

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety Washington, D.C. 20594

May 31, 2011

Group Chairman's Factual Report

OPERATIONAL FACTORS

ENG10IA055

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A. INCIDENT

Operator:	SkyWest Airlines, Inc.
Location:	General Mitchell Airport (MKE), Milwaukee, WI
Date:	September 28, 2010
Time:	1710 central daylight time ¹
Airplane:	Bombardier CL600-2B19, Registration Number: N498CA, Serial #: 7792

B. OPERATIONS GROUP

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C. SUMMARY

On September 28, 2010, about 1710 Central Daylight Time (CDT), a Bombardier CL600-2B19, registration number N498CA, operated by SkyWest Airlines, Inc. as flight 3074, landed on

¹ All times are central daylight time (CDT) based on a 24-hour clock, unless otherwise noted. Actual time of incident is approximate.

runway 7R with the left main landing gear (MLG) retracted at the General Mitchell Airport (MKE), Milwaukee, Wisconsin. The airline transport pilot and first officer, 1 flight attendant, and 39 passengers were not injured. Visual meteorological conditions prevailed for the 14 CFR Part 121 scheduled domestic passenger flight that was operating on an instrument flight rules (IFR) flight plan. The flight originated from Eppley Airfield (OMA), Omaha, Nebraska, at 1538 CDT, with a planned destination of General Mitchell Airport (MKE), Milwaukee, Wisconsin. All airplane occupants exited the airplane via the main cabin door with no injuries reported during the evacuation.

D. DETAILS OF THE INVESTIGATION

The Operations Group was formed in February 2011 to investigate flight crew performance and procedures used during the event.

The group obtained information from the company regarding flight crew experience, and training and written statements submitted by the crew² to the company Flight Safety Department. The group also obtained current copies of excerpts of the Airplane Flight Manual (AFM) and Quick Reference Handbook (QRH) from the airplane manufacturer.

The group conducted interviews of the flight crew members³, via telephone, and collected additional information from the operator regarding other landing gear malfunction events at the airline. The group discussed with the manufacturer, a plan to initiate a review, by the Engineering and Flight Operations departments, of the Gear Disagree procedure contained in the QRH and AFM.

E. FACTUAL INFORMATION

1.0 History of Flight

The incident flight crew departed OMA about 1538 bound for MKE. The first officer was the pilot flying. According to interviews with the crew, after selecting the landing gear down during approach to runway 7R, a GEAR DISAGREE message posted on the Engine Indicating Crew Alert System (EICAS) along with an associated aural alert. The flight crew performed a go around and received radar vectors from air traffic control (ATC) while trouble shooting the problem.

After executing the go around, the captain selected the gear back to the up position and initiated the "GEAR DISAGREE" procedure located in the QRH. The crew attempted to establish two way radio communications with their company dispatch without success. After some

² See Attachment 1 – Flight Crew Statements.

³ See Attachment 2 – Interview Summaries.

troubleshooting, the captain took over pilot flying (PF) duties and handed the QRH over to the first officer.

According to interviews, the crew declared an emergency, informed the ATC tower of the landing gear malfunction, and performed a fly by over runway 7R. The tower controller advised that the left main landing gear appeared to be retracted. The flight crew conducted a visual pattern and landed on runway 7R with the left main gear retracted. All occupants exited the airplane through the main cabin door.

2.0 Flight Crew Information

2.1 The Captain

The captain was 35 years old and had worked for SkyWest Airlines since August 2004. At the time of the incident, he was a captain on the CRJ based in Houston and was qualified to fly the CRJ 200, 700, and 900. He had previously been a first officer on the CRJ and on the Brasilia (EMB-120). A search of FAA records indicated that he had no history of accident, incidents, or violations in aviation and no record of investigations pending.

According to SkyWest Airlines he did not have a history of problems in either ground or flight training and all company administered flight checks had been completed satisfactorily.

2.1.1 The Captain's Pilot Certification Record

FAA records of the Captain indicated that:

<u>Private Pilot – Airplane Single Engine Land</u> certificate was issued on December 13, 2000. <u>Private Pilot – Airplane Single and Multiengine Land</u> certificate was issued on March 4, 2001. <u>Private Pilot – Airplane Single and Multiengine Land – Instrument Airplane</u> certificate was issued on March 18, 2001.

- <u>Commercial Pilot Airplane Multiengine Land Instrument Airplane Private Privileges –</u> <u>Airplane Single Engine Land</u> was issued on April 18, 2001.
- <u>Commercial Pilot Airplane Single and Multiengine Land Instrument Airplane</u> certificate was issued on April 18, 2001.

Flight Instructor – Airplane Multiengine certificate was originally issued on April 26, 2001.

<u>Flight Instructor – Airplane Multiengine – Instrument Airplane</u> certificate was originally issued on April 28, 2001.

<u>Flight Instructor – Airplane Single and Multiengine – Instrument Airplane</u> certificate was originally issued on May 3, 2001.

<u>Airline Transport Pilot – Airplane Multiengine Land – Commercial Privileges – Airplane Single</u> <u>Engine Land</u> certificate was issued on September 23, 2003. A CL-65 type rating with CL-65 circling approach VMC only and CL-65 SIC privileges only limitations was added on February 24, 2006. The CL-65 SIC privileges only limitation was removed on December 11, 2006.

2.1.2 The Captain's Pilot Certificates and Ratings Held at Time of the Accident

AIRLINE TRANSPORT PILOT (issued October 23, 2009) AIRPLANE MULTIENGINE LAND CL-65 COMMERCIAL PRIVILEGES AIRPLANE SINGLE ENGINE LAND LIMITATIONS: CL-65 CIRC. APCH. – VMC ONLY

<u>MEDICAL CERTIFICATE FIRST CLASS</u> (issued May 11, 2010) Limitations: None

2.1.3 The Captain's Training and Proficiency Checks Completed

Initial Type Rating CL-65: December 11, 2006 Last recurrent simulator training: June 14, 2010 Last recurrent ground training: November 6, 2009 Last line check on CL-65: December 7, 2009 Last Proficiency check: June 14, 2010

2.1.4 The Captain's Flight Times

The captain's flight times, based on SkyWest Airlines employment records:

Total pilot flying time	6313 hours
Total Pilot-In-Command (PIC) time	3054 hours
Total CL-65 flying time	4048 hours
Total CL-65 PIC time	3100 hours
Total flying time last 24 hours	7 hours 46 minutes
Total flying time last 7 days	7 hours 46 minutes
Total flying time last 30 days	73 hours 45 minutes
Total flying time last 12 months	886 hours 57 minutes

2.2 The First Officer

The first officer was 42 years old and was hired by SkyWest Airlines in November 2006. Prior to SkyWest Airlines, he had been a captain on a Beech 1900 and had flown both fixed wing and rotorcraft in the Jamaican military.

According to SkyWest Airlines he did not have a history of problems in ground or flight training and all company administered flight checks had been completed satisfactorily.

2.2.1 The F/O's Pilot Certification Record

FAA records of the F/O indicated that:

<u>Private Pilot - Airplane Single and Multiengine Land</u> certificate was issued on July 1, 2003 on the basis of and valid only when accompanied by Jamaica pilots license Number -----. All limitations and restrictions on the Jamaica pilot's license apply.

<u>Airline Transport Pilot – Airplane Multiengine Land</u> certificate was issued on October 6, 2004. A CL-65 type rating with CL-65 circling approach VMC only and CL-65 SIC privileges only limitations was added on January 10, 2007.

2.2.2 The F/O's Pilot Certificates and Ratings Held at Time of the Accident

AIRLINE TRANSPORT PILOT (issued September 20, 2010) AIRPLANE MULTIENGINE LAND CL-65 LIMITATIONS: CL-65 CIRC. APCH. – VMC ONLY CL-65 SIC PRIVILEGES ONLY

<u>MEDICAL CERTIFICATE FIRST CLASS</u> (issued September 20, 2010) Limitations: None

2.2.3 The F/O's Training and Proficiency Checks Completed

Initial Type Rating CL-65: January 10, 2007 Last recurrent simulator training: January 26, 2010 Last recurrent ground training: December 1 6, 2009 Last line check on CL-65: March 4, 2010 Last Proficiency check: January 26, 2010

2.2.4 The F/O's Flight Times

The F/O's flight times, based on SkyWest Airlines employment records:

Total pilot flying time	5042 hours
Total SIC time	2966 hours
Total flying time in CL-65	2966 hours
Total CL-65 second-in-command (SIC)	2966 hours

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time Total flying time last 24 hours Total flying time last 7 days Total flying time last 30 days Total flying time last 12 months

7 hours 46 minutes 26 hours 42 minutes 70 hours 0 minutes 842 hours 27 minutes

3.0 Aerodrome Information

Airport information was obtained from the Federal Aviation Administration's National Aeronautical Charting Office (NACO) Terminal Procedures Publication (TPP) and Airport Facility Directory (AFD). At the time of the incident, MKE field elevation was reported as 723 feet above mean sea level and was located approximately 5 miles south of Milwaukee, WI. The airport had 5 hard surface runways. NACO data indicated runway 1L/19R was grooved asphalt and concrete and was 9,690 long and 200 feet wide. Runway 7R/25L was grooved asphalt and concrete and was 7,761 feet long and 150 feet wide. Runway 13/31 was asphalt and concrete and was 5,538 feet long and 150 feet wide. Runway 7L/25R and 01R/19L were each less than 5,000 feet long.

Runway 7R had precision runway markings, high intensity runway lights (HIRL), a medium intensity approach light system with runway alignment indicator lights (MALSR), and a precision approach path indicator (PAPI) on the left side of the runway displaying a 3 degree glide path.

4.0 Meteorological Information

Weather reported at 1652 indicated wind from 060 at 7 knots, 10 statute miles visibility, few clouds at 8000 feet, scattered clouds at 10,000 feet, temperature 16 degrees C, dew point 11 degrees C, and altimeter setting 29.78 inches.

5.0 Flight Operations Procedures

SkyWest Airlines utilized the manufacturer's QRH on the flight deck during flight operations. During the incident, the flight crew applied the GEAR DISAGREE checklist contained in the Quick Reference Handbook (QRH)⁴.

The GEAR DISAGREE checklist⁵ included two parts, a "Gear Up Disagree", followed by a "Gear DN Disagree" procedure. Interviews with the flight crew indicated that the procedure to be used was determined by the position of the landing gear selector lever. If the Gear Disagree EICAS message occurred when the selector lever was in the up position, the crew was to use the Gear UP Disagree procedure and if the message occurred when the selector lever was in the down position, the Gear DN Disagree procedure was to be used.

⁴ CRJ Series Regional Jet Quick Reference Handbook Volume 2, model CL 600-2B19, revision 58 dated October 31, 2005. The Gear Disagree procedure was included on pages 13-4 through 13-7 of the QRH and was identified as temporary revision RJ/98, dated April 12, 2007.

⁵ See attachment 3 – QRH Gear Disagree and Landing Gear Up Unsafe Landing.

The captain indicated that he may have initially used the Gear UP Disagree procedure which eventually led him to the Gear DN Disagree procedure for trouble shooting prior to landing.

According to interviews with the crew, upon reaching step 8, the captain took over pilot flying duties, handed the QRH to the first officer, and asked him to interpret the notes contained in the procedure. After discussing their interpretation of the notes, the flight crew decided to leave the landing gear manual release handle in the extended position and proceeded to land. The captain stated that the notes in the checklist implied to him that the landing gear could come back up if he stowed the manual extension handle.

The CRJ Series Regional Jet QRH, page 13-7 stated, in part:

(4) LANDING GEAR MANUAL RELEASE PULL to full extension

And;

When hydraulic system 3 pressure is less than 200 psi:

(7) *HYDRAULIC 3A and 3B pumps*.....*ON*

NOTE

In some cases, switching hydraulic system 3 ON may cause the nose gear to lose downlock or to retract. If this occurs, the landing gear manual release handle must be stowed.

(8) LANDING GEAR MANUAL RELEASE STOW

NOTE

- 1. In some cases, stowing the landing gear manual release handle may cause the main or nose gear to retract. If this occurs, the landing gear manual release handle must again be pulled to full extension and left in this position until the gear pins have been installed.
- 2. With the landing gear manual release handle pulled, the HYD 3 HI TEMP caution message may eventually be posted.

GEAR DISAGREE warning message still persists:

Yes

(9) Landing Gear Up / Unsafe Landing ProcedureAccomplish (Refer to EMER 13--9)

NOTE

With the landing gear manual release handle pulled, the HYD 3 HI TEMP caution message may eventually be posted. -- END --

The captain stated that he felt they were under some time pressure due to the amount of fuel remaining on board, and decided to "put the QRH aside and focus on the approach and landing"⁶. The crew did not recall if they had completed step 9, which referred to the Landing Gear Up / Unsafe Landing Procedure, although the first officer thought he had completed a checklist for an abnormal or emergency landing. The captain stated he was not aware that step 9 referred to another checklist until he reviewed the procedure after the event.

6.0 Flight Operations Procedure Revision History

A review of the GEAR DISAGREE QRH procedure indicated that it had been revised a number of times since it was originally issued. An earlier version of the checklist included a step to leave the landing gear manual release handle in the extended position after use. The procedure was later revised and included a step to stow the handle after deployment of the landing gear. Revision RJ/98 dated, April 12, 2007, was then issued which maintained the step to stow the handle, and added notes indicating that stowing the handle could cause the landing gear to retract.

Earlier versions of the QRH also contained separate procedures for the Gear UP Disagree and the Gear DN Disagree scenarios. The two procedures were combined into one Gear Disagree procedure with revision 57 which was dated April 5, 2004.

7.0 Communications

No communications problems with ATC were noted at anytime during the event.

The captain stated that while he was executing the QRH procedure, he made repeated attempts to contact SkyWest Dispatch and Maintenance via Atlanta Radio⁷ to advise them of the situation

⁶ See Attachment 2 – Interview Summaries.

⁷ Atlanta Radio – a commercial provider of communications services.

and request additional guidance. He stated that he also attempted to contact Maintenance through the local Station Operations radio frequency. He was unable to contact them via radio but did eventually receive a response to an ACARS (Aircraft Communications Addressing and Recording System) message sent to Dispatch.

8.0 Additional Information

After the incident, Bombardier Regional Aircraft Division's Flight Operations and Engineering groups initiated a review and evaluation of the GEAR DISAGREE procedure. As a result of the review, the GEAR DISAGREE procedure was amended to clarify required crew actions.

After the incident, SkyWest Airlines published an informational article in an internal company flight operations newsletter available to flight crews. The article provided guidance on the use of the gear disagree checklist procedure and emphasized the identification of the proper procedure, the possibility that the procedure may need to be repeated multiple times to achieve success, and the direction to stow the manual extension handle after the gear has been extended.

SkyWest Airlines also modified their CRJ training program to include a discussion of gear disagree events during recurrent ground school, and a gear disagree scenario during flight crew recurrent simulator training.

Submitted by:

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