National Transportation Safety Board
Washington, DC 20594

Brief of Incident

Adopted 10/29/2010

DCA10IA022

File No. 0 | 01/19/2010 | Charleston, WV | Aircraft Reg No. N246PS | Time (Local): 16:00 EST

Make/Model:	Bombardier / CL600
Engine Make/Model:	Ge / CF34-3B1
Aircraft Damage:	Minor
Number of Engines:	2
Operating Certificate(s):	Flag Carrier/Domestic; Supplemental
Name of Carrier:	PSA AIRLINES INC
Type of Flight Operation:	Scheduled; Domestic; Passenger Only
Reg. Flight Conducted Under:	Part 121: Air Carrier

	Fatal	Serious	Minor/None
Crew	0	0	3
Pass	0	0	31

Last Depart. Point:	Same as Accident/Incident Location
Destination:	Charlotte, NC
Airport Proximity:	On Airport/Airstrip
Airport Name:	Yeager Airport
Runway Identification:	23
Runway Length/Width (Ft):	6300 / 150
Runway Surface:	Asphalt
Runway Surface Condition:	Dry

Condition of Light:	Day
Weather Info Src:	Unknown
Basic Weather:	Visual Conditions
Lowest Ceiling:	2600 Ft. AGL, Overcast
Visibility:	10.00 SM
Wind Dir/Speed:	290 / 003 Kts
Temperature (°C):	9
Precip/Obscuration:	

Pilot-in-Command Age: 38

Certificate(s)/Rating(s)

Airline Transport; Commercial; Multi-engine Land; Single-engine Land

Instrument Ratings

Airplane

Flight Time (Hours)

Total All Aircraft:	9525
Last 90 Days:	169
Total Make/Model:	4608
Total Instrument Time:	UnK/Nr

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History of Flight

On January 19, 2010, the flight crew of PSA Airlines, doing business as US Airways Express flight 2495, rejected the takeoff of a Bombardier CL-600-2B19, N246PS, which subsequently ran off the runway end and then stopped in the engineered materials arresting system (EMAS) installed in the runway end safety area at Yeager Airport (CRW), Charleston, West Virginia. None of the 31 passengers (including one lap-held child) or 3 crewmembers sustained injuries, and the airplane received minor damage. The flight was operating under the provisions of 14 Code of Federal Regulations (CFR) Part 121, and its intended destination was Charlotte Douglas International Airport, Charlotte, North Carolina.

The incident flight was the fifth flight for the flight crewmembers in the first day of a 3-day trip sequence, and they were scheduled to be on the ground at CRW for about 30 minutes. The first officer stated that, during that time, he completed a walk-around inspection of the airplane and received the takeoff performance data via the aircraft communications addressing and reporting system (ACARS). The ACARS performance data included the following: takeoff

weight 44,400 pounds, takeoff flap setting 20, FLEX 33 takeoff thrust setting (reduced thrust takeoff), V1 (takeoff decision speed) of 127 knots, and Vr (rotation speed) of 128 knots. The captain was the flying pilot for the incident flight.

According to cockpit voice recorder (CVR) information, the flight crew completed the Before Start checklist at 1554:25. (All times in this report are eastern standard time based on a 24-hour clock.) At 1558:51, the captain made a public address announcement indicating that the departure would be delayed about 15 minutes. At 1602:35, the first officer notified the local controller (LC) that the airplane was ready to taxi, and the LC instructed the flight crew to hold the airplane on the ramp. About 1 minute later, the flight crew started a personal conversation (that is, a conversation not pertinent to the operation of the airplane) after setting the parking brake, and this conversation continued until 1607:32 when the LC instructed the flight crew to taxi to runway 23. (The LC was working both the ground and local positions.) Flight data recorder (FDR) data indicated that, 1 second later, the parking brake was released and the airplane began to taxi.

At 1607:40, the captain continued the nonpertinent conversation. At 1608:44, the captain stated, “flaps twenty,” and then called for the Taxi checklist. FDR data indicated that, 1 second later, the flaps moved from the flaps 0 to the flaps 8 position. At 1609:02, the first officer began the Taxi Checklist, during which he stated, “flaps eight,” and the captain responded, “set.” At 1609:08, the first officer continued the checklist, stating, “flaps trims eight degrees,” and the captain responded, “eight.” The first officer completed the Taxi Checklist at 1609:13.

The captain continued the nonpertinent conversation from 1609:19 to 1611:47 when he called for the Before Takeoff checklist. At 1612:01, the first officer began the Before Takeoff checklist. At 1612:05, the LC cleared the airplane for takeoff, and the first officer acknowledged the instruction. (FDR data indicate that the airplane continually taxied from its initial taxi clearance at 1607:38 until its takeoff clearance at 1612:05.) At 1612:18, the first officer continued the Before Takeoff checklist, stating, in part, “takeoff briefing. No questions.” The first officer completed the checklist at 1612:27.

FDR data showed the airplane heading aligning with the runway heading and the engine thrust increasing to takeoff thrust at 1612:50. Three seconds later, the captain asked, “we’re cleared to go right?” and the first officer responded, “yup.” At 1613:06, the captain stated, “set thrust,” and the first officer responded, “thrust set.” Four seconds later, the captain stated, “eighty knots,” and the first officer responded, “checked.”

FDR data showed that, at 1613:20, the flaps position began moving from the flaps 8 toward the flaps 20 position and the speed was about 120 knots. At 1613:21, the first officer stated, “V one,” at which time, the airspeed was about 127 knots. Two seconds later, the CVR recorded the sound of the airplane master warning and then the flaps and spoilers configuration aural alerts. FDR data showed that, at 1613:25, both engine fan speeds began decreasing, the flight and ground spoilers were extended, and both of the captain’s brake pedals were depressed. The airplane reached a maximum airspeed of about 143 knots at 1613:26. At 1613:36, the first officer contacted the LC, stating, “rejecting…off the end of…runway two three.”

At 1613:38, the airplane entered the engineered materials arresting system (EMAS) at an airspeed of about 50 knots, and, about 3 seconds later, it stopped about 128 feet into the EMAS arrestor bed (178 feet from the runway end). (The EMAS is set back 50 feet from the runway end.)

Damage to Aircraft

The flaps, landing gear, and landing gear doors received minor damage.

Personnel Information

The captain, age 38, was hired by PSA Airlines on June 21, 1999. He held an airline transport pilot certificate with airplane multiengine land, Dornier DL 328,

and CL-65 ratings. (CL-65 is the rating given for CL-600 series airplanes.) The captain held a first-class medical certificate dated April 3, 2009, with a limitation that he must “wear corrective lenses.”

PSA Airlines records indicated that the captain had accumulated 9,525 total flight hours, including 4,608 hours as pilot-in-command in the CL-65 airplane. In the 90 days, 30 days, and 24 hours before the incident, the captain had flown 169, 39, and 4 hours, respectively. He received his last proficiency check on February 25, 2009; his last line check on August 6, 2009; and his last recurrent ground training on August 24 and 25, 2009.

The first officer, age 44, was hired by PSA Airlines on July 7, 2007. He held a commercial pilot certificate with airplane single and multiengine land and CL-65 (second-in-command privileges only) ratings. The first officer held a first-class medical certificate dated April 20, 2009, with no limitations.

PSA Airlines records indicated that the first officer had accumulated 3,029 total flight hours, including 1,981 hours in the CL-65 airplane. In the 90 days, 30 days, and 24 hours before the incident, the first officer had flown 249, 103, and 4 hours, respectively. He received his last proficiency check on August 20, 2009, and his last recurrent ground training on August 27 and 28, 2009.

Meteorological Information

Visual meteorological conditions prevailed at the time of the accident. The CRW surface weather observation indicated the following: winds calm, visibility 10 statute miles, scattered clouds at 4,500 feet, broken clouds at 5,500 feet and 8,000 feet, and altimeter setting 29.91 inches of mercury.

Airport Information

CRW is located about 3 statute miles east of Charleston, West Virginia, and sits atop a plateau about 280 feet above the surrounding terrain. Runway 5/23 is grooved asphalt, and it is 6,300 feet long and 150 feet wide and has precision markings and distance remaining signs on the right side. The terrain at the end of runway 23 drops off sharply about 350 feet.

An EMAS was installed at the departure end of runway 23 in September 2007. The EMAS is 170 feet wide and 455 feet long, including a 405-foot-long arrestor bed and a 50-foot-long setback from the runway end. Before installation of the EMAS, the runway end safety area was about 120 feet long.

According to the EMAS manufacturer, the EMAS at CRW is less than 600 feet long, which is the standard Federal Aviation Administration (FAA) EMAS installation; however, it has a standard 70-knot predicted performance for airplanes of similar size and weight to the Bombardier CL-600 (that is, the EMAS at CRW is designed to stop such airplanes if they enter the EMAS bed at 70 knots or less).

Flight Recorders

The airplane was equipped with a solid-state L-3 Communications Fairchild model FA2100 1020 CVR. The CVR was in good condition, and the audio information was extracted from it normally. Although the CVR recording began at 1432:14, the transcript starts at 1554:07 as the flight crew was conducting the Before Start checklist.

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Medical Information

In accordance with Federal regulations, the captain and first officer were tested by PSA Airlines for alcohol and five major drugs of abuse. Both pilots tested negative for drugs and alcohol.

Tests and Research

Accelerate-Stop Calculations

Bombardier computed the total distance required for the incident airplane to accelerate-stop using data from the FAA-approved Airplane Flight Manual. The calculations indicated that the airplane would have stopped about 5,730 feet from the beginning of the takeoff roll if the deceleration had been initiated at the planned V1 (127 knots) assuming an airplane weight of 44,400 pounds, flaps 20, reduced thrust, no thrust reverser, 897 feet elevation, and altimeter setting 29.91 inches of mercury. As noted, runway 23 is 6,300 feet long.

Additional Information

Maintenance Inspections

As a result of the incident, PSA maintenance personnel conducted the following inspections in accordance with the Airplane Maintenance Manual: rejected takeoff, pitot tubes, thrust reverser system, and takeoff configuration system. All system checks were normal.

Sterile Cockpit Procedures

The PSA Airlines Flight Operations Manual (FOM), Section 4.10.11, "Sterile Flight Deck," states, in part, that, during critical phases of flight, flight crewmembers are prohibited from performing nonessential duties or activities. The FOM stated that critical phases of flight include all ground operations involving taxi, takeoff, and landing, and all other flight operations conducted below 10,000 feet mean sea level except for cruise flight. The FOM stated that essential duties and activities were required for the safe operation of the aircraft and that nonessential duties and activities were not required for the safe operation of the aircraft.

Title 14 CFR 121.542, "Flight Crewmember Duties," states, in part, the following:
(a) No certificate holder shall require, nor may any flight crewmember perform, any duties during a critical phase of flight except those duties required for the safe operation of the aircraft…
(b)No flight crewmember may engage in, nor may any pilot in command permit, any activity during a critical phase of flight which could distract any flight crewmember from the performance of his or her duties or which could interfere in any way with the proper conduct of those duties. Activities such as eating meals, engaging in nonessential conversations within the cockpit and nonessential communications between the cabin and cockpit crews, and reading publications not related to the proper conduct of the flight are not required for the safe operation of the aircraft.
(c) For the purposes of this section, critical phases of flight includes all ground operations involving taxi, takeoff and landing, and all other flight operations conducted below 10,000 feet, except cruise flight.
Note: Taxi is defined as 'movement of an airplane under its own power on the surface of an airport.'

FAA Aeronautical Handbook, FAA-H-8083-9A, Chapter 8, "Techniques of Flight Instruction, Sterile Cockpit Rule," states, in part, the following:

Commonly known as the 'sterile cockpit rule,' Title 14 of the Code of Federal Regulations (14 CFR) section 121.542 requires flight crewmembers to refrain

from nonessential activities during critical phases of flight. As defined in the regulation, critical phases of flight are all ground operations involving taxi, takeoff, and landing, and all other flight operations below 10,000 feet except cruise flight. Nonessential activities include such activities as eating, reading a newspaper, or chatting.

The captain stated that he and the first officer had "probably not" maintained a sterile cockpit during the incident taxi. The first officer stated that, when the airplane was moving, the flight crewmembers were not supposed to discuss anything not pertinent to the flight. He stated that he and the captain did not maintain a sterile cockpit.

Flaps Procedures

The PSA Airlines FOM, Section 4.6.5, "Taxi Check (Challenge & Response, FO Flow)," provides the following information:

Once clear of the ramp area, the captain was to call for the flaps to be set and state what the flap setting should be. The F/O [first officer] was to perform the "Taxi Flow" prior to commencing the Taxi Checklist. The "Taxi Flow" called for the F/O to set the flaps to the takeoff setting. The second item on the Taxi Checklist called for both pilots to verify the flaps and trim were set for takeoff and state the flap setting and trim setting.

The CL-600 is certified for takeoff flap settings of 8 or 20, and each flap setting has different takeoff performance data (that is, different airspeeds and distances).

The captain stated that, during the Taxi checklist, the flap setting had to be verified by looking at the ACARS to see whether it indicated flaps 20 or flaps 8 and then looking at the Engine Indicating Crew Alerting System (EICAS) to verify that the flaps were properly set. He stated that he was not sure if he took these actions during the incident taxi and that he might have just repeated what the first officer said.

The first officer stated that the captain called for flaps 20 and then the Taxi checklist, which he subsequently performed. He indicated that he was aware that a flaps 20 setting was used for takeoffs at CRW. He stated that, to verify the flap setting, he typically touched the flap handle, looked at the EICAS, and confirmed the ACARS information. He stated that the only time the flap setting was verified was during the Taxi checklist.

Rejected Takeoff Guidance

The PSA Airlines FOM, Section 7.1.2, "Rejected Takeoff," states, in part, the following:

If the takeoff is rejected with both engines operating, the Captain will retard the thrust levers to reverse while using maximum braking.

PSA Airlines recommends an RTO [rejected takeoff] for any malfunction below 80 knots.
Above 80 knots, an RTO is recommended for items such as:
• Engine failure
• Fire warning
• Aircraft is considered unsafe or unable to fly
• Loss of directional control.

The FOM also stated that either pilot should call, "reject." A chart in the manual directed the captain to bring the thrust levers to idle, apply maximum braking, and apply maximum reverse thrust consistent with directional control. The chart directed the first officer to make standard landing callouts and notify air traffic

control.

The PSA Airlines FOM, Section 7.8.4, “V1,” states, in part, the following:
V1 is the maximum speed to which an aircraft can accelerate, lose an engine, and either stop or takeoff in the remaining distance.

FAA Advisory Circular 120-62, “Takeoff Safety Training Aid,” defines V1 speed as follows:
a. V1. The speed selected for each takeoff, based upon approved performance data and specified conditions, which represents:
(1) The maximum speed by which a rejected takeoff must be initiated to assure that a safe stop can be completed within the remaining runway, or runway and stopway;
(2) The minimum speed which assures that a takeoff can be safely completed within the remaining runway, or runway and clearway, after failure of the most critical engine at a designated speed; and
(3) The single speed which permits a successful stop or continued takeoff when operating at the minimum allowable field length for a particular weight.

The captain stated that the takeoff was normal until the 80-knot callout when he realized that the flaps were misconfigured. He stated that the incorrect flaps setting would have been a reason to abort the takeoff and that he did not know why he did not call for an RTO at that time. He stated that, when he realized that the flaps were not at the correct setting, he quickly reached over and moved the flap setting from 8 to 20 because he thought this action would solve the problem caused by him missing the misconfiguration earlier. He stated that, as soon as he moved the flaps handle, the airplane warnings alerted and he rejected the takeoff. He stated that he did not think the first officer had called out V1 before he initiated the RTO.

The first officer stated that he did not see the captain move the flaps. The first officer stated that, when they were at about 80 knots, he heard a “click” and a triple chime aural alert and saw “a red indication,” which was the master warning. He stated that, before the aural warnings sounded, he did not notice anything wrong or unusual. He stated that he heard the captain say something and then immediately initiate the RTO. He stated that he thought that the RTO was initiated before reaching V1 and that he knew that an RTO should not occur after reaching V1.

Probable Cause(s)

The National Transportation Safety Board determines the probable cause(s) of this incident as follows.

(1) The flight crewmembers unprofessional behavior, including their nonadherence to sterile cockpit procedures by engaging in nonpertinent conversation, which distracted them from their primary flight-related duties and led to their failure to correctly set and verify the flaps;

(2) the captains decision to reconfigure the flaps during the takeoff roll instead of rejecting the takeoff when he first identified the misconfiguration, which resulted in the rejected takeoff beginning when the airplane was about 13 knots above the takeoff decision speed and the subsequent runway overrun; and

(3) the flight crewmembers lack of checklist discipline, which contributed to their failure to detect the incorrect flap setting before initiating the takeoff roll. Contributing to the survivability of this incident was the presence of an engineered materials arresting system beyond the runway end.