues wind information on final approach. At this time, the remaining fuel was 1710 kg.

Billund Tower cleared the flight to land on runway 27 at 1850 hrs and informed the crew that the wind direction was 290°, wind velocity 48 knots gusting 66 knots, minimum 24 knots.

A minute later, Billund Tower informed the crew that the new QNH was 967 hPa, and that the wind

direction was 280°, wind velocity 42 knots gusting 65, knots minimum 24 knots.

At 1852 hrs Billund Tower again informed the crew about the wind conditions (280°/42, gusts 65, minimum 24).

The aircraft wind shear warning system detected a wind shear at 1852 hrs and warned the crew when the aircraft was at approximately 832 feet MSL (588 feet above threshold runway 27). Consequently, the crew initiated the go-around procedure.

At 1853 hrs the crew reported that they were going around, and Billund Tower instructed the crew to climb to 2000 feet on QNH 967 hPa and to contact Billund Approach on the frequency 127.575 MHz. The remaining fuel was now 1580 kg.

During the missed approach procedure and while flying in severe turbulence the maximum speed of the flaps / slats was exceeded.

The crew made contact with Billund Approach and asked if Esbjerg Airport had better weather conditions. Billund Approach informed the crew that Esbjerg Airport was closed, as the airport had been damaged (massive destruction of buildings and debris from buildings covering the runway). The crew then asked for another approach to Billund. Billund Approach informed the crew of two other airports in the area, but as the crew did not have complete data for the two airports (Karup and Aarhus), they decided to make another approach to Billund.

At 1856 hrs and with 1350 kg of remaining fuel, the crew were informed that the weather conditions at Billund were unchanged. The crew asked to be turned back for a new approach, and Billund Approach instructed the crew to turn left heading 090° and to climb to 3000 feet.

At 1857 hrs the crew informed Billund Approach that they had to declare an emergency and requested that the emergency services should be standing by. The crew informed Billund Approach that there was no other option than to land at Billund Airport.

At 1858 hrs Billund Approach asked the crew to inform them about the numbers of passengers and crew, as well as the amount of fuel upon landing – when time permitted.
At 1859 hrs the crew informed Billund Approach that there were 54 passengers and 7 crewmembers on board and that the estimated amount of fuel upon landing was 900 kg.

Billund Approach then offered the crew an ILS approach starting from 1800 feet, or a longer ILS approach starting from 3000 feet. The crew chose the approach starting from 3000 feet.

Billund Approach instructed the crew to turn left heading 360° for base leg and informed the crew that there was around 16 track miles to touch down, and that the wind direction at threshold runway 27 was 290°, wind velocity 40 knots, maximum 71 knots, minimum 27 knots. The time was now 1901 hrs and the remaining fuel was 1190 kg.

At 1902 hrs Billund Approach instructed the crew to turn left heading 300° and informed them that they were cleared for ILS approach to runway 27.

The crew informed Billund Approach that they were established on the localizer to runway 27. The time was now 1903 hrs and the remaining fuel was 1090 kg. The crew were instructed to contact Billund Tower on frequency 119.000 MHz.

The crew established contact with Billund Tower at 1903 hrs and the aircraft was cleared to land on runway 27. Billund Tower informed the crew that the actual wind direction was 290°, wind velocity 46 knots, maximum 71 knots, minimum 27 knots.

At 1907 hrs Billund Tower informed the crew that the new QNH was 968 hPa and that the surface wind was 290°, 45 knots.

At 1910 hrs Billund Tower informed the crew that the wind direction was 290°, wind velocity 43 knots gusting 66 knots.

At 1911 hrs the aircraft landed on runway 27 with 890 kg of remaining fuel.

During the last 2 minutes of the final approach the Airspeed (CAS) varied between 128 and 145 knots and the Groundspeed varied between 67 and 114 knots. The headwind component decreased from 64 knots to 31 knots.

On the last ILS approach to runway 27, the crew had to disregard the wind shear warnings (airspeed fluctuations and turbulence) in order to make the landing at Billund.

In order to comply with the wind limitations for ground operations the crew had to request wind checks during the taxi to the parking area.

During the flight the crew routinely received ATIS and VOLMET information using one of the VHF radios.

Later that day, a stroke of lightning hit the Malmo Tower. Malmo Airport was closed from 1945 hrs until the next day at 0700 hrs.

1.2 Injuries to persons

Injuries to persons

	Fatal	Serious	Minor	None
Commander	-	-	-	1
First officer	-	-	-	1
Cabin crew	-	-	-	5

Passengers	-	-	-	54
Other	-	-	-	-

1.3 Damage to aircraft

None. The inspection on 4th December 1999 after the flight did not reveal any defects caused by over speed of the flaps / slats, nor any defects caused by the severe turbulence.

1.4 Other damage

None.

1.5 Personnel information

The commander Age 52, male

Licence ATPL issued 28.01.1991

Type rating Boeing B737 issued 03.02.1999

Medical licence valid until 31.12.1999

Flying experience

	Last 24 hrs	Last 90 days	Total
All types	3	230	8300 hours
On type	3	230	235 hours
Landings	1	150	9000

The first officer Age 43, male

Licence ATPL issued 21.10.1997

Type rating Boeing B737 issued 24.12.1997

Medical licence valid until 31.01.2000

Flying experience

	Last 24 hrs	Last 90 days	Total
All types	7	200	3100 hours
On type	7	200	1300 hours
Landings	2	100	2000

1.6 Aircraft information

1.6.1 General aircraft information

Manufacturer: Boeing

Type: B737-500

Date of manufacture: 07.12.1990

Serial number: 24928

Aircraft registration: G-MSKB

Certificate of Airworthiness issued	12.11.1999	Valid until	11.11.2002
Certificate of Registration issued	18.11.1996	Valid until	No expiry date

1.6.2 Airframe

Time since new	22122 hours	17870 Landings
Time since overhaul	N/A	
Time since last inspection	'IA' Check c/o at 22101 Hrs	17856 Landings

1.6.3 Engines

Manufacture:	CFM	L/H (Port)	R/H (Starboard)
Type:		CFM 56	CFM 56
Model:		CFM 56-3-C1	CFM 56-3-B1
Date of Manufacture		1997	1990
Serial Numbers		858679	724635

1.6.4 N/A

1.6.5 Auxiliaries

There were no defects.

1.6.6 Defects

There were no defects.

1.6.7 Weight and balance

Operational flight preparation

Loadsheet (The Loadsheet data is partly presented below).

All weights in kilos

From/To	Flight	A/C Reg	Version		Crew	Date	Time
BHX CPH		GMSKB	735G 35C71M		2/5	03DEC99	1545
		Weight	Distribution				
Load in compartment		663	4/	663			
Passenger / Cabin bag			4457	38/ 15/ 0/ 0 TTL 53 Pax 0/ 21/ 32 SOC 0/ 0/ 0/ BLKD 0			
Total Traffic Load		05120					
Dry Operating Weight		33701					
Zero Fuel Weight Actual		38821		Max	46493		
Take Off Fuel		07500					
Take Off Weight Actual		46321		Max	51899	L	
Trip Fuel		03200					
Landing Weight Actual		43121		Max	49895		

Balance and Seating Conditions

BI	35.1	DOI	40.0
LIZFW	40.8	LITOW	41.5

Stab TO 4.5 Nose Up
Stab for 5/15 Flaps Only.
A19.B29.C5

Under Load before LMC	05578	
Last Minute Change, LMC	+1 Male	+88

Supplementary Information, SI

Basic Weight, BW 31950	Basic Index, BI 35.1	Catering 1207/6.7

1.6.8 Fuel and Time planning

Operational flight preparation

The flight was planned from Birmingham, BHX, EGBB, with an estimated time of departure, ETD, 1600 HRS UTC to Copenhagen, CPH, EKCH, with an estimated time of arrival, ETA, 1725 HRS UTC.
The destination alternate aerodrome was Malmo, MMX, ESMS.

	Fuel kg.	Time h:m	
Trip Fuel, TIF, from EGBB to EKCH	3200	01:25	647 nm W/C P71
Contingency	0535	00:15	
Diversion, from EKCH to ESMS	0935	00:23	FL130 M1 108 nm
Reserve, 30 minutes of holding	1042	00:30	
Required	5712	02:33	
Extra	1788		
Taxi	0100		
Tanks	7600		

Over-head diversion					
From CPH to MMX/ESMS	0300	00:21	FL370	M1	108 nm
Diversion					
From CPH to BLL/EKBI	1418	00:35	FL160	M36	160 nm

Note: The Reserve (Fuel) above is the same as Final Reserve Fuel according to the definition in JAR OPS 1. The amount of Reserve (Fuel) equals 30 minutes of holding at the Destination Alternate Aerodrome.

1.6.9 Limitations

According to the operators Boeing 737 Flying Manual following limitations apply

Wind Velocities

Maximum For Airstair Operation	40 knots	
Maximum Wind Encountered Whilst On Ground		65 knots

(After which a structural and functional check is required)

Maximum Crosswind Components – Take-Off / Landing

Dry	35/40 knots
Wet	25/40 knots

Note: When using asymmetric thrust reduced to 25 knots for landing

Contaminated (braking action better than poor)	15 knots
Icy/Slippery (braking action poor or less)	10 knots

Maximum Tailwind	Take-Off	10 knots
	Landing	10 knots

Maximum Gross Weights

Taxi	55999 kg
Take-Off	55899 kg
Landing	49895 kg
Zero Fuel	46493 kg

Fore economical reasons the Operator was using different Maximum Take-off Masses depending on the route to be operated.

Flaps Limiting Speeds

1&2	230 knots
5	225 knots
10	210 knots
15	195 knots
25	190 knots
30	185 knots
40	158 knots

Alternate Flap Extend 230 knots

AFM, Low Fuel Quantity

With less than 1,000 pounds (454 kilograms) indicated fuel load in either wing tank turn ON both wing tank boost pumps, open crossfeed valve and apply thrust as required. Avoid sustained high nose-up attitudes.

FCTM, Flight Operations with Low Fuel.

A low fuel condition exists when indicated fuel quantity is 1000 pounds/453 kilograms of fuel or less in either main tank. With this condition, open the crossfeed and turn on all fuel pumps switches. Avoid sustained high nose-up attitudes and excessive acceleration to prevent uncovering of the fuel pumps.

1.7 Meteorological information

General

The description of the weather conditions at Billund Airport on 3 December 1999 at 1720 HRS UTC.

A low-pressure area (953 hPa) was located at Hals (N 57° 00’ E 010° 19’) at 1800 HRS UTC.

Precipitation:	Rain showers		
Visibility:	6 km		
Clouds:	SCT/BKN ST/SC/CB	Cloud base:	800–1200 feet
Freezing level:	3000 feet		
Icing:	Moderate in clouds, CB		
Turbulence:	Moderate to severe Topographic turbulence and with CB activity		
Surface wind:	240-270° 30-35 knots in gusts 45-50 knots		
Wind at 500 feet:	240° 40 knots		
Wind at 1000 feet:	240° 40 knots		
Surface temp.:	6°C		
Dew point:	6°C		

The low-pressure area passed over the North Sea where the water temperature was a few degrees higher than the temperature used as input in the weather forecast model. The air in the low-pressure area received more energy from the water than anticipated, which resulted in a pressure drop of approximately 5 hPa, and a reduction of speed in the centre of the low-pressure area. Consequently, the pressure gradient was increased to a level above the forecasted which resulted in an increase of wind velocity.

1.7.1 Weather forecasts TAF & SIGMET

Weather reports issued between 1400-1500 hrs UTC, TAF & SIGMET.

Copenhagen, CPH
EKCH 031440Z 031524 19025G40KT 6000 –RA BKN015 TEMPO 1524 4000 SHRA BKN012CB BECMG 1517 24030G45KT TEMPO 1720 26030G55KT BECMG 2022 28030G55KT=

Malmo, MMX
ESMS 031430Z 031524 21024G48KT 6000 RA SCT006 BKN012 TEMPO 1524 2000 RA BKN004 PROP30 1524 RASN=

Billund, BLL
EKBI 031500Z 031524 23030G55KT 8000 BKN020 TEMPO 1524 2000 SHRASNGS BKN010CB BECMG 1820 30030G55=

Esbjerg, EBJ
EKEB 031500Z 031523 23025G55KT 8000 BKN015 TEMPO 1523 2000 SHRASNGS BKN010CB BECMG 1719 30040G60KT=

Aalborg, AAL
EKYT 031440Z 031524 16025G35KT 8000 SCT008 BKN015 BECMG 1517 21022G45KT TEMPO 1519 2000 SHRA TSRA BKN008 BKN012CB BECMG 1921 27025G50KT TEMPO 1924 2000

SHSNRA SHGR BKN008 BKN012CB=

Aarhus, AAR
EKAH 031500Z 031524 22022G40KT 8000 BKN015 TEMPO 1520 2500 SHRASN BKN010CB BECMG 1820 30030G45KT=

SIGMET valid 1200-1600 HRS UTC.

WSDN31 EKCH 031200
EKDK SIGMET 1 VALID 031200/031600 EKMI
COPENHAGEN FIR MOD/SEV TURB FCST BELOW 3000FT OVER SW-PART EKDK MOV E. NC=

Weather reports issued between 1500-1910 hrs UTC, TAF & SIGMET.

Copenhagen, CPH
EKCH 031650Z 031624 24045G65KT 6000 –RA BKN015 TEMPO 1620 4000 SHRA TSRA BKN012CB BECMG 2022 28035G55KT TEMPO 2024 1200 SHRASNGS BKN008 BKN012CB=

Malmo, MMX
ESMS none

Billund, BLL
EKBI 031600Z 031624 23045G70KT 8000 BKN015 TEMPO 1624 2000 SHRASNGS BKN010CB BECMG 1820 30030G55KT=

Esbjerg, EBJ
EKEB 031600Z 031623 24050G80KT 8000 BKN020 TEMPO 1623 2000 TSRA SHRASNGS BKN010CB BECMG 1719 30040G60KT=

Aalborg, AAL
EKYT none

Aarhus, AAR
EKAH 031510Z 031524 22022G40KT 8000 BKN015 TEMPO 1520 2500 TSRA SHRASN BKN010CB BECMG 1820 30030G45KT=

SIGMET valid 1600-2000 HRS UTC.
WSDN31 EKCH 031545
EKDK SIGMET 2 VALID 031600/032000 EKMI –
COPENHAGEN FIR SEV TURB FCST BELOW 3000FT S-PART MOV E NC=

1.7.2 Actual weather report METAR, SPECI & ATIS

Weather reports issued between 1400-1500 hrs UTC, METAR & SPECI.

Copenhagen, CPH
EKCH 031407Z 19029G43KT 9000 RA FEW009 BKN016 BKN020 05/04 Q0984 TEMPO BKN012=
EKCH 031420Z 19028G40KT 9000 RA FEW009 BKN015 BKN020 05/04 Q0983 TEMPO BKN012=
EKCH 031434Z 19028G43KT 9999 RA FEW008 BKN012 BKN020 05/04 Q0982 TEMPO BKN015=
EKCH 031450Z 19029G40KT 8000 –RA FEW008 BKN012 BKN020 05/04 Q0981 RERA TEMPO BKN015=

Malmo, MMX
ESMS 031420Z 18031KT 6000 RA BR SCT011 BKN013 05/04 Q0985 1729//95=
ESMS 031450Z 18029G39KT 6000 RA BR SCT010 BKN015 05/04 Q0983 1729//95=

Billund, BLL
EKBI 031410Z 21028G51KT 2500 RA BR SCT006 BKN008 08/07 Q0971=
EKBI 031420Z 21032G61KT 160V260 8000 –SHRA SCT009 BKN013CB 07/07 Q971 RERA=
EKBI 031450Z 23032G54KT –SHRA SCT012 BKN016CB 07/04 Q0969 RERA=

Esbjerg, EBJ
EKEB 031450 230235/50KT 5000 –SHRA FEW008 SCT020CB BKN030 08/08 Q0969=

Aalborg, AAL
EKYT 031412Z 14018G28KT 5000 –RASN BR BKN007 BKN014 04/03 Q0968 76290095=
EKYT 031421Z 16019G36KT 120V200 5000 RA BR BKN007 BKN014 05/03 Q0968 76290095=
EKYT 031439Z 17015KT 8000 –TSRA BKN007 SCT014CB BKN022 05/04 Q0966 76290095=
EKYT 031444Z 16015KT 6000 –TSRA FEW007 BKN014CB BKN022 05/03 Q0965 76290095=
EKYT 031450Z 19018G31KT 140V240 4000 TSRA FEW007 BKN014CB BKN022 05/04 Q0966 76290095=

Aarhus, AAR
EKAH 031420Z 19013G33KT 120V260 5000 RA BKN006 OVC008 06/06 Q0972=
EKAH 031452Z 20016G36KT 130V280 9000 –SHRA SCT006 BKN015CB 07/05 Q0970=

Weather reports issued from 1500 hrs to 1910 hrs UTC, METAR, SPECI & ATIS.

Copenhagen, CPH
EKCH 031520Z 19029G42KT 8000 RA FEW006 BKN012 BKN020 05/04 Q0979 TEMPO BKN015=
EKCH 031550Z 20031G44KT 9999 –RA FEW006 BKN016 BKN022 06/05 Q0977 RERA TEMPO BKN012=
EKCH 031620Z 20029G48KT 9999 FEW006 SCT016 BKN025 06/05 Q0975 TEMPO BKN012=
EKCH 031629Z 20032G58KT 9999 FEW006 SCT016 BKN025 06/04 Q0975 TEMPO BKN012=
EKCH 031645Z 21032G50KT 9999 FEW006 SCT016 BKN025 06/04 Q0974 TEMPO BKN012=
EKCH 031652Z 21030G45KT 9000 –SHRAGS SCT025CB BKN090 06/03 Q0974 TEMPO BKN012=

EKCH 031706Z 21026G44KT 9000 SCT025CB BKN090 06/04 Q0973 TEMPO BKN012=

EKCH 031720Z 21031G46KT 9000 –SHRA FEW025CB SCT045 BKN090 07/03 Q0972 TEMPO BKN012=
EKCH 031724Z 21032G48KT 6000 SHRA FEW006 BKN022CB BKN090 07/03 Q0972 TEMPO BKN012=
EKCH 031725Z 22032G55KT 6000 SHRA FEW006 BKN022CB BKN090 07/03 Q0971 TEMPO BKN012=
EKCH 031739Z 21036G56KT 9000 –SHRA FEW006 BKN022CB BKN090 06/03 Q0970 TEMPO BKN012=
EKCH 031750Z 22039G63KT 9999 FEW006 SCT022CB BKN045 06/01 Q0969 TEMPO BKN012=
EKCH 031809Z 21042G70KT 9999 –SHRA FEW006 SCT022CB BKN045 06/02 Q0967 TEMPO BKN012=
EKCH 031820Z 21047G66KT 9999 –SHRA FEW006 SCT022CB BKN045 06/02 Q0966 TEMPO BKN012=
EKCH 031826Z 21047G75KT 9999 –SHRA FEW006 SCT022CB BKN045 06/03 Q0965 TEMPO BKN012=
EKCH 031834Z 21047G69KT 4000 SHRA FEW006 BKN022CB BKN045 05/04 Q0965 BECMG 6000 TEMPO BKN012=
EKCH 031844Z 22048G71KT 4000 SHRA FEW006 BKN022CB BKN045 05/04 Q0964 BECMG 6000 TEMPO BKN012=
EKCH 031848Z 22050G81KT 3000 SHRA FEW006 BKN022CB BKN045 05/04 Q0964 BECMG 6000 TEMPO BKN012=
EKCH 031850Z 22050G81KT 5000 SHRA FEW006 BKN022CB BKN045 05/03 Q0964 BECMG 6000 TEMPO BKN012=

Malmo, MMX
ESMS 031520Z 18026KT 5000 RA BR SCT007 BKN010 05/04 Q0981 1729//95=
ESMS 031550Z 19029KT 6000 RA BR SCT006 BKN009 05/04 Q0979 1729//95=
ESMS 031620Z 19029G40KT 6000 RA BR SCT006 BKN008 05/05 Q0978 1729//95=
ESMS 031650Z 20028G40KT 7000 RA BR SCT007 BKN009 06/05 Q0976 1729//95=
ESMS 031720Z 20030G46KT 8000 SHRA BR SCT020CB BKN025 06/05 Q0974 1729//95=
ESMS 031750Z 21025KT 8000 TSRA BR SCT020CB BKN025 06/04 Q0972 1729//95=
ESMS 031820Z /////KT 8000 BR SCT020 06/03 Q0970 1729//95=
ESMS 031850Z /////KT 8000 BR SCT030 06/02 Q0967 1729//95=

Billund, BLL
EKBI 031520Z 21036G59KT 6000 –SHRA SCT013 BKN018CB 06/04 Q0966=
EKBI 031550Z 22047G72KT 8000 SHRA SCT010 BKN016CB 06/03 Q0962=
EKBI 031620Z 23042G64KT 6000 SHRA SCT008 BKN012CB 05/04 Q0959=
EKBI 1650Z 24038G55KT 5000 SHRAGS SCT007 BKN010CB 05/05 Q0957=
EKBI 031720Z 24030G49KT 6000 –SHRA SCT008 BKN012CB 06/06 Q0958 RERAGS=
EKBI 031750Z 27029G41KT 9999 –SHRA SCT012 BKN016CB 06/06 Q0960 RERAGS=

EKBI 031820Z 28047G66KT 7000 –SHRA BKN012 BKN015CB 04/04 Q0963=
EKBI 031850Z 28043G62KT 7000 –SHRA BKN012 BKN018CB 04/04 Q0966=

Esbjerg, EBJ
EKEB 031520Z 24052G84KT 200V260 3500 SHRA SCT009 BKN020CB 07/04 Q0966=
EKEB 031550Z 24052G86KT 2500 SHRA FEW009 SCT020CB BKN030 06/05 Q0963=
EKEB 031603Z 24058G87KT 220V280 3500 SHRA FEW009 SCT020CB BKN030 05/05 Q0962=
EKEB 031615Z 25057G94KT 3000 SHRA FEW009 SCT018CB BKN030 06/06 Q0962=
EKEB 031620Z 25056G88KT 3000 R08/1500N R26/P1500U SHRA SCT015CB BKN025 05/05 Q0962=
EKEB 031650Z VRB54G88KT 2500 SHRA SCT015CB BKN025 05/05 Q0962=
EKEB 031720Z 27056G78KT 3000 SHRA BKN025 05/05 Q0963=
EKEB 031750Z 29059G94KT 2500 SHRA SCT015CB BKN025 04/04 Q0967=
EKEB 031820Z 28054G78KT 4000 SHRA SCT015CB BKN025 05/04 Q0971=
EKEB 031850Z 29052G79KT 4000 SHRA SCT015CB BKN020 05/04 Q0973=

Aalborg, AAL
EKYT 031520Z 19014G30KT 160V240 9999 VCSH FEW007 SCT014CB 04/02 Q0963 RETS 76290095=
EKYT 031538Z 17010KT 130V200 7000 –SHRA FEW007 BKN014CB 04/02 Q0962 7690095=
EKYT 031550Z 17015G28KT 140V210 9999 VCSH SCT014CB 05/02 Q0961 76290095=
EKYT 031610Z 18017KT 8000 –SHRA SCT014CB 05/04 Q0959 76290095=
EKYT 031620Z 18014KT 140V200 8000 –SHRA SCT014CB 04/02 Q0958 76290095=
EKYT 031650Z 15009KT 8000 –SHRA BKN018CB 04/02 Q0955 76290095=
EKYT 031720Z 07008KT 040V100 6000 –RA BKN012 03/02 Q0954 76290095=
EKYT 031750Z 35007KT 310V060 5000 SHRA SCT006 BKN012CB BKN024 03/02 Q0955 76290095=
EKYT 031820Z 33009KT 300V010 9999 SCT012CB BKN030 BKN050 02/02 Q0956 76290095=
EKYT 031850Z 31010KT 280V340 9999 FEW020 02/02 Q0957 76290095=

Aarhus, AAR
EKAH 031511Z 20013G33KT 130V290 9000 TSRA SCT006 BKN015CB 07/06 Q0969=
EKAH 031519Z 22014G38KT 130V270 9000 –SHRA SCT006 BKN015CB 07/05 Q0968 RETS=
EKAH 031549Z 21017G41KT 9000 –SHRA FEW006 SCT015CB SCT040 07/03 Q0966=
EKAH 031619Z 21019G43KT 140V260 5000 –SHRA FEW006 SCT015CB SCT040 06/03 Q0962=
EKAH 031649Z 21019G41KT 150V280 5000 –SHRA FEW006 SCT011CB BKN020 05/03 Q0959=
EKAH 031720Z 21016G40KT 140V260 5000 –SHRA SCT011CB BKN018 05/03 Q0955=
EKAH 031734Z 22016G30KT 170V280 5000 –SHRA SCT011CB BKN018 05/04 Q0954=
EKAH 031750Z 22015G33KT 170V300 8000 –SHRA SCT014CB BKN020 05/04 Q0954=
EKAH 031818Z 26022G42KT 210V290 8000 –SHRA SCT014CB BKN020 06/04 Q0954=
EKAH 031850Z 27028G45KT 230V300 9999 SCT015CB BKN022 05/03 Q0956=

Copenhagen, CPH

EKCH ARRIVAL ATIS time 1809 hrs UTC
This is Copenhagen airport arrival information kilo
One eight zero nine
Expect ILS approach runway in use for landing two two left
Runway wet with patches
Transition level six five
Reduced separation procedures on final
After landing expedite vacating runway
Wind for landing two one zero degrees four eight knots maximum seven zero minimum two three knots
Visibility one zero kilometres
Light showers of rain
Few six hundred feet scattered cumulonimbus two thousand two hundred feet broken four thousand four hundred feet
Temperature six dew point two QNH nine six seven
Tempo broken one thousand two hundred feet
This was Copenhagen airport arrival information kilo.

Billund, BLL
EKBI ATIS time 1621 hrs UTC
Billund airport information charlie
One six two zero
Expect radar vectoring for ILS approach
Runway in use two seven
Runway wet transition level five zero
Wind two four zero degrees four zero knots maximum six zero knots
Minimum one six knots
Visibility six kilometres showers of rain
Scattered eight hundred feet broken cumulonimbus one thousand two hundred feet
Temperature five dew point four QNH nine five eight
This was Billund airport information charlie

Billund, BLL
EKBI ATIS time 1634 hrs UTC
Billund airport information delta
One six two zero
Expect radar vectoring for ILS approach
Runway in use two seven
Runway wet transition level five zero
Runway two seven closed due to disabled aircraft
Runway expected operational at one seven four five
Wind two four zero degrees four zero knots maximum six zero knots minimum one six knots
Visibility six kilometres showers of rain
Scattered eight hundred feet broken cumulonimbus one thousand two hundred feet
Temperature five dew point four QNH nine five eight

This was Billund airport information delta
(Billund ATIS between 1634 and 1737 hrs UTC are intentionally not included).

Billund, BLL
EKBI ATIS time 1737 hrs UTC
Billund airport information India one seven two zero
Expect radar vectoring for ILS approach
Runway in use two seven
Runway wet transition level five zero
Runway two seven closed due to disabled aircraft
Runway expected operational at one seven four five
Wind two five zero degrees three two knots maximum four eight knots minimum one six knots
Visibility six kilometres light showers of rain
Scattered eight hundred feet broken cumulonimbus one thousand two hundred feet
Temperature six dew-point six QNH nine five nine
Recent rain and small hail
This was Billund airport information india

Billund, BLL
EKBI ATIS time 1739 hrs UTC
Billund airport information juliet
One seven three eight
Expect radar vectoring for ILS approach
Runway in use two seven
Runway wet transition level five zero
Wind two eight zero degrees two seven knots maximum four nine knots minimum one six knots
Visibility one five kilometres light showers of rain
Scattered one thousand two hundred feet broken cumulonimbus one thousand five hundred feet
Temperature six dew-point six QNH nine five nine
Recent rain and small hail
This was Billund airport information juliet

(Billund ATIS between 1739 and 1850 hrs UTC are intentionally not included).

Billund, BLL
EKBI ATIS time 1850 hrs UTC
Billund airport information victor
One eight five zero
Expect radar vectoring for ILS approach
Runway in use two seven
Runway wet transition level four five
Wind two eight zero degrees four four knots maximum six six knots minimum two four knots
Visibility seven kilometres light showers of rain

Broken one thousand two hundred feet broken cumulonimbus one thousand eight hundred feet
Temperature four dew point four
QNH nine six six
Severe turbulence reported on final runway two seven
This was Billund airport information victor.

Esbjerg, EBJ,
EKEB. ATIS was not installed at Esbjerg Airport.

1.8 Aids to navigation

The aircraft was equipped with FMS.
The navigation aids at Copenhagen and Billund Airports were serviceable while the navigation aids at Esbjerg Airport were unserviceable.

1.9 Communications

The aircraft was equipped with VHF and HF communication radio systems.
The crew communicated with ATC using the VHF radios.

1.10 Aerodrome information

Copenhagen, CPH,
EKCH

Position (ARP)	55 37 05N 012 39 22E		
Elevation	17 feet MSL		
Runway 22L (MAG 221.1°)	3300 x 45 meters	ILS CAT II & III	GP 3°
Approach Light System 22L	900 meters White		
Pavement Strength (all runways)	PCN 80 /F/C/X/U		
Aerodrome category for fire fighting	CAT 9		

Ground-based wind shear detection equipment was available. This system, SINSITRON DOPPLER-SODAR was a remote-sensing instrument for detection of wind and temperature in the lower atmosphere. The equipment operated according to the same principle as a radar, but acoustic waves were being used instead of microwaves. Short, powerful sound pulses were transmitted and received by antennas, orientated in three different directions. The antennas were operated alternatively and provided information about the horizontal and vertical wind by putting together wind components and integrate in time.

The function of one antenna channel is described below, as the working procedure for all three antennas was the same. The powerful sound-pulse hit areas of temperature variability in the atmosphere, which caused echoes that were sent back to the antenna. The magnitude of the echoes corresponded to the intensity of the temperature structure in the air mass drifting over the antenna. The frequency content of the echoes was correlated with the motion of the air mass and by comparing transmitted and received frequency (Doppler), the real velocity will be obtained. The microprocessor in the system had the control function of the computer.

The digitalized data of the computer contained wind data from the three antennas and the temperature structure from the vertical antenna. The software calculates the wind speed, as well as direction and temperature intensity at different height levels. The calculated data was presented on a colour display in tables and graphs where the temperature structure was classified in colours depending on the intensity.

The result of the detection was not displayed at Tower controller position, but was only used as information in the ATIS.

Due to the high wind velocity and the generated background noise, the system was not able to record any wind shear. The SODAR system was mainly designed to detect wind shear at low wind speed conditions.

Billund, BLL,
EKBI

Position (ARP)	55 44 25N 009 09 06E			
Elevation	247 feet MSL			
Runway 27 (MAG 267.8°)	3100 x 45 meters	ILS CAT II & III	GP 3°	
Approach Light System runway 27	900 meters			
Pavement Strength (all runways)	PCN 110 /F/A/X/T			
Aerodrome category for fire fighting	CAT 9			

Ground-based wind shear detection equipment not available.
ATS Communication Facilities

ATIS C/S Billund Airport Information	Freq 118.775	DOC: FL 200 / 60NM	Language EN

Note: DOC is Designated Operational Range.

Esbjerg, EBJ,
EKEB

Position (ARP)	55 31 33N 008 33 04E			
Elevation	97 feet MSL			
Runway 26 (MAG 261.5°)	2600 x 45 meters	ILS CAT II	GP 3°	
Approach Light System 26	900 meters			
Pavement Strength (all runways)	PCN 60 /F/A/W/T			
Aerodrome category for fire fighting	CAT 5			

Ground-based wind shear detection equipment not available.

Malmo, MMX,
ESMS

Position (ARP)	55 32.9N 013 21.2E			
Elevation	236 feet MSL			
Runway 17 (MAG 172°)	2800 x 45 meters	ILS CAT II	GP 3°	
Approach Light System runway 17	900 meters			
Pavement Strength (17/35)	PCN 80 /F/B/X/T			
Aerodrome category for fire fighting	CAT 7			

AIS Briefing issued by Birmingham AIS at 1451 hrs (only the parts including Swedish and Danish aerodromes are quoted).

AIS Briefing BHX-CPH

Copenhagen Kastrup

EKCH --- Acft to contact Kastrup Apron on freq 121.90 acft to state cnfmd tkof time.

--- Rwy 22R LLZ/DME. DA 490 HAT 476. RVR CAT C 1200 CAT D 1600 Oct 250500-Jan 071600.

--- Rwy 22L VOR/DME. DA 480 HAT 472. RVR CAT C 1200 CAT D 1600 Oct 250500- Jan 071600.

--- Twy S renamed NB.

--- Twy M C/Line lgts U/S.

The following alternates have no significant items.

MMX (Malmo, ESMS), GOT (Goteborg, ESGG), RKE (Copenhagen Roskilde, EKRK).

En route nav aids.

Sweden

---Nil

Denmark

---Nil

The AIS Briefings are issued through the system of another British operator. They are specific to the Operator.

The Danish Airport AIS offices transmit the request for a NOTAM to the International NOTAM Office - NOF EKCH who then issues and transmits the NOTAM to the stations on the addressee list. The communication system used to transmit NOTAMs was the AFTN system.

Note: AFTN is Aeronautical Fixed Telecommunications Network.

NOTAMs issued after 1451 or not included in the AIS Briefing issued by Birmingham AIS at 1451 hrs.

Billund, BLL,

EKBI

(A0471/99 NOTAMN

Q) EKDK/QMRLC/IV/NBO/A/000/999/

A) EKBI B) 9912031630 C) 9912031750

E) Rwy 27 closed due to disabled aircraft)

(EKBI AIS transmitted the request for this NOTAM to EKCH AIS at 1630 hrs).

The NOTAM referred to above was issued following an incident that took place on 3 December 1999 at

1520 hrs UTC. The result of the investigation regarding this incident was published in HCL Information, No. 2/2000 (in Danish). Runway 27 at EKBI was closed for landing from 1521 hrs to 1725 hrs UTC on 3 December 1999.

Esbjerg, EBJ,
EKEB
(B0979/99 NOTAMN
Q) EKDK/QIXAS/I/B/A/000/999/
A) EKEB B) 9912031429 C) 9912061600EST
E) L HP 376 KHz U/S)
(The time EKEB AIS transmitted the request for this NOTAM to EKCH AIS is unknown).

(B0981/99 NOTAMN
Q) EKDK/QFALC/IV/NBO/A/000/999/
A) EKEB B) 9912031650 C) 9912040700EST
E) AD Closed due to massive destruction of buildings
and debris from buildings covering the runway)
(EKEB AIS transmitted the request for this NOTAM to EKCH AIS at 1650 hrs).

(B0984/99 NOTAMN
Q) EKDK/QICAU/I/BO/A/000/999/
A) EKEB B) 9912031929 C) 9912041200EST
E) ILS Rwy 26 not avbl)
(EKEB AIS transmitted the request for this NOTAM to EKCH AIS at 1830 hrs).

(B0985/99 NOTAMN
Q) EKDK/QICAU/I/BO/A/000/999/
A) EKEB B) 9912031931 C) 9912101200EST
E) ILS Rwy 08 not avbl)
(EKEB AIS transmitted the request for this NOTAM to EKCH AIS at 1830 hrs).

The Danish CAA had issued a Local ATS instruction 'FKAB' concerning preservation of NOTAMs. The instruction states that Danish NOTAMs series A-B-C-D shall be saved 1 year after the expired date or after date of cancellation. The expired or cancelled NOTAMs would then be destroyed on the first of January each year.

A complete recovery of the NOTAMs valid for 3 December 1999 was not possible.
The NOTAMs were not kept for investigation purpose in a record system that e.g. could reveal when a NOTAM was issued, the contents of the NOTAM, by whom and to whom the NOTAM was sent.

1.11 Flight recorders

Data from the cockpit voice recorder was not recovered.
The DFDR was removed on request from Flight Operations for readout. The retrieved data was of a good

quality and useable for investigation purposes. The remaining fuel information was measured in lbs. In this rapport the remaining fuel is indicated in kilograms.

1.12 Wreckage and impact information
There was no damage to the aircraft.

1.13 Medical and pathological information
The medical information was not considered to be a factor.

1.14 Fire
There was no fire.

1.15 Survival aspects
There was no injury to persons.

1.16 Test and research
None.

1.17 Organization and management information
The Operator was a Scheduled Air Services Operator who started operations in May 1983.
The operation was carried out according to JAR OPS 1, in force since April 1998.
The Operator had established a Quality Assurance System which included a Quality Manager, QM.
The QM secured the flight data and made the data available to the Danish Aircraft Accident Investigation Board. Furthermore the QM took immediate action by adding further and more complete airport information on Aalborg (EKYT) and Aarhus (EKAH) to the aircraft library.

1.18 Additional information
The ATC crew at Copenhagen ACC and the ATC crew at APPR/TWR at EKCH had an information system at their stations. This system was able to retrieve and display weather information and NOTAMs along with other information.

The Air Traffic Controller at the Approach/Departure position had no real time indications of microburst, wind sheer or other adverse meteorological phenomena.

An ATS-Instruction No. 6 covered the procedure concerning flight information. The instruction was written in Danish and part of this instruction is translated into English as follows below:

"1. Scope
1.1 Flight information service shall be given to all aircraft which is assumed to be affected by the information, and
a) to aircraft which is under air traffic control
b) or to any other aircraft known by the ATS unit in question
.....

2. The extent of flight information service

2.1 The flight information service must transmit the following information:

….

d) information regarding any change in the performance of navigation aids,

e) information regarding any change in the condition of airports, aerodromes, and their relative installations and aids, including information regarding the condition of the relative traffic areas when covered by snow, ice, or water,

….

j) any other information assumed to be of relevance for the flight safety.

3. Methods of transmission

3.1 Flight information must be transmitted as follows:

a) by an individual call to an aircraft; this method is preferred as it ensures that the receipt of information is confirmed,

c) by a general call and transmission without receipt to all relevant aircraft,

..... “

2. Analysis

2.1 The flight planning

The Ground Operations staff planned the flight prior to the crew reporting time.
The AIS briefing was printed at 1451 hrs UTC and would therefore only reflect NOTAMs issued before 1451 hrs.
The AIS briefing was pre-selected to cover certain areas and a limited number of airports. The briefing indicated that the flight could be operated as planned.

The meteorological briefing was printed at approximately the same time as the AIS briefing. It contained information on the same airports as the AIS briefing. The weather forecasts issued between 1400 and 1500 hrs indicated that the flight could be operated as planned.

The crew reported at 1500 hrs. The crew had access to additional AIS / MET information.

The operational flight plan indicated a trip fuel of 3200 kg and a minimum required take-off fuel of 5712 kg.
The commander added 1788 kg of extra fuel to the flight plan - given a planned take-off fuel of 7500 kg. Without this extra fuel (1788 kg) it would not have been possible to divert from Copenhagen to Billund Airport at 1820 hrs.

The aircraft centre of gravity and aircraft mass were within the limitations.

2.2 The information during the flight

A disabled aircraft blocked runway 27 at Billund Airport from 1520 hrs to 1725 hrs. The SIGMET 2 was issued at 1545 hrs covering the period from 1600 hrs to 2000 hrs. At 1650 hrs Esbjerg Airport was closed by a NOTAM due to massive destruction of buildings.

The crew made radio contact with Copenhagen Control at1649 hrs. The SIGMET 2, as well as the information indicating that Esbjerg and Billund Airports were closed was not transmitted to the crew.

The ATC controllers followed the normal ATC procedure and issued only information concerning the destination airport. Other information would – according to procedures - only be transmitted to the flight when requested by the crew.

The published Designated Operational Coverage of the Billund ATIS was FL 200 / 60 nm.
At 1621 hrs UTC the Billund ATIS did not indicate that runway 27 was closed. From 1634 until 1737 hrs UTC the Billund ATIS indicated that the runway 27 was closed due to disabled aircraft. At 1739 hrs UTC the Billund ATIS indicated that the runway 27 was reopened. This information cannot be considered available for the crew because the aircraft was outside the Designated Operational Coverage (FL 200 / 60 nm) of the Billund ATIS from 1634 hrs to 1739 hrs, except for a few minutes when the aircraft was in the western part of the LUGAS approach holding to Copenhagen Airport. The great circle distance from Billund to the LUGAS reporting point was approximately 66 nm.

The great circle distance from EKCH to EKBI was 119 nm.
The line of sight is approximately D = 1.225 ($\sqrt{Ht} + \sqrt{Hr}$) where D is the line of sight in nm, Hr is the height in feet of the receiving antenna, and Ht is the height in feet of the transmitting antenna. The line of sight at 3000 feet MSL and with an Outside Air Temperature of 0°C was approximately 85 nm (Hr~2900 feet & Ht~250 feet). Under normal circumstances it was not possible for the crew to receive the Billund VHF radio-transmitted ATIS while the flight was at Copenhagen Area at / or below 3000 feet, because the aircraft was below the line of sight, and because the aircraft was outside the Designed Operational Coverage for Billund ATIS.

The information regarding the status of Billund Airport was passed on to the flight crew by the Copenhagen ATC after a go-around, and at the time when the crew were considering a diversion to Billund.

Billund Airport was reopened time 1725 hrs. Information about the reopening of the airport was not made available to the crew before the flight actually diverted to Billund at 1820 hrs.

The information regarding the status of Esbjerg Airport was passed on to the flight crew by the Billund ATC after a go-around and at a time when the crew were considering a diversion to Esbjerg.

There was no ATIS available at Esbjerg Airport.

Malmo Airport ATIS did not transmit wind information after 1750 hrs due to a stroke of lightning in the wind measuring system. No other system was available for the measurement of wind direction and speed.

The Danish AAIB considers the exceptional circumstances on December 3, 1999 as significant changes in status of ground installations. This information must be considered as vital information.

2.3 The progress of the flight

The flight entered the holding at LUGAS at 1722 hrs with 4750 kg of remaining fuel. The remaining fuel was sufficient to reach Malmo, Billund, Esbjerg, Aarhus, Aalborg, Goteborg, Hamburg, Oslo, or Stockholm Airports with a sufficient Final Reserve Fuel.

The flight was cleared for ILS approach to runway 22 left at Copenhagen at 1757 hrs. The remaining fuel was 3830 kg. The remaining fuel was sufficient to reach Malmo, Billund, Esbjerg, Aarhus, Aalborg, Goteborg, Hamburg or Oslo with sufficient Final Reserve Fuel.

The adverse weather condition at Copenhagen Airport with strong winds and turbulence resulted in an unstable approach with overspeed of the flaps / slats. Consequently, the crew initiated a go-around procedure.

At the beginning, the radar vectoring of the diverting flight was a heading of 120°. This heading would bring the aircraft in a position closer to a new approach for Copenhagen runway 22 left and for Malmo runway 17, but it was bringing the aircraft further away from Billund Airport. At the time of the go-around the crew did not inform the ATC that a diversion to Billund was imminent. The ATC assumed initially that the crew would try another approach to EKCH runway 22 left.

After the go-around it was not possible for the crew to get any wind information for the planned destination alternate airport, Malmo. Neither Malmo ATIS nor ATC could supply the crew with the information. Consequently, the crew selected their second destination alternate airport, Billund (EKBI).

The crew were then informed that Billund Airport was possibly still closed. Billund had, however, been reopened at 1725 hrs, or 51 minutes before the crew requested to divert to Billund.

After the weather report for Billund was received, the flight started to divert to Billund at 1820 hrs with 2815 kg of remaining fuel. The remaining fuel was sufficient to reach (Malmo,) Billund, Esbjerg, Aarhus, Aalborg, Goteborg or Hamburg with a sufficient Final Reserve Fuel. At this time, the weather report for Billund indicated that the situation at Billund Airport was considerably better than the situation at Copenhagen Airport, but during the flight to Billund the weather situation at Billund Airport deteriorated rapidly.

The diverting flight requested FL 200 and was cleared initially to FL 200, then shortly after cleared to FL 140. The flight cruised from Copenhagen Area to Billund at FL 140 using Engine Anti-Ice and frequently also Airframe Anti-Ice.

The flight was established on the ILS approach to runway 27 at Billund and was in contact with the tower at 1847 hrs. The remaining fuel was 1710 kg, equal to approximately 49 minutes of holding. At this time, the

aircraft had used approximately 1610 kg fuel from the go-around at Copenhagen (at 1808 hrs) to the final approach at Billund (at 1847 hrs), or approximately 192 kg more than indicated in the operational flight plan. The 192 kg equals approximately 13.5% more fuel than planned. The additional time used was 4 minutes or 11% more time than planned for diversion. The average fuel-flow during the diversion was approximately 2477 kg / hour. The average planned diversion fuel-flow was approximately 2431 kg / hour. The average actual fuel-flow during the diversion was approximately 1.9% higher than the average planned fuel-flow for diversion. The remaining fuel (1710 kg) was sufficient to reach Karup (EKKA), Vojens/Skrydstrup (EKSP) or (Esbjerg) with a sufficient Final Reserve Fuel.

During the approach at Billund, the aircraft wind shear warning system warned the crew of a wind shear. Consequently, the crew followed the go-around procedure. The remaining fuel was 1580 kg which equals approximately 46 minutes of holding. This amount of fuel (1580 kg) was sufficient to reach (Esbjerg,) Vojens/Skrydstrup, Karup or to make a new approach at Billund but sufficient Final Reserve Fuel could not be assured.
After the go-around the crew were informed that Esbjerg Airport was closed.

Billund Approach informed the crew about the two available airports, Karup and Aarhus, but the crew did not have complete information about the airports. Only Karup Air Base would have been within the fuel-range.

After the go-around and before the second approach to Billund, the crew estimated that the amount of fuel available would be less than the Final Reserve Fuel during the approach. Consequently, the crew declared an emergency and informed Billund of their intentions.

The ATC crew at Billund did not add more workload to the flight crew when asking information by using the phraseology ‘- when time permitting - numbers of crew and passengers and the estimated fuel upon landing -’.

The crew had to disregard all indications of wind shear during the second approach, as an additional go-around could have resulted in an airborne flameout. A theoretical additional go-around would have resulted in a landing fuel of approximately 200 kg.

The aircraft landed at 1911 hrs with 890 kg of remaining fuel, which equals to approximately 25.6 minutes of holding.

The go-around and the following approach and landing covered a track distance of approximately 59 nm, and the aircraft consumed approximately 690 kg of fuel. The time used was approximately 18 minutes.

2.4 Aircraft information

During the flight, the aircraft exceeded speed limitations for slats / flaps operations and was exposed to severe turbulence. The inspection on the following day revealed that there was no damage to the aircraft.

2.5 Meteorological information

The Meteorological Briefing consisted of weather cards. The Meteorological Briefing also included TAFs and METARs covering the same airports as the airports covered in the AIS Briefing. This briefing was printed at approximately the same time as the AIS Briefing. This briefing was not recovered. According to Appendix 1 of JAR-OPS 1.1065 there are no requirements to file the Meteorological Briefing documents after the flight.

The forecasted wind direction and velocity given in the **EKCH TAF 031440Z** 03**1524** was

19025G40KT	the corresponding cross wind component was 13 knots gusting 21 knots
BECMG 1517 24030G45KT	the corresponding cross wind component was 10 knots gusting 15 knots
TEMPO 1720 26030G55KT	the corresponding cross wind component was 19 knots gusting 35 knots
BECMG 2022 28030G55KT	the corresponding cross wind component was 26 knots gusting 47 knots.

The forecast indicated that the runway could be wet at the ETA +/- 1 hour (1641 to 1841 hrs UTC).
The aircraft cross wind limitations for landing on dry and wet runways was 40 knots.
The flight to the destination, EKCH, was planned within the crosswind limitations for an ETA of 1741 hrs UTC +/- 1 hour.

The forecasted wind direction and velocity given in the **ESMS TAF 031430Z** 03**1524** was

21024G48KT	the corresponding cross wind component was 15 knots gusting 30 knots.

The forecast indicated that the runway could be wet at the ETA +/- 1 hour (1704 to 1904 hrs UTC).
The aircraft cross wind limitations for landing on dry and wet runways was 40 knots.
The flight to the destination alternate, ESMS, was planned within the crosswind limitations for an ETA of 1804 hrs UTC +/- 1 hour.

Copenhagen, CPH

The actual wind direction and velocity given in the **EKCH METAR and SPECI** were

Actual report at	Actual wind direction and velocity	Crosswind component (RWY 22L)
1520Z	19029G42KT	15G22
1550Z	20031G44KT	11G16
1620Z	20029G48KT	10G17
1629Z	20032G58KT	12G21
1645Z	21032G50KT	06G10
1652Z	21030G45KT	06G09
1706Z	21026G44KT	05G08
1720Z	21031G46KT	06G09
1724Z	21032G48KT	06G09
1725Z	22032G55KT	01G01
1739Z	21036G56KT	07G11
1750Z	22039G63KT	01G01
1809Z	21042G70KT	08G13
1820Z	21047G66KT	09G13
1826Z	21047G75KT	09G14
1834Z	21047G69KT	09G13

1844Z	22048G71KT	01G01
1848Z	22050G81KT	01G02
1850Z	22050G81KT	01G02

During the period from 1520 hrs to 1850 hrs the maximum steady crosswind component on runway 22 left was 15 knots, and the maximum crosswind component in gusts was 21 knots. The aircraft was within the maximum crosswind limits during this time period.
At 1809 hrs, at Copenhagen Arrival Information, the wind information was: wind direction 210°, wind velocity 48 knots, maximum 70 knots, minimum 23 knots. The corresponding crosswind components are 09, 13 and 04 knots. The aircraft was within the maximum crosswind limitation.

The Kastrup Tower reported wind information at 1808: wind direction 210°, wind velocity 45 knots, gusts 70 knots. The corresponding crosswind component was 9 and 13 knots. The aircraft was within the maximum crosswind limitation.

Malmo, MMX
The actual wind direction and velocity given in the **ESMS METAR and SPECI** were

Actual report at	Actual wind direction and velocity	Crosswind component (RWY 17)
1520Z	18026KT	04
1550Z	19029KT	09
1620Z	19029G40KT	09G12
1650Z	20028G40KT	13G19
1720Z	20030G46KT	14G22
1750Z	21025KT	15
1820Z	/////KT	N/A
1850Z	/////KT	N/A

During the period from 1520 hrs to 1750 hrs, the maximum steady crosswind component on runway 17 was 15 knots, and the maximum crosswind component in gusts was 22 knots. The aircraft was within the maximum crosswind limits during this time period. After 1750 hrs there is no wind information available.

Billund, BLL
The actual wind direction and velocity given in the **EKBI METAR and SPECI** were

Actual report at	Actual wind direction and velocity	Crosswind component (RWY 27)
1520Z	21036G59KT	30G50
1550Z	22047G72KT	35G53
1620Z	23042G64KT	26G39
1650Z	24038G55KT	18G26
1720Z	24038G55KT	18G26
1750Z	27029G41KT	01G02
1820Z	28047G66KT	10G14
1850Z	28043G62KT	09G13

During the period from 1750 hrs to 1850 hrs, the maximum steady crosswind component on runway 27 was 10 knots, and the maximum crosswind component in gusts was 14 knots. The aircraft was within the maximum crosswind limits during this time period.

At 1850 hrs, at the Billund Airport Information, the wind information was: wind direction 280°, wind velocity 44 knots, maximum 66 knots, minimum 24 knots. The corresponding crosswind components are 09, 14, and 05 knots. The aircraft was within the maximum crosswind limitation.
The Billund Approach and Tower reported wind information to the crew at:

1840Z	290°	45KT	Maximum	73KT	Minimum	27KT
1847Z	280°	50KT	Maximum	76KT	Minimum	24KT
1850Z	290°	48KT	Maximum	66KT	Minimum	24KT
1851Z	280°	42KT	Maximum	65KT	Minimum	24KT
1852Z	280°	42KT	Maximum	65KT	Minimum	24KT
1901Z	290°	40KT	Maximum	71KT	Minimum	27KT
1903Z	290°	46KT	Maximum	71KT	Minimum	27KT
1907Z	290°	45KT				
1910Z	290°	43KT	Maximum	66KT		

In the time interval from 1840 hrs to 1910 hrs the maximum crosswind component occurred at 1840 hrs. The gusts were 73 knots and the corresponding crosswind component was 28 knots.
At 1910 hrs the wind direction was 290°, wind velocity 43 knots, gusts 66 knots. The corresponding crosswind components were 16 and 25 knots. The aircraft was within the maximum crosswind limitation.

Aalborg, AAL
The actual wind direction and velocity indicated in the **EKYT METAR and SPECI** were

Actual report at	Actual wind direction and velocity	Crosswind component (RWY 08L/26R)
1520Z	19014G30KT	13G29
1538Z	17010KT	10
1550Z	17015G28KT	15G28
1610Z	18017KT	17
1620Z	18014KT	14
1650Z	15009KT	08
1720Z	07008KT	02
1750Z	35007KT	07
1820Z	33009KT	08
1850Z	31010KT	07

In the time interval from 1750 hrs to 1850 hrs, the maximum crosswind component occurred at 1820 hrs. There were no gusts. The steady crosswind component was 8 knots. The maximum wind velocity was 10 knots.

The actual wind direction and velocity compared to the forecast, **TAF, for Copenhagen**, CPH, EKCH, issued on 3 December, 1999 at 1440 hrs, covering the period from 1500 hrs to 2400 hrs:

Actual report at	Actual wind	Forecasted wind	Maximum deviation
1520	19029G42KT	19025G40KT BECMG 24030G45KT	50°/04G03
1550	20031G44KT	19025G40KT BECMG 24030G45KT	40°/06G04
1620	20029G48KT	19025G40KT BECMG 24030G45KT	40°/04G08
1629	20032G58KT	19025G40KT BECMG 24030G45KT	40°/07G18
1645	21032G50KT	19025G40KT BECMG 24030G45KT	30°/07G10
1652	21030G45KT	19025G40KT BECMG 24030G45KT	30°/05G05
1706	21026G44KT	24030G45KT TEMPO 26030G55KT	50°/04G11
1720	21031G46KT	24030G45KT TEMPO 26030G55KT	50°/01G09
1724	21032G48KT	24030G45KT TEMPO 26030G55KT	50°/02G07
1725	22032G55KT	24030G45KT TEMPO 26030G55KT	40°/02G10
1739	21036G56KT	24030G45KT TEMPO 26030G55KT	50°/06G11
1750	22039G63KT	24030G45KT TEMPO 26030G55KT	40°/09G18
1809	21042G70KT	24030G45KT TEMPO 26030G55KT	50°/12G25
1820	21047G66KT	24030G45KT TEMPO 26030G55KT	50°/17G21
1826	21047G75KT	24030G45KT TEMPO 26030G55KT	50°/17G30
1834	21047G69KT	24030G45KT TEMPO 26030G55KT	50°/17G24
1844	22048G71KT	24030G45KT TEMPO 26030G55KT	40°/18G26
1848	22050G81KT	24030G45KT TEMPO 26030G55KT	40°/20G36
1850	22050G81KT	24030G45KT TEMPO 26030G55KT	40°/20G36

The forecast for Copenhagen (EKCH) issued on 3 December, 1999 at 1440 hrs was significantly different from the actual weather observations, with the exception of observation 1652. (Not within ‘Operationally desirable accuracy of forecasts’).

The actual wind direction and velocity compared to the forecast, **TAF AMD, for Copenhagen**, CPH, EKCH, issued on 3 December 1999 at1650 hrs, covering the period from 1600 hrs to 2400 hrs:

Actual report at	Actual wind	Forecasted wind	Maximum deviation
1620	20029G48KT	24045G65KT	40°/16G17
1629	20032G58KT	24045G65KT	40°/13G07
1645	21032G50KT	24045G65KT	30°/13G15
1652	21030G45KT	24045G65KT	30°/15G20
1706	21026G44KT	24045G65KT	30°/19G21
1720	21031G46KT	24045G65KT	30°/14G19
1724	21032G48KT	24045G65KT	30°/13G17
1725	22032G55KT	24045G65KT	20°/13G10
1739	21036G56KT	24045G65KT	30°/09G09
1750	22039G63KT	24045G65KT	20°/06G02
1809	21042G70KT	24045G65KT	30°/03G05
1820	21047G66KT	24045G65KT	30°/02G01
1826	21047G75KT	24045G65KT	30°/02G10
1834	21047G69KT	24045G65KT	30°/02G04

1844	22048G71KT	24045G65KT	20°/03G06
1848	22050G81KT	24045G65KT	20°/05G16
1850	22050G81KT	24045G65KT	20°/05G16

The forecast for Copenhagen (EKCH), issued on 3 December 1999 at 1650 hrs was significantly different from the actual weather observations in the period from 1620 hrs to 1739 hrs, and again from 1848 hrs to 1850 hrs. (Not within 'Operationally desirable accuracy of forecasts'). In the period from 1750 hrs to 1844 hrs, the forecast was different from the observations, but within 'Operationally desirable accuracy of forecasts'.

The actual wind direction and velocity compared to the forecast, **TAF, for Malmo**, MMX, ESMS, issued on 3 December, 1999 at 1340 hrs, covering the period from 1500 hrs to 2400 hrs:

Actual report at	Actual wind	Forecasted wind	Maximum deviation
1520Z	18026KT	21024G48KT	30°/02G48
1550Z	19029KT	21024G48KT	20°/05G48
1620Z	19029G40KT	21024G48KT	20°/05G08
1650Z	20028G40KT	21024G48KT	10°/04G08
1720Z	20030G46KT	21024G48KT	10°/06G02
1750Z	21025KT	21024G48KT	00°/01G48
1820Z	/////KT	21024G48KT	N/A
1850Z	/////KT	21024G48KT	N/A

The forecast for Malmo (ESMS), issued on 3 December, 1999 at 1340 hrs, was significantly different from the actual weather observations in the time interval from 1520 hrs to 1550 hrs and at 1750 hrs. (Not within 'Operationally desirable accuracy of forecasts'). In the period from 1620 hrs to 1720 hrs the forecast was within 'Operationally desirable accuracy of forecasts'.
There were no wind observations available after the weather observation at 1750Z.

The SIGMET (EKDK SIGMET 1) did reflect the actual moderate to severe topographic turbulence.

The SIGMET (EKDK SIGMET 2) did reflect the actual severe topographic turbulence that was experienced by the crew. However, the SIGMET covered the southern part of EKDK FIR. The sector from Copenhagen to Billund is, in general, not considered the southern part of Denmark. The SIGMETs did not reflect the serious effect from the wind on the ground installations. The SIGMET is not designed to supply information concerning the status of ground installations.
The EKDK SIGMET 2 was not transmitted to the crew.

Ground-based wind shear detection equipment was not available at Billund Airport.

Ground-based wind shear detection equipment was available at Copenhagen Airport, but the system was not designed to supply useful information at high-surface wind velocity. At high-surface wind velocities wind shear and severe turbulence are likely to occur.

The Radar Air Traffic Controller had no real time indications of microburst, wind sheer or other adverse meteorological phenomena. Consequently the Radar Operator could give radar vectoring to an aircraft into adverse weather without having any knowledge of this.

2.6 Communications

As a standard, the ATS unit will give flight information to the aircraft concerning the destination airport and any other information on request from the flight crew, however any airport in the vicinity of an aircraft must be considered as a potential alternate airport, and therefore information regarding significant changes in the status of the ground installations and airports should consequently be given to the aircraft.

2.7 NOTAMs

The NOTAMs issued on 3 December, 1999 could not be completely reconstructed for investigation purposes as the NOTAMs were not kept in a suitable registration system.

The recovered NOTAMs, A0471/99, B0984/99 and B0985/99 were issued long after the event leading to the issuing of the NOTAMs.

The NOTAM, A0471/99, regarding the closing and reopening of Billund Airport, (EKBI), was issued at 1630 hrs, even though Billund Airport was closed from 1521 hrs to 1725 hrs.

The NOTAM, A0471/99, regarding the closing and reopening of Billund Airport, (EKBI), could not be known by the flight crew before take-off, as the NOTAM was issued after the flight was airborne.

The NOTAM, B0981/99, regarding the closing of Esbjerg Airport, (EKEB), could not be known by the flight crew before take-off, as the NOTAM was issued after the flight was airborne.

The majority of Danish airports were not covered in the AIS Briefing issued at Birmingham Airport at 1451 hrs, but even if the major Danish airports had been covered in the AIS briefing, the NOTAMs A0471/99, B0981/99, B0984/99 and B0985/99 would not have been available in the NOTAM system before 1451 hrs, as the events (leading to issuing of the NOTAMs) took place after 1451 hrs.

The NOTAM B0979/99 could have been included in the AIS briefing issued at 1451 hrs, as the event leading to issuing of the NOTAM took place before 1429 hrs, and the NOTAM was issued at 1429 hrs.

2.8 The Operator

The Operator had a Quality Assurance System that took preventive action by adding complete airport information on two additional airports to the aircraft library.

3. Conclusions

3.1 Summary

The flight was planned within the operational limitations and extra fuel was uplifted.

During the flight, unforecasted and deteriorating weather conditions developed with wind gusts above 90

knots in some areas leading to the closing of airports and the destruction of ground installations.

The information concerning closed airports and unavailable ground installations was not passed on to the crew immediately, but was given after the go-around was performed and when a diversion was imminent. The late information to the crew about the availability of airports, reduced the ability to reach alternate airports until only one airport was possible to reach.

During the second approach and when landing at the only airport available, the crew had to disregard wind-shear warnings, such as fluctuating airspeed and severe turbulence due to a limited amount of remaining fuel.

Significant information regarding destroyed ground installations and closed airports is considered information concerning flight safety, even for flights that are in transit. Aircraft within the Copenhagen FIR do not have any formalised means to obtain this kind of information without delay, except for the cases where the crew ask ATC a specific question, or in case ATC is aware of the intentions of the crew.

3.2 Significant factors

1. Significant information concerning flight safety was not passed on to the flight crew with a minimum delay.

2. The adverse weather condition with strong winds and severe turbulence.

3.3 Factors

1. The weather forecasts were significantly different from the actual weather observations.

2. The crew did not have complete airport information about the Danish airports that were considered to be suitable for the operator.

3. The NOTAM system was not effective. There was a time delay before some of the NOTAMs were transmitted to the system. The NOTAM system was not useful for the aircraft during the flight.

4. Safety recommendations

4.1 Initiated preventing actions.

1. The operator added complete operational information on Aalborg (EKYT), and Aarhus (EKAH), to the aircraft library.

4.2 Recommendations.

4.3 Implemented preventing actions.

1. The operator added complete operational information on Aalborg (EKYT), and Aarhus (EKAH), to the aircraft library.

The Danish Aircraft Accident Investigation Board recommends that

The Danish Civil Aviation Administration ensures that vital information concerning flight safety shall be made available to all aircraft operating within Copenhagen FIR with a minimum of delay. (REC-01-2001).

The Danish Aircraft Accident Investigation Board recommends that

The Danish Civil Aviation Administration ensures (when technical feasible) that ATC radar operators are equipped with real time display indicating adverse meteorological phenomena. (REC-02-2001).

The Danish Aircraft Accident Investigation Board recommends that

The Danish Civil Aviation Administration ensures that NOTAMs can be easily reconstructed for accident and incident investigation purposes. (REC-03-2001).

5. Appendices

A) Radar Track displayed on map of Denmark.

B) Radar Track displayed with comments.

C) Appendix 1 To JAR-OPS 1.1065 – Document Storage Periods.

D) SIGWX – LOW LEVEL valid 1800 HRS UTC 03.12.1999.

E) SFC Analysis 1800 HRS UTC.

F) SFC Analysis 1500 HRS UTC.

G) SFC Analysis 1200 HRS UTC.

H) NOAA Satellite Picture 1615 HRS UTC.

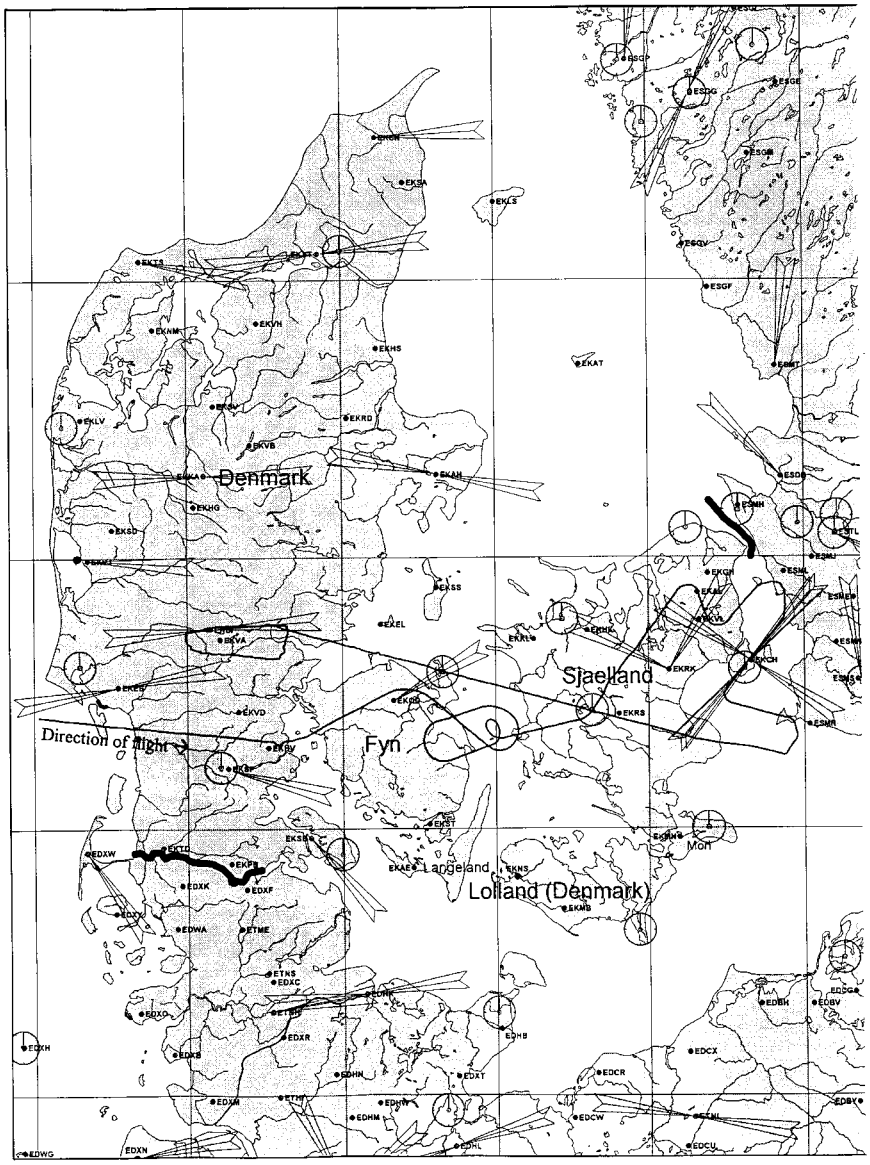
I) Radar Picture Denmark 1700 HRS UTC.

J) Radar Picture ‘Rømø’ 1700 HRS UTC.

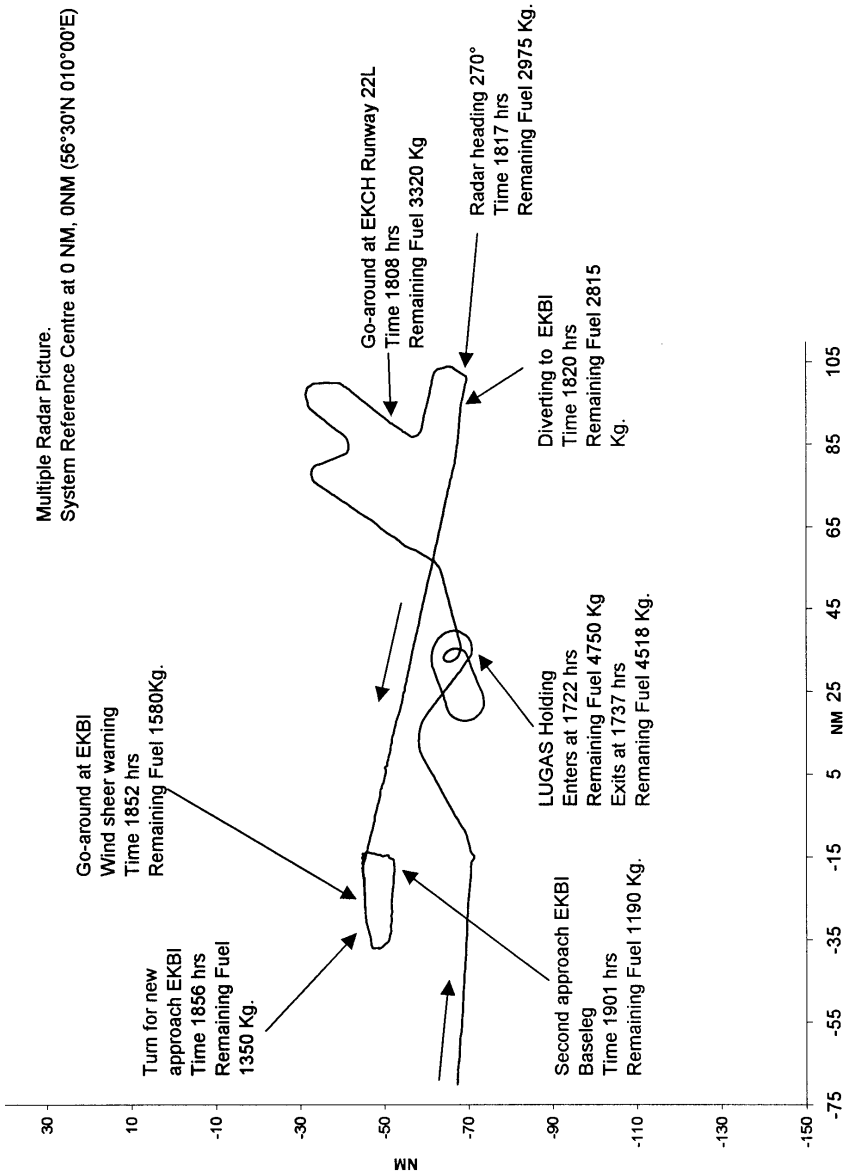
K) Radar Picture ‘Sindal’ 2000 HRS UTC.

L) ICAO Annex 3, Meteorological Service for International Air Navigation, Page 88.

Appendix A


Denmark
Sjaelland
Fyn
Direction of flight
Langeland
Lolland (Denmark)
MOH

Appendix B


Multiple Radar Picture.
System Reference Centre at 0 NM, 0NM (56°30'N 010°00'E)
Go-around at EKBI
Wind sheer warning
Time 1852 hrs
Remaining Fuel 1580Kg.
Turn for new
approach EKBI
Time 1856 hrs
Remaining Fuel
1350 Kg.
Second approach EKBI
Baseleg
Time 1901 hrs
Remaining Fuel 1190 Kg.
LUGAS Holding
Enters at 1722 hrs
Remaining Fuel 4750 Kg
Exits at 1737 hrs
Remaining Fuel 4518 Kg.
Diverting to EKBI
Time 1820 hrs
Remaining Fuel 2815
Kg.
Go-around at EKCH Runway 22L
Time 1808 hrs
Remaining Fuel 3320 Kg
Radar heading 270°
Time 1817 hrs
Remaining Fuel 2975 Kg.
NM
30
10
-10
-30
-50
-70
-90
-110
-130
-150
-75
-55
-35
-15
5
25
45
65
85
105
NM

Appendix C

Appendix 1 To JAR-OPS 1.1065 - Document Storage Periods

Date: March 1, 1998

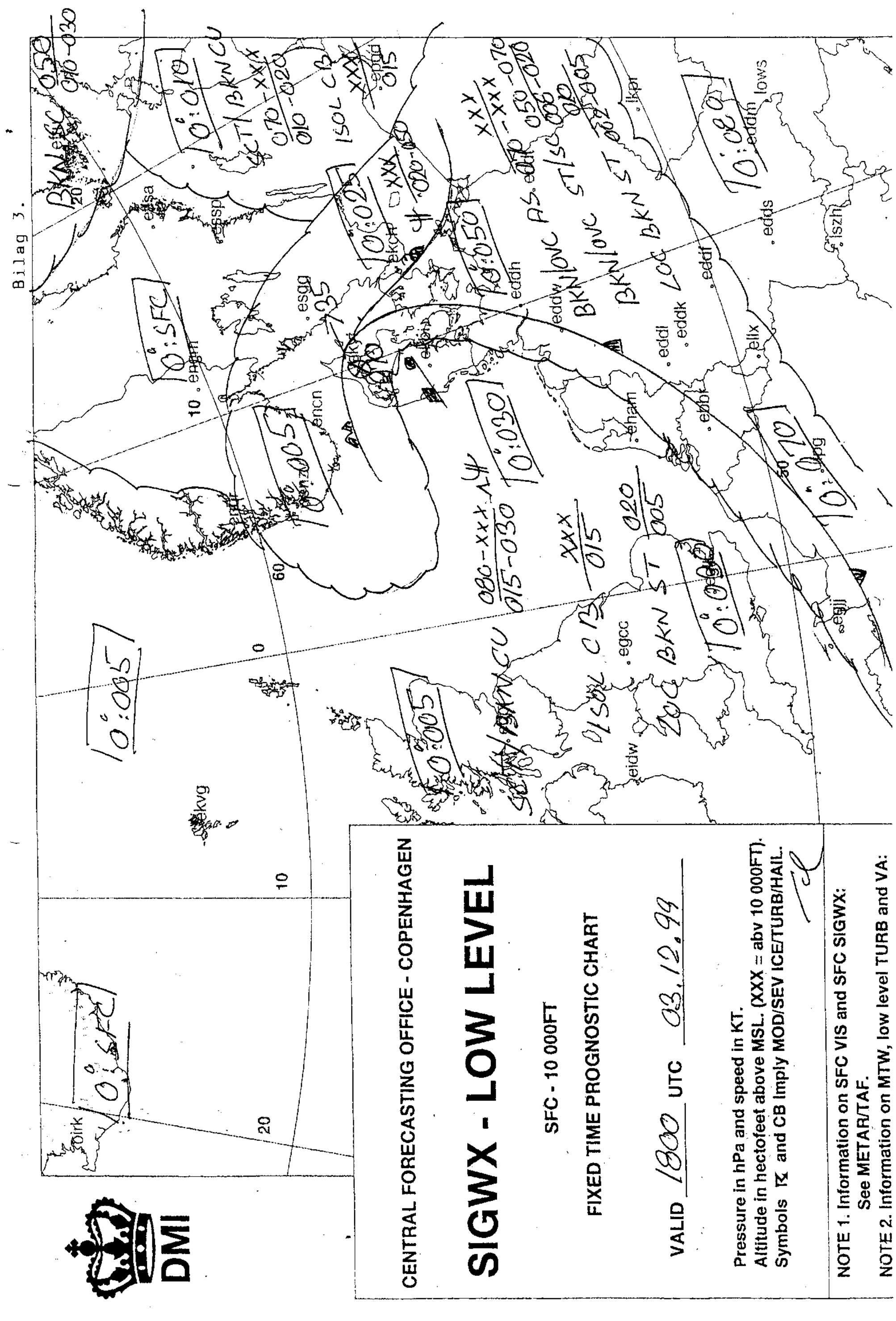
An operator shall ensure that the following information/documentation is stored in an acceptable form, accessible to the Authority, for the periods shown in the Tables below.

Note: Additional information relating to maintenance records is prescribed in Subpart M.

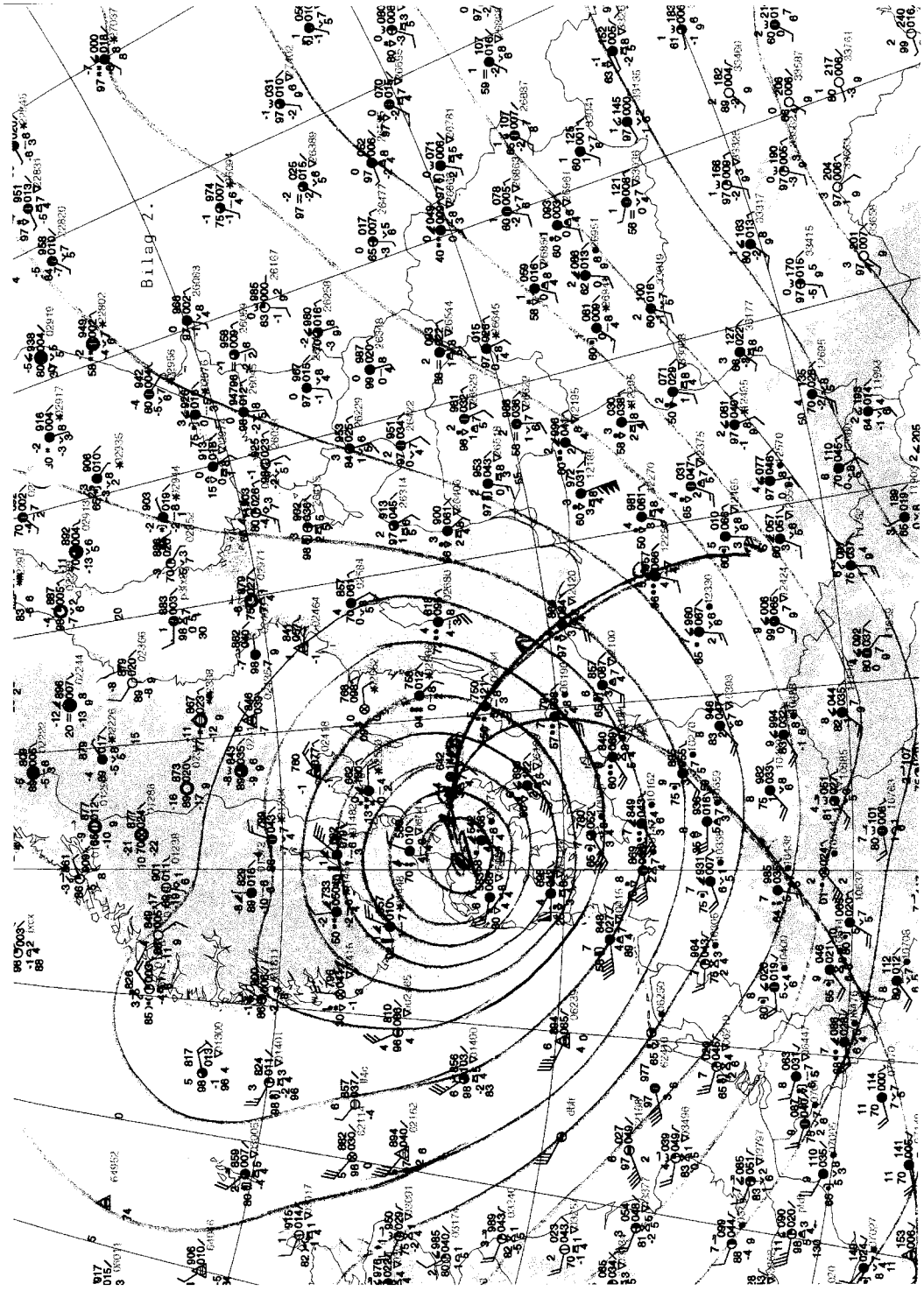
Table 1 - Information used for the preparation and execution of a flight

Information used for the preparation and execution of the flight as described in JAR-OPS 1.135	
Operational flight plan	3 months
Aeroplane Technical log	24 months after the date of the last entry
Route specific NOTAM/AIS briefing documentation if edited by the operator	**3 months**
Mass and balance documentation	3 months
Notification of special loads including dangerous goods	3 months

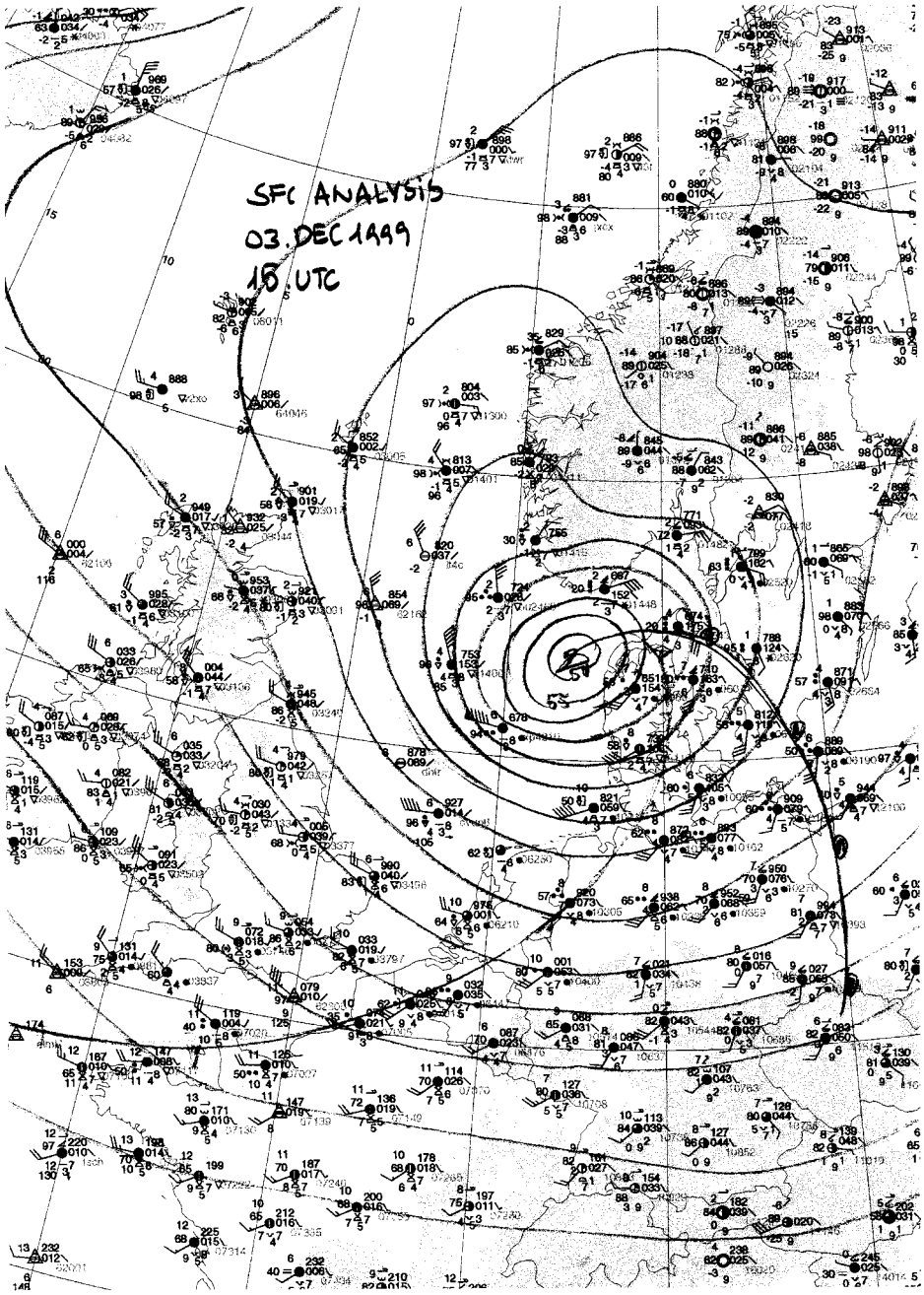
Appendix D


Bilag 3.
CENTRAL FORECASTING OFFICE - COPENHAGEN
SIGWX - LOW LEVEL
SFC - 10 000FT
FIXED TIME PROGNOSTIC CHART
VALID 1800 UTC 03.12.99
Pressure in hPa and speed in KT.
Altitude in hectofeet above MSL. (XXX = abv 10 000FT).
Symbols and CB imply MOD/SEV ICE/TURB/HAIL.
NOTE 1. Information on SFC VIS and SFC SIGWX: See METAR/TAF.
NOTE 2. Information on MTW, low level TURB and VA:
DMI

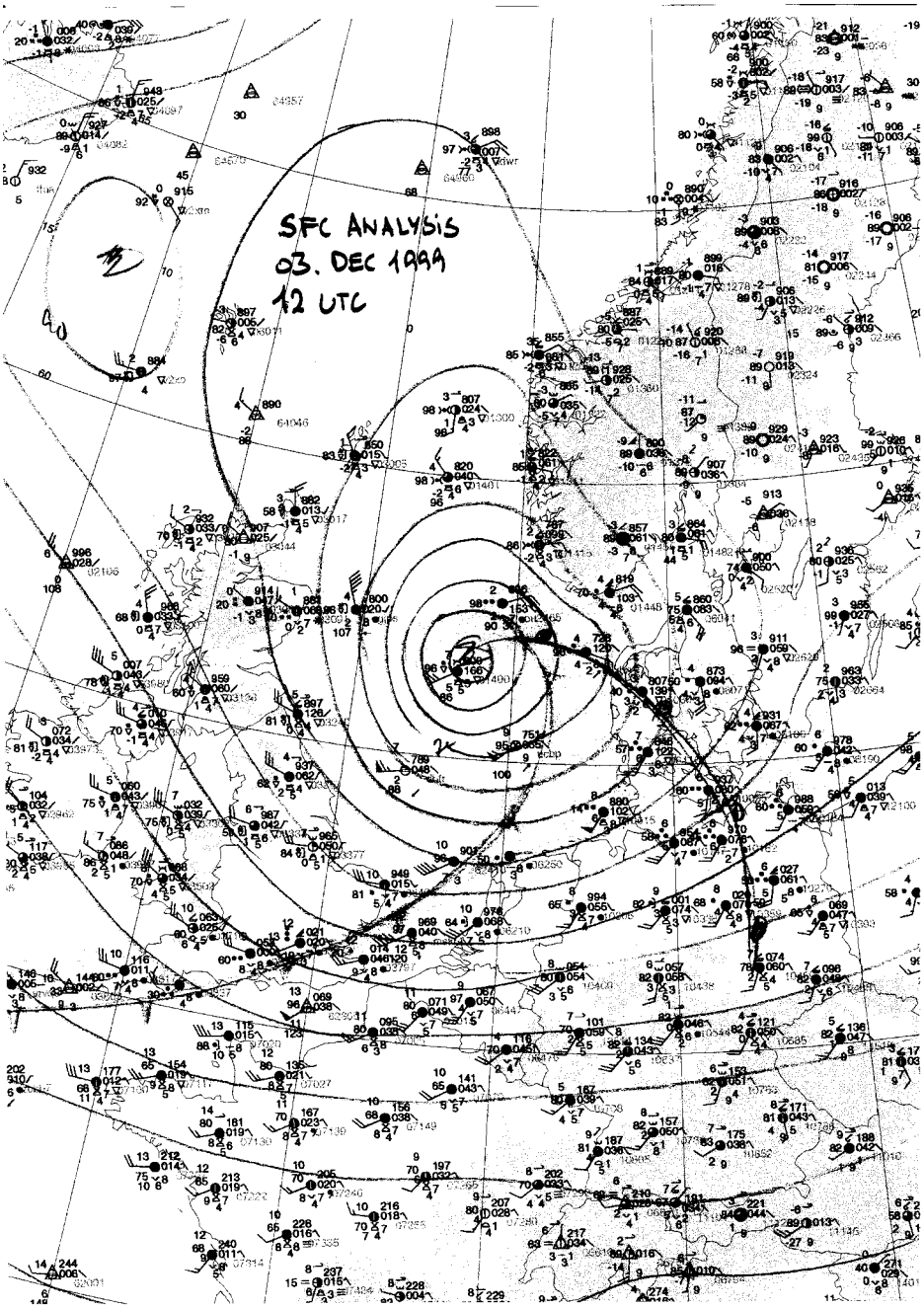
Appendix E



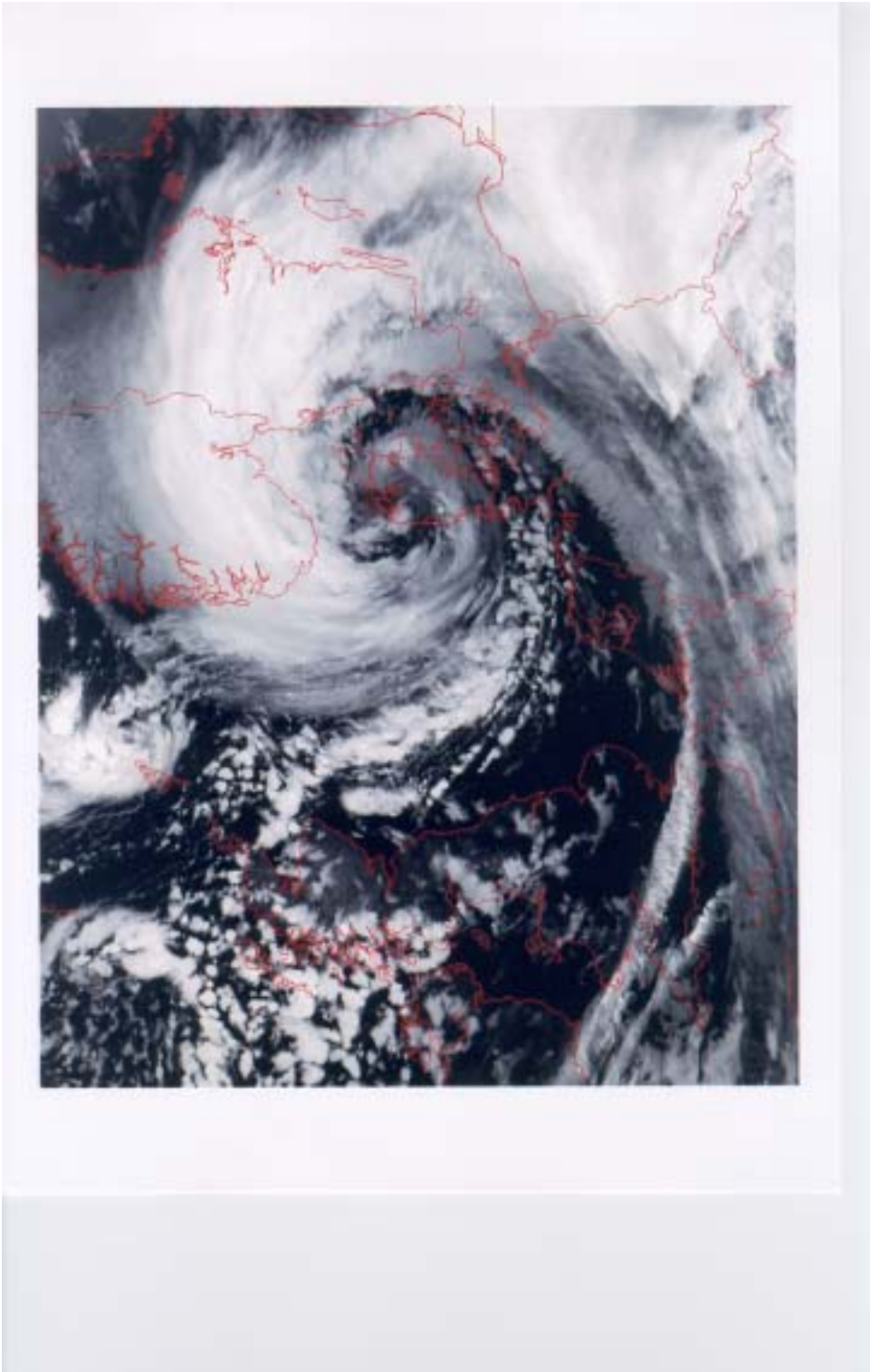
Appendix F



Appendix G



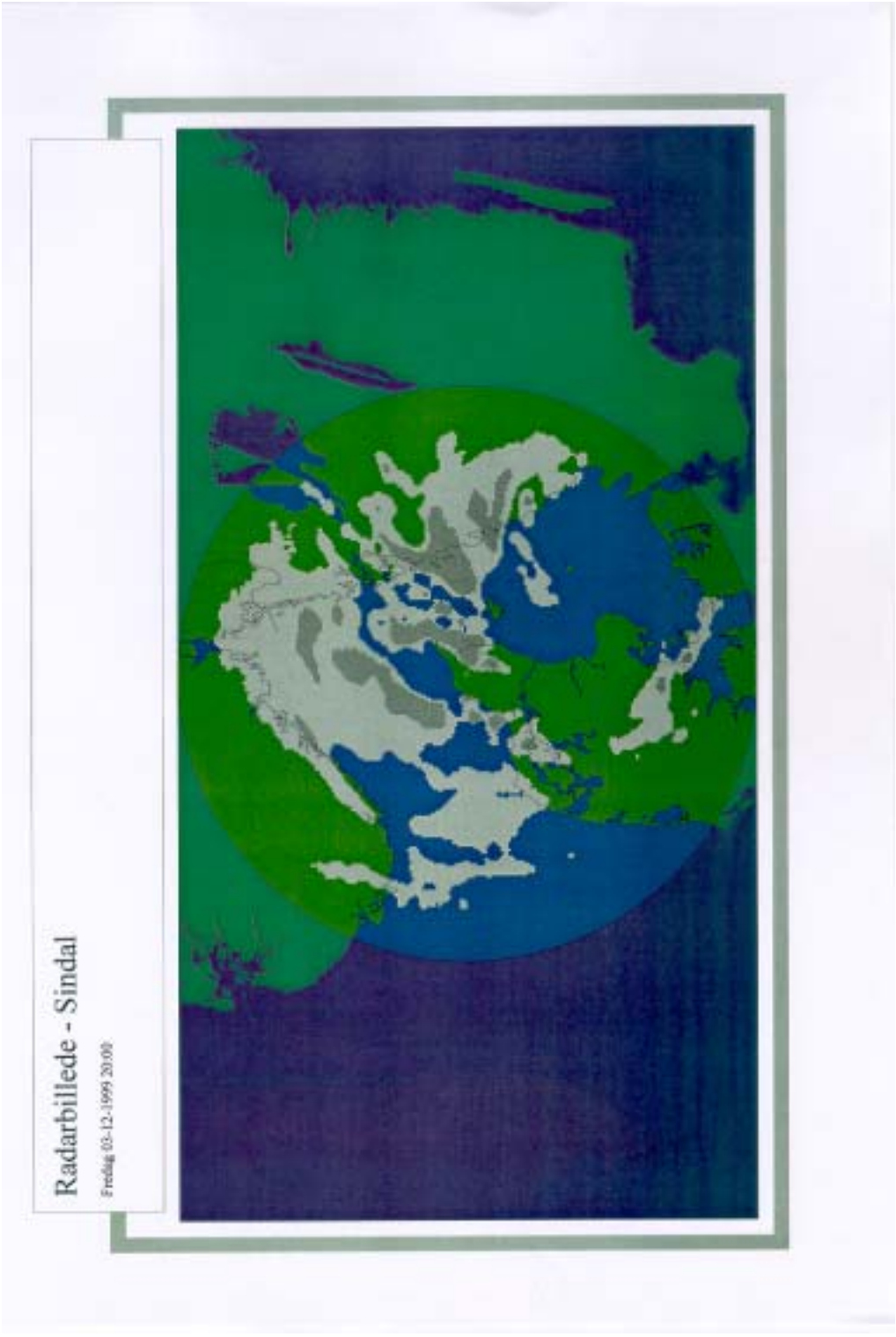
Appendix H



Appendix I

Appendix J

Appendix K



Appendix L

ATTACHMENT E. OPERATIONALLY DESIRABLE ACCURACY OF FORECASTS

Note 1.— The guidance contained in this table relates to Chapter 6 — Forecasts, in particular to 6.1.1.

Note 2.— If the accuracy of the forecasts remains within the operationally desirable range shown in the second column, for the percentage of cases indicated in the third column, the effect of forecast errors is not considered serious in comparison with the effects of navigational errors and of other operational uncertainties.

Element to be forecast	*Operationally desirable accuracy of forecasts*	*Minimum percentage of cases within range*
	AERODROME FORECAST	
Wind direction	± 30°	80% of cases
Wind speed	± 9 km/h (5 kt) up to 46 km/h (25 kt) ± 20% above 46 km/h (25 kt)	80% of cases
Visibility	± 200 m up to 700 m 30% between 700 m and 10 km	80% of cases
Precipitation	Occurrence or non-occurrence	80% of cases
Cloud amount	± 2 oktas	70% of cases
Cloud height	± 30 m (100 ft) up to 120 m (400 ft) ± 30% between 120 m (400 ft) and 3 000 m (10 000 ft)	70% of cases
Air temperature	± 1°C	70% of cases
	LANDING FORECAST	
Wind direction	± 30°	90% of cases
Wind speed	± 9 km/h (5 kt) up to 46 km/h (25 kt) ± 20% above 46 km/h (25 kt)	90% of cases
Visibility	± 200 m up to 700 m ± 30% between 700 m and 10 km	90% of cases
Precipitation	Occurrence or non-occurrence	90% of cases
Cloud amount	± 2 oktas ± 30% between 700 m and 10 km	90% of cases
Cloud height	± 30 m (100 ft) up to 120 m (400 ft) ± 30% between 120 m (400 ft) and 3 000 m (10 000 ft)	90% of cases