Australian Government

Australian Transport Safety Bureau

Fuel Mayday declaration involving Boeing 737-838, VH-VZO

abeam Wave Rock, Western Australia on 18 July 2022

ATSB Transport Safety Report

Aviation Occurrence Investigation (Short)

AO-2022-035

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Addendum

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Executive summary

What happened

On the 18 July 2022, at 2110 Coordinated Universal Time, a Qantas Airways Boeing 737-838, registered VH-VZO and operated as flight number QF933, departed Brisbane Airport, Queensland, on a scheduled air transport flight to Perth Airport, Western Australia. There were 174 people on board, including 2 flight crew members.

During the approach to Perth, air traffic control (ATC) advised the crew there were significant delays, over and above the promulgated estimated delay time, for arrivals into Perth. The aircraft did not have enough fuel to hold for the extra time and the flight crew declared a fuel MAYDAY. The aircraft was then given priority for the approach and landed with their final reserve fuel intact.

What the ATSB found

The ATSB found the aircraft had departed with the required fuel onboard. During the cruise, when the aircraft descended from flight level (FL) 340 to FL 280, the aircraft was not flown at the speed schedule displayed on the flight plan. This resulted in the aircraft using more fuel than planned. The fuel burn returned to the planned rate later in the flight however, the aircraft had used an extra 600–700 kg of fuel. Despite that increased usage, as the aircraft passed the decision point, there was sufficient fuel to continue the flight to Perth.

The ATSB also found that ATC had applied the required priority to the aircraft. However, the timing of the advice of airborne delay greater than the promulgated estimate of 10 minutes resulted in the aircraft being unable to land with the required fuel reserve. This left the flight crew with no other option than to declare a fuel MAYDAY to receive priority landing and preserve their required fuel reserve.

Safety message

Sophisticated flight planning and monitoring systems allow fuel usage and aircraft movement to be accurately determined. While operational requirements may necessitate deviation from the plan, this incident illustrates that decisions by flight crew and air traffic controllers that result in higher-than-planned fuel usage can reduce available airborne options.

Where flight crew find that they may not have the required fuel reserve, it is vital, as in this case, that flight crew alert air traffic control and if necessary, declare a Fuel MAYDAY. This will ensure that the aircraft receives priority during the approach, preventing an unsafe situation from developing.

The investigation

Decisions regarding the scope of an investigation are based on many factors, including the level of safety benefit likely to be obtained from an investigation and the associated resources required. 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 2110 Coordinated Universal Time on 18 July 2022, a Qantas Airways Boeing 737-838, registered VH-VZO and operated as flight number QF933, departed Brisbane Airport, Queensland, on a scheduled air transport flight to Perth Airport, Western Australia (Figure 1). There were 174 people on board, including 2 flight crew members.

Due to significant forecast headwinds, the flight was planned to fly south of the direct path, overhead Mildura, Adelaide, across the Great Australian Bight, then to Perth and estimated to take 5 hours and 30 minutes. Early in the cruise, the aircraft encountered stronger headwinds than forecast so the flight crew contacted air traffic control (ATC) and requested, and received, a clearance to fly slightly north of the planned track.

The aircraft was descended earlier than planned from flight level (FL) 340[1] to FL 280, due to turbulence and to also take advantage of lesser headwinds and remained at this level as it passed Adelaide.

Figure 1: Flight path

Source: Google Earth with Flightradar 24 data, annotated by ATSB

At this stage of the flight, the flight crew identified that they were using more fuel than planned and discussed diverting to Adelaide to load more. However, as they would be required to hold while they used fuel to reduce the aircraft's weight to under the maximum landing weight, and they had sufficient fuel to continue to the destination, they decided to continue to Perth.

To assist their in-flight planning, the crew assessed the wind speeds using an application on an iPad and requested reports of actual wind strength from flight crew in other aircraft, flying at different altitudes. As they were crossing the Great Australian Bight, they received a report from another crew, advising that the wind at FL360 was about 15 kt less than forecast and consequently they climbed from flight level (FL) 280 to FL 360, again, earlier than planned.

Subsequently, they discussed diverting to Kalgoorlie to load more fuel. However, due to the runway length at Kalgoorlie, they would still be required to hold to reduce the aircraft's landing

[1] Flight level: at altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 340 equates to 34,000 ft.

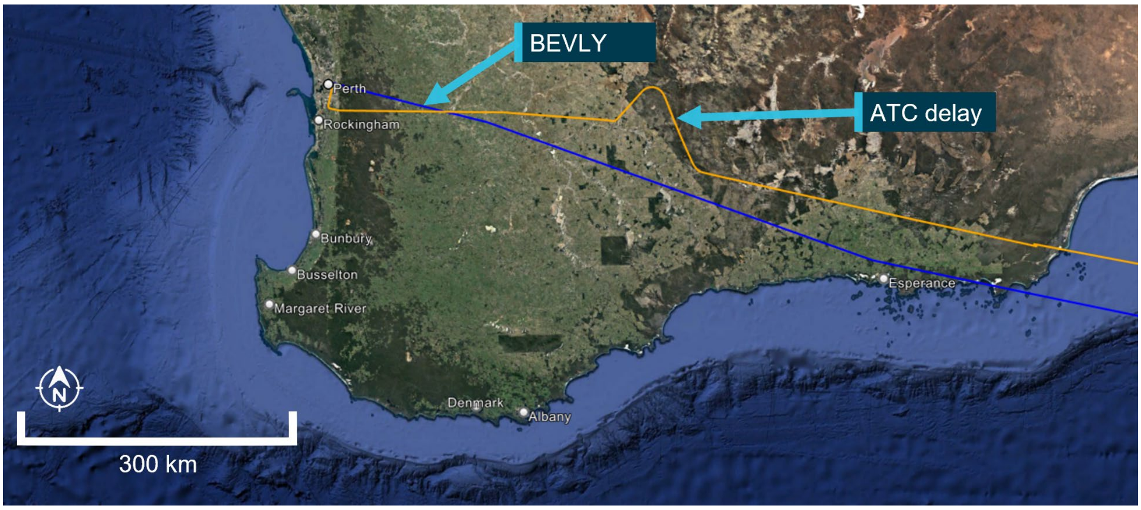
weight. The weather forecast for Kalgoorlie was also showing an INTER,[2] where the visibility was reduced to 5,000 m in rain with broken cloud[3] at 800 ft. Consequently, as they still had the required fuel to fly to Perth, they elected to continue.

As they passed the decision point all engines (DPA),[4] they again assessed that as there were no fuel-related weather requirements at Perth and that they had sufficient fuel on board to continue the flight.

The flight crew continued to request, and receive, track shortening from ATC. Later in the cruise, ATC advised the crew there were significant delays for arrivals into Perth and they could expect around 13 minutes delay before passing BEVLY, a waypoint[5] on the arrival procedure (Figure 2). ATC instructed the crew to reduce to minimum speed and to temporarily turn off-track to delay the BEVLY passing time. The crew had estimated passing BEVLY at 0226 and asked ATC for the expected passing time and were subsequently advised it would be 0242. They advised ATC that they were carrying 10 minutes of traffic holding fuel, which was required for traffic holding at Perth. As such, they could cross the waypoint at 0236 however, they did not have enough fuel on board to cross BEVLY at 0242. They also advised they would need to remain at altitude until they passed HAMTN, a waypoint on the arrival procedure, and to descend at 230 kt in a continual descent to conserve fuel.

ATC advised the flight crew that the order of aircraft in the arrival sequence could not be changed unless they declared a fuel MAYDAY, which the crew subsequently did. The aircraft was then given priority for the approach.

Figure 2: Approach path



Source: Google Earth with Flightradar 24 data, annotated by ATSB

Prior to the approach, the crew briefed on the procedures for a low fuel warning.[6] During the approach, they received a FUEL LOW warning for the right fuel tank when there was about 930 kg of fuel remaining in the tank. The crew followed the non-normal checklist and selected the cross-feed selector to OPEN and selected fuel pumps to ON. This resulted in fuel being used

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2 INTER: an intermittent deterioration in the forecast weather conditions, during which a significant variation in prevailing conditions is expected to last for periods of less than 30 minutes duration.

3 Cloud cover: in aviation, cloud cover is reported using words that denote the extent of the cover – 'broken' indicates that more than half to almost all the sky is covered.

4 Decision point all engines: The waypoint or waypoints nominated on the flight plan, but not beyond the top of descent, from which the aircraft may divert to a different airport with all engines operating while meeting all inflight fuel requirements.

5 Waypoint: A defined position of latitude and longitude coordinates, primarily used for navigation.

6 Due to a Federal Aviation Administration requirement for a low fuel alert when there was 45 minutes of fuel remaining, Boeing had set this alert at 907 kg of fuel remaining in each fuel tank.

primarily from the right fuel tank.[7] The low fuel warning activated for the left fuel tank 38 seconds prior to landing. At that stage, there was 676 kg of fuel remaining in the right fuel tank.

The aircraft landed at Perth at 0248 with the required final reserve fuel intact plus 300 kg of fuel, 5 hours and 38 minutes after take-off.

Context

Flight plan

The flight was planned using the operator's flight planning system. Fuel for the following was included:

- taxi
- trip (take-off, climb, cruise and descent to 1,500 ft above Perth)
- departure allowance to set heading (see the section titled *Operator requirements*)
- contingency fuel (see the section titled *Contingency fuel*)
- 10 minutes of fuel for traffic holding at Perth (see the section titled *Traffic holding fuel*)
- approach (see the section titled *Operator requirements)*
- final reserve fuel (see the section titled *Final reserve fuel)*
- extra fuel (see the section titled *Operator requirements*)

The crew advised that 300 kg of freight was removed from the aircraft to allow the minimum flight planned fuel amount to be carried. The weather forecast for the flight's arrival time was such that no extra fuel was required for weather holding, nor was an alternate airport required.[8]

Contingency fuel

According to the Civil Aviation Safety Regulations (CASR) Part 121 manual of standards (MOS) section 7.03, contingency fuel is 'the amount of fuel required to compensate for unforeseen factors'. Further, Part 121 MOS subsection 1.04 *definitions* (1) defined unforeseen factors as

> factors that could have an influence on an aeroplane's fuel consumption to the planned destination aerodrome, including:
>
> (a) the aeroplane's deviation from the expected fuel consumption data for an aeroplane of that type; and(b) extended delays and deviations from planned routings or cruising levels.

The contingency fuel for a turbine-engine aircraft where a point of in-flight replanning is specified,[9] must include the higher of either:

- 5% of the trip fuel from the in-flight replanning point to the planned destination,[10] or

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7 The fuel pumps in the aeroplane have allowable variations in output pressure. If there is a sufficient difference in pump output pressures and the cross-feed valve is opened, fuel feeds to the operating engines from the fuel tank with the highest pump output pressure. This may result in fuel unexpectedly coming from the tank with the lowest quantity.

8 Qantas had a dispensation under arrangements allowing operators to transition from legacy fuel requirements to the requirements of CASR Part 121 (which came into effect on 2 December 2021). This dispensation allowed Qantas to operate under their previous permission in relation to alternate aerodrome requirements and a fuel operational variation. This meant that on the occurrence flight a destination alternate aerodrome was not required, whereas it would have been required for a Part 121 operation. This also allowed Qantas to operate without the 15 minutes holding fuel required under section 7.02 where the destination aerodrome did not require an alternate aerodrome.

9 Point of in-flight replanning is a point en-route, determined by the operator before the flight commences, at which the aeroplane can:

> (a) if it arrives at the point with adequate fuel to complete the flight to the planned destination aerodrome while maintaining the required fuel—continue to that aerodrome; or
> (b) otherwise—divert to an en-route alternate aerodrome while maintaining the required fuel.

10 Qantas have advised that their flight planning software has not been updated and calculated 10% of the trip fuel from the in-flight replanning point to the planned destination.

- not less than the amount of fuel required to fly, in ISA[11] conditions, for 5 minutes at holding speed, at 1,500 ft above the planned destination.

The flight plan included fuel to fly for 5 minutes at 1,500 ft, as this was the greatest amount.

Traffic holding fuel

The Aeronautical Information Package En-route supplement provided an estimate for delays for flights into Perth. This stated that at the time the flight was due to land, they could expect up to 10 minutes airborne delay. This was an advisory time only and the actual holding time could vary.

The flight plan included 10 minutes holding fuel.

Final reserve fuel

A turbine-engine aeroplane is required to carry 30 minutes of fuel to allow the aircraft to fly at holding speed, at 1,500 ft above the aerodrome elevation. This must be available at the completion of the flight.

Operator requirements

The operator's procedures provided a fuel allowance including:

- a departure allowance to allow for a departure from an airport where a known lengthy departure procedure is required prior to joining the flight planned track
- an approach allowance of 300 kg of fuel.

Qantas also had a requirement that a Boeing 737 aircraft have 2,700 kg or 70 minutes of fuel when they arrived overhead the destination airport, whichever was greater. This amount was inclusive of the required contingency, traffic holding, approach and final reserve fuel. Once the aircraft had departed, there was no requirement to preserve the extra fuel to meet this pre-flight requirement.[12]

The flight plan included almost 700 kg to fulfill this requirement.

Operator fuel planning procedures

According to the operator's fuel planning procedures, the pilot in command (PIC) should only order discretionary fuel to cater for a known, but unplanned, operational reason. If the PIC believed payload should be offloaded to allow for extra fuel, they were required to consult with the integrated operations centre (IOC), who would assess the commercial implications. They were also required to submit a pilot report.

The pilot advised that as they had the required minimum fuel for the flight, they did not offload any further freight to load extra fuel. They advised if there had been space, they may have added extra fuel. They also advised that if they had decided to take extra fuel, they were confident they would not have encountered any pressure from management. They advised that since the COVID-19 pandemic began, Qantas management had advised flight crews to take their time when conducting pre-flight planning and to take extra fuel if they thought it was required.

Cost index

The cost index (CI) is the ratio between the operating cost of an aircraft and the fuel burn. The lower the cost index the slower the flight and therefore the lower the fuel burn, however the aircraft will be operating longer. Consequently, it will have a higher operating cost. The CI for the maximum range is 0.

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11 International Standard Atmosphere (ISA): hypothetical meteorological conditions that provide standard temperatures and pressures at specified altitudes. ISA conditions are used as a datum for calculating aircraft performance data.

12 This did not remove the requirement that all regulated fuel requirements must be preserved during the flight.

Qantas flight administration manual advised that the cost index:

> provided on the flight plan is derived from a number of data sources and policy requirements. Based on variations in operating conditions for each flight, the cost index balances various interrelated costs to minimise the total operating expense of the flight. While the pilot in command may vary the cost index, this should only be done based on sound command and commercial judgement.

The CI should be entered into the flight management computer (FMC) during the preparation for the flight and the aircraft should be climbed, cruised and descended[13] at the FMC generated ECON[14] speed/ Mach number. The CI on the flight plan for this flight was 10. The flight crew was required to enter this figure into the FMC prior to the flight.

Flight planning system

The Qantas flight planning system was designed to search for the most efficient route for the flight. The system would select enroute descents and climbs to take account the changing weight of the aircraft and the forecast wind. It would also display the Mach number[15] required for the most efficient cruise at the planned altitude, for the selected cost index. The flight plan showed the forecast wind for 1 flight level above and 2 flight levels below the planned flight level.

The flight plan also displayed the decision point all engines (DPA) (among other relevant decision points) with the expected fuel remaining and the minimum fuel required to fly from this point to the destination. The flight plan showed that the minimum fuel required at the DPA to continue to Perth was 2,600 kg.

Boeing flight plan check

The ATSB did not have access to flight planning software to check the accuracy of the Qantas fuel plan. As such, The Boeing Company (Boeing) was contacted to prepare an independent flight plan, using the forecast weather data. Boeing subcontracted the flight planning to another company. However, their software did not allow them to enter the actual forecast winds over the entire flight plan and consequently they used an average wind vector for the flight. Their flight planning system calculated that the required flight fuel[16] was 15,211 kg. The flight plan produced on the day by the Qantas flight planning system calculated that the flight fuel[17] required was 15,190 kg.

Flight plan track versus actual track

The ATSB downloaded the data from the aircraft's flight data recorder. Figure 3 shows verified flight data for certain recorded parameters during the flight. The data showed the:

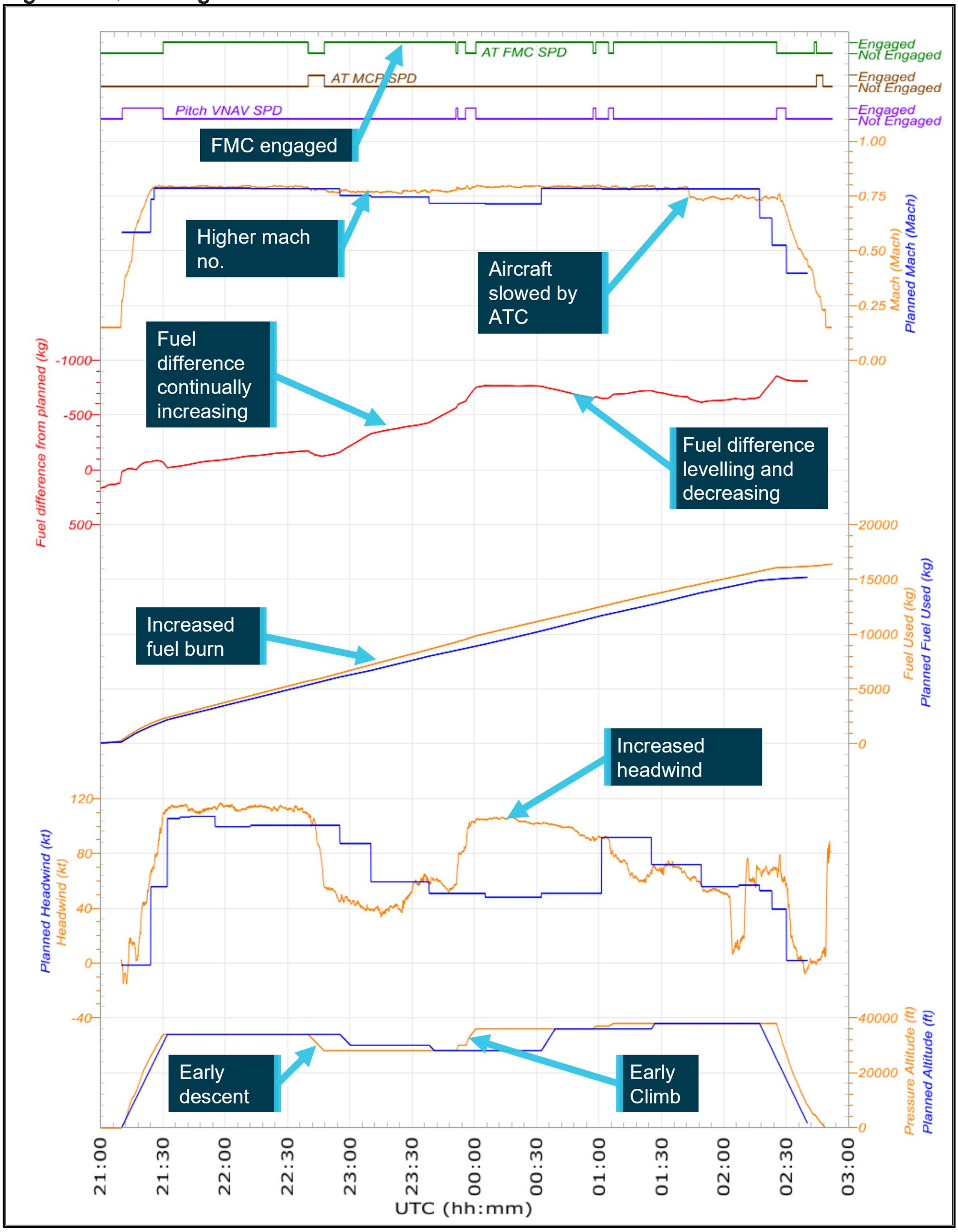
- aircraft took off with approximately 170 kg more fuel than planned
- flight crew selected VNAV[18] speed during the climb segments
- flight crew selected speed on the master control panel to control the speed during descent
- FMC generated speed was utilised during the cruise segments.

At approximately 2242, the aircraft descended earlier than planned from FL 340 to FL 280, following assessment of the actual winds. The crew then engaged the FMC for the cruise at

13 During the descent, when the aircraft goes below 5,000 ft above ground level, the maximum speed is 250 kt.
14 The ECON speed uses CI as an input that is based on a detailed accounting of actual costs.
15 The ratio between the true air speed (TAS) and the local speed of sound (LSS). This ratio, which equals one when the TAS is equal to the LSS, is known as the Mach Number (M) and is very important in aircraft operating at high speed.
16 Flight fuel included fuel from commencement of take-off to Perth Airport.
17 Qantas flight fuel included fuel from commencement of take-off to 1,500 ft at the destination.
18 When VNAV is selected, the autopilot will fly the FMC-programmed speed.

FL 280, however, the Mach number did not reduce to that planned, resulting in the aircraft using more fuel than expected in the flight plan.

Figure 3: QF933 flight data



Source: ATSB

The data also showed that at 2348, when the aircraft climbed early from FL 280 to FL 360, the aircraft had approximately 800 kg of fuel less than planned. The actual fuel burn then reduced while the aircraft was flown at a higher level than planned however, the fuel quantity remained approximately 600/700 kg below the planned level for the remainder of the flight.

The review also identified that the Cost Index parameter was not correctly recorded in the flight data.[19]

Table 1 shows the planned Mach number versus the average Mach number for the different altitudes flown.

Table 1: Planned Mach number versus the average Mach number flown

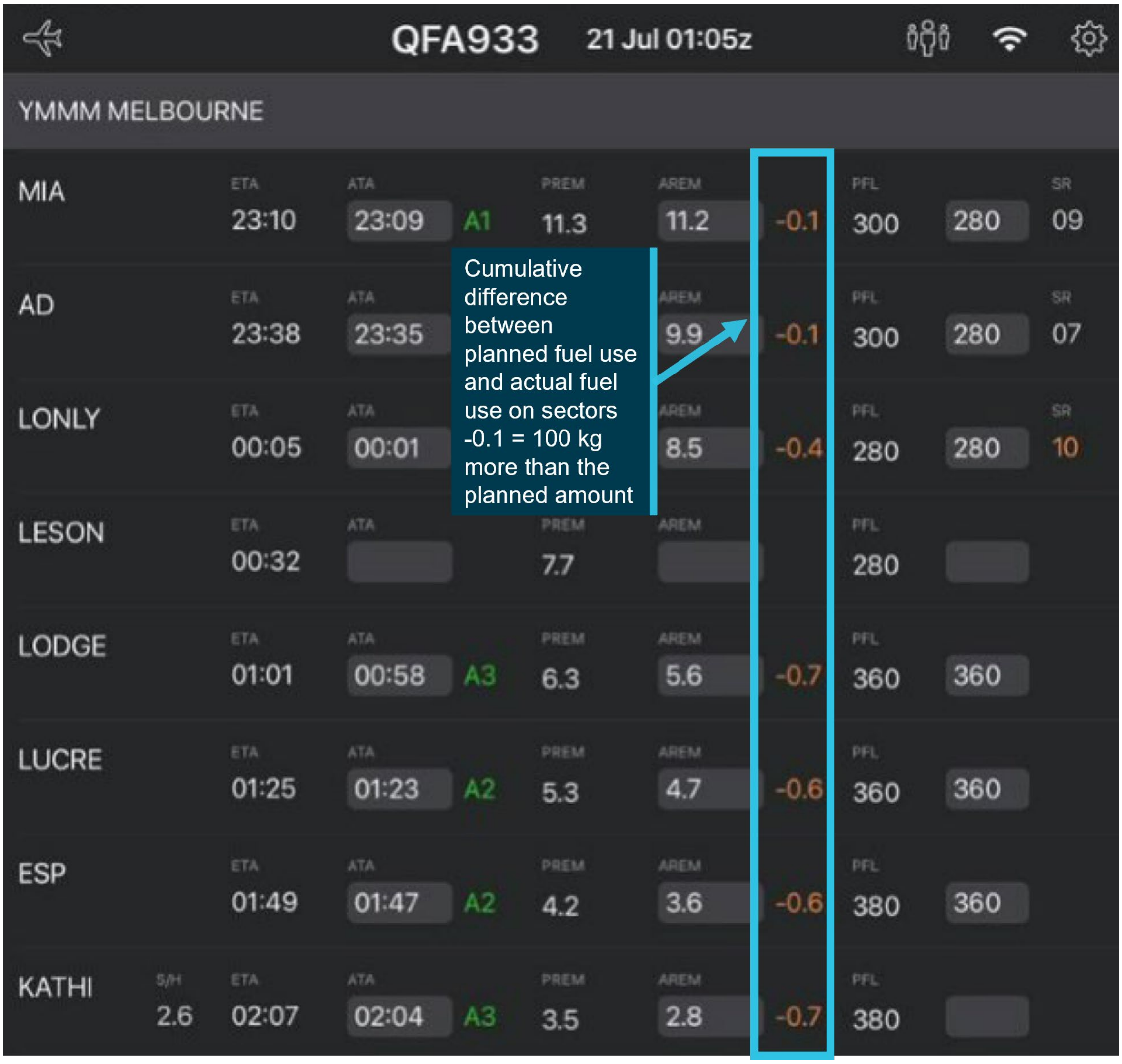
Elapsed time (hr)	Altitude (ft)	Planned Mach	Average Mach
0.37 – 1.47	34,000	0.785	0.792
1.55 – 2.59	28,000	0.713	0.770
3.08 – 4.05	36,000	0.781	0.792
4.14 – 4.50	38,000	0.782	0.788*

*Before speed reduction for sequencing into Perth

The fuel plan in the FMC identified to the flight crew that the aircraft was using more fuel than planned during the first part of the flight and then later in the flight, returned to approximately the expected fuel burn (Figure 4).

19 Qantas advised the parameter for the cost index was not recording correctly for all flights.

Figure 4: Fuel plan as displayed in the aircraft flight management computer



Source: Operator, annotated by ATSB

Data supplied by Qantas showed that at the DPA (KATHI) there was 2,800 kg of fuel remaining on board.

Adherence to the flight plan

The Qantas Flight administration manual (FAM) stated:

> Subject to airmanship and other operational influences flight crew are to utilise mid-segment climb (MSC)….
>
> No deviations from flight plans are to be initiated by the pilot in command other than those occasioned by normal operational requirements (e.g. deviations due to weather, safety considerations, etc.).

The operator confirmed that they would expect a flight crew to deviate from a flight plan where there were operational reasons to do so. They also advised that the crew was expected to fly the appropriate speed for the selected level - generally this would be the FMC generated ECON speed for the flight planned cost index.

Perth Airport forecast

The terminal area forecast for Perth at the time of arrival showed that from 2300 the wind was from 100° at 8 kt with visibility greater than 10 km, showers of rain, scattered cloud at 1,500 ft and broken cloud at 2,500 ft.[20] From 0300 on the 18 July, the wind was from 150° at 8 kt with visibility greater than 10 km, no significant weather and scattered cloud at 3,000 ft.

The alternate minima for Perth were a cloud base of 400 ft and 1,600 m visibility.[21]

Air traffic arrival sequence

As the air traffic flow management system[22] was not in operation at the time of this occurrence, there were no pre-arranged arrival times into Perth.

In accordance with AIP Enroute 1.4 – 8 Assessment of Priorities, during the approach, an aircraft with an emergency will get priority in all circumstances. ATC will then apply priority to 'an aircraft which is first able to use the desired airspace in the normal course of its operation'. Consequently, regardless of where an aircraft departed from, they would be placed in the arrival sequence for an airport in order of their actual time of arrival at the relevant approach points. ATC then used speed control, vectoring or holding to achieve an orderly flow of aircraft.

Order of landing

Table 2 shows the order of landing and the delays[23] applied around the time QF933 arrived.

Table 2: Aircraft order of landing when QF933 landed

Aircraft	Departure	Estimated time due (UTC)	Actual time landed (UTC)	Delay
F100	Paraburdoo	0237	0244	392 seconds
B737 (QF933)	Brisbane	0242	0248	400 seconds
F100	Bunbury	0241	0251	607 seconds
F100	Newman	0247	0253	369 seconds
A320	Newman	0244	0256	725 seconds
DHC-8	Golden Grove	0244	0302	1045 seconds
F100	Coondewanna	0248	0304	975 seconds

QF933 received an actual delay of 400 seconds (6.67 minutes), however they had been allocated a delay of 16 minutes at BEVLY.[24]

Emergency fuel state

Civil Aviation Safety Regulations Part 121 MOS 7.08 stated that the pilot in command (PIC) should advise ATC of a minimum fuel state if they are committed to land at an airport and where any changes to the clearance will result in the aircraft landing with less that the final reserve fuel. The MOS also stated that the flight crew should not expect any form of priority handling as a result of declaring minimum fuel.

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20 Cloud cover: in aviation, cloud cover is reported using words that denote the extent of the cover – 'scattered' indicates that cloud is covering between a quarter and a half of the sky.

21 As the flight was operating under the Qantas fuel dispensation, they were not required to comply with the alternate minima requirements for Part 121. For a Boeing 737 aircraft these would be a cloud ceiling of 1,200 ft and visibility of 5,000 m.

22 Air traffic flow management is a system where depending on the forecast traffic, aircraft are given a departure time to ensure a managed traffic flow to an airport and to reduce airborne delays.

23 Airservices Australia calculate the flight delay by comparing the estimated flight time (using nominal system track information and nominal aircraft performance data for specific aircraft types) and actual flight time for the portion of the flight within 250 NM of the destination aerodrome.

24 The flight crew advised the FMC-generated time of arrival at BEVLY was 3 minutes earlier than the estimate ATC had in their system, possibly due to the track shortening requested by the flight crew and approved by ATC.

Where the PIC has calculated that the aircraft will land with less than the final reserve fuel, the flight crew

> must declare a situation of 'emergency fuel' by broadcasting 'MAYDAY MAYDAY MAYDAY FUEL'.

As this is a distress message, the aircraft will be given priority to land.

Safety analysis

The Boeing 737-838 departed Brisbane on a scheduled air transport passenger flight to Perth with the operator-required minimum fuel onboard. The planned flight fuel was verified independently as being sufficient for the flight. The fuel plan included extra fuel to meet the Qantas requirement that a 737 arrive at 1,500 ft above the destination airport with 2,700 kg or 70 minutes of fuel.

During the cruise segments, a Mach number faster than the planned value was flown, resulting in the aircraft using approximately 700–800 kg of extra fuel in the first part of the flight. The FMC was most likely selected to the ECON speed, which will use the selected cost index to set the best economy speed. The ATSB could not verify what cost index value was selected by the flight crew prior to the flight, as this parameter was not correctly recorded in the flight data.

During the flight, the flight crew detected the extra fuel burn and after consultation with a flight crew in another aircraft climbed the aircraft early. While this resulted in the aircraft having a stronger headwind, the fuel burn reduced to approximately the planned rate.

As the aircraft passed the decision point all engines, the crew assessed that, while less than the planned amount, they had enough fuel to meet the requirements and continued to Perth. They were later advised by air traffic control (ATC) that longer than expected traffic delays were anticipated and they would be delayed by approximately 16 minutes.

A review of the Airservices Australia data indicated ATC had applied the required priority to the aircraft. However, the airborne advice from ATC that the aircraft's approach would be delayed for longer than the promulgated advisory of 10 minutes, resulted in the aircraft having insufficient holding fuel. Additionally, at the time of that advice the aircraft was relatively close to Perth so there was no opportunity for the crew to reduce fuel consumption by any significant amount over the remaining flight time to comply with the increased holding.

This left the flight crew with no other option than to declare a fuel MAYDAY to receive priority landing and preserve their required fuel reserve.

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 MAYDAY declaration involving Boeing 737-838, VH-VZO abeam Wave Rock, Western Australia on 18 July 2022.

Contributing factors

- When the aircraft changed flight levels during the cruise, the speed for the lower altitude specified in the flight plan was not flown, resulting in a higher fuel burn than planned, although still sufficient to meet the requirements of the flight as the aircraft passed the decision point.
- As the aircraft approached Perth, the crew received a delayed arrival time over and above the published 10 minutes estimated airborne traffic delay, resulting in insufficient fuel to meet the extended delay. This necessitated the declaration of a fuel MAYDAY as the aircraft would have landed with less than the required fixed fuel reserve.

General details

Occurrence details

Date and time:	18 July 2022, 1048, Western Standard Time	
Occurrence class:	Incident	
Occurrence categories:	Low fuel event	
Location:	abeam Wave Rock, Western Australia	
	Latitude: 32º 25.60002' S	Longitude: 118º 54.49998' E

Aircraft details

Manufacturer and model:	The Boeing Company 737-838	
Registration:	VH-VZO	
Operator:	Qantas Airways Limited	
Serial number:	34191	
Type of operation:	Part 121 Australian air transport operations – Larger aeroplanes	
Activity:	Commercial air transport scheduled domestic	
Departure:	Brisbane, Queensland	
Destination:	Perth, Western Australia	
Persons on board:	Crew – Unknown	Passengers – Unknown
Injuries:	Crew – Nil	Passengers – Nil
Aircraft damage:	None	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the flight crew
- Qantas Airways Pty Ltd
- Airservices Australia
- The Boeing Company

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 following directly involved parties:

- the flight crew
- Qantas Airways Pty Ltd
- Airservices Australia
- United States National Transportation Safety Board
- The Boeing Company.

Submissions were received from:

- the flight crew
- Qantas Airways Pty Ltd
- Airservices Australia
- Civil Aviation Safety Authority

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

Australian Transport Safety Bureau

About the ATSB

The ATSB is an independent Commonwealth Government statutory agency. It is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers.

The ATSB's purpose is to improve the safety of, and public confidence in, aviation, rail and marine transport through:

- independent investigation of transport accidents and other safety occurrences
- safety data recording, analysis and research
- fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia, as well as participating in overseas investigations involving Australian-registered aircraft and ships. It prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, international agreements.

Purpose of safety investigations

The objective of a safety investigation is to enhance transport safety. This is done through:

- identifying safety issues and facilitating safety action to address those issues
- providing information about occurrences and their associated safety factors to facilitate learning within the transport industry.

It is not a function of the ATSB to apportion blame or provide a means for determining liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

Terminology

An explanation of terminology used in ATSB investigation reports is available on the ATSB website. This includes terms such as occurrence, contributing factor, other factor that increased risk, and safety issue.