ACCIDENT

Aircraft Type and Registration:	Dassault Falcon 7X, VQ-BSO
No & Type of Engines:	3 Pratt & Whitney Canada PW307A engines
Year of Manufacture:	2009 (Serial no: 64)
Date & Time (UTC):	24 November 2016 at 1450 hrs
Location:	London City Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 3 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Minor abrasions to the right winglet
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	43 years
Commander's Flying Experience:	7,900 hours (of which 2,687 were on type) Last 90 days - 65 hours Last 28 days - 37 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft was taxiing into the General Aviation apron under the guidance of a marshaller, who was being assisted by two 'wing walkers' monitoring the aircraft wing tip clearance. During a turn to the left, the right winglet of the aircraft, struck the nose of another aircraft which was parked, causing it damage.

History of the flight

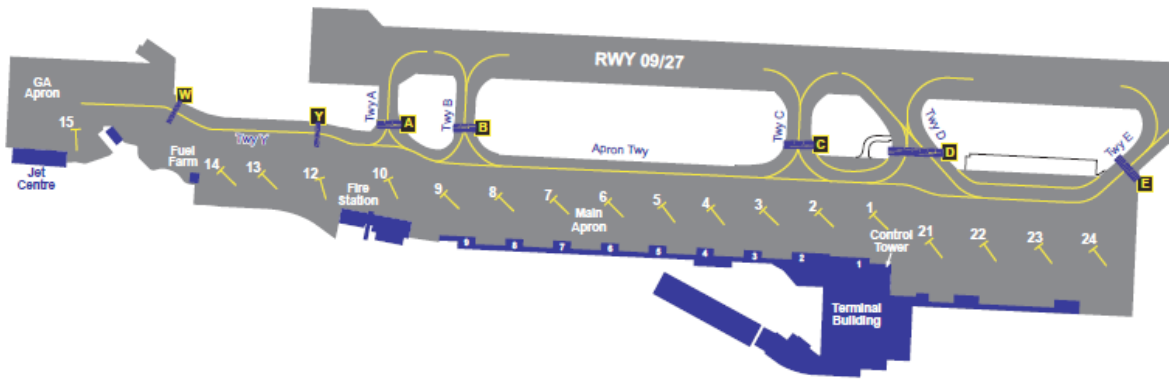

Figure 1

London City Airport Parking/Docking Chart

The aircraft had arrived from Rotterdam on a private flight. The weather was good and the airport's apron surface was dry. The intention of the ground handling staff was to park the aircraft on the General Aviation (GA) apron, located at the western end of the airport (Figure 1), 'nose in' to the 'Jet Centre' terminal building.

Other aircraft were parked on the apron and a marshaller and two 'wing walkers' were in position to guide VQ-BSO between two parked aircraft - their approximate positions on the apron and the intended taxi route for VQ-BSO are shown at Figure 2. VQ-BSF was parked on the western end of the apron further forward than normal and its flight crew were in their seats, as they were shortly due to depart. Another Falcon 7X was parked on Stand 15, facing approximately north.

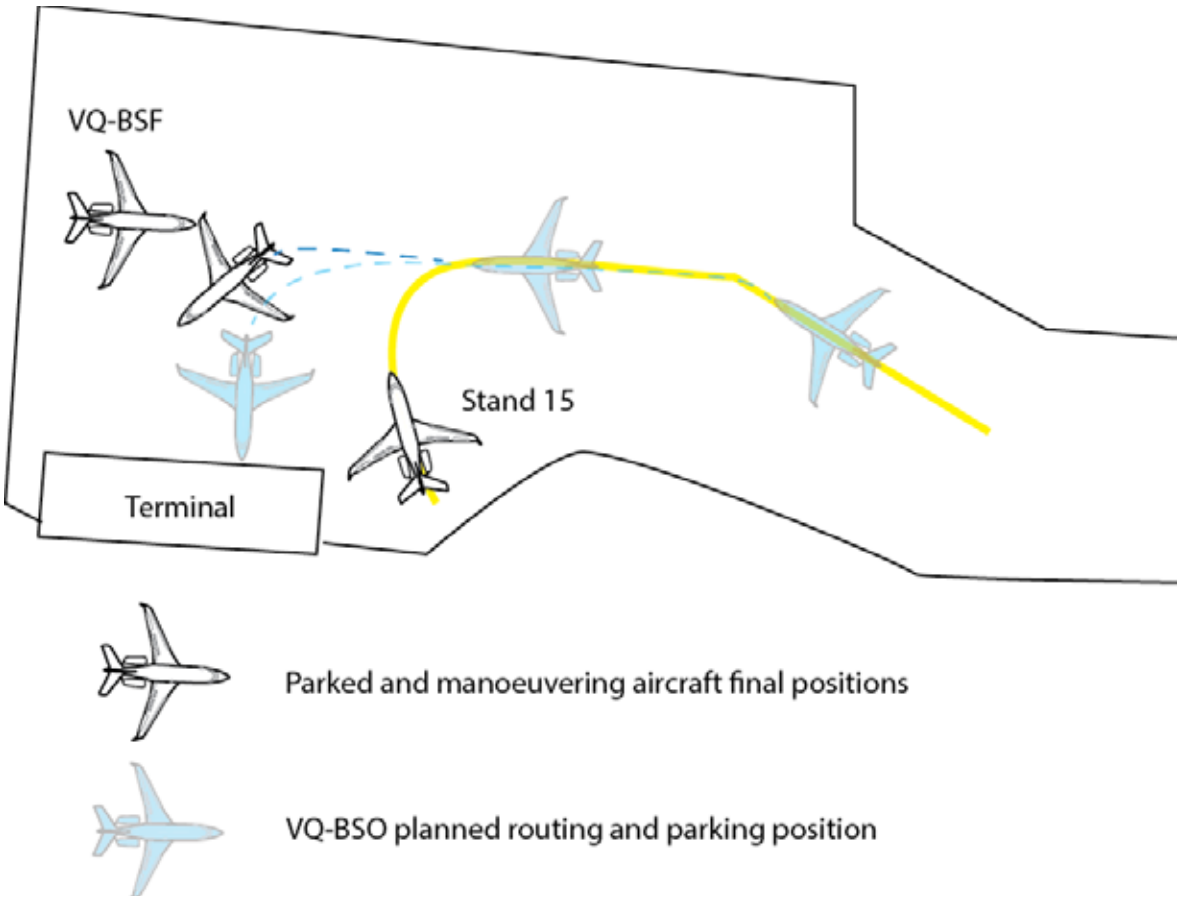

Figure 2 (not to scale)

Diagram of the intended and actual routing of VQ-BSO, and the parked aircraft

The commander of VQ-BSO was occupying the right pilot's seat[1], with the co-pilot, as the handling pilot, in the left seat taxiing the aircraft. Initially, the co-pilot followed the taxi line into the parking area and then, having identified the marshaller, followed his signals, whilst the commander monitored the right wing walker. The aircraft was marshalled ahead until

Footnote

[1] The operator's standard operating procedure is for the pilot handling to fly from the left seat. All pilots are qualified to fly from either seat.

clear of the parked aircraft on its left and beyond what the handling pilot, who had parked on the GA apron at London City before, thought was the normal turning point. The co-pilot remarked on this to the commander and, shortly afterwards, the marshaller indicated a left turn towards the terminal. The handling pilot followed the signals whilst the commander monitored the right wing tip. The marshaller then indicated a tighter left turn and both flight crew watched his signals. As the turn tightened, the speed of the right wing tip increased and the wing walker monitoring the right wing tip realised, at a late stage, that there was insufficient clearance. He crossed his arms in front of his chest, in a STOP signal, instead of above his head, but this was not seen by the marshaller, who, at that point, was looking to his right. The impact of the right winglet of VQ-BSO on the nose of VQ BSF was felt by VQ-BSO's flight crew, who brought the aircraft to a stop. The damage caused by the collision is shown below at Figure 3.

Figure 3
Damage caused by the collision

Although the damage to the radome and radar antenna of VQ-BSF was significant, the winglet of VQ-BSO only suffered minor abrasions and, following an engineering inspection, required no maintenance action. There were no injuries to persons on board either aircraft or on the ground.

Organisational information

*London City Airport GA Apron procedures***.**

The London City GA apron is used to park private, corporate aircraft of varying sizes and, apart from the apron entry line and Stand 15, which is located on the south-eastern corner of the apron, there are no ground markings for parking or taxiing on the concrete surface.

Both the UK AIP and the operator's Jeppesen aeronautical charts instruct pilots taxiing on the apron to follow the marshaller's instructions.

Clearance distances

London City Airport was certified under the EU Aerodrome Regulation (EU.139/2014) in February 2016. With a wingspan of 26.21m, the Falcon 7X aircraft is classed as a code C aircraft, for which the minimum clearance distance should be at least 4.5m. The relevant regulation is set out below:

'CS ADR-DSN.E.365 Clearance distances on aircraft stands

(a) The safety objective of clearance distances on aircraft stands is to provide safe separation between an aircraft using the stand and any adjacent building, aircraft on another stand and other objects.

(b) An aircraft stand should provide the following minimum clearances between an aircraft entering or exiting the stand and any adjacent building, aircraft on another stand and other objects:

Code Letter	*Clearance*
A	*3 m*
B	*3 m*
C	*4.5 m*
D	*7.5 m*
E	*7.5 m*
F	*7.5 m*

London City Jet Centre Ramp Instructions

This document contains the airport's procedures for marshalling aircraft and covers the staff requirements, procedures and signals to be used when marshalling aircraft at the airport. All the ground handling staff had received the required training and were in date with their qualifications.

The following paragraphs are of relevance to the incident:

> *'Care must be taken to ensure that the aircraft is protected during marshalling manoeuvres. On some types of aircraft, the pilot may not be able to see the aircraft wingtips; therefore, it is essential that precise signals are required to inspire confidence in the marshaller's ability. A wing tip marshaller should be used at all times.*
>
> *Particular attention must be paid to the effect of 'wing growth' during turns, this is where due to swept back nature of some aircraft types the wings appear to grow during turns, particularly where the turn is near an obstruction.*
>
> *Marshallers should lead the aircraft with signals, indicating aircraft changes in direction with steady signals rather than a rapid change of signal which may induce an over-reaction from the pilot.*
>
> *When marshalling in a congested area marshallers MUST ensure that the aircraft path is clear from any obstruction.*
>
> *There may be a need to manoeuvre aircraft in close proximity to other aircraft whilst on the Jet Centre ramp. This can prove very dangerous and must be approached with caution. It is the responsibility of the staff member marshalling/towing the aircraft to ensure they have sufficient numbers of wingmen present when manoeuvring aircraft in close proximity.*
>
> *Whilst operating during times of restricted vision such as night time/fog the use of reflective wands must be used during all aircraft movements to ensure full vision is obtained by the crew and clear signals throughout.'*

Wing growth

Wing growth is peculiar to swept-wing aircraft, such as the Falcon 7X. When moving in a straight line, the width of the area over which the wing structure passes equates to the wingspan. In the case of the Falcon 7X this is 26.21m. When a sharp turn is made to the left around the stationary left wheel, the radius of turn is from the left main wheel to the right wing tip, the arc of which subtends a greater distance out from the centre of the fuselage. This increase in radius or wing growth is illustrated at Figure 4.

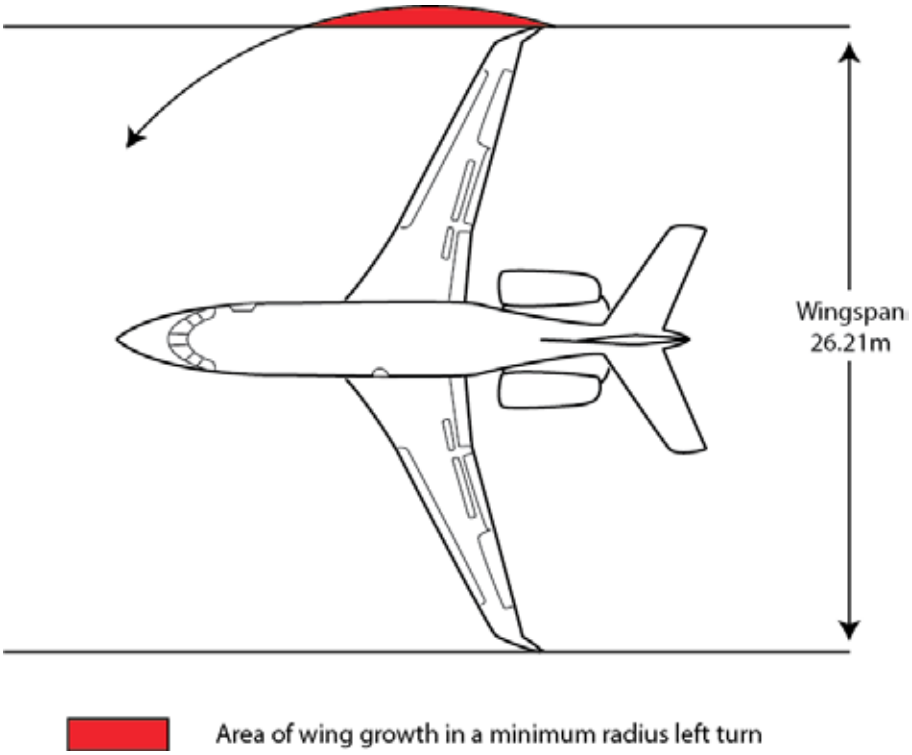

Figure 4
Wing growth

The aircraft operator

The aircraft was one of a fleet of Falcon 7X aircraft operated by a major company, which carried out an internal investigation and provided a copy of its report to the AAIB.

The report identified six areas where safety action could be taken and made the following recommendations:

> '*1. The Corporate Fleet should review the 'Bowties' under development to assess, in the light of the findings of this report, the robustness of the barriers and then introduce them as soon as possible.*
>
> *2. To carry out a review of the most frequented destinations to determine which present the highest risk, and then conduct formal risk assessments of those identified as requiring one, and include the findings in the Company Rout Guide.*
>
> *3. The London City Jet Centre should conduct a further risk assessment and hazard identification of its apron operations taking a view of 'what, when and if' activities should take place and what enhanced mitigations can be put in place to reduce risk. Conducting this with the involvement of The Fleet is recommended, and it should include future potential aircraft types – such as the Falcon 8X.*

4. *Whilst acknowledging that Recommendation 3 may result in findings that include this one, it is recommended independently that the London Jet Centre establish a suitable position, and then paint, a ground marking on the west side of the apron that defines the limit for parked aircraft to project.*
5. *London City Jet Centre should determine whether the use of a dedicated radio channel is feasible and potentially a safety enhancement for ground operations on their apron.*
6. *The Fleet should include in its recurring CRM training an increase in emphasis on the concepts of 'group think'/'risky shift' and the fact that generally when a sense of unease is experienced it is with good cause and should be acted upon.'*

The airport operator

The London City Airport operator also carried out an internal investigation. Their assessment of the cause of the accident was the failure of the marshaller to observe the non-standard STOP signals given by the right wing walker when VQ-BSO's winglet became close to the nose of VQ-BSF, the parked aircraft. At that moment, the marshaller was watching the left wing tip walker to his right. The flight crew were watching the marshaller and the rate of the left turn had also increased the speed of the right wing tip, which gave the right wing walker less time to initiate the STOP signal.

The airport operator listed the following contributory factors:

'1. *The parking of 2 large aircraft (Dassult Falcon 7X) on Stand 15 and position 2, which left limited space for another aircraft of the same type to manoeuvre through. Additionally the aircraft on position 2 was not parked up to the jet blast barrier and was parked further forward leaving a lesser gap.*
2. *The late initiation of a left turn instructed by the marshaller.*
3. *The marshaller focussing on one side of the aircraft more than the other, due to the belief that the aircraft's left wing would be more at risk of losing clearance than the right wing.*
4. *The right 'wing walker' not providing clear marshalling signals in accordance with ICAO; no use of wands.*
5. *No equipment was used as a further control measure to hand signals by the 'wing walkers'.'*

Recorded information

Airport CCTV recorded the incident and was made available to the investigation. It clearly showed the events described in the History of the flight, especially the increase in speed of the right winglet during the tightened turning manoeuvre.

Analysis

Corporate aircraft vary significantly in size and London City Airport has a relatively small parking area on the GA apron on which to accommodate them. To mark the surface with parking stands accommodating the larger corporate aircraft and taxi lines to occupy those stands, whilst ensuring the 'CS ADR-DSN.E.365 Clearance distances', would limit the number of parking positions available. For that reason, aircraft can be parked using a marshaller to optimise the use of the parking area in order to provide the maximum number of parking places, consistent with the size of the aircraft occupying the area.

The marshaller and wing walkers were all trained and qualified to carry out their duties and equipped in accordance with the airport requirements. The incident occurred due to the late left turn of VQ-BSO and the marshaller not seeing the stop signal given by the right wing walker. This was compounded by the increase in wingtip speed due to the tightening of the turn and the resulting 'wing growth'.

Safety actions

London City Airport identified the following safety actions:

'*1. The parking positions for the Falcon 7X should be identified and the position of their main and nose wheels marked on the apron surface.*

2. All the Jet Centre's marshallers should receive refresher training on the correct ICAO marshalling signals.

3. Marshalling wands must be used for all manoeuvring not just at night or in reduced visibility.

4. Initially, marshallers and 'wing walkers' would be equipped with belt mounted horns to provide an audio STOP signal. This would subsequently be replaced providing digital radios on a dedicated frequency.

5. A new supervisory level appointment would be created to oversee all parking.'

Conclusion

The collision occurred due to the late left turn directed by the marshaller and him not seeing the STOP signal from the right wing walker, due to his attention being focussed on the left wing walker. The effect of 'wing growth' also contributed to the collision.

Both the aircraft and airport operators have identified safety actions intended to prevent reoccurrence, which they are in the process of implementing.