NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

May 9, 2018

Group Chairman's Factual Report

OPERATIONAL FACTORS

OPS17IA014AB

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A. INCIDENT

Operators: Compass Airlines and Virgin America[1]
Location: San Francisco International Airport (SFO), San Francisco, CA
Date: February 15, 2017
Time: 2000 Pacific Standard Time (PST)[2]
Airplane: Embraer 175/Airbus A-320
Flight No.: Compass 6081/Redwood[3] 920

B. OPERATIONAL FACTORS GROUP

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C. SUMMARY

On February 15, 2017, about 2000 Pacific standard time, a runway incursion occurred on runway 28L at San Francisco International Airport (SFO), San Francisco, California, when Virgin America, call sign Redwood, flight 920 was on line up and wait clearance issued by the local air traffic controller and Compass Airlines, call sign Compass, flight 6081 was cleared to land on the same runway. The air traffic control tower (ATCT) controllers received an Airport Surface Detection System Model X (ASDE-X)[5] logic alert between the two aircraft and commanded the Compass flight to "go around." The crew subsequently performed a go-around maneuver. There were no injuries reported to the crew or passengers of either flight. Both flights were operating under the provisions of 14 *Code of Federal Regulations* Part 121. The Compass flight was arriving at SFO from their departure airport of Los Angeles International Airport (LAX), Los Angeles, California. Virgin America was operating the flight from SFO to McCarran-Las Vegas International Airport (LAS), Las Vegas, Nevada. Night visual meteorological conditions (VMC) prevailed at the time of the incident.

[1] Virgin America was acquired by the Alaska Air Group in April of 2016
[2] All times in the report will be in Pacific Standard Time except as otherwise noted. At the time of the incident Greenwich Mean Time, also known as Zulu, was 8 hours ahead of PST and the date and time of the event was February 16, 2017 0400Z
[3] Redwood was the call sign for Virgin America flights
[4] Prior to July 18, 2018 Mr. Ryan Davis had separated from Compass Airlines and Mr. Zachary Bridge was assigned to the Operational Factors Group
[5] Airport Surface Detection System — Model X (ASDE-X) is a surveillance system using radar, multi-lateration and satellite technology that allows air traffic controllers to track surface movement of aircraft and vehicles.

D. DETAILS OF THE INVESTIGATION

Interviews were conducted with the two pilots operating Compass flight 6081, on March 3, 2017 via teleconference. Company manuals were obtained from Compass personnel. Pilot certification information was obtained from the Federal Aviation Administration (FAA).

Interviews were conducted with the two pilots operating Virgin America (Redwood) flight 920, on March 20, 2017 via teleconference. Company guidance was obtained from Virgin America personnel. Pilot certification information was obtained from the FAA.

E. FACTUAL INFORMATION

1.0 History of the Flights

1.1 Compass Flight 6081

Compass flight 6081 had an original scheduled departure time of 1845 and an actual departure time of 1842, with a scheduled arrival time of 2010.

The crew reported that they began the last day of their 3-day trip at Sacramento International Airport (SMF), Sacramento, California. They flew from SMF to LAX, LAX to SFO (incident flight), and then SFO to LAX.

According to the pilots, the event flight was a "standard flight" and was an "easy day." They briefed for the visual approach to runway 28L and were going to back up the approach with the Instrument Landing System (ILS) approach to runway 28L. The flight was cleared for the visual approach to runway 28L. Although they considered that their flight was above the anticipated flight path for the visual approach, the airplane was configured and stable by 1,000 feet above ground level (agl). The flight was switched over from the approach frequency to the tower frequency prior to the outer maker. The pilot monitoring contacted tower and the flight was cleared to land on runway 28L, about 10 miles from the runway threshold. The captain, at the request of the pilot flying, requested a wind speed check from the ATCT controller.

The first officer described the area at the approach end of the runway as "darker than normal" and the captain reported seeing what appeared to be a "vague light" on the runway.

About 400 feet agl the ATCT controller told the flight to go around, which the flight crew complied with. The go-around and second approach were uneventful[6].

1.2 Virgin America Flight 920

Virgin America flight 920, was an Airbus A-320 aircraft, operating a flight from SFO to LAS.

The crew reported that the incident flight was leg 4 for the day and they were on day 2 of a 4-day pairing.

[6] Source: Attachment 1 – Compass Airlines Flight Crew Interview Summaries, pgs. 4 and 8

The crew reported that the airplane had no maintenance deferrals and that there were no exterior light deferrals on the aircraft. The first officer further stated that the exterior lights were operable and operating at the time of the overflight.[7]

Prior to being pushed back from the gate the navigation lights, logo lights, and beacon were illuminated.

According to the captain of the flight, they had been issued a line up and wait clearance onto runway 28L, and the captain illuminated the nose light, runway turn off lights, strobes, and the landing lights were extended but remained "OFF", as required by company guidance, until issued a takeoff clearance. He did not hear the Compass flight check in with SFO tower or that they had been cleared to land runway 28L, when they had received their line up and wait clearance.

The captain further stated that after an extended wait time on the runway, which was estimated to be about a minute and a half, they monitored their TCAS[8] and discussed the "close proximity of the target on final." However, they further provided that due to the close proximity of runway 28L and runway 28R, it was difficult to determine the runway that the TCAS target was lined up with.

The Compass flight was issued a "Go Around" clearance from the ATCT and the Virgin America crew heard and felt the vibration of the airplane during the go-around.

The Virgin America flight subsequently was issued a takeoff clearance and departed. The remainder of the flight was uneventful. While on their departure climb, the crew heard the departure controller ask the Compass crew the reason for the go-around. The Compass crew stated, "tower assigned."[9]

2.0 Flight Crew Information

2.1 Compass Flight Crew Information

The flight crew consisted of a captain and a first officer.

2.1.1 The Captain

The captain was 27 years old; held an Airline Transport Pilot (ATP) certificate with a rating for airplane multiengine land, with type ratings on the ERJ-170[10] and ERJ-190, and commercial privileges for airplane single-engine land. He held an FAA first-class medical certificate dated May 17, 2016, with no waivers or limitations. At the time of the incident he was based at Los Angeles International Airport (LAX), Los Angeles, California.

[7] Source: Operational Factors Attachment 2 "Flight Crew Interview Summaries – Virgin America" pgs. 3 and 7
[8] Traffic Collision and Avoidance System
[9] Source: Attachment 2 – Flight Crew Interview Summaries – Virgin America pg. 3
[10] Embraer S.A. ERJ 170-100 STD, ERJ 170-100 LR, ERJ 170-100 SU, ERJ 170-100 SE, ERJ 170-200 STD, ERJ 170-200 LR, ERJ 170-200 SU, ERJ 190-100 STD, ERJ 190-100 LR, ERJ 190-100 IGW, ERJ 190-100 ECJ, ERJ 190-200 STD, ERJ 190-200 STD, ERJ 190-200 LR, ERJ 190-200 IGW. Source: FAA order 8900.1 Figure 5-88

According to the captain's interview summary, he had been a captain on the ERJ-170/190 series aircraft since June of 2015[11]. He stated that a captain's line was typically built with 11-12 days off per month, which was the minimum days off allowed. The day of the incident was the last day of a 3-day trip. He further reported that he had never been involved in an accident or incident, nor had he ever been a check airman with Compass Airlines.

He was the pilot monitoring on the incident flight.

2.1.2 The Captain's Training[12]

A summary of the captain's recent training events at Compass Airlines was as follows:

Recurrent Ground School[13]	June 9, 2016
Initial Ground School[14]	February 6, 2015
IOE[15]	April 23, 2015
Upgrade[16]	June 8, 2016
Most Recent Proficiency Check	December 17, 2016
Most Recent Line Check	November 24, 2016
Most Recent FAA Observation	July 12, 2016

2.1.3 The Captain's Flight Times[17]

The captain's flight times provided to the NTSB:

Total pilot flying time	4,300
Total ERJ 170/190 flying time	1,600
Total ERJ 170/190 PIC time	600
Total flying time preceding 24 hours	5:10
Total flying time last 7 days	23:17
Total flying time last 60 days	128:13
Total flying time last 90 days	150:43

2.2 The First Officer

The FO was 42 years old; held an ATP certificate with a rating for airplane multiengine land, type ratings on the CL-65,[18] ERJ-170, and ERJ-190, and with commercial privileges for airplane single-engine land. He also held an FAA first-class medical certificate dated September

[11] See Attachment 1 – Flight Crew Interview Summaries
[12] See Attachment 3 – Flight Crew Recent Training and Flight Time.
[13] Recurrent ground instruction included Advance CRM, General Operational Subjects, Hazardous Material Training, Security Training, Aircraft Systems, Emergency Drills, Situation Training, and Weight & Balance and Performance.
[14] Initial Ground School instruction included Advanced CRM, Basic Indoctrination, Hazardous Material Training, Security Training, Aircraft Systems, Emergency Drills, Emergency Situation Training, High Altitude Ops Training, and Weight and Balance.
[15] Initial Operating Experience
[16] Upgrade training began with initial ground school and concluded June 20, 2015 with Consolidation Knowledge & Skills training as required under *CFR* Part 121.434
[17] Flight times were gathered from the captain's interview summary (which are estimates) and company records.
[18] Bombardier CL-600-2B19, CL-600-2C10, CL-600-2D24, CL-600-2D15, Source FAA Order 8900.1 Figure 5-88

17, 2016, with a limitation of "must wear corrective lenses," which he reported he was wearing at the time of the incident. At the time of the incident he was based at LAX.

According to the first officer's interview he had been flying the EMB-170/190 series aircraft since December 12, 2016 and had accumulated about 75 hours of total flight experience in the EMB-170/190 aircraft. He was a reserve pilot and he had flown the entire 3-day trip with the incident captain.

He was the pilot flying for the incident flight.

2.2.1 The First Officer's Training[19]

A summary of the FO's most recent training events at Compass Airlines was as follows:

Date of Hire with Compass	September 29, 2016
Initial Ground School[20]	October 21, 2016
IOE	January 16, 2017
Most Recent Line Check	January 16, 2017
Line Oriented Evaluation	December 12, 2016

2.2.2 The First Officer's Flight Times[21]

The FO's flight times provided to the NTSB:

Total pilot flying time	4,700
Total ERJ 170/190 flying time	52:57
Total flying time preceding 24 hours	5:10
Total flying time last 7 days	15:20
Total flying time last 60 days	52:57
Total flying time last 90 days[22]	52:57

3.0 Virgin America Flight Crew Information

The flight crew consisted of a captain and a first officer.

3.1 The Captain

The captain was 50 years old; held an ATP certificate with a rating for airplane multiengine land, commercial privileges for airplane single-engine land and single-engine sea, and type

[19] See Attachment 5 – Compass Airlines Flight Crew Training and Recent Flight Time.
[20] Initial ground school consisted of CRM, basic indoctrination, General operational subjects, hazardous material training, security training, aircraft systems, emergency drills, emergency situation training, high altitude ops training, and weight and balance.
[21] Flight times were gathered from the first officer's interview summary (which are estimates) and company records.
[22] First Officers first flight in the EMB170/190 series occurred on December 27, 2016

ratings on the Airbus A-320[23], BA-3100[24], BA-4100[25], CL-65[26]. He held an FAA first-class medical certificate dated May 17, 2016, with a limitation of "must have corrective lenses for near vision." At the time of the incident he was based at John F. Kennedy International Airport (JFK), Jamaica, New York.

According to the captain's interview summary, he had been a captain on the A320 series aircraft since initially hired by Virgin America in October of 2006[27].

He was the pilot flying on the incident flight.

3.1.1 The Captain's Flight Times[28]

The captain's flight times provided to the NTSB[29]:

Total pilot flying time	19,000
Total A-320 flying time	10,000
Total A-320 PIC time	10,000

3.2 The First Officer

The FO was 42 years old; held an ATP certificate with a rating for airplane multiengine land, commercial privileges for airplane single-engine land, and type ratings on the A-320, B-737[30], BE-400[31], LR-JET[32], and MU-300. He also held an FAA first-class medical certificate dated September 17, 2016, with a limitation of "must wear corrective lenses." At the time of the incident he was based at JFK. His date of hire with Virgin America was September 9, 2010.

He was the pilot monitoring for the incident flight.

[23] Airbus (formerly known as Groupement d'Inerte Economique Airbus Industires, France) A-318, A-319, A-320, A-321 Airbus. Source FAA Order 8900.1, Figure 5-88
[24] British Aerospace Corporation HP.137, MK. 1, Jetstream Series 200, Jetstream 3101, Jetstream 3201. Source: FAA Order 8900.1, Figure 5-88
[25] British Aerospace Corporation Jetstream 4100. Source: FAA Order 8900.1, Figure 5-88
[26] Bombardier CL-600-2B19, CL-600-2C10, CL-600-2D24, CL-600-2D15, Source FAA Order 8900.1, Figure 5-88
[27] Source: Attachment 2 – Virgin America Flight Crew Interview Summaries
[28] Flight times were gathered from the captain's interview summary (which are estimates) and company records.
[29] All flight times are estimates that were provided during the captain's interview
[30] The Boeing Company B-737-100, B-737-200, B-737-300, B-737-400, B-737-500, B-737-600, B-737-700C, B-737-800, B-737-900. Source: FAA Order 8900.1, Figure 5-88
[31] Beechcraft Corporation MU-300, MU-300-10, 400, 400A, 400T. Source: FAA Order 8900.1, Figure 5-88
[32] Learjet Inc. 24,24A, 24B, 24D, 24E, 24F, 25, 25B, 25C, 25D, 25F, 28, 29, 31, 31A, 35, 35A, 36, 55, 55B, 55C. Source: FAA Order 8900.1, Figure 5-88

4.0 Airplane Information

4.1 Compass Airlines

Photo 1: Photo of incident airplane, N214NN

The incident airplane was an Embraer E-175-200LR, N214NN, Serial number 17000508. It was powered by 2 GE CF34-8E5 engines. It was registered to American Airlines Inc, Fort Worth, Texas and operated by Compass Airlines.

4.2 Virgin America

Photo 2: Photo of incident airplane, N627VA.[33]

The incident airplane was an Airbus 320-214, N627VA, serial number 2851. It was equipped with two CFM International CFM56-5B4/P engines. It was registered to Wells Fargo Bank Northwest NA Trustee, Salt Lake City, Utah and operated by Virgin America.

5.0 Meteorological Information

Airport weather observations for SFO were obtained from the National Weather Service. Airport weather information found in the METAR[34] for SFO originated from an Automated

[33] Source: Jetphotos.net website.
[34] Aviation Routine Weather Reports. Source: Aviation Weather Services AC00-45F pg. 3-1

Surface Observing System (ASOS). The following METARs were issued for SFO for the time period surrounding the incident:

[1856 PST] METAR KSFO 160156Z 00000KT 10SM FEW110 SCT150 BKN200 16/09 A2998 RMK AO2 SLP151 T01610094=

[1956 PST] METAR KFO 160256Z 06003KT 10SM FEW110 SCT150 BKN200 16/10 A2998 RMK AO2 SLP 153 T0156010050=

[2056 PST] METAR KSFO 160356Z 20019KT 10SM FEW100 BKN120 BKN180 160/04 A2999 RMK AO2 SLP155 T1560039=

According to the United States Naval Observatory, Astronomical Applications Department website, official sunset was at 1749 and the end of civil twilight was at 1856. Official moonrise was at 2245. The moon was a waning gibbous with 77% of the moon's visible disk illuminated.

6.0 Airport Information

San Francisco International Airport was the main commercial airport for the city of San Francisco, California, and located about 8 miles to the southeast of downtown San Francisco. It had four runway surfaces designated as 1L/19R, 1R/19L, 10L/28R and 10R/28L.

6.1 Airport Diagram and Notes

According to the FAA Chart Supplements[35] Runway 10R/28L was 11,381-foot-long and 200-foot-wide grooved, asphalt.

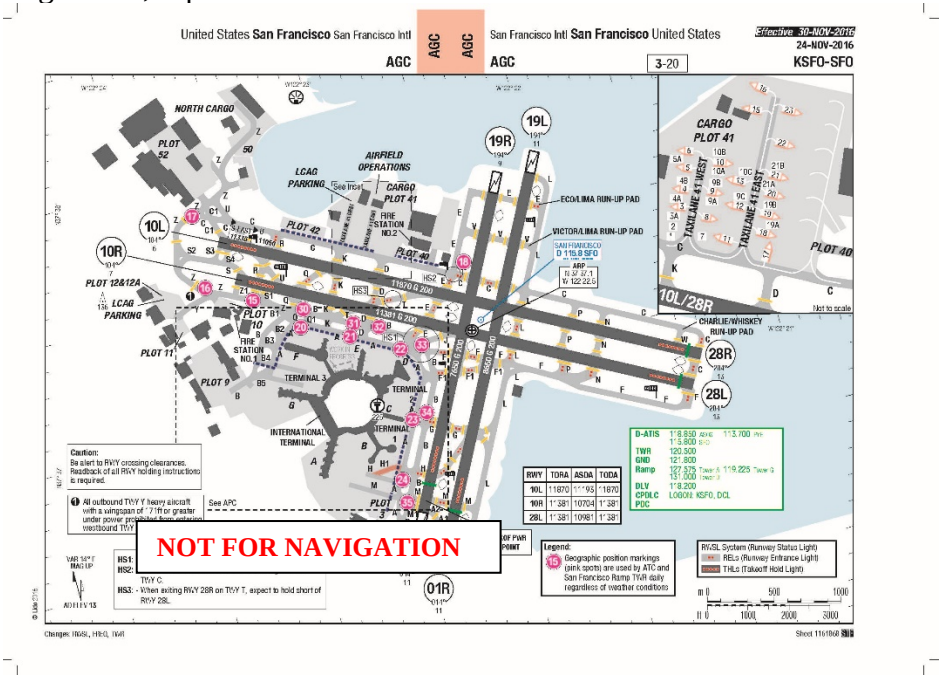


Figure 1: LIDO[36] Airport Chart for SFO.

[35] Formerly known as the Airport/Facility Directory
[36] Compass Airlines, at the time of the incident used LIDO approach charts

7.0 Compass Airlines Procedures

7.1 Approach Briefing[37]

The Compass Airlines Flight Operations Manual, Chapter 9 "Normal Operations", Crew Briefing/Communications contained the following guidance in regard to the approach briefing:

A. The crew will conduct the approach brief during the appropriate phase of flight as specified in AOM I. The briefing should be accomplished early in the descent to aid in arrival planning. Crews should prioritize all relevant conditions that exist for that particular arrival, approach and landing, as well as establishing Bottom Lines and Backup Plans as necessary. If a runway change occurs after the approach briefing is complete, revise the briefing, navigation setup and minimums accordingly.

B. Crews should emphasize the critical elements of the approach, missed approach and landing.

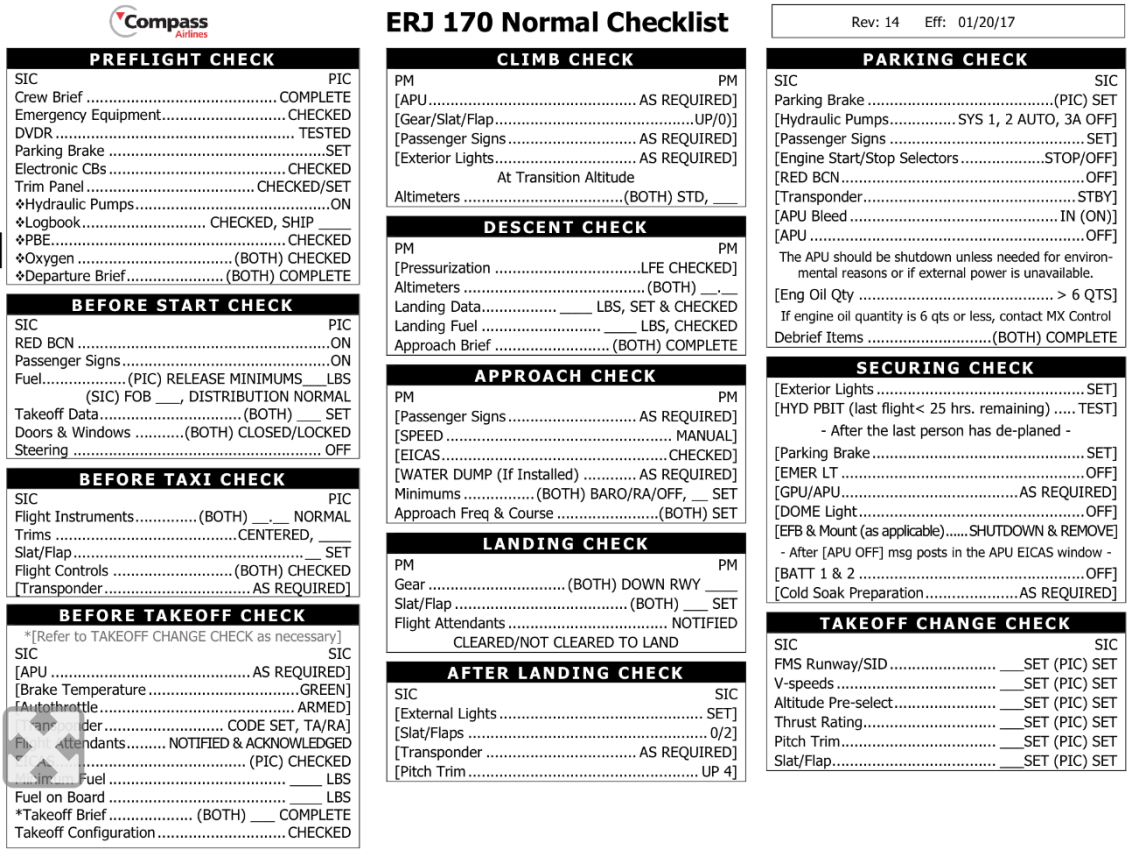
*C. The Pilot flying will use the acronym **WASP** to ensure you conduct a complete briefing.*

1. ***W**eather (PF)*
    - *a. ATIS*
    - *b. NOTAMS*
    - *c. Airfield conditions*
2. ***A**pproach strategy (PF)*
    - *a. Type of Approach and Automation level*
    - *b. Planned runway*
    - *c. VRF adjustment*
    - *d. Flap setting*
    - *e. Use of reverse thrust*
    - *f. Bottom lines to address special conditions*
3. ***S**pecial procedures, i.e. noise abatement, traffic pattern, speed restrictions, engine failure procedure. (PF)*
4. ***P**rocedure information from the approach chart (PF)*
    - *a. Chart date and approach tittle*
    - *b. CHART CHANGES NOTICES*
    - *c. Designated approach/runway*
    - *d. Primary Navaid and frequency*
    - *e. Inbound course*
    - *f. Initial altitude*
    - *g. MSA*
    - *h. TDZE*
    - *i. FAF and crossing altitude*
    - *j. Minima – MDA/DA/DDA/DH (RA/BARO)*
    - *k. Required Visibility*
    - *l. Planned taxiway for runway exit*
    - *m. Missed approach plan*
    - *n. GPS approaches require verification of waypoints, tracks, distances, glide path angles, altitude constraints and threshold crossing altitude.*

[37] See Attachment 3 – Compass Airlines Approach Briefings

7.2 Normal Checklist

The Compass Airlines Normal Checklist, Revision 14, Effective date January 20, 2017 contained the following guidance:



Compass Airlines

ERJ 170 Normal Checklist

Rev: 14 Eff: 01/20/17

PREFLIGHT CHECK

SIC	PIC
Crew Brief	COMPLETE
Emergency Equipment	CHECKED
DVDR	TESTED
Parking Brake	SET
Electronic CBs	CHECKED
Trim Panel	CHECKED/SET
❖Hydraulic Pumps	ON
❖Logbook	CHECKED, SHIP ____
❖PBE	CHECKED
❖Oxygen	(BOTH) CHECKED
❖Departure Brief	(BOTH) COMPLETE

BEFORE START CHECK

SIC	PIC
RED BCN	ON
Passenger Signs	ON
Fuel	(PIC) RELEASE MINIMUMS___LBS
	(SIC) FOB ___, DISTRIBUTION NORMAL
Takeoff Data	(BOTH) ___ SET
Doors & Windows	(BOTH) CLOSED/LOCKED
Steering	OFF

BEFORE TAXI CHECK

SIC	PIC
Flight Instruments	(BOTH) __.__ NORMAL
Trims	CENTERED, ____
Slat/Flap	__ SET
Flight Controls	(BOTH) CHECKED
[Transponder	AS REQUIRED]

BEFORE TAKEOFF CHECK

*[Refer to TAKEOFF CHANGE CHECK as necessary]

SIC	SIC
[APU	AS REQUIRED]
[Brake Temperature	GREEN]
[Autothrottle	ARMED]
[	CODE SET, TA/RA]
[	NOTIFIED & ACKNOWLEDGED
[	(PIC) CHECKED
[	____ LBS
Fuel on Board	____ LBS
*Takeoff Brief	(BOTH) ___ COMPLETE
Takeoff Configuration	CHECKED

CLIMB CHECK

PM	PM
[APU	AS REQUIRED]
[Gear/Slat/Flap	UP/0)]
[Passenger Signs	AS REQUIRED]
[Exterior Lights	AS REQUIRED]
At Transition Altitude	
Altimeters	(BOTH) STD, ___

DESCENT CHECK

PM	PM
[Pressurization	LFE CHECKED]
Altimeters	(BOTH) __.__
Landing Data	____ LBS, SET & CHECKED
Landing Fuel	____ LBS, CHECKED
Approach Brief	(BOTH) COMPLETE

APPROACH CHECK

PM	PM
[Passenger Signs	AS REQUIRED]
[SPEED	MANUAL]
[EICAS	CHECKED]
[WATER DUMP (If Installed)	AS REQUIRED]
Minimums	(BOTH) BARO/RA/OFF, __ SET
Approach Freq & Course	(BOTH) SET

LANDING CHECK

PM	PM
Gear	(BOTH) DOWN RWY ____
Slat/Flap	(BOTH) ___ SET
Flight Attendants	NOTIFIED
CLEARED/NOT CLEARED TO LAND	

AFTER LANDING CHECK

SIC	SIC
[External Lights	SET]
[Slat/Flaps	0/2]
[Transponder	AS REQUIRED]
[Pitch Trim	UP 4]

PARKING CHECK

SIC	SIC
Parking Brake	(PIC) SET
[Hydraulic Pumps	SYS 1, 2 AUTO, 3A OFF]
[Passenger Signs	SET]
[Engine Start/Stop Selectors	STOP/OFF]
[RED BCN	OFF]
[Transponder	STBY]
[APU Bleed	IN (ON)]
[APU	OFF]

The APU should be shutdown unless needed for environmental reasons or if external power is unavailable.

[Eng Oil Qty	> 6 QTS]

If engine oil quantity is 6 qts or less, contact MX Control

Debrief Items	(BOTH) COMPLETE

SECURING CHECK

[Exterior Lights	SET]
[HYD PBIT (last flight< 25 hrs. remaining)	TEST]

- After the last person has de-planed -

[Parking Brake	SET]
[EMER LT	OFF]
[GPU/APU	AS REQUIRED]
[DOME Light	OFF]
[EFB & Mount (as applicable)	SHUTDOWN & REMOVE]

- After [APU OFF] msg posts in the APU EICAS window -

[BATT 1 & 2	OFF]
[Cold Soak Preparation	AS REQUIRED]

TAKEOFF CHANGE CHECK

SIC	SIC
FMS Runway/SID	___SET (PIC) SET
V-speeds	___SET (PIC) SET
Altitude Pre-select	___SET (PIC) SET
Thrust Rating	___SET (PIC) SET
Pitch Trim	___SET (PIC) SET
Slat/Flap	___SET (PIC) SET

Figure 2: ERJ 170 Normal Checklist[38]

8.0 Virgin America Procedures

8.1 Normal Procedures

According to Virgin America's A318/A319/A320/A321 Flight Crew Operating Manual, "Standard Operating Procedures – Before Takeoff"[39] the following guidance was provided on when to illuminate the required exterior lights:

EXTERIOR LIGHTS…….. SET

- *When cleared to "Line UP and Wait", turn on NOSE (TAXI), RWY TURN OFF, STROBE AND WING lights. (While in position awaiting take-off clearance, turn off NOSE light.)*
- *When "Cleared for Take-Off", turn on LAND and NOSE (T.O.) lights.*

[38] See Attachment 4 - Compass Airlines ERJ 170 Normal Checklist
[39] See Attachment 5 - Virgin America A318/A319/A320/A321 FCOM – Normal Procedures

- *If you see an aircraft in take-off position on a runway with forward facing light ON, that aircraft has most likely received its take-off clearance and could be departing immediately.*

8.2 Exterior Lighting – Controls and Indicators

According to Virgin America's A318/A319/A320/A321 Flight Crew Operating Manual, "Aircraft Systems – Lights – Exterior Lighting – Controls and Indicators" provided the following graphic depiction of the exterior lights that could be illuminated:

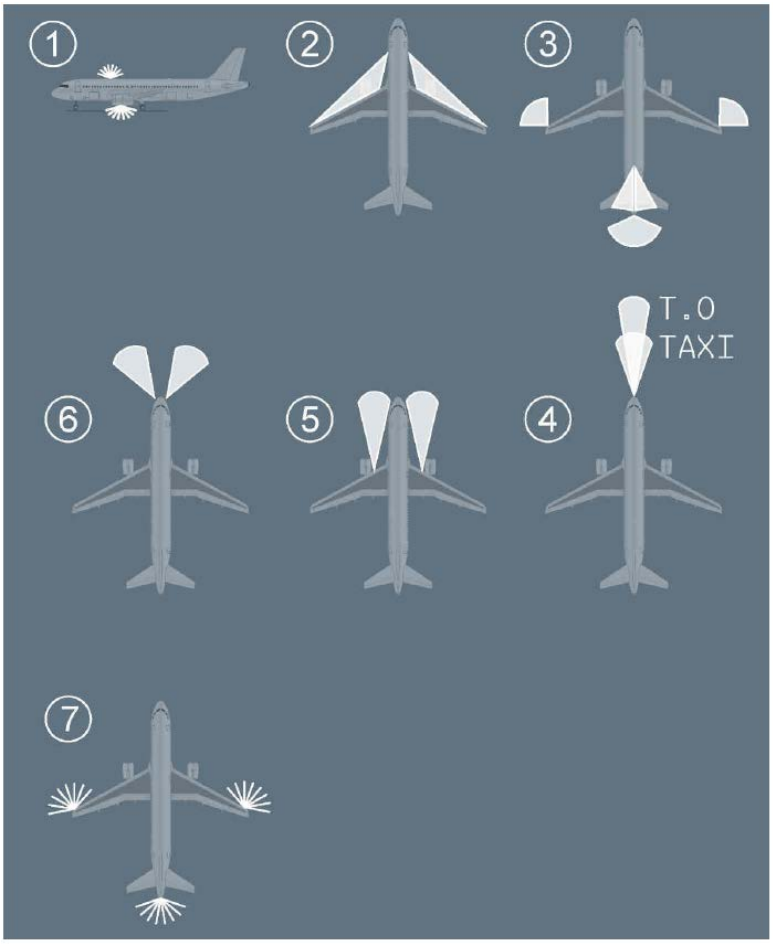


Figure 3: Exterior Lighting Available

8.3 Overhead Panel

The A318/A319/A320/A321 Flight Crew Operating Manual provided both a figure of the overhead lighting panel switches and a textual description of the positions of the switch. The numbers on the figure and textual description coincides with the numbers for the graphic depictions in Figure 3, in Section 8.2 above.

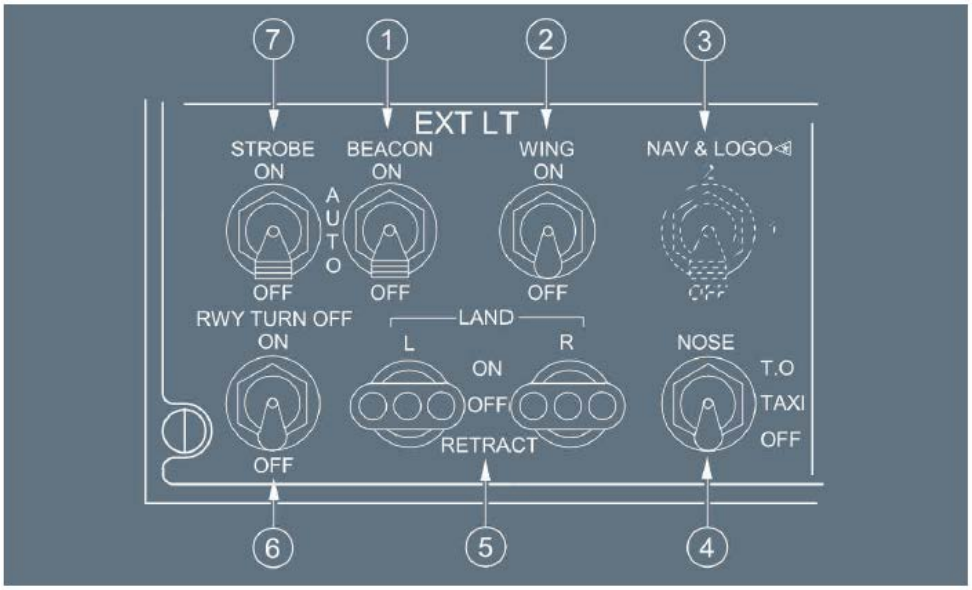


Figure 4: Overhead Lighting Panel

The textual description of each switch as follows:

(1) BEACON sw

This switch turns on and off the two flashing red lights, one on top and one on the bottom of the fuselage.

(2) WING sw

This switch turns on and off two beam lights on each side of the fuselage. These lights provide lighting on the wing leading edge and on the engine air intake to detect ice accretion.

(3) NAV & LOGO ◁ sw

There are single navigation light, or dual navigation lights ◁ on each wing and in the APU tail cone.

A blue light ◁ below each navigation light allows to monitor the navigation light wear (LED technology). When NAV & LOGO ◁ sw is ON, this light ◁ flashes in blue if the navigation light replacement should be planned.

There are logo lights ◁ in the upper surface of each horizontal stabilizer. These lights provide lighting for the company logo on the vertical stabilizer provided the main landing gear is compressed, or depending on the aircraft configuration, when flaps are extended (at least 15 ° on some aircraft) or slats are extended.

The NAV & LOGO ◁ sw can have one of the following configuration:

ON : Turns on the NAV and the LOGO lights ◁ .
OFF : The NAV and the LOGO lights ◁ are off.

or

2 : Turns on NAV 2 and the LOGO lights ◁ .
1 : Turns on NAV 1 and the LOGO lights ◁ .
OFF : The NAV and the LOGO lights ◁ are off.

(4) NOSE sw

This switch turns the taxi and takeoff lights on and off.

TO : Turns on both taxi and takeoff lights.

TAXI : Turns on only taxi light.

OFF : Taxi and takeoff lights off.

Note: These two lights, attached to the nose gear strut, go off automatically when landing gear is retracted.

(5) L and R LAND sel

These selectors control the landing lights.

ON : Extends the (left or right) landing lights which come on automatically when fully extended.

OFF : Shuts off the landing lights which remain extended.

RETRACT : Shuts off and retracts the landing lights.

(6) RWY TURN OFF sw

This switch turns the runway turn-off lights on and off.

Note: These lights go off automatically when landing gear is retracted.

(7) STROBE sw

This switch turns on and off the three synchronized strobe lights, one on each wing and one below the tail cone.

A blue light ◁ below each strobe light allows to monitor the strobe light wear (LED technology). When STROBE sw is OFF or BEACON sw is ON, this light ◁ flashes in blue if the strobe light replacement should be planned.

ON : The strobe lights flash white.

AUTO : The strobe lights come on automatically when the main landing gear is not compressed.

OFF : The strobe lights are off.

Figure 5: Overhead Lighting Panel Description

9.0 FAA Procedures

9.1 Runway Safety - Line Up and Wait

According to FAA Runway Safety – Current Events: Line Up and Wait:[40]

- ***Beginning on September 30, 2010****, the words "Position and Hold" will no longer be used to instruct a pilot to enter the runway and await takeoff clearance. Under the new "Line Up and Wait" phraseology, the controller will:*
  - *State the* ***call-sign.***
  - *State the departure runway.*
  - *State* ***"Line Up and Wait"****.*
- ***Differences in phraseology contribute to runway incursions.*** *Analysis by the National Transportation Safety Board (NTSB) revealed that differences between FAA and International Civil Aviation Organization (ICAO) air traffic control phraseology contribute to runway incursion risks. NTSB recommended that the FAA adopt the international standard terminology:* ***"Line Up and Wait"*** *to replace "Position and Hold".*
- ***FAA Safety Analysis****. In accordance with its Safety Management System procedures, the FAA Air Traffic Organization conducted a safety analysis of this recommendation. FAA implemented mitigations to ensure a safe transition from the old phraseology to the new.*
- ***Exercise caution.*** *Be aware the phrase "Traffic Holding in Position" will continue to be used to advise other aircraft that traffic has been authorized to "Line Up and Wait" on an active runway.*
- ***REMEMBER: Never cross a hold line without explicit ATC instructions. You may not enter a runway unless you have been:***
  - ***Instructed to cross or taxi onto that specific runway***
  - ***Cleared to take off from that runway, or***
  - ***Instructed to "Line Up and Wait" on that specific runway***

9.2 Aeronautical Information Manual

The Aeronautical Information Manual (AIM) Chapter 5 “Air Traffic Procedures” Section 5-2-4 “Line Up and Wait (LUAW) provided the following guidance:

a. Line up and wait is an air traffic control (ATC) procedure designed to position an aircraft onto the runway for an imminent departure. The ATC instruction “LINE UP AND WAIT” is used to instruct a pilot to taxi onto the departure runway and line up and wait.

b. This ATC instruction is not an authorization to takeoff. In instances where the pilot has been instructed to line up and wait and has been advised of a reason/condition (wake turbulence, traffic on an intersecting runway, etc.) or the reason/condition is clearly visible (another aircraft that has landed on or is taking off on the same runway), and the reason/condition is satisfied, the pilot should expect an imminent takeoff clearance, unless advised of a delay. If you are uncertain about any ATC instruction or clearance, contact ATC immediately.

c. If a takeoff clearance is not received within a reasonable amount of time after clearance to line up and wait, ATC should be contacted.

[40] Source: https://www.faa.gov/airports/runway_safety/news/current_events/lauw/

NOTE – *FAA analysis of accidents and incidents involving aircraft holding in position indicate that two minutes or more elapsed between the time the instruction was issued to line up and wait and the resulting event (for example, land-over or go-around). Pilots should consider the length of time that they have been holding in position whenever they HAVE NOT been advised of any expected delay to determine when it is appropriate to query the controller.*

d. Situational awareness during line up and wait operations is enhanced by monitoring ATC instructions/clearances issued to other aircraft. Pilots should listen carefully if another aircraft is on frequency that has a similar call sign and pay close attention to communications between ATC and other aircraft. If you are uncertain of an ATC instruction or clearance, query ATC immediately. Care should be taken to not inadvertently execute a clearance/instruction for another aircraft.

e. Pilots should be especially vigilant when conducting line up and wait operations at night or during reduced visibility conditions. They should scan the full length of the runway and look for aircraft on final approach or landing roll out when taxiing onto a runway. ATC should be contacted anytime there is a concern about a potential conflict.

f. When two or more runways are active, aircraft may be instructed to "LINE UP AND WAIT" on two or more runways. When multiple runway operations are being conducted, it is important to listen closely for your call sign and runway. Be alert for similar sounding call signs and acknowledge all instructions with your call sign. When you are holding in position and are not sure if the takeoff clearance was for you, ask ATC before you begin takeoff roll. ATC prefers that you confirm a takeoff clearance rather than mistake another aircraft's clearance for your own.

g. When ATC issues intersection "line up and wait" and takeoff clearances, the intersection designator will be used. If ATC omits the intersection designator, call ATC for clarification.

h. If landing traffic is a factor during line up and wait operations, ATC will inform the aircraft in position of the closest traffic within 6 flying miles requesting a full-stop, touch-and-go, stop-and-go, or an unrestricted low approach to the same runway. Pilots should take care to note the position of landing traffic. ATC will also advise the landing traffic when an aircraft is authorized to "line up and wait" on the same runway.

NOTE- *ATC will normally withhold landing clearance to arrival aircraft when another aircraft is in position and holding on the runway.*

i. Never land on a runway that is occupied by another aircraft, even if a landing clearance was issued. Do not hesitate to ask the controller about the traffic on the runway and be prepared to execute a go-around.

NOTE – *Always clarify any misunderstanding or confusion concerning ATC instructions or clearances. ATC should be advised immediately if there is any uncertainty about the ability to comply with any of their instructions.*

10.0 Advisory Circular AC 120-74B

AC 120-74B "Parts 91, 121, 125, and 135 Flightcrew Procedures During Taxi Operations", Section 7h "Use of Exterior Aircraft Lights to Make the Aircraft More Conspicuous" provided the following guidance on the use of lights:

1. ***General****. Exterior aircraft lights may be used to make an aircraft operating on the airport surface more conspicuous. Pilots may use various combinations of exterior lights to convey their location and intent to other pilots, ATC, and ground personnel. Certain exterior lights*

may also be used in various combinations to signal whether the aircraft is on a taxiway or on a runway, in position on the runway but holding for takeoff clearance, crossing an active runway or moving down the runway for takeoff.

2. ***Exterior Lights**. To the extent possible and consistent with aircraft equipage, operating limitations, and flight crew procedures, pilots should illuminate exterior lights as follows.*
    a. ***Engines Running.** Turn on the rotating beacon whenever an engine is running.*
    b. ***Taxiing.** Prior to commencing taxi, turn on navigation, position, anti-collision, and logo lights if available. To signal intent to other pilots, turn on the taxi light when the aircraft is moving or intending to move on the ground, and turn it off when stopped or yielding or as a consideration to other pilots or ground personnel. Strobe lights should not be illuminated during taxi if they will adversely affect the vision of other pilots or ground personnel.*
    c. ***Crossing a runway.** All exterior lights should be illuminated when crossing a runway.*

        CAUTION: Flightcrews should consider any adverse effects to safety that illuminating the forward-facing lights will have on the vision of other pilots or ground personnel during runway crossings.
    d. ***Entering the Departure Runway for Takeoff or LUAW.** When entering a runway, either for takeoff or when taxiing into LUAW, flightcrews should make their aircraft more conspicuous to aircraft on final behind them and to ATC by turning on all lights, except for landing lights, that highlight the aircraft's silhouette. Strobe lights should not be illuminated if they will adversely affect the vision of other pilots. At night, and cleared to LUAW, consider ling up slightly to the left or right of the centerline (CL) approximately 3 feet) to enable a landing aircraft to visually differentiate that your aircraft from the runway lights.*
    e. ***Takeoff.** Turn on all lights, including landing lights, when takeoff clearance is received, or when commencing takeoff roll at an airport without an operating control tower.*

F. LIST OF ATTACHMENTS

Attachment 1 – Compass Airlines Flight Crew Interview Summaries
Attachment 2 – Virgin America Flight Crew Interview Summaries
Attachment 3 – Compass Airlines – Approach Briefing
Attachment 4 – Compass Airlines – E170 Normal Checklist
Attachment 5 – Compass Airlines – Flight Crew Training and Recent Flight Time
Attachment 6 – Virgin America– Exterior Lighting Chart
Attachment 7 - Virgin America– Takeoff Lighting Standard Operating Procedure
Attachment 8 – Weather and Sun and Moon Data
Attachment 9 – Operational Factors Party Form

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