Havarikommissionen
Accident Investigation Board Denmark

BULLETIN

Accident

26-12-2016

involving

BAE AVRO RJ100

SE-DST

and

AIRBUS A340

OY-KBC

ECCAIRS Release 5

Certain report data are generated via the EC common aviation database

FOREWORD

This bulletin reflects the opinion of the Danish Accident Investigation Board regarding the circumstances of the occurrence and its causes and consequences.

In accordance with the provisions of the Danish Air Navigation Act and pursuant to Annex 13 of the International Civil Aviation Convention, the safety investigation is of an exclusively technical and operational nature, and its objective is not the assignment of blame or liability.

The safety investigation was carried out without having necessarily used legal evidence procedures and with no other basic aim than preventing future accidents and serious incidents.

Consequently, any use of this bulletin for purposes other than preventing future accidents and serious incidents may lead to erroneous or misleading interpretations.

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BULLETIN

General

File number:	HCLJ510-2016-322
UTC date:	26-12-2016
UTC time:	15:09
Occurrence class:	Accident
Location:	Copenhagen, Kastrup (EKCH) - aircraft stand E77
Injury level:	None

Aircraft

Aircraft registration:	SE-DST
Aircraft make/model:	BAE AVRO RJ100
Current flight rules:	Instrument Flight Rules (IFR)
Operation type:	Non-Commercial Operations Relocation Positioning
Flight phase:	Taxi
Aircraft category:	Fixed Wing Aeroplane Large Aeroplane
Last departure point:	Sweden ESGG (GOT): Goteborg/Landvetter
Planned destination:	Denmark EKCH (CPH): Kobenhavn/Kastrup
Aircraft damage:	Substantial
Engine make/model:	Textron Lycoming (LF507-1F)

Aircraft registration:	OY-KBC
Aircraft make/model:	AIRBUS A340
Flight phase:	Tow
Aircraft category:	Fixed Wing Aeroplane Large Aeroplane
Aircraft damage:	Minor

SYNOPSIS

Notification

All times in this report are UTC.

The Area Control Centre at Copenhagen, Kastrup (EKCH) notified the Aviation Unit of the Danish Accident Investigation Board (AIB) of the accident on 26-12-2016 at 15:43 hours.

The AIB notified the Danish Transport, Construction and Housing Authority (DTCHA), the French Accident Investigation Board (Le Bureau d'Enquêtes et d'Analyses - BEA), the European Aviation

Safety Agency (EASA), the Directorate-General for Mobility and Transport (DG MOVE), the Swedish Accident Investigation Board (Statens Haverikommission - SHK), the UK Air Accidents Investigation Branch (AAIB), and the International Civil Aviation Organization (ICAO) of the accident on 2-1-2017 at 14:46 hours.

BEA, EASA and SHK appointed non-travelling accredited representatives to the AIB safety investigation

Summary

A towbarless tractor (TBL) towed OY-KBC on taxiway T, and the winglet of OY-KBC collided with the tail section of SE-DST, which had not fully parked at aircraft stand E77.

Independent expectations led to three diverging mental realities affecting the sequence of events:

1. The TBL driver perceived SE-DST as standing within the marked demarcation of aircraft stand E77 and expected that SE-DST was outgoing traffic but in sequence behind OY-KBC under tow
2. The flight crew of SE-DST awaited and expected aircraft stand entry guidance and stopped the aircraft approximately 14 meters in front of the aircraft stand stopping mark at aircraft stand E77
3. Kastrup Apron expected that SE-DST had fully parked given that approximately nine minutes had passed since the arrival of SE-DST at aircraft stand E77

The accident occurred in twilight and under visual meteorological conditions (VMC).

FACTUAL INFORMATION

History of the flight

The accident occurred on taxiway T at EKCH.

Upon landing on runway 22L at 14:51 hours, the flight crew of SE-DST got taxi instructions by Kastrup Apron (121.625 MHz) on taxiing to aircraft stand E77 via taxiway B, taxiway V, and taxiway T.

Arriving at aircraft stand E77 at 14:57 hours, the flight crew of SE-DST noticed that the ground handling personnel had not yet arrived at the aircraft stand. By radio in order to request ground handling assistance, the flight crew of SE-DST several times contacted their handling agent.

See appendix 1.

The flight crew of SE-DST was concerned that aircraft wing clearance to obstacles outside of the marked aircraft manoeuvring area of aircraft stand E77 was insufficient for moving the aircraft onto the aircraft stand and insufficient for the coming departure. For that reason, the flight crew decided to move the aircraft onto the aircraft stand guided by the yellow aircraft stand centre line, and the flight crew then stopped the aircraft approximately 14 metres in front of the aircraft stand stopping mark.

While waiting for the ground handling personnel to arrive and waiting for aircraft stand entry guidance, the aircraft engines were running.

At 15:06:56 hours, the TBL driver by radio (via frequency modulation (FM) channel 3) contacted Kastrup Apron and requested towing instructions for towing OY-KBC from hangar 5 to an aircraft stand.

At that point, it was the perception of the apron controller at Kastrup Apron that SE-DST had fully parked at aircraft stand E77.

At 15:07:50 hours, Kastrup Apron instructed the TBL driver to tow OY-KBC to aircraft stand C29 via taxiway T, taxiway V and to hold short of taxiway S. The TBL driver read back the towing instructions.

See appendix 2.

An onboard flight deck operator in OY-KBC handled the aircraft auxiliary power unit and the aircraft external lights. No radio communication between the TBL driver and the onboard flight deck operator was established.

When entering taxiway T, the TBL driver observed and perceived SE-DST as standing (aircraft anti-collision light on) within the marked demarcation of aircraft stand E77. It was the perception of the TBL driver that SE-DST was outgoing traffic but awaiting taxi instructions and therefore in sequence behind the towed OY-KBC.

The onboard flight deck operator in OY-KBC did not notice the presence of SE-DST, until the right winglet of OY-KBC collided with the tail section of SE-DST.

The TBL driver stopped the TBL and reported to Kastrup Apron that the towed OY-KBC had collided with an aircraft at aircraft stand E77 and that no one had suffered any injuries.

Injuries to persons

Injuries	*Crew*	*Passengers*	*Others*
Fatal			
Serious			
None	5		2

Damage to aircraft

The right winglet of OY-KBC suffered minor damages

See appendix 3 picture 1. The AIB removed the name of the operator.

The horizontal stabilizer, the elevator and the rudder of SE-DST suffered substantial damages.

See appendix 3 picture 2.

Personnel information

The commander of SE-DST

The commander (41 years) was the holder of an Airline Transport Pilot License (ATPL (A)).

A few times each year since 2004, the commander had operated at EKCH. The commander had no experience of parking at aircraft stands E76-E78.

Flying experience.

	Last 24 hours	Last 90 days	Total
All types	2	79	9613
This type	2	79	5663
Landings this type	1	34	2022

The TBL driver

The TBL driver had approximately 15 years of operator aircraft towing experience at EKCH.

That week, the TBL driver's working schedule (from 23-12-2016 until 25-12-2016) was from 13:30 hours until 23:30 hours.

On the day of the accident, the TBL driver's working schedule was from 13:30 hours until 20:30 hours.

The TBL driver felt well rested.

The towing of OY-KBC was a routine and non-stressful task.

On 25-2-2015, the TBL driver performed the latest operator aircraft towing recurrent training. The operator aircraft towing recurrent training was valid until 24-2-2018.

Aircraft information

General information

Registration:	SE-DST
Manufacturer:	British Aerospace
Model:	Avro RJ100
Serial number:	E3247
Year of manufacture:	1994

Registration:	OY-KBC
Manufacturer:	Airbus
Model	A340-313
Serial number:	467
Year of manufacture:	2002

Shutdown checklist of SE-DST

Shutdown Checklist		
HYDRAULICS	OFF	R
FUEL PUMPS	OFF	R
GENERATORS 1 & 4	OFF/RESET	R
TAXILIGHTS	OFF	R
HEATERS/DETECTOR	OFF	R
BLEEDS	OFF	R
BEACON/STROBES	OFF	R
BRAKES	SET	R
RADAR	OFF	R
ENGINES	OFF	R
TRANSPONDER	STBY	R
SEAT BELT SIGN	OFF	R
HANDLING FREQ	MONITOR	R

Meteorological information

Aviation routine weather report (METAR)

ekch 261450z 27016kt 9999 few020cb sct032 bkn073 03/01 q1008 rera ts tempo 27025g40kt shrags bkn020cb=

ekch 261520z 27020g32kt 9999 few024cb bkn042 04/01 q1008 tempo 27025g40kt shrags bkn020cb=

Automatic terminal information service (ATIS)

This is Copenhagen arrival information tango at 1450. Expect ILS approach. Runway in use for landing 22L. Runway 22L wet. Transition level 65. Wind for landing 270 degrees 15 knots. Visibility 12 kilometers. Few cumulonimbus 2000 feet. Scattered 3200 feet. Broken 7300 feet. Temperature 3. Dewpoint 1. QNH 1008. Temporary 270 degrees 25 knots maximum 40 knots. Moderate rain showers. Broken cumulonimbus 2000 feet. This was Copenhagen arrival information tango.

Communication

The flight crew of SE-DST was in radio contact with Kastrup Apron (121.625 MHz).

The TBL driver was in radio contact with Kastrup Apron (FM channel 3).

Aerodrome information

General - EKCH

Airport position (ARP):	55 37 04.50N 012 39 21.50E
Elevation:	17 feet
Magnetic variation:	2.5°E (July 2010)
Apron surface (taxi lanes):	Asphalt
Apron surface (stands):	Concrete
Taxiway edge light:	Blue - light intensity low
Taxiway centreline light:	Green
Aircraft stand number E77:	Docking guidance system - Centreline/stop marking

Surface movement guidance and control system (S-MGCS)

EKCH had installed S-MGCS that provided services and aids to aircraft and vehicles in order to maintain aerodrome throughput under all local weather conditions whilst maintaining the required level of safety.

Due to radar limitations (tolerances and precision), S-MGCS at EKCH was not an off and on block aircraft stand disposition tool.

S-MGCS radar labels (white colour with mode S radar information) - attached to in-taxiing aircraft and radar presented to the apron controllers - were time-limited (10 minutes). After 10 minutes, the S-MGCS radar label - for instance at aircraft stands E76-E78 - automatically changed to blue with only primary radar information and in this particular case presented the assigned transponder code of SE-DST.

It was a general perception of apron controllers and certain aerodrome operating personnel at EKCH that flight crews did not fully comply with chapter 6.7 of the Danish Aeronautical Information Publication (AIP) on use of mode S transponder upon parking at EKCH.

At the time of the accident, S-MGCS at EKCH was fully operational.

AIP Denmark

The below text are extracts of the AIP Denmark - EKCH.

6. Taxiing, parking, start up and deicing
6.1 Marshaller assistance

The Pilot of an Aircraft entering an Aircraft stand must NOT proceed unless:

a) The Docking Guidance System is operational and ready, displaying the correct Aircraft type, or

b) A CPH Marshaller is present, providing guidance for the Aircraft onto the Stand. The CPH Marshaller are easily recognizable by wearing bright red hi-vis clothing and yellow/orange bats. The CPH marshallers also drive the FOLLOW ME vehicles.

During the stand-entry and parking phase the Pilot should ignore hand signaling by any other ground staff present at the stand or in the loading bridge. When marshaller assistance is compulsory for the particular Aircraft stand in question, the Pilot will be advised by the ATS-Unit.

Otherwise, Pilots should notice that in general Marshaller assistence for Taxi and Stand entry guidance will be available only ON REQUEST. The marshaller assistance is free of charge.

6.7 Aircraft with mode S transponder.

Copenhagen Airport, Kastrup (EKCH) has installed a surface movement guidance and control system utilizing transponder mode S signals. Aircraft operators are asked to ensure that the transponders are able to operate according to ICAO specifications when the aircraft is on the ground (Annex 10, volume IV, 3.1.2.8.5.3 and 3.1.2.10.3.10).

Flight crew are required to select the assigned mode A (Squawk) code and activate the mode S transponder:

- from commencement of push-back or taxi, whichever comes first

- after landing, until the aircraft is fully parked on stand. After parking the mode A code 2000 must be set before selecting OFF or STDBY.

Flight crew of aircraft equipped with a mode S transponder that has an aircraft identification feature should also select the aircraft identification (Idem 7 of the ICAO flight plan) before activating transponder.

Docking guidance system

Yellow guide & stop line on the surface	Use yellow centre line for directional guidance while moving into the stand	Stop when cockpit seat is positioned abeam yellow stop line extending left from the stand centre line	Usually, the aeroplane type is painted along the stop line on the surface

Operator of SE-DST (route manual)

For EKCH ground chart (extract) - see appendix 4.

Flight crew use of transponder at EKCH (extract).

9. ACFT WITH TRANSPONDER MODE S

Flight crew are required to select assigned mode A (squawk) code and activate mode S transponder:

- *from commencement of push-back or taxi, whichever comes first.*
- *After LDG, until ACFT is fully parked on stand. After parking the mode A code 2000 must be set before selecting OFF or STDBY.*

Flight crew of ACFT equipped with mode S transponder that has an identification feature should also select ACFT identification before activating the transponder.

The TBL driver

For the towing of OY-KBC, aerodrome charts were available to the TBL driver.

Flight recorders

Solid State Cockpit Voice Recorder (SSCVR)

SE-DST:

Manufacturer:	Fairchild Model A100A
Part number:	93-A100-80
Serial number	60789

The SSCVR appeared undamaged.

The AAIB recovered the SSCVR data. However, the SSCVR data were not useful to the AIB safety investigation, because the beginning of the preserved SSCVR data started 23 minutes after the time of the accident.

AIB safety investigation

Security camera recording

See appendix 5. The AIB removed the names of the operators.

An outline of the accident site

See appendix 6.

Aircraft stand E77

A panoramic view of aircraft stand E77 - see appendix 7.

When moving the aircraft onto aircraft stand E77, the flight crew of SE-DST stopped the aircraft approximately 14 metres in front of the aircraft stand stopping mark (*"OTHER AIRCRAFT"*).

The painted yellow markings on aircraft stand E77 were distinct.

At the time of the accident, the hangar area north and the aircraft stand E77 were fully illuminated.

See appendix 8. The AIB removed the names of the operators.

The position of an Avro RJ100 optimum parked at aircraft stand E77 - see appendix 9.

Taxiway T

The TBL towed OY-KBC on the green illuminated and distinctly yellow painted taxiway centerline.

See appendix 10.

S-MGCS

At 15:07:02 hours, the white S-MGCS radar label (mode S radar information) of SE-DST changed colour from white to blue (primary radar information and in this particular case the assigned transponder code of SE-DST).

See appendix 11.

Aerodrome handling agreement

a. The operator of SE-DST (extract).

According to our valid agreement (written in accordance to IATA SGHA Appendix B edition 2010) with XXXX marshaling shall be arranged for at arrival/departure by XXXX.

The AIB replaced the name of the handling agent with *XXXX*.

b. The handling agent of SE-DST at EKCH (extract).

3.2 Marshalling

3.2.1 (b) arrange for marshalling at arrival and/or departure.

On request by each operator, we may arrange marshalling service. Marshalling service shall only be provided by EKCH.

Push back and towing practices (OY-KBC)

The aircraft manufacturer and the operator of OY-KBC had implemented push back and towing practices.

Below is an extract of the operator's push back and towing practices. The AIB replaced the name of the operator with *XXXX* and replaced certain references to internal operator documents with *YYYY*.

Flight Deck Operator

XXXX allows ground personnel trained according to the syllabus YYYY, or equivalent, to act as flight deck operators during towing. Whenever there is need for a flight deck operator, that person shall use the applicable checklists in YYYY.

7.13. The flight deck operator shall also:

- *Obey the person responsible for the towing operation.*
- *Coordinate signals and communication methods with the towing vehicle operator, or the marshaller, as applicable.*
- *Before towing starts, sit in the left hand pilot's seat with the seat belt fastened.*
- *Adjust the brake pedals, so that the brakes can be applied immediately in an emergency.*
- *During the entire operation, be on the alert for hazardous situations and be prepared to operate the brakes.*

ANALYSIS

General AIB safety investigation

To some point, the lack of relevant SSCVR data (SE-DST) hampered the AIB safety investigation.

However, available S-MGCS radar data, voice recordings of radio communication with Kastrup Apron and interviews with involved personnel compensated for this lack of relevant SSCVR data.

The actual weather conditions had no influence on the sequence of events.

Appropriate aerodrome charts were available to the flight crew of SE-DST and to the TBL driver.

Towing of OY-KBC

The TBL driver was a qualified TBL driver and had years of aircraft towing experience at EKCH.

The AIB finds that a combination of latent risk factors might have had an influence on the sequence of events:

- It was a non-stressful and routine task for the TBL driver and the flight deck operator, which might have led to complacency reducing positional awareness and alertness of hazardous situations

- The TBL driver did notice the presence of SE-DST at aircraft stand E77. However, the TBL driver may have acted from his expectations rather than factual information (the actual position of SE-DST). The TBL driver's expectations related to:

    a. towing instructions
    b. SE-DST perceived as standing within the marked demarcation of aircraft stand E77
    c. the TBL driver's perception of SE-DST being number two in sequence

- To the TBL driver, twilight might have obscured the marked and painted demarcation of aircraft stand E77

- The TBL driver and the flight deck operator did not establish dual radio communication

- The TBL driver did not challenge his expectations

SE-DST at aircraft stand E77

Kastrup Apron instructed SE-DST to park at a dimensionally correct designated aircraft stand.

Local conditions like markings on and illumination of aircraft stand E77 had no influence on the sequence of events.

A divergence (the operator/the flight crew versus the handling agent) of expectations of marshalling service combined with limited flight crew familiarity with operations at EKCH might have led to doubt and hesitation by the flight crew.

The flight crew expected unconditional marshalling service arranged by the handling agent. The handling agent provided arrangement of marshalling service on request by the operator/the flight crew.

The divergence of expectations, limited flight crew operational familiarity at EKCH, and the flight crew concern of obstacle clearance at aircraft stand E77 most likely resulted in the flight crew stopping the aircraft approximately 14 meters in front of the aircraft stand stopping mark.

Kastrup Apron and S-MGCS

Approximately nine minutes after SE-DST had arrived at aircraft stand E77, the TBL driver (OY-KBC) requested towing instructions (at 15:06:56 hours).

Approximately one minute later (at 15:07:50 hours), Kastrup Apron issued towing instructions to the TBL driver.

In the period between 15:06:56 hours and 15:07:50 hours, the S-MGCS radar label of SE-DST changed colour from white (mode S radar information) to blue (primary radar information). S-MGCS still presented the assigned transponder code of SE-DST.

Because SE-DST had not yet fully parked at aircraft stand E77, the flight crew in accordance with procedures (the operator checklist and the AIP Denmark) had not set the aircraft transponder in standby mode.

A combination of various conditions most likely affected the issue of the towing instructions to the TBL driver:

- S-MGCS at EKCH was not an off and on block aircraft stand disposition tool
- Approximately nine minutes had passed since the arrival of SE-DST at aircraft stand E77
- S-MGCS presented (in blue) primary radar information of SE-DST
- It was a general perception of apron controllers and certain aerodrome operating personnel at EKCH that flight crews did not fully comply with the AIP Denmark on use of mode S transponder upon parking at EKCH
- Kastrup Apron expected that SE-DST had fully parked at aircraft stand E77

CONCLUSION

A TBL towed OY-KBC on taxiway T, and the winglet of OY-KBC collided with the tail section of SE-DST, which had not fully parked at aircraft stand E77.

Independent expectations led to three diverging mental realities affecting the sequence of events:

1. The TBL driver perceived SE-DST as standing within the marked demarcation of aircraft stand E77 and expected that SE-DST was outgoing traffic but in sequence behind OY-KBC under tow
2. The flight crew of SE-DST awaited and expected aircraft stand entry guidance and stopped the aircraft approximately 14 meters in front of the aircraft stand stopping mark at aircraft stand E77
3. Kastrup Apron expected that SE-DST had fully parked given that approximately nine minutes had passed since the arrival of SE-DST at aircraft stand E77

APPENDIX 1

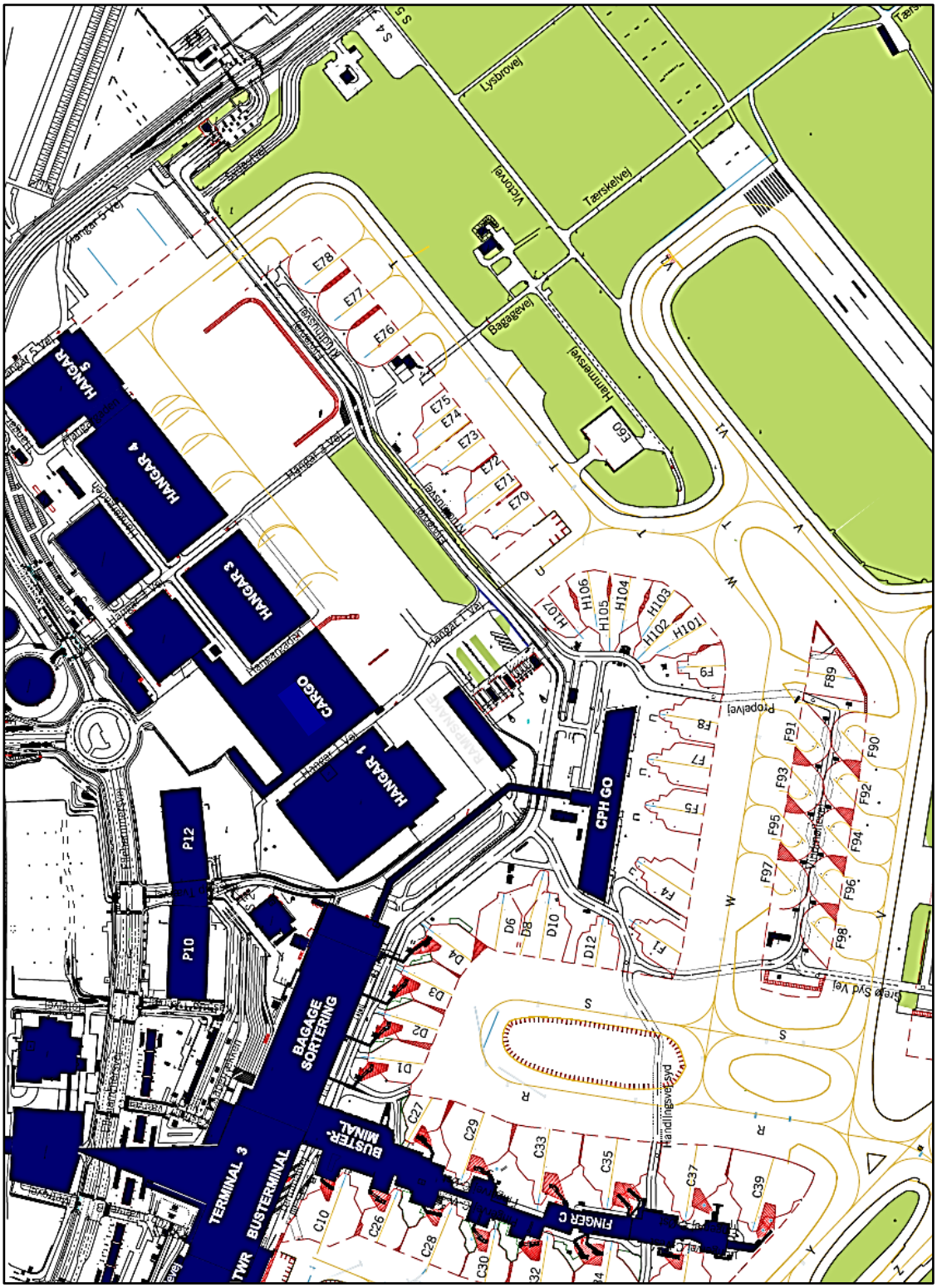
Return to history of flight

Time: 14:57 hours

Note. The AIB has removed the aircraft call sign.

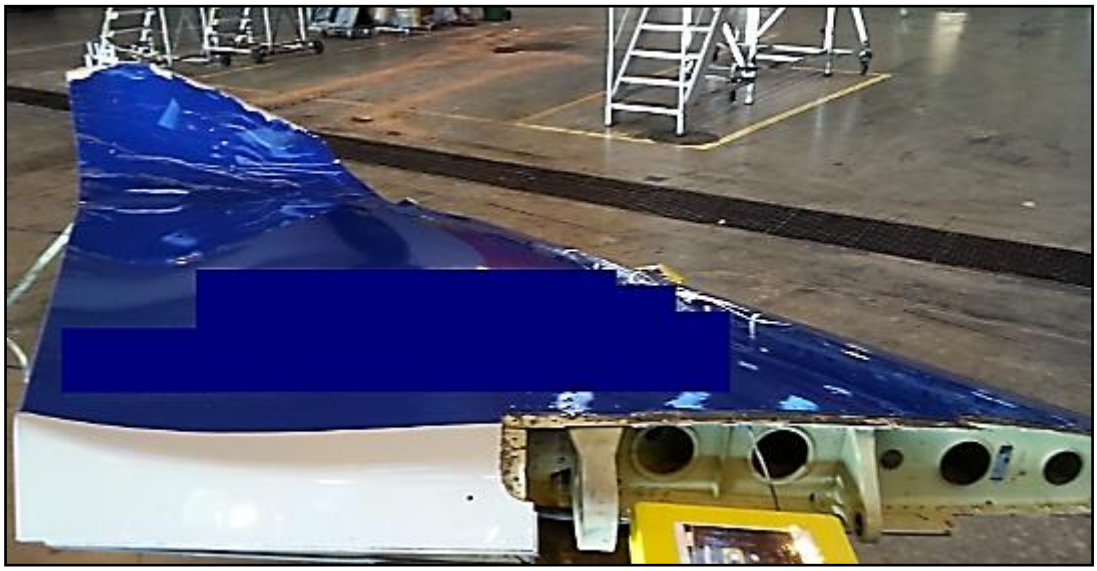
APPENDIX 2

Return to history of flight



APPENDIX 3

Return to damage to aircraft

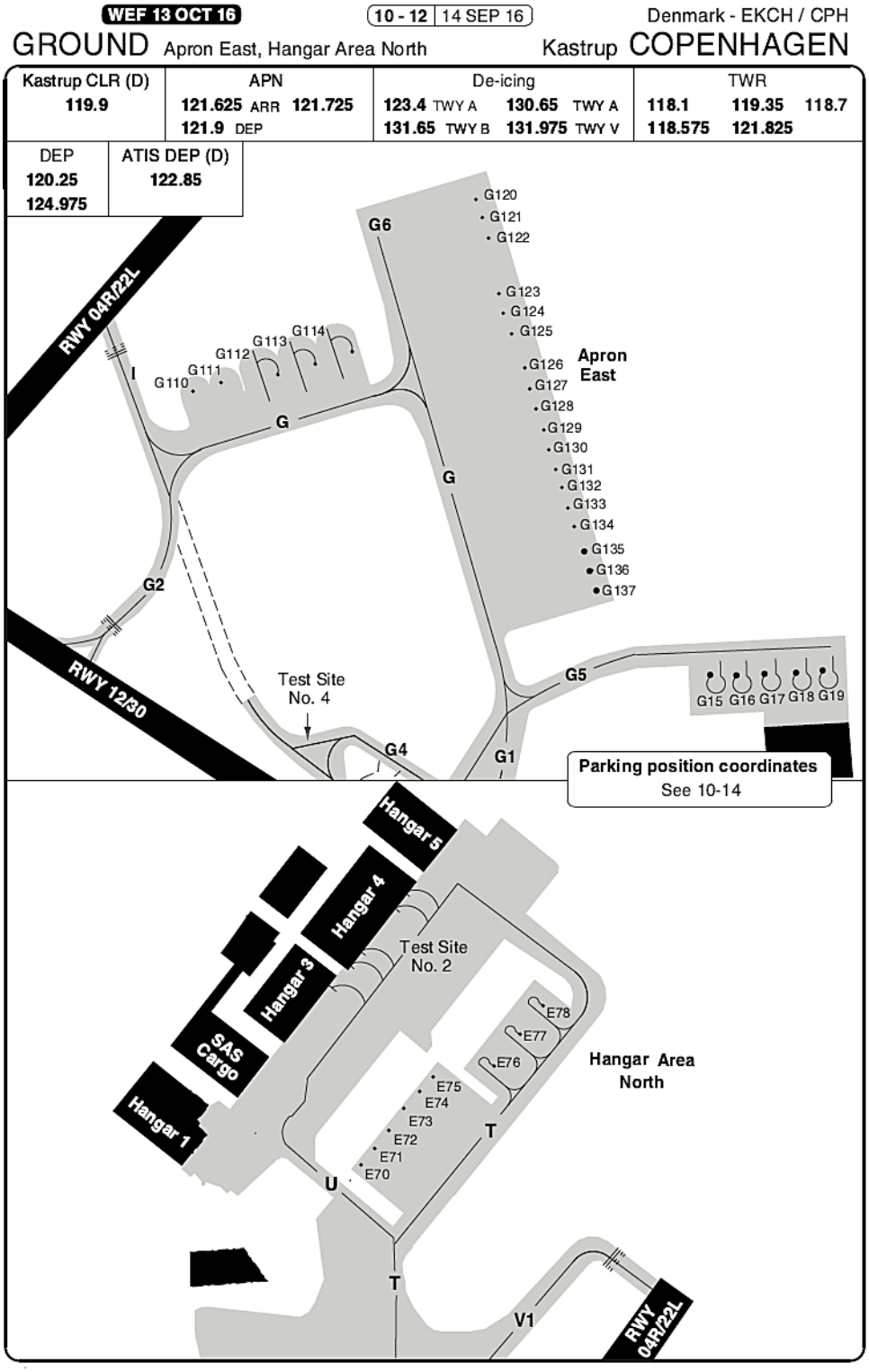


Picture 1

Picture 2

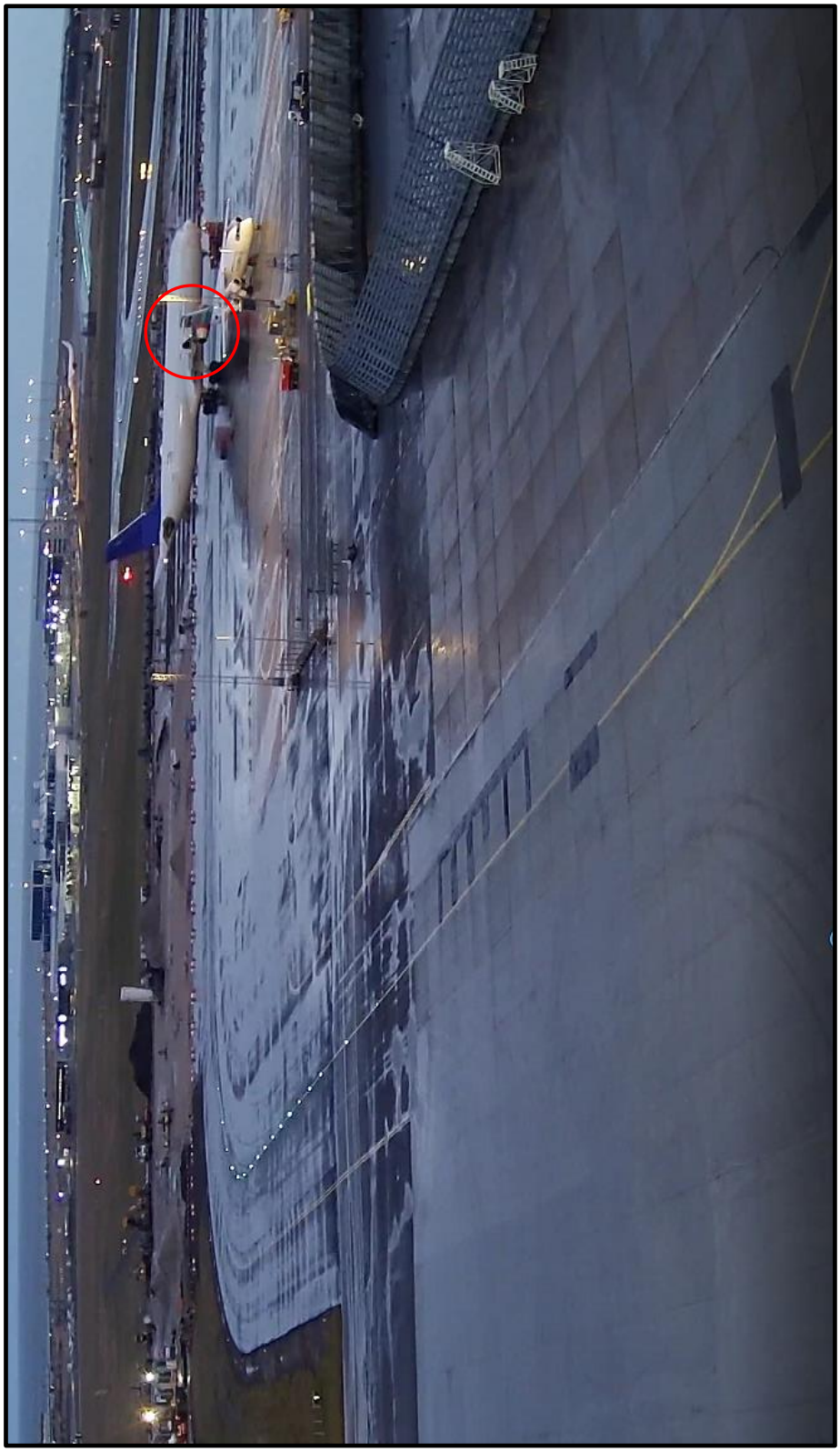
APPENDIX 4

[Return to operator of SE-DST]



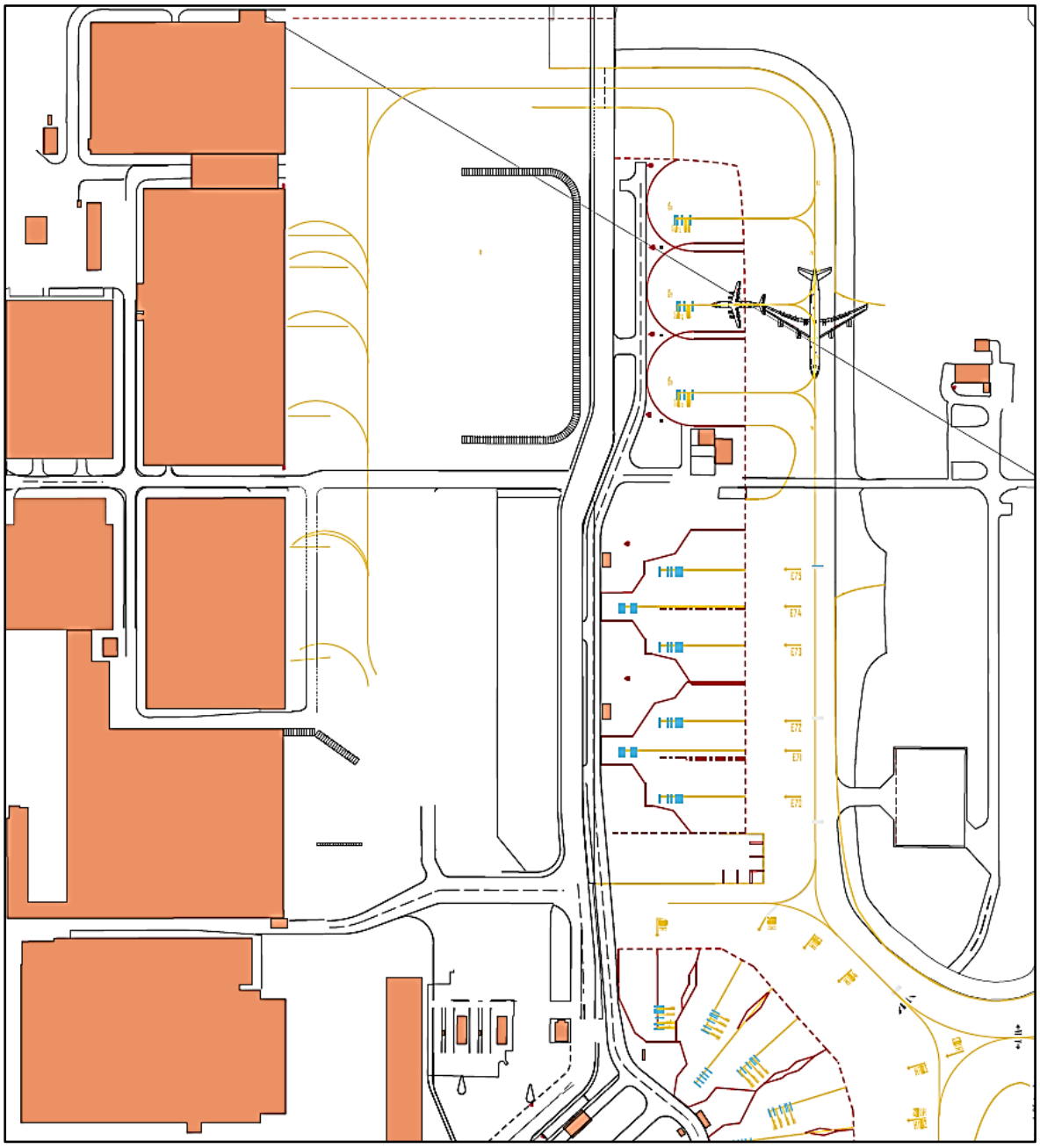
APPENDIX 5

Return to security camera recording



APPENDIX 6

Return to an outline of the accident site



Note. The outline of the accident site is not to scale.

APPENDIX 7

Return to aircraft stand E77

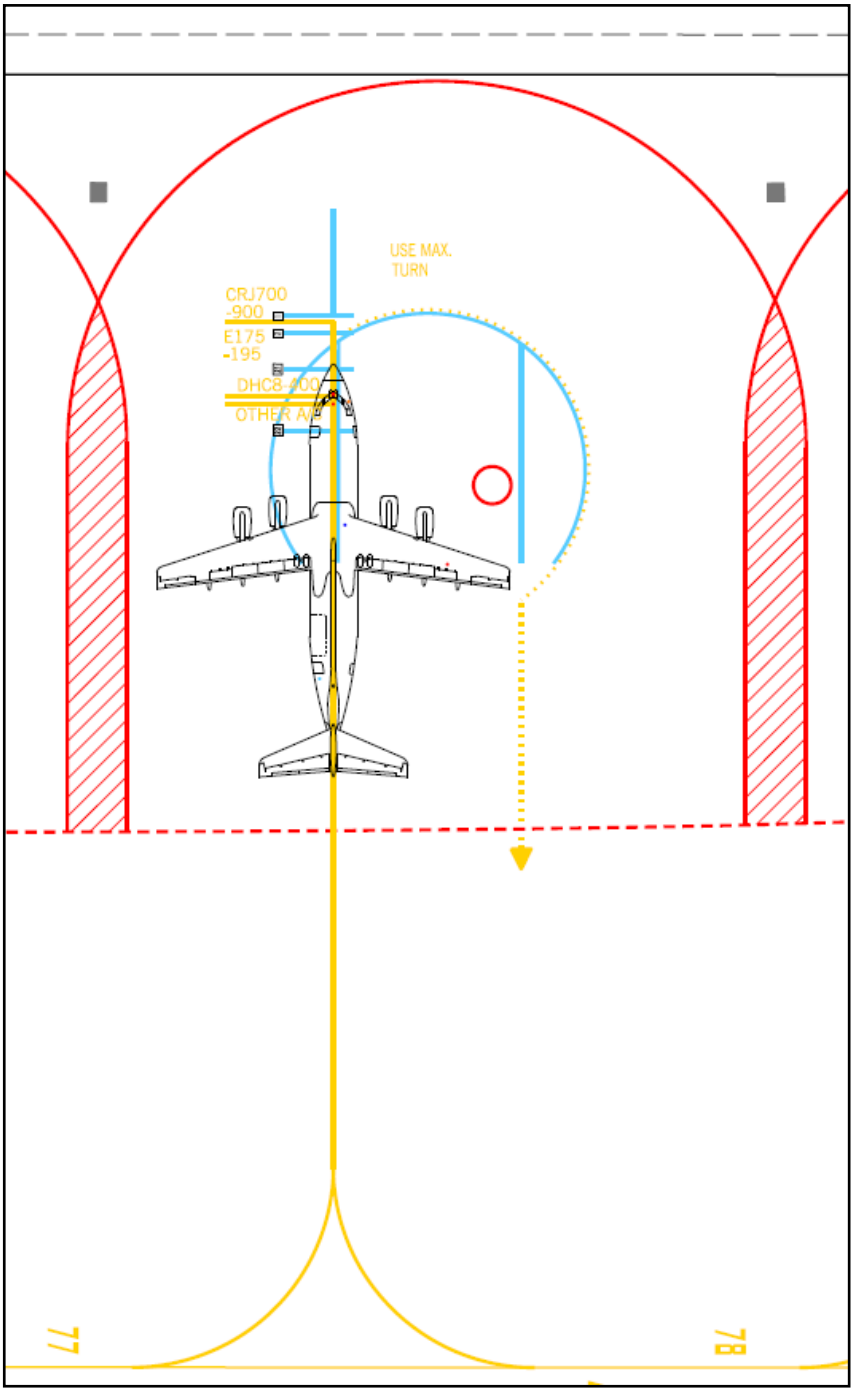
Note. The time that the picture was taken was not the time of the accident.

APPENDIX 8

Return to aircraft stand E77

APPENDIX 9

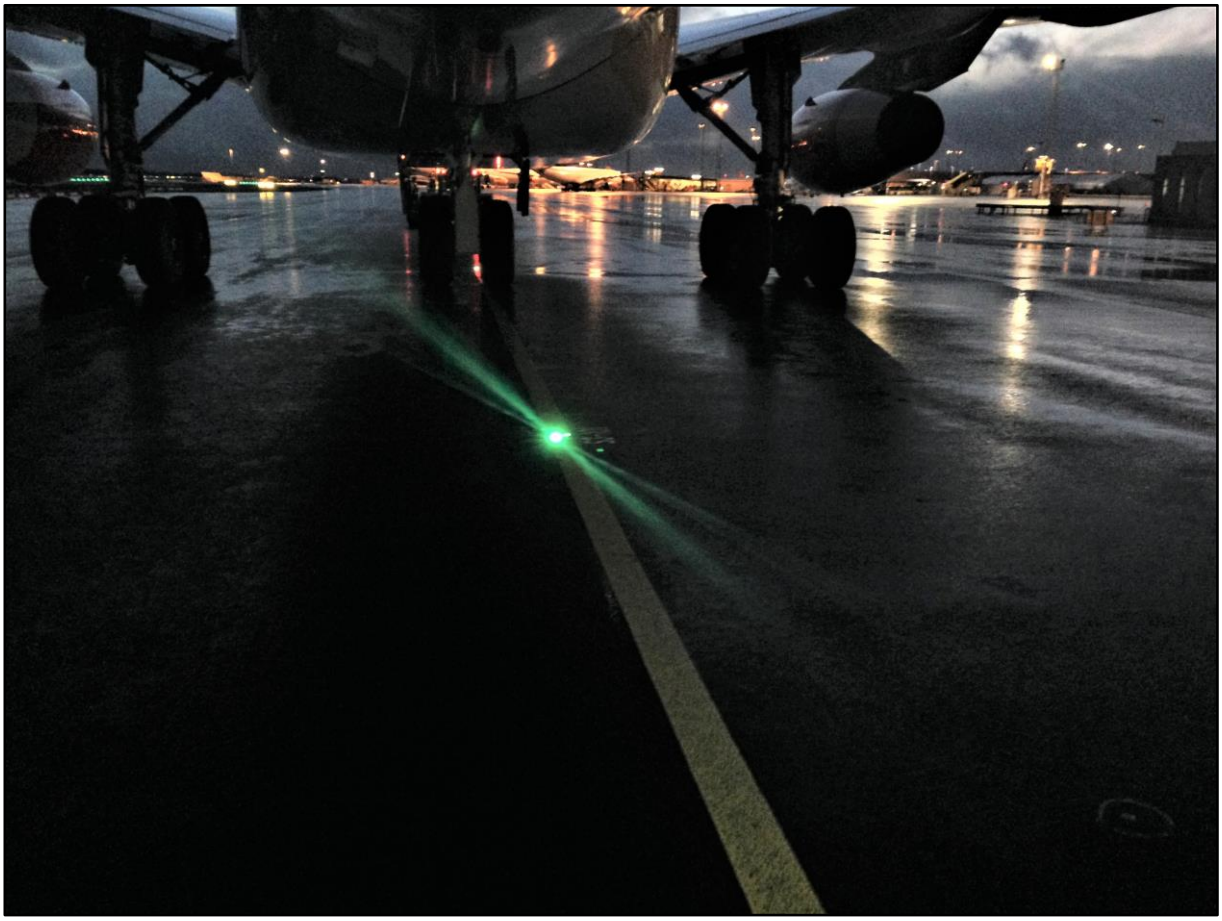
Return to aircraft stand E77



Note. The outline of aircraft stand E77 is not to scale.

APPENDIX 10

Return to taxiway T



APPENDIX 11

Return to S-MGCS

Time: 15:07:02 hours