NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

November 13, 2013

Group Chairman's Factual Report

OPERATIONAL FACTORS

DCA13FA082AB

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A. ACCIDENT

Location:	Newark Liberty International Airport (KEWR), Newark, New Jersey
Date:	May 1, 2013
Time:	1924: eastern daylight time[1]
Airplane(s):	Airbus A330-300, Reg. LN-RKO, S/N 515 Embraer E145, Reg. N17560, S/N 145605

B. OPERATIONAL FACTORS GROUP

B. David Tew (to Oct. 25, 2013)
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C. SUMMARY

On May 1, 2013, at Newark Liberty International Airport (KEWR), Newark, NJ, at about 1924 pm (EDT) an ExpressJet Embraer ERJ-145, flight number 4226 was taxiing northbound on Taxiway Romeo (R) for departure to Nashville International Airport (KBNA), Nashville, TN, (BNA) from Runway 22R and was stationary on Taxiway R between the intersections of Taxiways Mike (M) and Yankee (Y) in sequence for departure. Taxiing behind the ExpressJet was a Scandinavian Airlines (SAS) Airbus A333, flight number 908, awaiting departure to Oslo Airport, (ENGM), Oslo, Norway. SAS was subject to a departure flow restriction and was advised to turn right at Taxiway M and hold short of Runway 22R at Taxiway M. As SAS made the right turn onto Taxiway M the left wing struck the horizontal and vertical stabilizer of the ExpressJet ERJ-145. The damage to the SAS airplane was minor with scratches on the winglet, and the damage to the ExpressJet airplane was substantial with damage to both the horizontal and vertical stabilizer. There were no reported injuries.

D. DETAILS OF THE INVESTIGATION

An Operations Group was not formed and the Operations investigator did not travel to the scene of the accident. All investigative work was accomplished from NTSB Headquarters via telephone and Email. Crew statements were received from both the SAS crew and the ExpressJet crews. Supplementary materials were requested from both airline companies and from the FAA.

[1] All times are eastern daylight time (EDT) based on a 24-hour clock, unless otherwise noted.

On October 28, 2013, the NTSB Chief of the Operational Factors Division (AS-30) took over as the operations investigator for this accident investigation.

E. FACTUAL INFORMATION

1.0 History of Flight

The crew of SAS 908 departed ENGM at about 1107 Norway daylight time (GMT +1) and arrived at KEWR at approximately 1305 EDT (GMT – 4) on Tuesday April 30, 2013. They spent the night in a Jersey City, NJ hotel and according to their written statements all had a "good night's sleep." In the morning of Wednesday May 1, 2013,the captain said he awoke about 0530, and the first officer said he woke up about 0630. At 1600, the crew met in the hotel lobby for transportation to the airport. They were picked up about 1700, for the approximately thirty minute ride to KEWR. For the flight to ENGM they had an additional crewmember, a check pilot who occupied the cockpit jumpseat in order to supervise the new first officer. After preflight preparations, the crew boarded, and the airplane was pushed back from the gate at 1901; one minute later than scheduled. SAS 908 had on board: 3 cockpit crew, 8 cabin crew, and 245 passengers.

ExpressJet 4226 pushed back from the gate at 1857, and after leaving the ramp area, the crew was instructed to hold short of taxiway Y on taxiway R. They were told to wait for and follow the first B737 that approached from their left. While waiting for the B737, they stopped on taxiway R facing toward the northeast and set their parking brake. ExpressJet had on board: 2 cockpit crew, 1 cabin crew, and 31 passengers.

After leaving the gate area, SAS 908 was initially cleared to taxi northbound on taxiway R, and was told to hold short of taxiway Y, however after taxiing past taxiway K, the ground controller first told SAS to make a left turn onto taxiway M, but since the turn was too sharp, he then told SAS to make a right turn onto taxiway M. They were then instructed to cross runway 22R on taxiway Y, then turn left on taxiway P to hold short of runway 22R on the east side of the runway.

The SAS crew said that they saw the ExpressJet airplane, but the sun was low on the horizon, which made it difficult to look in that direction. They were also checking runway 22R, which they were crossing, to ensure there was no conflicting traffic. The SAS crew said they evaluated the clearance between their airplane and the ERJ-145, and they estimated that their wing would clear the other airplane. As SAS 908 turned on taxiway M, the winglet of the A330 contacted the tail section of the ExpressJet ERJ-145. The SAS crew said they did not feel the impact and were not initially aware of having collided with the other airplane. They were informed of the collision after they had crossed runway 22R and were on taxiway P. The ExpressJet crew stated that they did not see the SAS A330 pass behind them, but felt the impact as the A330 winglet struck the ERJ-145 empennage. In a follow-up statement, the SAS 908 captain stated that he was watching the winglet of his A330 relative to the wingtip of the ERJ-145, but did not see the tail of the ERJ-145, which was struck by the winglet of the A330. The SAS 908 crew further

stated that once they determined they would clear the ERJ-145, their focus was directed to their active runway crossing procedure.

SAS 908 stopped and shut down its engines until the airplane was inspected. They then restarted their engines and taxied back to their gate. The ExpressJet crew also shut down their engines and after a safety evaluation, they were towed back to the gate.

No injuries were reported by passengers or crew of either airplane.

2.0 Flight Crew Information

Captain of SAS 908
The pilot-in-command who occupied left cockpit seat at the time of the event. Information supplied by SAS:

Age at time of event	Approximately 57 years old
Date of hire with SAS	January 11, 1985
Date of first upgrade to a captain position	August 1, 1988
Date of transition or upgrade to A330	November 1, 1988
Total flight time	18,749:00
Total Pilot-in-Command flight time	15,500:00
Total time on accident airplane	[A330 – 1,517:00] [A340 – 1,836:00]
Current flight times	Last 24 hours: 7:00 Last 30 days: 77:00 Last 90 days: [A330 – 364:00] [A340 – 67:00] Last 12 months: [A330 – 364:00] [A340-215:00]
Most recent recurrent training	September 15, 2012
Most recent proficiency check	September 2, 2012
Most recent PIC line check	December 27, 2012
Previous accidents, incidents, violations, or disciplinary actions	2012 – Meeting with chief pilot regarding "commander role". No further action
Training and/or proficiency check failures	None
Airman certificate(s)	JAA Airline Transport Pilot License (ATPL) Issued by CAA of Norway – October 10, 2012 Type Rating(s): A340, A330 Instrument rating IR(A)ME
Medical Certificate	JAA Class 1 issued May, 18, 2012 VNL – Shall have available corrective spectacles for near vision and carry a spare set of spectacles. Expiration: Class 1 – June 1, 2013

First Officer of SAS 908

The second-in-command who occupied right cockpit seat at the time of the event. Information supplied by SAS:

Age at time of event	Approximately 52 years old
Date of hire with SAS	February 15, 1990
Date of first upgrade to a first officer position	February 15, 1990 (according to SAS)
Date of transition or upgrade to A330	[A330 – April 14, 2013] [A340 – March 1, 2007]
Total flight time	13,306:00
Total Pilot-in-Command flight time	5,438:00 PIC on DHC-8 Q400 with SAS
Total SIC time	7,868:00
Total time on accident airplane	[A330 – 31:00] [A340 – 758:00]
Current flight times	Last 24 hours: 7:00 Last 30 days: 23:00 Last 90 days: [A330 – 31:00] [A340 – 79:00] Last 12 months: [A330 – 31:00] [A340-629:00]
Type rated on accident airplane	March 7, 2012
Most recent recurrent training	October 26, 2012
Most recent proficiency check	April 19, 2013
Most recent SIC line check	March 28, 2012 (accident flight was current annual line check)
Previous accidents, incidents, violations, or disciplinary actions	None
Training and/or proficiency check failures	None
Airman certificate(s)	JAA Airline Transport Pilot License (ATPL) Issued by CAA of Norway – January 31, 2013 Type Rating(s): A340 Instrument rating IR(A)ME
Medical Certificate	JAA Class 1 issued September 19, 2012 VNL – Shall wear multifocal spectacles and carry a spare set of spectacles. RXO Requires specialist ophthalmolog examin every year.. Expiration: Class 1 – October 4, 2013. SAS representatives queried the pilot, who stated that he was wearing his spectacles at the time of the ground collision.

Captain of ExpressJet 4226

The pilot-in-command who occupied left cockpit seat at the time of the event. Information supplied by ExpressJet:

Age at time of event	Approximately 37 years old
Date of hire with ExpressJet	February 7, 2005
Date of first upgrade to a captain position	May 17, 2007
Date of transition or upgrade to ERJ-145	May 17, 2007
Total flight time	3,464:00 with ExpressJet
Total Pilot-in-Command flight time	3,704
Total time on accident airplane	3,464:00
Current flight times	Last 24 hours: 4:00 Last 30 days: 57:00 Last 90 days: 130:00 Last 12 months: 427:00
Most recent recurrent training	July 26, 2012
Most recent proficiency check	August 18, 2012
Most recent PIC line check	February 1, 2013
Previous accidents, incidents, violations, or disciplinary actions	Unknown
Training and/or proficiency check failures	Unknown
Airman certificate(s)	FAA -
Medical Certificate	FAA – First Class issued March 19, 2013 No Limitations

First Officer of ExpressJet 4226
The pilot-in-command who occupied left cockpit seat at the time of the event. Information supplied by ExpressJet:

Age at time of event	Approximately 31 years old
Date of hire with ExpressJet	April 30, 2007
Date of first upgrade to a first officer position	June 11, 2007
Date of transition or upgrade to ERJ-145	June 11, 2007
Total flight time	2,267:00 with ExpressJet
Total Pilot-in-Command flight time	None at ExpressJet
Total time on accident airplane	2,267:00
Current flight times	Last 24 hours: 4:00 Last 30 days: 57:00 Last 90 days: 130:00 Last 12 months: 440:00
Most recent recurrent training	March 13, 2013
Most recent proficiency check	March 16, 2013
Most recent PIC line check	March 20, 2013
Previous accidents, incidents, violations, or disciplinary actions	Unknown
Training and/or proficiency check failures	Unknown
Airman certificate(s)	FAA – Airline Transport Pilot (ATP) Issued March 16, 2013 CE-500, EMB-145, Commercial Pilot Privileges, Airplane Single Engine Land, (Limitations): English Proficient; ATP Circ Apch – VMC Only; EMB145 Circ. Apch – VC only; CE-500 SIC Privileges Only
Medical Certificate	FAA – First Class issued March 19, 2013 No Limitations

2.1 The Flight Crews' 72-Hour History

SAS 908 Captain:
According to captain's statement: (Time are in local time for location)
Night of April 28-29, 2013: "Good rest" at parent's home in Bergen, Norway

April 29, 2013: Woke at 0800, exercised on stationary bike, 37.5 km.
0915: Breakfast
1045: Driven by father to Bergen Airport, 15 minutes by car.
1155: Traveled by air from Bergen to Oslo, 45 min. flight.
1430: Annual medical check at SAS HMS, company medical center.
1600: Took Airport express train to Oslo Airport - Sandvika, 40 min. ride.
1645: Picked up at Sandvika station by brother-in-law, rode 5 minutes to his home.
1900: Moderate tempo jog in hilly terrain, 6km, 35:23 minutes.

2030: Dinner with sister and her family.
2300: Went to sleep, "good night's rest."

April 30, 2013: 0745 woke at sister's house, and ate breakfast there.
0845: Took airport express train to Oslo airport, 40 min. ride.
0950: Crew check-in and flight planning.
1107: Departed Oslo 3 minute ahead of schedule.
1305: Arrived at EWR 5 minutes ahead of schedule. Uneventful flight.
1400: Crew transported to hotel in Jersey City – less than a 30 min. ride.
1500: Workout in hotel gym, bike, weights, treadmill, (approx.. 1.5 hours)
1900: Dinner at nearby Thai restaurant with crew and three others.
2100: Went to bed at hotel, Had a "good night's sleep."

May 1, 2013: 0530: Woke up
0615: Workout in hotel gym, one hour on bike and light weights.
0900: Long and social breakfast at hotel. Lots of good healthy food.
1100: Rest and sleep in hotel room, approximately 3:00 sleep.
1600: Crew call time.
1700: Crew pick-up at hotel, transport to EWR, approx.. 30 min drive.
1901: Push back from gate.

The captain said that he did not consume any alcohol during the trip, and the last alcohol he consumed was two bottles of beer on February 16, 2013.

SAS 908 First Officer:
Approximate times according to first officer's statement: (Time are in local time for location)
Night of April 29, 2013:
2300: Went to bed. Had a "good night's sleep."
April 30, 2013:
0700: Awoke and had breakfast with wife and son.
Walked to airport express train (approximately a 15 min. walk.)
Arrived at Oslo Airport well ahead of scheduled check-in time.
He was receiving a check-ride for the A330 rating from OSL-EWR-OSL.
1107: Flight departed Oslo – The flight was uneventful.
1305: Flight arrived at EWR
1500: Arrived at hotel.
Took a shower, then walked to the "path" train to 33rd St. Visited B&H Photo and browsed store for a couple of hours. Returned to the hotel in New Jersey and met up with 7-8 other crewmembers for dinner.
1900: Dinner
2100: Returned to hotel
2230: Went to bed and had a "good night's sleep."

May 1, 2013:
0630: Woke up
0730: Breakfast in hotel with a couple crewmembers.

Repacked suitcase
Took a long walk
Stopped at Target and BestBuy and made some purchases.
Returned to hotel, ironed shirt and finished repacking.

1530-1630: Tried to sleep
1700: Crew pick-up. Went over flight paperwork on bus.
1735: Arrived at EWR, Set up airplane for return flight.

ExpressJet 4226 Crew :
The crew of the ExpressJet airplane involved in the accident did not submit a 72-hour history. Their aircraft was stationary on the taxiway with the parking brake set and was facing away from the SAS A330 at the time of the collision. They stated that fatigue on their part was not causal or contributory to the accident.

3.0 Aircraft Information

SAS A330 – Flight 908

Airplane Type	A330-300
Manufacturer	Airbus Industrie
Registration	LN-RKO
Serial Number	515
Engines	Rolls Royce Trent 722B
Crew And Passengers	2 pilots, 1 check-airman, 8 flight attendants, 245 passengers
Weight and Balance	Not applicable

ExpressJet ERJ-145 – Flight 4226

Airplane Type	ERJ-145
Manufacturer	Embraer S. A.
Registration	N17560
Serial Number	145605
Engines	Rolls Royce AE3007/AE3007A1P
Crew and Passengers	2 pilots, 1 flight attendant, 31 passengers
Weight and Balance	Not applicable

4.0 Meteorological Information

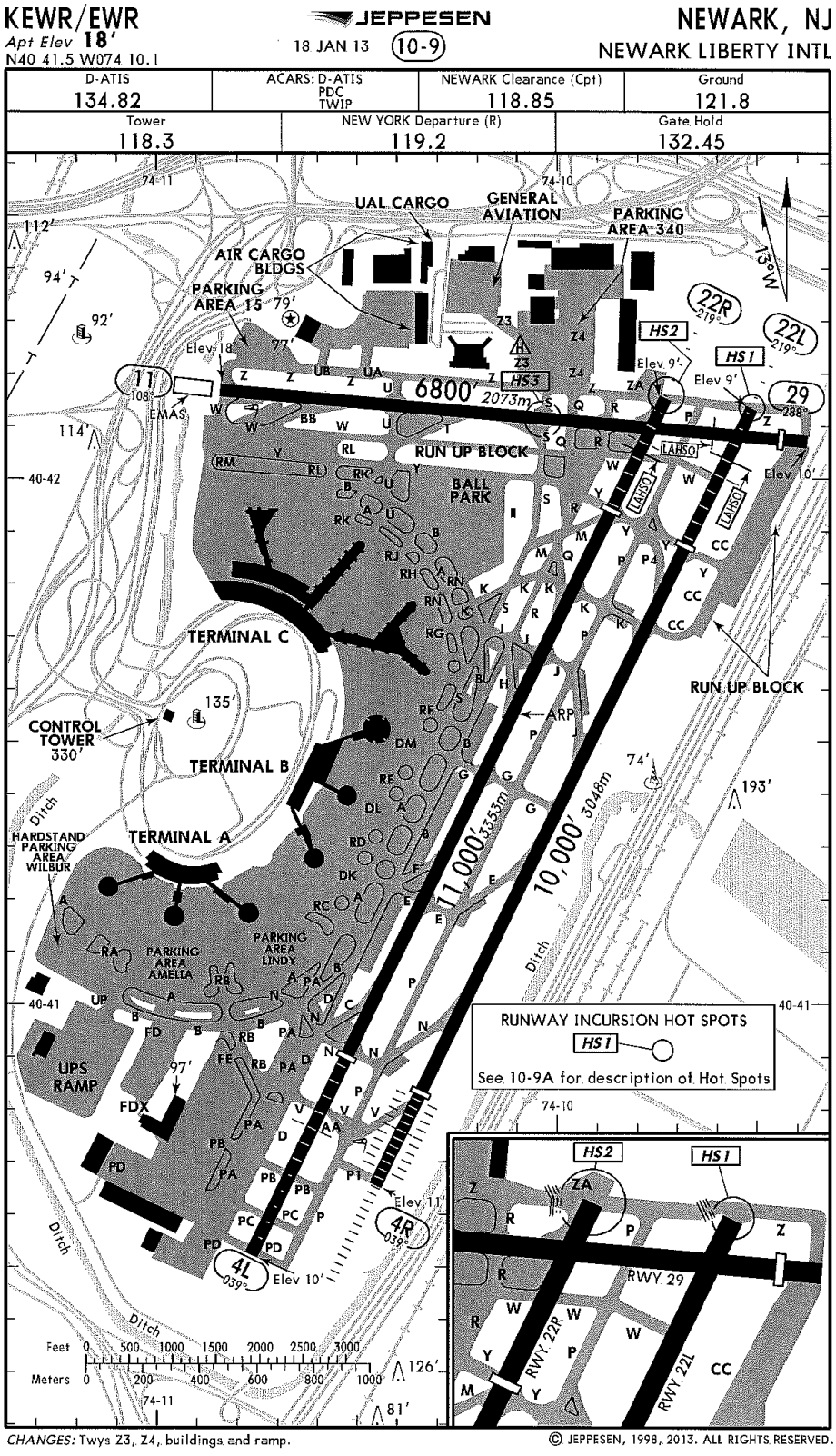
The weather at KEWR four minutes prior to the accident was reported as:
KEWR 012320Z 18007KT 10SM FEW250 14/07 A3046. Decoded, it reads: Newark Liberty International Airport weather observation at 2320Z (1920 EDT), wind from 180 degrees at 7 knots, visibility 10 statute miles, a few clouds at 25,000 feet, temperature 14 degrees Celsius (57.2 degrees Fahrenheit), dew point 7 degrees Celsius (44.6 degrees Fahrenheit), altimeter setting 30.46 inches of mercury.

The captain of SAS 908, who was steering the airplane at the time of the collision stated that, "the sun was sitting low to the northwest giving a strong blinding effect in that direction north of us on taxiway M. Still the small United Express Embraer EMB 145 standing there was in our sight." The first officer, who occupied the right cockpit seat stated that "the sun was setting and there was a strong glare on the left hand side of the aircraft as the sun was sitting over the buildings." The check-airman who was occupying a cockpit jumpseat also stated that "the sun was low just above the Embraer to our left, making it difficult to see."

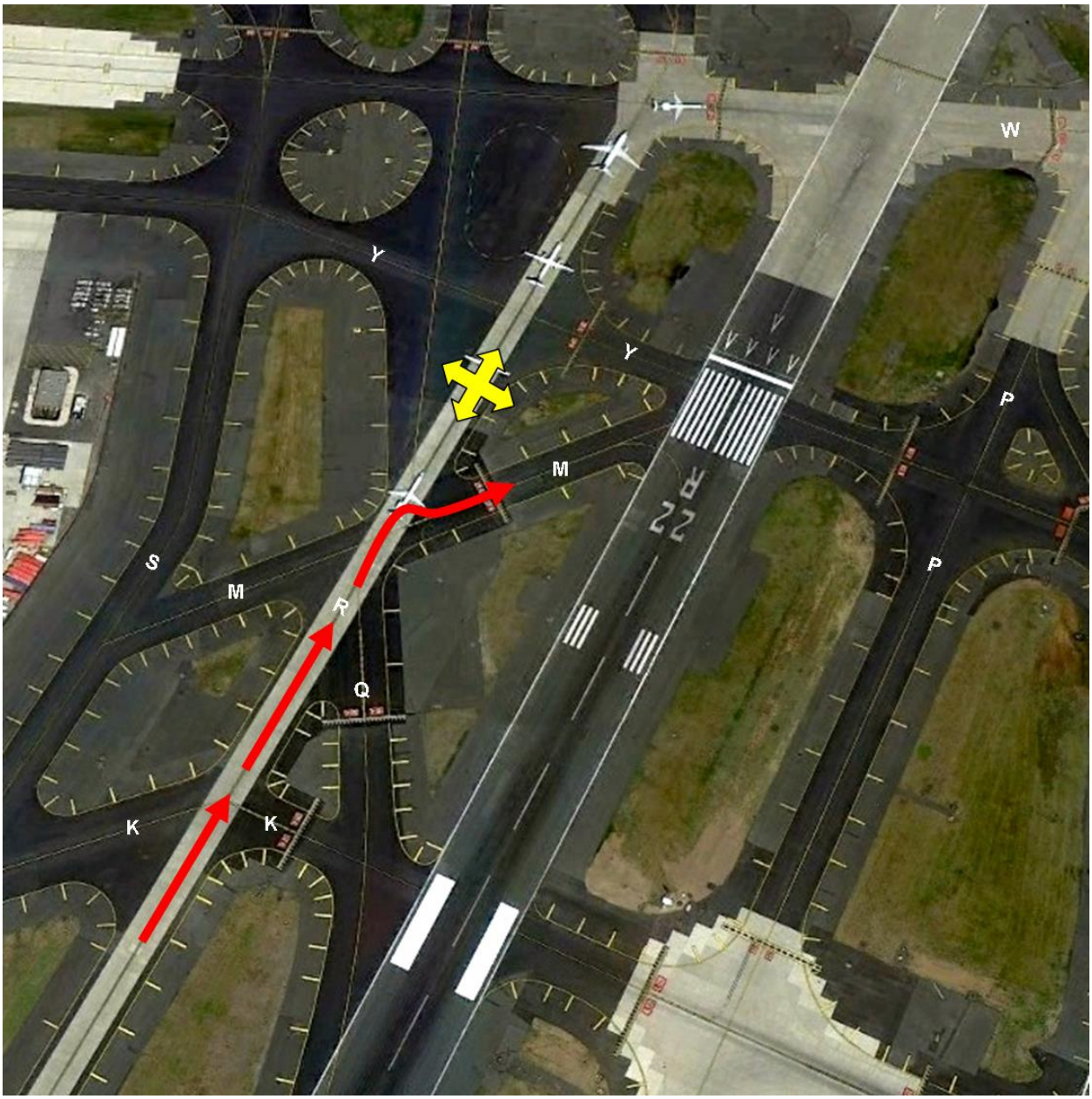
5.0 Communications

There were no known communications issues.

6.0 Airport Information



Newark Liberty International Airport (KEWR)



Google Earth Photo of Area Where Ground Collision Occurred
The Red Arrows Describe the Taxi Route of SAS 908 and the Yellow Cross Indicates the Approximate Area of the Parked Expressjet 4226.
(Note: It could not be determined the exact position of the ExpressJet ERJ-145 on taxiway R at the time of the impact.)

Newark Liberty International Airport (KEWR) was located at 40-41.550000N/074-10-07.2000W, about 3 miles south of the city of Newark, NJ. The airport elevation was 18 ft. mean sea level (MSL). The magnetic variation at the time of the accident was 13W.

The KEWR taxiways were nominally 75 feet wide and marked with a centerline and taxiway edge lines. There were no markers or other indications to provide guidance for traffic clearance on intersecting taxiways, nor were they required.

7.0 Organizational Information

Scandinavian Airlines (SAS), formerly Scandinavian Airlines System was founded in 1946 and is the flag carrier of Denmark, Norway, and Sweden. The airline presently operates approximately 130 aircraft to about 90 destinations. At the time of the accident, the SAS fleet consisted of Airbus A319, A320, A321, A330, A340, Boeing B737, and Bombardier CRJ900 airplanes. The SAS corporate offices are located near the Stockholm Arlanda Airport, Stockholm, Sweden.

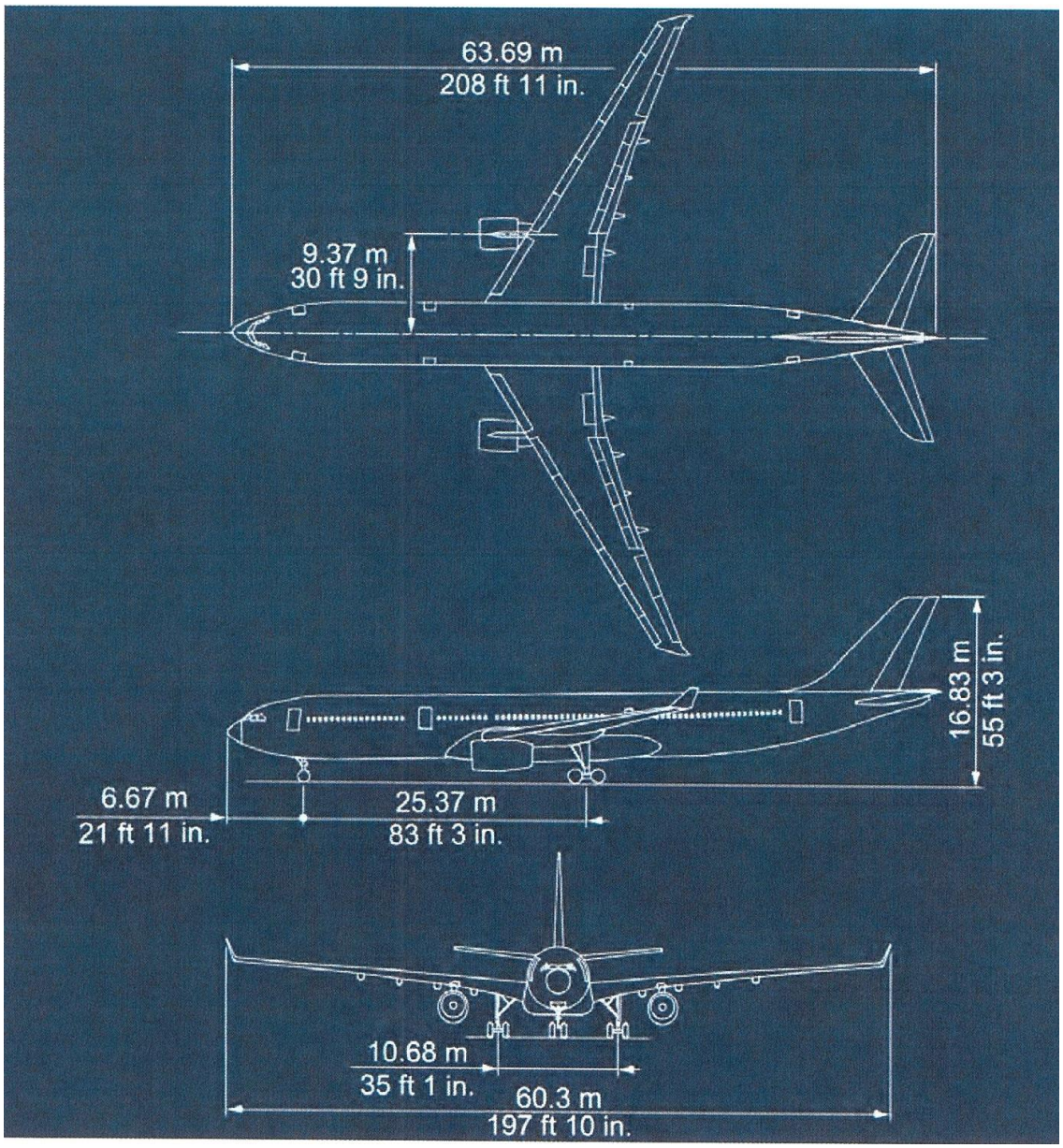
ExpressJet Airlines, Inc., founded 1n 1986, is an American airline headquartered near the Hartsfield-Jackson Atlanta International Airport, Atlanta, Georgia. The airline purports itself to be the largest regional airline in the world with over 400 aircraft, providing service to about 194 destinations. The ExpressJet fleet consists of Bombardier CRJ200, CRJ700ER, CRJ900ER, Embraer ERJ-135, and ERJ-145 airplanes.

8.0 Airplane Dimensions

Airbus A300-300

The principal dimensions of the Airbus A3330-300 are as follows:

- Total length 208’ 11” (63.69 m)
- Wingspan 197’ 10” (60.3 m)
- Height Vertical Stabilizer 55’ 3” (16.83 m)
- Width of Main landing Gear 35’ 1” (10.68 m)
- Distance of Main Gear from Nose 85’ 3” (25.37 m)
- Distance of Nose Gear from Nose 21’ 11” (6.67 m)
- Minimum Radius to make a 180 degree turn 150’ 11” (46 m)

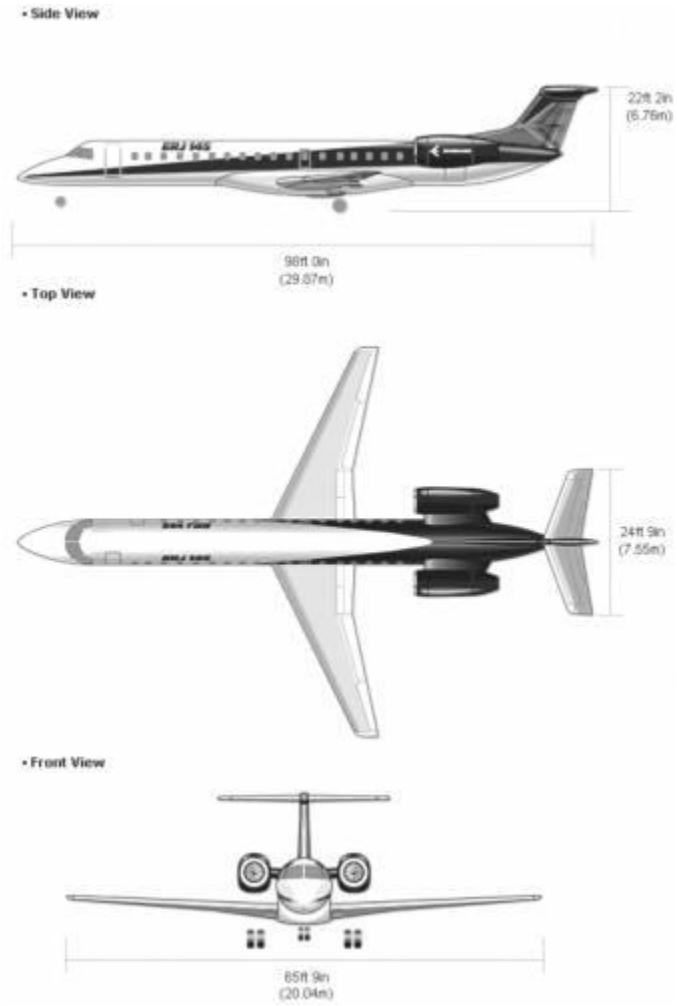


A330-300 Dimensions

Embraer ERJ-145

The principal Dimensions of the Embraer ERJ-145 are as follows:

- Total length 98’ 0” (29.87 m)
- Wingspan 65’ 9” (20.04 m)
- Height Vertical Stabilizer 22’ 2” (6.76 m)



8.1 SAS Ground Operations Guidance

Written Guidance

A review of SAS manuals could not locate any specific training, guidance, procedures or techniques to ensure wingtip clearance during ground operations. They did however indicate that other than on a ramp or apron area, with external guidance, taxing past obstructions should only be attempted if the distance separating the obstruction was greater than one-quarter the span of the airplane’s wing. The manuals described techniques for taxiing the airplane on the

centerline of the taxiway or runway, but did not offer any specific guidance on how to ensure that the wing tips would clear obstructions when taxiing straight or during turns.

In answer to specific questions, SAS supplied statements pertaining to the **SAS Operations Manual Part A**, **§8.4.1.2.3 Taxiing**.

- The Commander is solely responsible for ensuring that the aircraft does not come in contact with any object while being maneuvered under its own power."
- "An aircraft shall normally not be closer that one quarter wingspan from any obstacle when taxiing on the airport's maneuvering area."
- It is the duty of the pilot-not-flying [PNF] to inform the pilot flying [PF], if at any time, the aircraft comes closer than one quarter wingspan to obstacles on his side of the aircraft.
- Taxi guide line/markings do not always ensure adequate obstacle-free clearance and shall be used with caution. Whenever doubt exists, assistance from ATC should be requested.

The company provided additional information regarding taxi operations. These comments stated:

- That it was possible to see the wingtips from the cockpit of the A330, but it required "moving close to the side window and turning the torso backwards."
- When taxiing along a taxiway, they shall visually judge any obstacle to be at least the distance of a quarter wing span away. On the A330, that would be approximately 15 meters (49.2 feet). However, with guidance on the ramp apron or hardstand, the clearance may be less.
- Taxi training was essentially accomplished on-the-job during initial experience line flying.
- SAS procedures are for the pilot flying to also taxi the airplane. First officers would normally taxi the airplane when they were designated as the pilot flying. The exception was for single engine taxi, which was done by the captain.

Judgemental Oversteer Technique

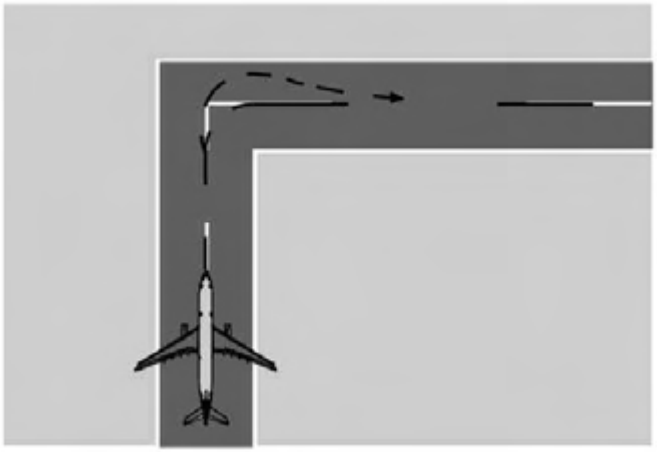


Illustration From SAS A330/A340 Flight Crew Training Manual Showing Path of Nose Gear During Judgmental Oversteer Maneuver.

**ON A/C A330-300

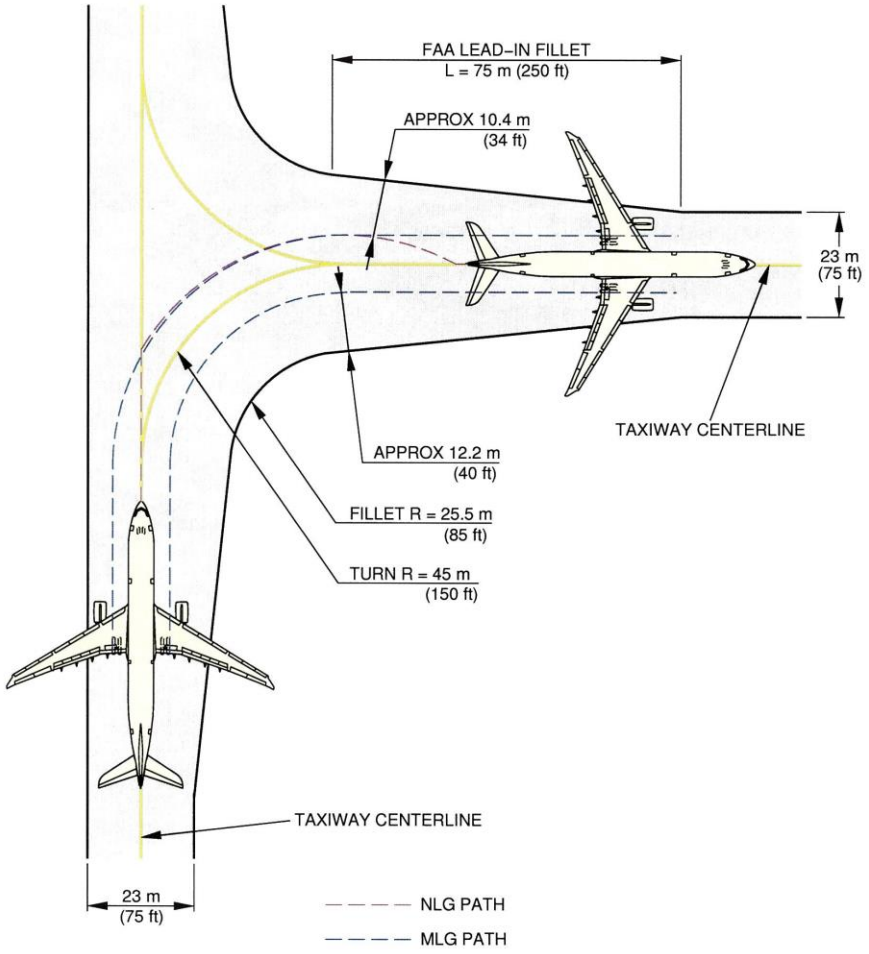


Illustration From A330 Manual Showing Judgmental Oversteer, Taxiway to Taxiway

The SAS A330/A340 Flight Crew Training Manual (FCTM) describes "judgmental oversteering." This technique is to ensure that the main landing gear path remains on the paved taxiway during turns. The technique is to allow the nose wheel to progress sufficiently beyond the midpoint of the taxiway so that the following main gear will essentially straddle the centerline during the turn, and not cut the corner across the unpaved area. The amount of oversteer depends on the angle of the turn and is a technique gained with experience.

A discussion of ExpressJet ERJ-145 taxi and ground operations are not applicable, since the ERJ-145 airplane was parked with brakes set facing away from the SAS A330 at the time of the collision.

8.2 Position of Parked ExpressJet ERJ-145.

The distance between the centerline of taxiway Y to the centerline of taxiway M is approximately 487 feet. That is the area within which ExpressJet 4026 was instructed to hold short of taxiway Y on taxiway R, in order to give way to a B737 that would pass in front of them on taxiway Y. The wingspan of a B737 is approximately 113 feet, which would indicate that if the B737 was positioned on the centerline of taxiway Y, its wing would project about 56.5 feet from the centerline of taxiway Y onto taxiway R. There were no hold short lines or other guidance indicators on taxiway R that would ensure wingtip clearance of a passing aircraft on taxiway Y, nor were such lines or guidance required. There were no lines or other guidance indicators on taxiway R that would ensure wingtip clearance from an airplane passing on taxiway M, nor were such lines or indicators required.

8.2 Applicable FAA and European Joint Aviation Requirements (JAR) Ground Operations Guidance.

14 CFR, Part 91.3 (a): "*The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft."*

14 CFR, Part 91.111 (a): "*No person may operate an aircraft so close to another aircraft as to create a collision hazard."*

14 CFR, Part 91.113 (b): "*When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft. When a rule of this section gives another the right of way, the pilot shall give way to that aircraft and may not pass over, under, or ahead of it unless clear."*

FAA Aeronautical Information Manual (AIM).
Dated August 25, 2011, Chapter 2. *"Being centered on the taxiway centerline does not guarantee wingtip clearance with other aircraft or objects."*

Dated August 25, 2011, Chapter 4. *"ATC clearances or instructions pertaining to taxiing are predicated on known traffic and known physical conditions. Therefore, it is important that pilots clearly understand the clearance or instruction. Although an ATC clearance is issued for taxiing purposes, when operating in accordance with the CFRs, it is the responsibility of the pilot to avoid collision with other aircraft."*

JAR-OPS 1.085 (e) (3) Crew Responsibilities:

(a) "A crew member shall be responsible for the proper execution of his duties that:
(1) are related to the safety of the aeroplane and its occupants; and

(2) are specified in the instructions and procedures laid down in the Operations Manual."

JAR-OPS 1.095 Authority to Taxi an Aeroplane:

(a) "An operator shall take all reasonable steps to ensure that an aeroplane in his charge is not taxied on the movement area of an aerodrome by a person other than a flight crew member, unless that person, seated at the controls:
(1) Has been duly authorized by the operator or a designated agent and is competent to:
(i) Taxi the aeroplane;
(ii) Use the radiotelephone; and
(2) Has received instruction in respect to aerodrome layout, routes, signs, markings, lights, air traffic control signals and instructions, phraseology and procedures, and is able to conform to the operational standards required for safe aeroplane movement at the aerodrome."

JAR-OPS 1.120 Endangering Safety:

(a) "An operator shall take all reasonable measures to ensure that no person recklessly or negligently acts or omits to act:
(1) So as to endanger an aeroplane or person therein;
(2) So as to cause or permit an aeroplane to endanger any person or property."

F. Drug and Alcohol Testing

Neither crew were given drug and alcohol tests after the accident. In a meeting with the New York Port Authority Police, the Captain of SAS 908 asked to be tested for drug and alcohol per: 14 CFR 91.17. The Captain stated that he was told that it was "not deemed necessary as we all appeared to be on very good shape and not in any way under the influence of any substance." He further stated that he still requested some sort of a test to avoid any later speculation. That "test" was "performed by us 'walking the line' up and down the finger from plane to terminal. Not surprisingly we all passed it with excellence."

The flight crew of the ExpressJet ERJ-145 were not drug and alcohol tested, and no reason was given by the company for that omission.

G. LIST OF ATTACHMENTS

Attachment 1: SAS A330 FCTM – TAXI OPERATIONS
Attachment 2: SAS 908 CREW STATEMENTS
Attachment 3: EXPRESSJET 4226 CREW STATEMENTS
Attachment 4: ADDITIONAL QUESTIONS FOR THE CREW OF SAS908
Attachment 5: SAS 908 CREW 72 HOUR HISTORY

Submitted by:

Paul R. Misencik – Chief, AS-30 November 13, 2013

ATTACHMENT 1- SAS A330 FCTM – TAXI OPERATIONS

TAXI ROLL AND STEERING

Applicable to: ALL

Before taxi, check that the amber "NWS DISC" ECAM message is off, to ensure that steering is fully available.

THRUST USE

Only a little power is needed above thrust idle, in order to get the aircraft moving (N1≈ 40 %). Excessive thrust application can result in exhaust-blast damage or Foreign Object Damage (FOD). Thrust should normally be used symmetrically.

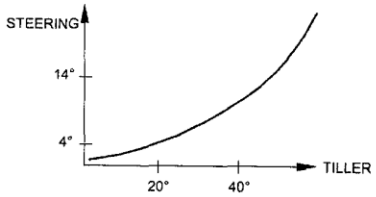
TILLER AND RUDDER PEDALS USE

Pedals control nosewheel steering at low speed (± 6 ° with full pedal deflection). Therefore, on straight taxiways and on shallow turns, the pilot can use the pedals to steer the aircraft, keeping a hand on the tiller. In sharper turns, the pilot must use the tiller.

STEERING TECHNIQUE

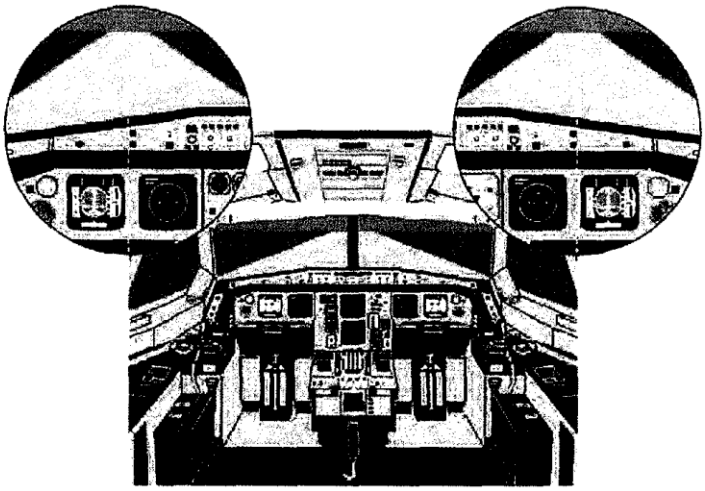
The Nosewheel steering is "by-wire" with no mechanical connection between tiller and the nosewheel. The relationship between tiller deflection and nosewheel angle is not linear and the tiller forces are light.

tiller deflection vs nosewheel steering angle



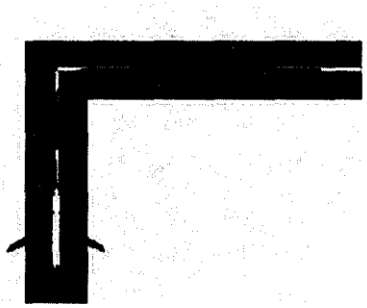
Therefore, the PF should move the tiller smoothly and maintain the tiller's position. Any correction should be small and smooth, and maintained for enough time to enable the pilot to assess the outcome. Being over-active on the tiller will cause uncomfortable oscillations.
On straight taxiways, the aircraft is correctly aligned on the centerline, when the centerline is lined-up between the PFD and ND.

Correctly Following the Centerline



If both pilots act on the tiller or pedals, their inputs are added until the maximum value of the steering angle (programmed within the BSCU) is reached.
When the seating position is correct, the cut-off angle is 20 °, and the visual ground geometry provides an obscured segment of 53 ft (16.15 m). During taxi, a turn must be initiated before an obstacle approaches the obscured segment. This provides both wing and tail clearance, with symmetric thrust and no differential braking.
Asymmetric thrust can be used to initiate a tight turn and to keep the aircraft moving during the turn. If nosewheel lateral skidding occurs while turning, reduce taxi speed or increase turn radius. Avoid stopping the aircraft in a turn, because excessive thrust will be required to start the aircraft moving again.
The flight crew should be aware that the main gear on the inside of a turn will always cut the corner and track inside of the nosewheel track. For this reason, over-steer must be used.

Oversteering technique



When exiting a tight turn, the PF should anticipate the steer out. Additionally, the PF should allow the aircraft to roll forward for a short distance to minimize the stress on the main gears.
In the event that one or more tires is/are deflated on the main landing gear, the maximum permitted steering angle will be limited by the aircraft speed. Therefore, with one tire deflated, the aircraft speed is limited to 7 kt and nosewheel steering can be used. With two tires deflated, the aircraft speed is limited to 3 kt and nosewheel steering angle should be limited to 30 °.
For turns of 90 ° or more, the aircraft speed should be less than 10 kt.

180 ° TURN

For turn of 180°, the following procedure is recommended for making a turn in the most efficient way.

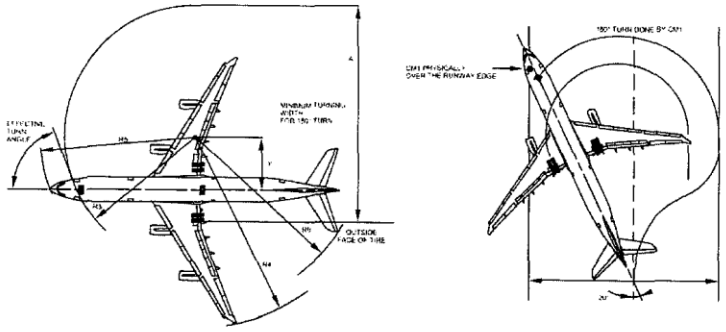
For the CM1

- Taxi on the right-hand side of the runway, and turn left to establish a 20 ° divergence from the runway axis (using the ND or the PFD). The maximum ground speed is 10 kt.
- When CM1 assesses to be physically over the runway edge, smoothly initiate a full deflection turn to the right
- Asymmetric thrust will be used during the turn. Anticipation is required to ensure that asymmetric thrust is established before the turn is commenced [50 % N1 or 1.05 EPR], to maintain a continuous speed of approximately 8 kt throughout the maneuver.
- It is essential to keep minimum ground speed during the turn in order not to need to increase the thrust too significantly so as not to get stuck. It is a good practice that the CM2 calls the GS from ND while in turn

- Differential braking is not recommended, to prevent stress on the landing gear assembly. In addition, a braked pivot-turn is **NOT** permitted (i.e. braking to fully stop the wheels on one main gear).
- On wet or contaminated runway, more specifically when turning on the runway white or yellow painted marking, tight turn lead to jerky rides of the nose wheel which are noisy and uncomfortable.

For the CM2, the procedure is symmetrical (taxi on the left hand side of the runway).

Aircraft dimensions



BRAKE CHECK

Applicable to: ALL

When cleared to taxi, the PF should set the Parking Brake to "OFF". When the aircraft starts to move, the PF should check the efficiency of the normal braking system by gently pressing the brake pedals, to ensure that the aircraft slows down. The PNF should also check the triple brake indicator to ensure that brake pressure drops to zero. This indicates a successful changeover to the normal braking system.

CARBON BRAKE WEAR

Applicable to: ALL

Carbon brake wear depends on the number of brake applications and on brake temperature. It does not depend on the applied pressure, or the duration of the braking. The temperature at which maximum brake wear occurs depends on the brake manufacturer. Therefore, the only way the pilot can minimize brake wear is to reduce the number of brake applications.

TAXI SPEED AND BRAKING

Applicable to: ALL

On long, straight taxiways, and with no ATC or other ground traffic constraints, the PF should allow the aircraft to accelerate to 30 kt, and should then use one smooth brake application to decelerate to 10 kt. The PF should not "ride" the brakes. The GS indication on the ND should be used to assess taxi speed.

BRAKE TEMPERATURE

Applicable to: ALL

The FCOM limits brake temperature to 300 °C before takeoff is started.
This limit ensures that, in the case of hydraulic fluid leakage, any hydraulic fluid, that may come into contact with the brake units, will not be ignited in the wheelwell.
This limit does not ensure that, in the case of a high energy rejected takeoff, the maximum brake energy limitation will be respected.
Thermal oxidation increases at high temperatures. Therefore, if the brakes absorb too much heat, carbon oxidation will increase. This is the reason why the brakes should not be used repeatedly at temperatures above 500 °C during normal operation. In addition, after heavy braking, the use of brake fans ⋖ can increase oxidation of the brake surface hot spots, if the brakes are not thermally equalized.

BRAKING ANOMALIES

Applicable to: ALL

If the ACCU PRESS drops below 1 500 PSI, the flight crew should be aware that the Parking Brake can, quite suddenly, become less efficient. This explains the amber range on the hydraulic pressure gauge of the ACCU PRESS.
If the flight crew encounters any braking problems during taxi, they should set the A/SKID & N/W STRG Sw to OFF. They should not apply pressure to the pedals while setting the A/SKID & N/W STRG Sw to OFF. Then, the PF should refer to the triple brake indicator and modulate the pressure as necessary.

BRAKE FANS ⋖

Applicable to: ALL

Brake fans cool the brakes, and the brake temperature sensor. Therefore, when the brake fans are running, the indicated brake temperature will be significantly lower than the indicated brake temperature when the brake fans are off.

ATTACHMENT 2 - SAS 908 CREW STATEMENTS

EWR incident 01MAY3012 SK908

Crew statements

Commander:
During out taxiing we, SAS 908 an Airbus A-330/300, were initially cleared northbound along taxiway R to hold short of Y. After having passed K the ground controller admitted to have made an error bringing us ahead of a United B-757. A reshuffle was therefore necessary for the right sequencing for departure. First he wanted us to make a sharp 135 degree left turn on M, but realizing that the turn would be too tight, we were told to make a 45 degree right turn onto that same taxiway M, then cross runway 22R on taxiway Y, turn left on P to hold short of W on the opposite side of the runway. All these taxiways and the runway are in close proximity to each other, a frequency change to tower was also involved in the process and the runway crossing was expected to be done expeditiously. We were three pilots in the cockpit all very aware of the situation and paying close attention first of all to the runway crossing. The sun was sitting low to the northwest giving a strong blinding effect in that direction north of us on taxiway M. Still the small United Express Embraer EMB 145 standing there was in our sight. The proximity of his right wing was evaluated to be close, but not to close, and in any event our wing was of course much higher than theirs. When on taxiway P a possible hit with the other aircraft's tail was brought to our attention. Nothing was felt by any of us in the cockpit or by anyone in the cabin. The damage to our plane was superficial scratches to the paint only.

First Officer:
After pushback from stand 63 at satellite B3 onto RF face east, taxi instructions were given. Taxi RF onto B and follow traffic in line for 22R, but hold short Y to let a B737 ahead. On R passing K ground control tell us to monitor twr frequency. A few seconds later tower told us to go back to ground frequency. Ground tells us they made a mistake and want us to turn left on M. Before letting them know that's too tight a turn ground comes back tells us to take a right turn on M and hold short 22R. Sent over to twr again. Tower wants us to cross 22R in an expeditious manner and enter Y and P and hold short on W. The sun was setting and there was a strong glare on the left hand side of the aircraft as the sun was sitting over the buildings. Also there was as always, a lot of focus on checking 22R for free passage on left and right side. We never felt we hit the aircraft, an EMB 145 in the tail section with our left wing. Entering P tower told us to hold short of W as there was a possible hit when leaving R onto M.
Hope this clarifies the happening.

Captain, Line Check Pilot, seated on jump seat:
We were taxiing out as Sk908 on 01 may 2013.
We proceeded according to clearance from ground along R to hold short of Y.
Traffic was heavy, there was a long queue and we started only one engine.
We were sent to tower and shortly thereafter sent back to ground and informed that they had made a mistake on the sequencing. We were initially asked if we could make a left 135 degree turn on to M, but after we hesitated on the reply he told us to turn right on M.
At this time we were holding behind a United Embraer.
Shortly thereafter we received clearance to cross 22R at the same time as we observed another aircraft moving into takeoff position. The sun was low just above the Embraer to our left, making it difficult to see.

ATTACHMENT 3 – EXPRESSJET 4226 CREW STATEMENTS

5-1-13

Operating Flt 4226 EWR to BNA.
We were intructed to hold short of
taxi way Y on R and wait for
the first 737 to follow from the
left. We sat at the instructed
intersection for several mindes With
the parking Brake set. While waiting
an SAS aircraft passed behind us and
clipped our tail/empennage.

[redacted]
Captain [redacted]

Approx 7:30p Local our A/C was struck By SAS A330. our Position was Romeo Short of Yankee with parking brake set, Awaiting sequenced Traffic from The right. our Tail/empenage was Struck by a Passing A/C. we shut down engines and requested Visual evaluation by other aircraft. we remained in position until ARFF/NYPA Arrived, And we were eventually Towed to gate.

[redacted]

First officer

ATTACHMENT 4 – ADDITIONAL QUESTIONS FOR THE CREW OF SAS908

EWR incident 01MAY2013 SK908

Additional questions

- Can they see the A-330 wingtip from the cockpit?
  Yes it is possible by moving close to the side window and turning the torso backwards.

- How do they judge if they have clearance to pass something?
  Generally when taxiing along a taxiway centerline they shall visually judge any obstacle to be at least at a distance of a quarter of a wing span. For this A330 approximately 15m.
  When taxiing by use of guidance, apron/stands, they can taxi closer to objects.

- Did they receive any A-330 taxi training in the simulator or airplane? If so, what was it?
  Taxi training is a focus area during initial line flying. In SAS Airbus aircraft (A320 -A340) pilot flying is pilot taxiing on ground. This means that already as First Officer you are trained to taxi the aircraft.
  Out taxiing on one engine is however always performed by the Commander.

- Was either pilot watching the wingtip as it was passing the ExpressJet 145?
  Yes the Commander watched the winglet relation to the Embraer right wingtip. He did not see the tail of the aircraft.

- Which wingtip hit [I believe it was the left] and where were the pilots focusing their view when the collision occurred?
  Left winglet hit the tail of the Embraer. When the Commander had ensured sufficient clearance between the two wings full focus was directed to the crossing of an active runway procedure.

- Were the pilots told of the other airplane?
  There was no specific information regarding the Embraer aircraft. The out taxing was slow with many stops and the aircraft was in sequence in front of SK908.

- Is there any written guidance in their manuals about taxiing and taxi clearance of objects? If so, could I request copies of any taxi guidance?
  Extract from SAS Operations Manual Part A:
  §8.4.1.2.3. Taxiing

The following instructions are valid during taxiing:
• The CDR is solely responsible for ensuring that the aircraft does not come in contact with any object while being maneuvered under its own power.
• Aircraft clear signal shall be received from startup person before taxiing is commenced.
• Taxi/landing lights or other external lights, according to the procedures for respective aircraft type, should be switched on as an acknowledgment that clear signal has been received before parking brakes are released and taxiing is commenced.
• When entering/departing the parking stand, ensure that no equipment, e.g. ladders, stairs, trucks or baggage-carts, etc., or personnel are parked/standing inside the aircraft in-taxiing hazard zone.
• An aircraft shall normally not be closer than one quarter wing span from any obstacle when taxiing on the airports manuvering area.
It is the duty of the PNF to inform the PF if, at any time, the aircraft comes closer than one quarter wing span to obstacles on his side of the aircraft.

• Taxi guide lines/markings do not always ensure adequate obstacle-free clearance and shall be used with caution. Whenever doubt exists, assistance from ATC should be requested.
• Care shall be taken to ensure that the aircraft is taxied in such a way that slipstream or blast from its engines will not cause damage.
• If an unexpected instruction is received before taxiing, review the routing on the taxi route chart and conduct a briefing, in order to ensure that both flight crew members have fully understood the instructions.
• If taxi instructions are complex or at unfamiliar airports, write down all instructions, eventually request progressive taxi instructions (i.e.: step by step routing directions) if needed.
• An aircraft shall furthermore not cross or enter a runway without a clear permission to do so. This is also applicable for non-active runways. To the extent possible, lookout shall confirm that no conflict exists. The use of other available information may aid in achieving this goal.
• Care shall be taken when taxiing on ice or snow-covered tarmacs or approaching nosein parking stands to ensure that the taxi speed is not greater than will ensure an immediate stop if conditions so dictate.
• Minimum taxiway widths are detailed in respective OM-B. Exemption may be obtained from NPH FO.
• When taxiing, both flight crew members shall be "in the loop" for actively monitoring and updating their progress and location on the ground taxi route chart; this includes knowing the aircraft's present position and mentally calculating the next location on the route: PF-guided-by-PNF with cross-confirmation should be the operational standard.
Be alerted by any information not consistent with what is expected. If you have any doubt at any time of aircraft location, stop and immediately inform ATC. Do not hesitate to ask for a "Follow-me" vehicle.
• Reduce taxi speed when approaching any intersection, for proper signs and markings identification.
• When approaching a runway, alertness to detect the hold-line on the taxiway is required.
Hold-line may be farther from the runway than expected, particularly at intersections where several taxiways intersect with RWY. Also be alert on snow covered taxiways and actively use the taxiways signs to identify position.
• Before crossing a runway, ensure that the taxi instructions include an explicit clearance to cross that runway, this requirement also includes crossing of non-active runways. If any uncertainty, do not hesitate to ask ATC.
• If possible, turn on strobe light whenever crossing or entering a runway.
• Use all available resources (heading indicators, airport charts, airport signs, markings lighting and air traffic control) to keep the aircraft on its assigned flight and/or taxi route. The pilots shall have the airport chart readily available when taxiing.
• An aircraft shall stop and hold at all lighted stopbars and may only proceed when the lights are turned off and explicit clearance to continue has been received.
In case of malfunctioning airport light control with stopbar still on, the illuminated stop bar shall only be crossed after careful CDR consideration and with specific clearance from TOWER.
• Checklist reading or other cockpit preparation activities shall not be initiated nor continued during adverse conditions requiring special attention. It is of particular importance for all flight crew members to concentrate their attention on taxiing the aircraft when operating in unfavorable conditions, i.e. low visibility, unfamiliar airports, congested areas etc. During these conditions, it is strongly recommended to refrain from checklist reading while the aircraft is moving.
• If possible, perform the before-takeoff check list when the aircraft is stationary.
• When cleared lineup or takeoff, visually scan to the left and to the right and check approach path is clear of traffic. Use the TCAS display, when ATC transponder is switched on, to remain aware of traffic on approach.
• If uncertain about T/O clearance received, a confirmation shall always be requested from ATC, not from the other pilot.
• ATC shall be advised if additional time on the runway is required prior to initiating the takeoff roll.

ATTACHMENT 5 - SAS 908 CREW 72 HOUR HISTORY

Flight crew; Last 72 hours

Captain
Night April 28th - 29th 2013: good night sleep at my parents in Bergen, Norway.

April 29th 2013:
08:00: 1hour training stationary bike, 37,5 km
09:15: Breakfast
10:45: Brought to Bergen Airport by my father, 15 min by car.
11:55: Travelled by air Bergen -Oslo, 45 min
14:30: Annual medical check at SAS HMS, company's medical center.
16:00: Airport express train Oslo Airport - Sandvika, 40min
16:45: Picked up at Sandvika train station by brother-in-law by car, 5 min to their home
19:00: Moderate tempo jog in hilly terrain, 6km, 35:23 minutes.
20:30: Dinner with my sister and her family
23:00: Went to bed. Good night's sleep at my sister's

April 30th 2013:
07:45: Breakfast at my sister's
08:45: Airport express train Sandvika - Oslo Airport, 40 min
09:50: Check in for duty. Planned flight with FD crew and briefing with CC.
11:07: Departure OSL, 3 minutes ahead of schedule
13:05: (local time) arrival EWR, 5 minutes ahead of schedule after uneventful flight.
14:00: Crew transported to hotel in Jersey city, less than 30 min.
15:00: Training in hotel gym, 1hour bike, 23,7 miles, 15 min weights, 3km jog tredmill, 14,18 min
19:00: Dinner at nearby Thai restaurant with FD crew and 3 others.
21:00: Went to bed at hotel.

May 1st 2013:
05:30: Woke up after good night's sleep
06:15: Training in hotel gym, 1 hour bike, some light weight training
09:00: Long and social breakfast at hotel, lots of good and healthy food.
11:00: Rest and sleep in hotel room, approximately 3 hours sleep
16:00: Call time
17:00: Pick up at hotel, crew transport to EWR less than 30 min
19:01: Push back, 1 min behind schedule

No alcohol consumed for the whole period. Last time was 2 bottles of beer February 16th.

First Officer

I went to bed at 11pm the 29th of April. Had a good night sleep, and got up 7am next morning. Had a breakfast with my wife and son before walking from our house to the airport express train (approximately a 15 min walk). Arrived at Oslo airport well ahead of scheduled check-in time. I was having a check ride flight for the A330 rating from OSL to EWR and return.

The flight left OSL 11:10 am and was uneventful, arriving EWR at 1:10am. Arrived at the hotel at about 3pm. Unpacked and took a shower. Walked to the "Path" train and stood off at 33rd street. Walked down to B&H photo and browsed through their store for a couple of hours.
Returned to the hotel at New Jersey and met up with7-8 other crewmembers for dinner at 7pm. Returned to the hotel about 9pm, and went to bed at 10:30pm. Had a good night sleep and woke up at 6:30am the morning of 1st of May.

Had breakfast at the hotel with a couple of crew members at 7:30am and sat until 9:30am. Went back to my room, took a shower and started to repack my suitcase. Took a long walk on the New Jersey side to familiarize my selves with the area. Stopped at Target and Bestbuy and picked up some toiletries and cables. Returned to hotel, ironed my shirt and finished packing. Pick-up at 5pm, and tried to sleep from 3:30pm until 4:30pm. At pick up we got together in the back of the bus and went through the flight documentation until arriving in good time at EWR at 5:35pm. We had plenty of time to set up the aircraft for the return flight.

After the incident we returned to the gate, and the first official to approach the flight deck was a police officer. He took a statement with all 3 of us present. We all suggested that it probably was a good idea with alcohol/drug test. The police officer separately had us walk down the jet way under supervision. I personally had one bottle of beer and one glass of red wine with my dinner the evening before. I have never in my entire life used any kind of drugs.

I hope this statement clarify my 72 hours prior to the incident.