

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**AVIATION INVESTIGATION REPORT
A14H0002**



RUNWAY INCURSION AND RISK OF COLLISION

**7506406 CANADA INC.
AGUSTA AW 139 (HELICOPTER), C-GYNM
AND
FEDERAL EXPRESS
AIRBUS 300B4-622R N748FD
OTTAWA MACDONALD-CARTIER INTERNATIONAL
AIRPORT, OTTAWA, ONTARIO
05 JUNE 2014**

Canada

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Aviation Investigation Report A14H0002

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Ottawa, Ontario

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Summary

The 7506406 Canada Inc. Agusta AW 139 (registration C-GYNM, serial number 41245), operating as Life Flight 4 Medevac (LF 4 Medevac), was on an instrument flight rules (IFR) flight plan from the Ottawa Macdonald-Cartier International Airport, Ontario, to Pembroke, Ontario, on 05 June 2014. LF 4 Medevac received taxi instructions and was instructed to contact the tower when holding short of Runway 25. A correct readback was obtained by the ground controller, and at 0848 Eastern Daylight Time, LF 4 Medevac contacted the tower when holding short of Runway 25. The airport controller acknowledged, amended LF 4 Medevac's IFR clearance, and then observed LF 4 Medevac taxiing across the hold short line while a Federal Express Corp. Airbus 300B4-622R (registration N748FD, serial number 633), operating as Federal Express Flight 152 Heavy (FDX 152 Heavy), was landing on Runway 25. The airport controller instructed LF 4 Medevac to stop. When LF 4 Medevac stopped taxiing, FDX 152 Heavy was decelerating through a ground speed of 110 knots, approximately 2600 feet from the intersection of Runway 25 and Taxiway Echo.

Le présent rapport est également disponible en français.

Factual information

History of the flight

The 7506406 Canada Inc. (hereafter called Ornge Rotor Wing)¹ Agusta AW 139 helicopter, operating as Life Flight 4 Medevac (LF 4 Medevac), was operating as an instrument flight rules (IFR) flight from the Ottawa Macdonald-Cartier International Airport (CYOW), Ontario, to the Pembroke Airport (CYTA), Ontario, to position for a patient transfer. There were 4 crew members on board, comprising 2 flight crew and 2 paramedics.

Figure 1. Ottawa Macdonald-Cartier International Airport (Source: Google Earth, with TSB annotations)



After receiving an IFR clearance² from the clearance delivery controller,³ LF 4 Medevac requested taxi instructions to taxi from the apron where Ornge Rotor Wing has its hangar (hereafter called Ornge apron) located at the south end of Taxiway Echo (Figure 1). At 0845:46,⁴ LF 4 Medevac received instructions to taxi via Taxiway Echo to Runway 25, and to

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- ¹ When reference is made to Ornge Rotor Wing, it shall be taken to mean 7506406 Canada Inc. (Source: 7506406 Canada Inc. *Company Operations Manual*, Preamble).
 - ² An air traffic control (ATC) clearance is an authorization issued by an ATC unit for an aircraft to proceed within controlled airspace in accordance with the conditions specified by that unit. (Source: NAV CANADA, *Air Traffic Control Manual of Operations [ATC MANOPS]*, Version 2, Effective 03 April 2014 to 15 October 2014, Definitions).
 - ³ The clearance delivery controller is the duty controller assigned to the clearance delivery position in an airport control tower. (Source: NAV CANADA, *Ottawa Tower Unit Procedures Manual*).
 - ⁴ All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours).

contact the tower on frequency 118.8 megahertz holding short on Taxiway Echo south of Runway 25. A correct readback⁵ was obtained by the ground controller.⁶

Federal Express Flight 152 Heavy (FDX 152 Heavy) was on an IFR flight from Montréal International (Mirabel) Airport (CYMX), Quebec, to CYOW, with 2 flight crew on board. At 0846:20, FDX 152 Heavy was cleared to land on Runway 25 by the airport controller.⁷

The LF 4 Medevac flight crew was unaware that FDX 152 Heavy had been cleared to land on Runway 25 because the landing clearance was issued on the tower frequency while LF 4 Medevac was taxiing and monitoring the ground frequency.

At 0848:15, LF 4 Medevac contacted the tower at the hold short line on Taxiway Echo south of Runway 25, and the airport controller immediately amended LF 4 Medevac's IFR clearance stating "LF 4 Medevac Roger, while we wait⁸ amend your Ottawa 3⁹ for a right turn heading 290° balance unchanged". The pilot not flying (PNF) asked the airport controller to repeat the transmission. Upon reception and readback of the amended IFR clearance, the PNF realized that the pilot flying (PF) had begun taxiing across the hold short line.

Upon observing LF 4 Medevac taxiing over the hold short line, the airport controller told the crew to hold short and stop.

The FDX 152 Heavy flight crew flew a stable approach and made a normal rotation to flare the aircraft. While in the flare, the PNF of FDX 152 Heavy heard the airport controller instruct someone to stop. The runway remained clear, and the crew continued the landing. The FDX 152 Heavy flight crew did not see LF 4 Medevac until they had slowed down to taxi speed. The helicopter had entered the runway protected area¹⁰ on Taxiway Echo, south of Runway 25; however, it had not entered the runway environment.

⁵ An air traffic controller is required to obtain a readback of an instruction to an aircraft to hold short of a runway. (Source: NAV CANADA, Air Traffic Control Manual of Operations [ATC MANOPS], Version 2, Effective 03 April 2014 to 15 October 2014, section 133.4).

⁶ The ground controller is the duty controller assigned to the ground control position in an airport control tower. (Source: NAV CANADA, Air Traffic Control Manual of Operations [ATC MANOPS], Version 2, Effective 03 April 2014 to 15 October 2014, Definitions).

⁷ The airport controller is the duty controller assigned to the airport control position in an airport control tower. (Source: NAV CANADA, Air Traffic Control Manual of Operations [ATC MANOPS], Version 2, Effective 03 April 2014 to 15 October 2014, Definitions).

⁸ "While we wait" is not standard phraseology in the Air Traffic Control Manual of Operations (ATC MANOPS).

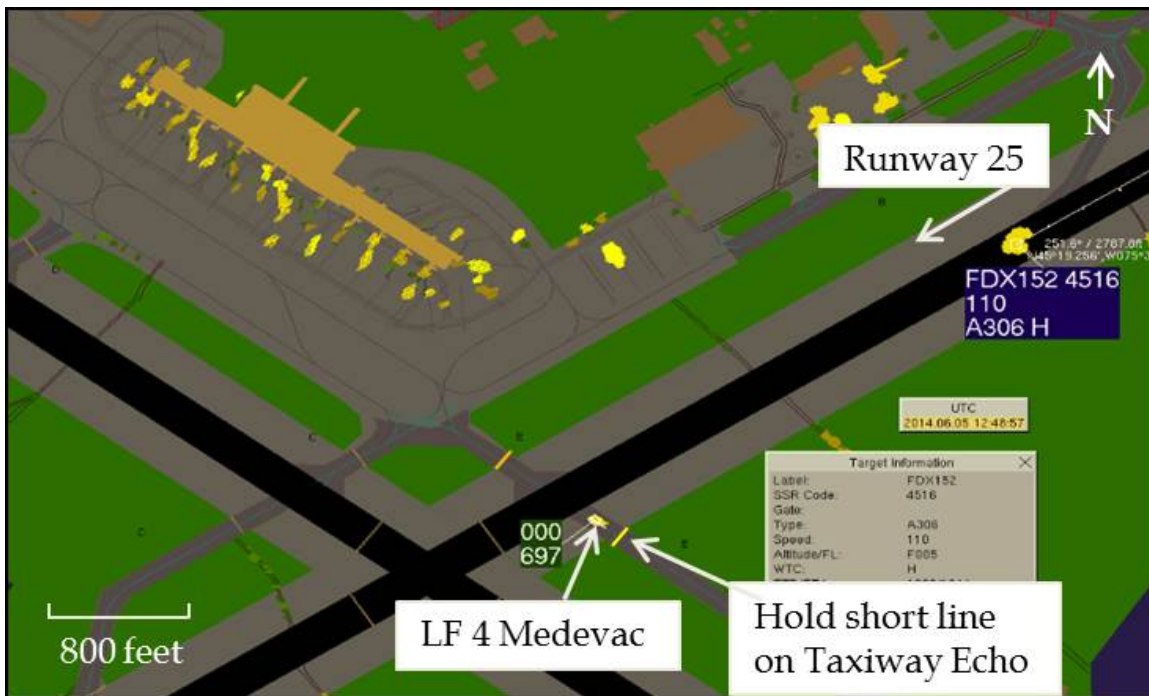
⁹ The Ottawa 3 is a standard instrument departure at CYOW that requires an aircraft to climb on heading 251° on departure. (Source: NAV CANADA, *Canada Air Pilot*, CAP 4, Effective 29 May 2014 to 24 July 2014).

¹⁰ A runway protected area is the area around an active runway established to protect aircraft taking off and landing from taxiing aircraft and ground traffic. (Source: NAV CANADA, Air Traffic Control Manual of Operations [ATC MANOPS], Version 2, Effective 03 April 2014 to 15 October 2014, Definitions).

The airport surface detection equipment (ASDE)¹¹ display indicated that as FDX 152 Heavy was on short final approaching the threshold of Runway 25, LF 4 Medevac was taxiing over the hold short line, accelerating through a ground speed of 5 knots, to eventually reach a ground speed of 7 knots before stopping.

When LF 4 Medevac stopped taxiing, FDX 152 Heavy had landed and was decelerating through a ground speed of 110 knots, approximately 2600 feet from the intersection of Runway 25 and Taxiway Echo (Figure 2). The ASDE display showed LF 4 Medevac beyond the hold short line on Taxiway Echo. The helicopter was, however, not on Runway 25; it had stopped just adjacent to it. Approximately 30 seconds had elapsed from the time when the LF 4 Medevac PNF had contacted the tower to when they stopped taxiing.

Figure 2. Ottawa Macdonald-Cartier International Airport airport surface detection equipment (ASDE) display (Source: NAV CANADA, with TSB annotations)



Once FDX 152 Heavy had slowed to a ground speed of less than 10 knots, approximately 240 feet from the LF 4 Medevac helicopter, the crew was instructed by the airport controller to taxi right on Taxiway Echo (north of Runway 25) and to contact ground once off the runway. FDX 152 Heavy informed the airport controller that they wanted to ensure that they had the required space to taxi by the LF 4 Medevac helicopter before continuing. When asked by the airport controller if it could back up, LF 4 Medevac was able to turn around and taxi back to the hold short line. FDX 152 Heavy taxied to the apron as initially instructed.

¹¹ Airport surface detection equipment (ASDE) is a ground-radar surveillance system that provides controllers with information on the movement of aircraft and vehicles on runways and taxiways. (Source: NAV CANADA, Runway Safety Initiatives, available at: <http://www.navcanada.ca/EN/products-and-services/Pages/on-board-safety-initiatives-runway-safety-initiatives.aspx> [last accessed on 08 July 2015]).

LF 4 Medevac subsequently departed for Pembroke.

Ottawa Macdonald-Cartier International Airport

The Ottawa Airport Authority operates CYOW in accordance with the standards set out in the Transport Canada Manual, *Aerodrome Standards and Recommended Practices* (TP312E).¹² NAV CANADA provides air traffic control (ATC) services at the airport, operating from an ATC tower located on the airfield, and from the area control centre facility located in Montréal. Service is provided for both visual flight rules (VFR) and IFR traffic.¹³

Runway 25 at CYOW was being used for arrivals and departures. Runway 25 is 8000 feet long and 200 feet wide.

Hold short lines at the intersection of Taxiway Echo and Runway 25 are located on Taxiway Echo, 90 metres (295 feet) from the Runway 25 centreline.

Weather

The CYOW aviation routine weather report issued at 0800 was as follows: wind variable at 2 knots, visibility 15 statute miles, broken ceiling at 2800 feet above ground level (agl), overcast ceiling at 3500 feet agl, temperature 13°C, dew point 11°C, and altimeter 29.75 inches of mercury.

Ornge Rotor Wing

Safety management

Ornge Rotor Wing did not have an approved safety management system, nor was one required by regulations.

In accordance with section 5.1 of the company's *Corporate Safety Manual*, the flight crew submitted an aviation safety report to its aviation safety office on the day of the occurrence. A safety investigation was completed, and the report was published for the purpose of a review by Transport Canada (TC).

Flight crew

Records indicate that the LF 4 Medevac flight crew was certified and qualified for the flight in accordance with existing regulations.

The PF was the designated pilot-in-command and had approximately 5600 hours total flying time, including 700 hours on the Agusta AW 139. The PF's duty day began at 0800 following

¹² Ottawa Macdonald-Cartier International Airport, *Airport Operations Manual*, 20 March 2014, p. Gen 2.

¹³ *Ibid.*, Pt 1-4.

an 11-hour rest period.¹⁴ The PF had worked the previous day until 2100, following 5 days off and could not recall previous sleep cycles.

The PNF had approximately 4500 hours total flying time, including 440 hours on the Agusta AW 139. The PNF was also captain-certified on the Agusta AW 139. The PNF's duty day began at 0700 following 3 days off. Regular sleep cycles of 8 hours were reported for the 3 previous nights.

Fatigue was not considered a factor for either pilot.

Air traffic services

Staffing

Staffing in the Ottawa tower met unit standards.¹⁵ There were 4 air traffic controllers on duty. Three positions were operational, including the clearance delivery, ground control and airport control positions. The fourth air traffic controller was on a break and not in the tower at the time of the occurrence.

The airport controller was licensed and qualified for the operation. The airport controller had worked the previous 3 days following 4 days off duty. There was no indication that fatigue was a factor.

In accordance with the NAV CANADA *Operations Investigations Guidelines Manual*, section 500, following the incident, the airport controller was replaced by the fourth controller, who had been recalled to the tower.

Air traffic control procedures

NAV CANADA Air Traffic Control Manual of Operations (ATC MANOPS), section 412.1 provides direction for issuing an initial IFR clearance, and section 415 provides direction and phraseology for amending an IFR clearance.

"While we wait" is non-standard phraseology; however, the investigation revealed that some airport controllers at CYOW used that phraseology. "Line up and wait", which is recognized phraseology in ATC MANOPS, is an instruction given by an air traffic controller to an aircraft to enter the runway to be used for take-off and to wait.

ATC MANOPS does not require an air traffic controller to repeat an instruction to "hold short" once a pilot has reported holding as previously instructed. Some air traffic controllers at CYOW are reluctant to repeat an instruction to "hold short", as an instruction to "hold short" requires that a readback be obtained. However, to reduce the risk of a runway

¹⁴ Minimum rest period is defined as a total of 11 hours from engines off or rotors stopped (7506406 Canada Inc., Flight Operations Directive, 7506406-FO-DIR-019, Revision 1, 25 October 2012).

¹⁵ NAV CANADA, *Ottawa Tower Unit Procedures Manual*, section 72.

incursion, some controllers do repeat a “hold short” instruction in critical situations, such as when an aircraft is departing or landing on the runway.

Section 336.14 of the ATC MANOPS provides direction for issuing a take-off clearance to a departing aircraft as follows:

- Aircraft identification;
- Unit identification, if required;
- Special information, such as a hazard or obstruction;
- Control instruction, such as a turn or heading after takeoff;
- Wind information, if required; and
- Cleared for take-off Runway (number) or from (name of taxiway, runway intersection or threshold), cleared for take-off Runway (number).

Human factors

Expectancy

Expectation has an influence on perception. The context in which a message occurs plays an important role in how it is interpreted, and in many circumstances, people hear what they want to hear.

A mistaken hypothesis or assumption is an important contributor to human error. An example is a pilot taking off without air traffic control clearance, because something occurred to give the pilot the assumption that a proper clearance would be received.¹⁶ Expectancy can also be greater after a long experience of a consistent circumstance, without an appreciation that the current situation is different.¹⁷

The LF 4 Medevac PF had been operating at CYOW for 15 years. The PF’s experience was that when departing from CYOW on an IFR flight, a clearance to take off was commonly given after an amendment to an IFR clearance.

For IFR flights, it is common for airport controllers to amend the IFR departure clearance by assigning heading or altitude changes. This is normally done while holding short of the runway until it is available, as in this case.

The format for the issuance of a take-off clearance may include control instructions such as a heading to follow (ATC MANOPS 336.14). This may contribute to a pilot’s expectation that a take-off clearance would follow a heading change instruction.

¹⁶ R.D. Campbell and M. Bagshaw, *Human Performance and Limitations in Aviation*, 3rd Ed., Oxford: Blackwell Science, 2002, p. 118.

¹⁷ Ibid.

While receiving the amendment to the IFR clearance, the PF started taxiing from the hold short line on Taxiway Echo to Runway 25, without having received authorization to taxi or a clearance to take off.

Distraction

A distraction is anything that draws a person's attention away from the task they are performing.

The omission of a required action is the most frequent causal factor in occurrences. An omission is often the result of a distraction.

The Ornge Rotor Wing's *AW 139 Standard Operating Procedures* (SOPs) require that the PF set the heading bug to an amended heading. While listening and processing the amendment to the IFR clearance, the LF 4 Medevac PF set the amended heading of 290° on the heading bug as the helicopter began to taxi across the hold short line.

Section 3.2.1 of the SOPs states, "before taxiing on to a runway or helicopter landing area, the PF shall visually check that there are no arriving or departing aircraft that may cause conflict, instructing the PNF to check the other side of the aircraft if necessary."

The PF did not look left or right to check if the runway was clear prior to taxiing across the hold short line.

TSB Watchlist

Risk of collision on runways is a 2014 Watchlist issue

Airport operations require aircraft and vehicles to move between ramps, taxiways, and runways. Sometimes this movement creates conflicts between aircraft, or between aircraft and vehicles. These conflicts can also happen when aircraft or vehicles mistakenly occupy an active take-off or landing area.

In a 10-year period from 2004 through 2013, there were 4153 of these conflicts, known as runway incursions, in Canada.¹⁸ Given the millions of takeoffs and landings each year, incursions are rare, but their consequences can be catastrophic.

Since the TSB first placed this issue on its Watchlist in 2010, the number of these occurrences has remained too high: in 2010 there were 346, followed by 454 in 2011, 429 in 2012, and 381 in 2013. They continue to occur more than once a day.

The TSB has made findings and reported publicly on the risk of collisions on runways.¹⁹ The Board remains concerned that incursions and the risk of collisions will continue until better defences are put in place.

¹⁸ Transport Canada Civil Aviation Daily Occurrence Reporting System (CADORS).

TSB laboratory reports

The TSB completed the following laboratory reports in support of this investigation:

- LP 135/2014 - CVR [cockpit voice recorder] Download
- LP 136/2014 - FDR [flight data recorder] / ASDE [airport surface detection equipment] Data Analysis

¹⁹ TSB aviation investigation reports A99W0036, A00W0062, A00Q0114, A00P0206, A01O0299, A03C0099, A04P0047, A04P0397, A04Q0089, A07O0305, A08H0002, A08O0215, A09W0026, A09W0037, A10W0040, A11Q0170, and A13O0045.

Analysis

The LF 4 Medevac flight crew was certified and qualified for the flight in accordance with existing regulations, and the weather was not a factor. This analysis will focus on the events, conditions, and underlying factors that caused or contributed to the occurrence.

Upon reaching the hold short line on Taxiway Echo, the LF 4 Medevac pilot not flying (PNF) contacted the airport controller as previously instructed by the ground controller. While holding short of Runway 25 on Taxiway Echo, LF 4 Medevac was given an amendment to its instrument flight rules (IFR) clearance.

The amendment to LF 4 Medevac was transmitted immediately following the PNF's call, which resulted in the PNF asking the airport controller to repeat it. The airport controller's first transmission to LF 4 Medevac began with non-standard phraseology "while we wait", which can be confused with "line up and wait". It was during the response to the second transmission from the airport controller that the PNF realized that they had begun to taxi.

If air traffic control (ATC) uses non-standard phraseology, there is a risk of inconsistencies and miscommunication between ATC and the pilot.

The pilot flying (PF) started to taxi across the hold short line as the PNF was reading back the amendment to their IFR clearance. The PF understood that they could "line up and wait" as the airport controller's transmission did not start with an instruction to "hold".

The PF's action was consistent with his experience at Ottawa Macdonald-Cartier International Airport (CYOW). Based on experience when departing CYOW on an IFR flight, the LF 4 Medevac PF expected that a clearance to take off would follow the amendment to the IFR clearance.

The PF's attention may have been channelized on listening to and processing the amendment to their IFR clearance and setting the new heading of 290° on the heading bug. Likely due to distraction, before taxiing across the hold short line on Taxiway Echo without authorization, the LF 4 Medevac PF did not follow company standard operating procedures (SOPs) which required the PF to visually check that the runway was clear of traffic. LF 4 Medevac was monitoring the ground frequency when Federal Express Flight 152 Heavy (FDX 152 Heavy) was issued landing clearance on the tower frequency, and this might also have contributed to the PF not being aware of the landing aircraft and not checking the runway for traffic before taxiing.

If flight crews do not follow company SOPs before taxiing onto a runway, there is an increased risk of collision between aircraft.

The LF 4 Medevac PF's expectation that a clearance to take off would follow the amendment to their IFR clearance resulted in LF 4 Medevac taxiing across the hold short line without authorization. The probable distraction caused by listening to and processing the amendment, while setting the new heading on the heading bug, likely resulted in the LF 4 Medevac PF not checking if the runway was clear before taxiing across the hold short line,

leading to the runway incursion. There was a risk of collision as FDX 152 Heavy was landing on Runway 25 and LF 4 Medevac was taxiing across the hold short line on Taxiway Echo proceeding to Runway 25.

Findings

Findings as to causes and contributing factors

1. While holding short of Runway 25 on Taxiway Echo, Life Flight 4 Medevac was given an amendment to its instrument flight rules clearance. The airport controller's first transmission to Life Flight 4 Medevac began with non-standard phraseology "while we wait", which can be confused with "line up and wait".
2. Based on experience when departing the Ottawa Macdonald-Cartier International Airport on an instrument flight rules flight, the Life Flight 4 Medevac pilot flying expected that a clearance to take off would follow the amendment to the instrument flight rules clearance.
3. The probable distraction caused by listening to and processing the amendment, while setting the new heading on the heading bug, likely resulted in the Life Flight 4 Medevac pilot flying not checking if the runway was clear before taxiing across the hold short line, leading to the runway incursion.
4. There was a risk of collision as Federal Express Flight 152 Heavy was landing on Runway 25 and Life Flight 4 Medevac was taxiing across the hold short line on Taxiway Echo proceeding to Runway 25.

Findings as to risk

1. If air traffic control uses non-standard phraseology, there is a risk of inconsistencies and miscommunication between air traffic control and the pilot.
2. If flight crews do not follow company standard operating procedures before taxiing onto a runway, there is an increased risk of collision between aircraft.

Safety action

Safety action taken

Orange Rotor Wing

As a result of the occurrence, the Orange Rotor Wing Aviation Safety Office issued the following aviation safety bulletins:

- Bulletin AS-BULL-145, 19 June 2014, reminding flight crews to be diligent when receiving and acknowledging air traffic control (ATC) clearances and to ask for clarification when doubt exists. The bulletin also reminded flight crews that both crew members should understand the clearance, instruction and/or information before proceeding.
- Bulletin AS-BULL-150, 08 August 2014, describing the pilot's account of the occurrence. The bulletin was shared with flight crews as a lessons learned opportunity.

NAV CANADA

A review of the event was included in the Ottawa tower local refresher training for all staff, in November 2014, with emphasis on the importance of using standard phraseology.

This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on 10 June 2015. It was released on 15 July 2015.

Visit the Transportation Safety Board's website (www.tsb.gc.ca) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the transportation safety issues that pose the greatest risk to Canadians. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.