



Australian Government

Australian Transport Safety Bureau

Fuel data occurrence involving Bombardier Dash-8-315, VH-TQE

Tamworth Regional Airport, New South Wales, on 15 January 2021

ATSB Transport Safety Report

Aviation Occurrence Investigation (Short)

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Addendum

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Safety summary

What happened

In the evening on 15 January 2021, a QantasLink Bombardier Dash-8-315 aircraft, registered VH-TQE, was being prepared for a scheduled passenger service from Tamworth to Sydney, New South Wales. There were two flight crew, two cabin crew and 29 passengers on board. During the pre-flight preparations, the flight crew misread the aircraft's fuel tank gauges and interpreted the total fuel on board to be about 340 kg more than the actual quantity.

The incorrect fuel figure was subsequently used to complete pre-flight documentation and data entry inputs, and the aircraft departed Tamworth with inaccurate load, take-off and fuel management data. The error was not detected by the flight crew until the aircraft reached its cruise level, when it was corrected, and the flight continued without further incident.

What the ATSB found

The ATSB found that the captain and first officer were distracted by the circumstances associated with the Tamworth arrival and this probably influenced the inaccuracy of the initial fuel check. Having made the initial error, the flight crew formed an incorrect mental model of the aircraft fuel state that persisted throughout the pre-flight preparations. The crew identified the error when seeking out new fuel-related information during the cruise procedural check.

What has been done as a result

Following this incident, QantasLink provided internal communications to flight crew on checklist usage and cross checking of data. QantasLink also intends using the incident as a case study in its human factors/non-technical skills training program.

Safety message

Data input error is one of the ATSB's *SafetyWatch* priorities. Flight crews can guard against errors similar to those in this incident by applying effective threat and error management strategies that recognise when such threats may arise and put in place suitable actions to minimise error potential. These actions include the strict adherence to standard operating procedures, clear and concise communication and independent cross checks between pilots.

The investigation

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope investigation was conducted in order to produce a short investigation report, and allow for greater industry awareness of findings that affect safety and potential learning opportunities.

The occurrence

At about 1658 Eastern Daylight-saving Time¹ on 15 January 2021, a QantasLink Bombardier Dash-8-315 aircraft, registered VH-TQE (Figure 1), arrived at Tamworth Regional Airport, New South Wales. The aircraft was operating as a scheduled passenger service from Sydney to Tamworth with 23 passengers, and then returning to Sydney with 29 passengers at a planned departure time of 1740. The crew comprised the captain, first officer (FO) and two cabin crew. The captain was pilot flying (PF) and the FO was pilot monitoring for both sectors.²

Figure 1: VH-TQE



Source: Supplied

Shortly after parking the aircraft at Tamworth, the captain left their seat and stood at the doorway between the flight deck and cabin. There had been thunderstorms while approaching Tamworth and the captain thought the disembarking passengers might have questions about the arrival.

The FO remained on the flight deck and finalised the records for the completed flight. As part of this task, the FO read the analogue gauges of the two fuel tanks as indicating a total remaining fuel quantity of 3,830 pounds (see the section titled *Fuel gauges*). The FO recorded this quantity as the shutdown fuel in the flight record without completing the required fuel quantity validation check (see the section titled *Standard operating procedures*).

Soon after, the FO provided the captain with the flight record to cross check the information entered. The captain recalled checking the fuel gauges and mentally calculating the total fuel to be

¹ Eastern Daylight-saving Time (EDT): Coordinated Universal Time (UTC) + 11 hours.

² Pilot Flying (PF) and Pilot Monitoring (PM): procedurally assigned roles with specifically assigned duties at specific stages of a flight. The PF does most of the flying, except in defined circumstances; such as planning for descent, approach and landing. The PM carries out support duties and monitors the PF's actions and the aircraft's flight path.

about 3,820 pounds. The captain also omitted the fuel quantity validation check, and the FO then submitted the flight record electronically.

Shortly afterwards, the flight crew started completing the flight record for the return flight to Sydney and, as the aircraft did not require refuelling, entered a fuel figure of 3,830 pounds. The FO and captain then began their assigned 'before start' checks. One of the captain's assigned checks was to physically verify the fuel quantity. The captain, however, recalled the fuel quantity from memory and entered that figure (3,820 pounds) into the aircraft's flight management system (FMS)³ without verifying it.

The captain later completed the departure briefing using the same fuel figure. Following the departure briefing, the captain and FO undertook the 'before start' checklist. This involved cross checking items, with the FO reading each item in the checklist and the captain actioning them. The captain recalled looking at the fuel gauges for the fuel quantity check but again relied on memory to read out the fuel figure.

As the aircraft's load sheet weight data was in kilograms, the flight crew converted the fuel figure into kg (3,820 pounds to 1,733 kg). The load sheet for the return flight was submitted at 1714, recording a total fuel on board of 1,733 kg and a take-off weight of 16,908 kg. The flight crew then used this take-off weight to calculate the aircraft's take-off data, and at 1735, the aircraft departed Tamworth (see the section titled *Load, take-off and fuel management data*).

At about 1750, the aircraft reached its assigned cruise level. Shortly after, the flight crew identified a fuel data mismatch during the procedural fuel check for that stage of the flight. They soon established that the fuel quantity used for all pre-flight activities and tasks had been incorrect (the correct fuel figure had been about 3,081 pounds). The fuel figure within the FMS was then amended, the aircraft load data recalculated, and sufficient fuel for the flight was verified.

The aircraft completed the flight to Sydney without further incident and the fuel figure error was reported by the flight crew on arrival. The fuel remaining on board the aircraft in Sydney was reconciled correctly and no defect with the fuel system or instrumentation was identified.

Context

Flight crew

The captain held an Airline Transport Pilot (Aeroplane) Licence and had recently been promoted to that position. The captain had a total flying time of 2,650 hours, having flown 86 hours in the previous 90 days. The captain's total time included 83 hours on the Bombardier Dash-8-315 (Q300) aircraft and 1,205 hours as a FO on the Bombardier Dash-8-400 (Q400).

The FO held a Commercial Pilot (Aeroplane) Licence and a total flying time of 1,706 hours, having flown 67 hours in the previous 90 days. The FO had accrued a total of 346 hours on the Q300.

Both the captain and FO reported experiencing a high level of workload in the final phase of the Sydney to Tamworth flight due to thunderstorms in the vicinity of the airport. They also stated that, once the aircraft had landed, they both experienced a stress response to the high workload arrival. The captain stated that 'the adrenaline was still coming from the previous flight making us do things quicker'. As such, it is likely that the flight crew's attentional focus was reduced during the pre-flight preparations for the return to Sydney.

The ATSB found no indicators that increased the risk of either the captain or FO experiencing a level of fatigue known to have an effect on performance.

³ An FMS is an integrated navigation management system that provides flight crew with navigation, flight planning and fuel management data. QantasLink procedures required the PF to configure the FMS for the planned flight, including entering the total fuel on board. The FMS would then automatically update the fuel on board, gross weight and predicted fuel requirements as the flight progressed based on the initial values entered.

Fuel gauges

The Q300 aircraft has two analogue fuel quantity gauges located on the lower part of the engine instrument panel (Figure 2). The gauges fitted to VH-TQE indicated the quantity of usable fuel in each of the two main tanks in pounds. The flight crew needed to add these quantities to determine the total fuel on board.

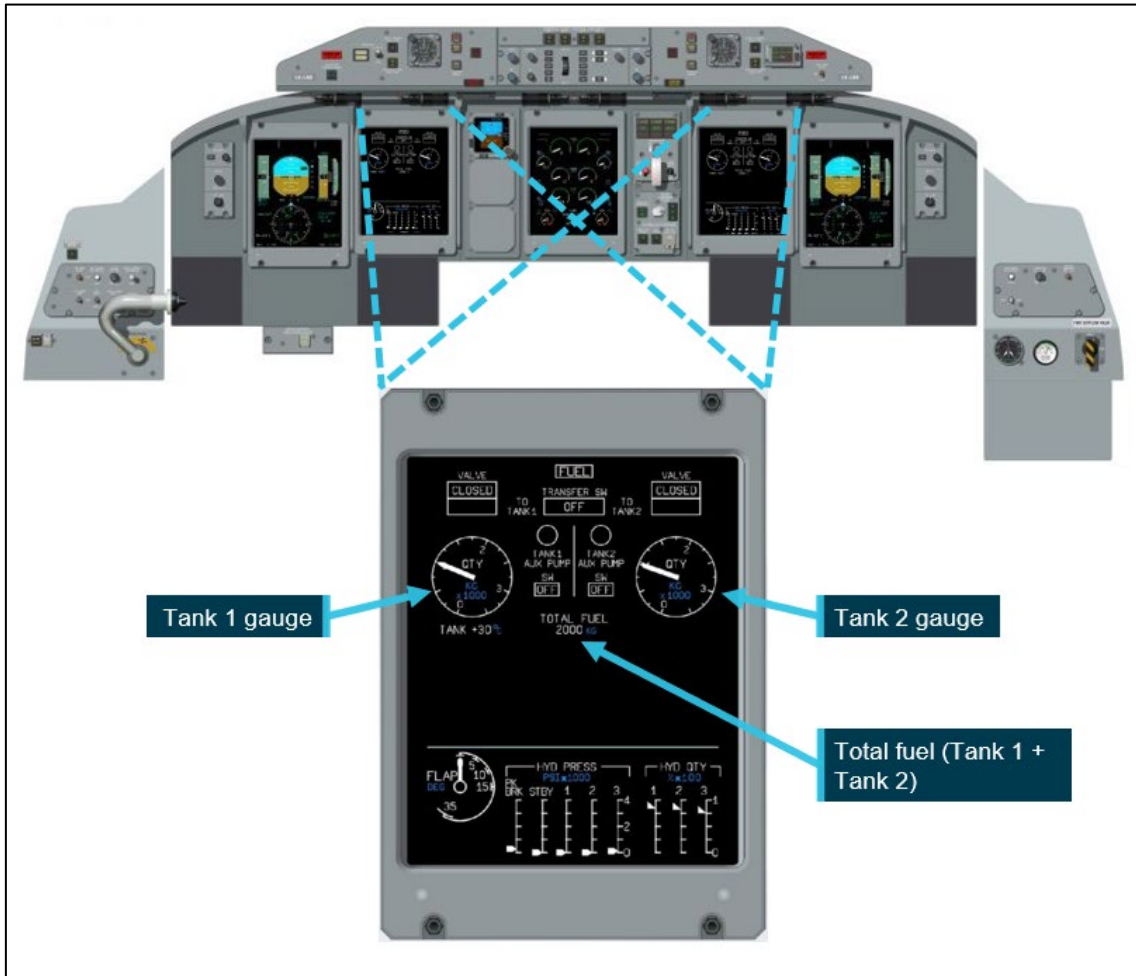
Figure 2: Q300 fuel gauge layout



Source: QantasLink, adapted and annotated by the ATSB

The captain had only recently commenced operating the Q300 and had significantly more experience on the Q400 aircraft. In the Q400, the fuel quantity is presented on the aircraft's multi-function display and includes a digital readout of the total fuel quantity, removing the need for any calculation (Figure 3).

Figure 3: Q400 fuel gauge layout



Source: QantasLink, adapted and annotated by the ATSB

Standard operating procedures

QantasLink procedures required the flight crew to check or confirm the fuel on board the aircraft on five separate occasions prior to departure. Had these procedures been followed properly, the incorrect fuel figure would most probably have been identified. However, on each occasion the flight crew either did not complete the required procedure or did so erroneously (see Table 1).

Table 1: Standard operating procedures (fuel) and crew actions comparison

Procedure	Procedural requirement(s) – fuel	Flight crew action(s)
Flight record (QL-2)	<ul style="list-style-type: none"> • 'check actual fuel burn against the estimated fuel burn from the nav log' • 'fuel at shutdown must be verified against fuel gauges' • 'all entered fields need to be cross checked by both crew members' 	<ul style="list-style-type: none"> • an incorrect shutdown fuel figure was identified and recorded by the FO • neither the captain nor the FO checked the actual fuel burn against the estimated fuel burn from the nav log • the captain's cross check of the fuel gauge readings did not identify the incorrect fuel figure
Before start checks	<ul style="list-style-type: none"> • captain to 'confirm the fuel quantity is correct, adequate for the planned flight(s) as cross checked with the OFP [operational flight plan]' 	<ul style="list-style-type: none"> • the captain recalled the incorrect fuel figure from memory rather than reading the fuel gauges • the captain did not check the fuel quantity against the OFP
Departure briefing	<ul style="list-style-type: none"> • PF to verbally confirm 'the fuel on board meets requirements as per before start checks' 	<ul style="list-style-type: none"> • the captain verbally restated the incorrect fuel figure
Before start checklist	<ul style="list-style-type: none"> • 'ensure that the fuel on board has been checked against the fuel required on the OFP. State the fuel quantity currently on board as indicated on the fuel gauges' • 'the person reading the checklist should also confirm each checklist item called is configured correctly as the checklist is read' 	<ul style="list-style-type: none"> • the captain recalled the incorrect fuel figure from memory rather than reading the fuel gauges • the captain did not confirm the fuel on board had been checked against the fuel required on the OFP • the checklist compliance and fuel figure error was not identified by the FO
Load sheet	<ul style="list-style-type: none"> • Cross check 'fuel – ramp fuel weight' 	<ul style="list-style-type: none"> • the captain and FO both entered the incorrect fuel figure in their independent load sheets • the cross check did not identify the incorrect fuel figure

Load, take-off and fuel management data

The load sheet submitted by the flight crew before departing Tamworth incorrectly recorded the aircraft's ramp fuel as 1,733 kg (3,820 pounds). As a result, the calculated take-off weight of 16,908 kg was also incorrect. The flight crew then used the incorrect take-off weight to determine the take-off data, resulting in higher than required V speeds.⁴ Additionally, the fuel figure entered into the FMS by the captain during the pre-flight activities was also incorrect. Consequently, the fuel data presented to the flight crew during the early stages of the flight were erroneous.

Safety analysis

Both the captain and FO described experiencing a physiological response to the Tamworth arrival, which persisted throughout the pre-flight preparations for departure. This physiological distraction probably degraded their attentional focus and resulted in the initial misinterpretation of the fuel gauges. Additionally, the captain had limited experience on the Q300 aircraft in which the flight crew was required to mentally calculate the total fuel on board. This additional cognitive step

⁴ V speeds: take-off reference speeds or V speeds are provided by the manufacturer to assist pilots in determining when a rejected take off should be initiated, and when the aircraft can rotate, lift off and climb

probably increased the chance of the error and made it more difficult to identify the error once it had occurred.

As a result of the actions during the initial fuel quantity identification, the captain and FO formed an incorrect mental model of the aircraft’s fuel state. This, coupled with ongoing reduced attentional focus, probably led them to recall the incorrect fuel figure during subsequent pre-flight activities. The same factors probably influenced the flight crew’s cross checks and contributed to the captain and FO omitting procedural checks aimed at capturing fuel quantity errors. Consequently, neither identified the error until the aircraft was airborne, when they followed procedures by seeking out new information during the cruise fuel check.

Findings

ATSB investigation report findings focus on safety factors (that is, events and conditions that increase risk). Safety factors include ‘contributing factors’ and ‘other factors that increased risk’ (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition ‘other findings’ may be included to provide important information about topics other than safety factors.

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

From the evidence available, the following findings are made with respect to the fuel data event involving Bombardier Dash-8-315, VH-TQE at Tamworth Regional Airport, on 15 January 2021.

Contributing factors

- The flight crew misread the aircraft’s fuel gauges after arrival at Tamworth probably as a result of distraction. This created an inaccurate mental model of the fuel quantity on board which, in turn, hampered identification of this error during subsequent pre-flight preparations for departure.
- The incorrect fuel figure was used in pre-flight documentation and data entry inputs resulting in the aircraft departing Tamworth with inaccurate load, take-off, and fuel management data.

Safety actions

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Safety action by QantasLink

Following this incident, QantasLink provided internal communications to flight crew on checklist usage and cross checking of data. QantasLink also intends using the incident as a case study in its human factors/non-technical skills training program.

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the flight crew of VH-TQE
- QantasLink
- Avdata
- Airservices Australia

Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the flight crew of VH-TQE and QantasLink.

A submission was received from QantasLink.

The submission was reviewed and, where considered appropriate, the text of the report was amended accordingly.

General details

Occurrence details

Date and time:	15 January 2021 – 1745 EDT	
Occurrence class:	Incident	
Occurrence category:	Loading related	
Location:	Tamworth Regional Airport, New South Wales	
	Latitude: 31° 05.02' S	Longitude: 150° 50.48' E

Aircraft details

Manufacturer and model:	Bombardier DHC-8-315	
Registration:	VH-TQE	
Operator:	Eastern Australia Airlines (operating as QantasLink)	
Serial number:	596	
Type of operation:	Regular Public Transport	
Departure:	Tamworth Regional Airport, New South Wales	
Destination:	Sydney Airport, New South Wales	
Persons on board:	Crew – 4	Passengers – 29
Injuries:	Crew – None	Passengers – None
Aircraft damage:	None	