RNSA

Rannsóknarnefnd samgönguslysa

REPORT ON SERIOUS INCIDENT

Case nr.: **22-042F006**

Date: **13 June 2022**

Location: **Enroute from Malaga, Spain, to Keflavik, Iceland**

Description: **Declared an emergency due to possible low fuel availability**

1. FACTUAL INFORMATION

Location and time	
Location:	Enroute from Malaga, Spain to Keflavik, Iceland
Date:	13. June 2022
Time[1]:	00:56

Aircraft	
Type:	Airbus A320-251N
Register:	TF-PPA
Year of manufacture:	2021
Serial number:	9357
CoA:	Valid
Engines:	Two LEAP-1A26

Other information	
Type of flight:	Commercial flight
Persons on board:	6 crew and 118 passengers
Injury:	None
Damage:	None
Short description:	Declared an emergency due to uncertainty of fuel availability

[1] All times in the report are UTC times, unless otherwise stated.

History of the flight

The aircraft was on a scheduled passenger flight from Malaga in Spain to Keflavik Iceland. The minimum required fuel for the trip was 11,487 kg. The flight crew decided to depart with a total fuel of 11,780 kilograms to have the option of having Egilsstaðir Airport as an alternate airport as well as Akureyri Airport. The preflight inspection, preparations, taxiing, and take-off were routine, and the aircraft departed Malaga at 21:13.

The first part of the flight was normal, and at 21:35, the aircraft reached its cruising altitude of FL380.

When the aircraft was about to enter the oceanic area, a cabin crew member visited the flight deck, moved the observer seat from its stowed position and sat down. A little later, or at 22:26, the flight crew received the following seven fault messages from the ECAM[2] System:

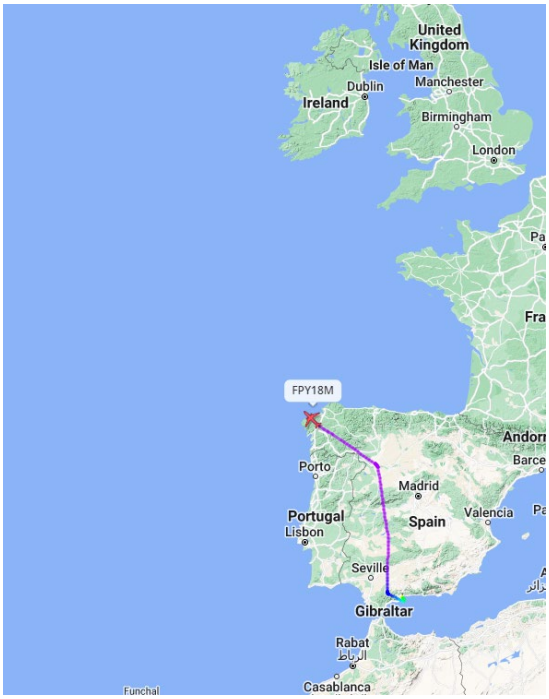


Figure 1: Location of the aircraft at 22:26, when the error messages were displayed.

1. Autopilot OFF warning
2. Auto flight FAC 2 Fault
3. Auto flight FCU 2 Fault
4. Air conditioner control 2B Fault
5. Cabin pressure system 2 Fault
6. Fuel FQI channel 2 Fault
7. Brake system 2 Fault

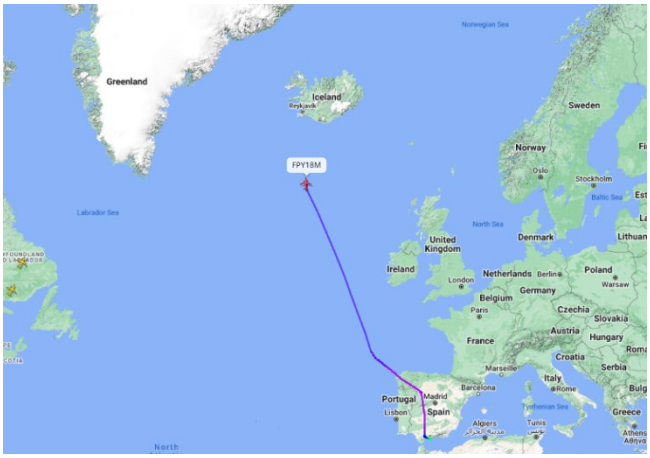
The pilots discussed the situation and decided to continue the flight since these were for crew awareness and cleared the messages.

[2] Electronic Centralized Aircraft Monitoring

About ten minutes later, at 22:36, the flight descended from FL380 to FL320, as instructed by ATC, unrelated to the advisory messages.

The following two fuel checks performed by the flight crew were as expected, but when they performed the third one, they noticed a hollow amber triangle on the ECAM (see Case 3 in Figure 6). From this they interpreted that the transfer valves from the outer wing fuel tanks to the inner wing fuel tanks were in transition position, neither fully open nor fully closed.

This led the flight crew to re-evaluate the fuel quantity available since this could mean that it might not be possible to retrieve the fuel from the outer wing tanks. Given the distance to Keflavik, the flight crew now expected to land with approximately 300 kg of usable fuel, much less than the planned fuel quantity at the destination, 1,900 kg. Subsequently, the flight crew requested ATC for the highest possible flight level, which turned out to be FL380. At 00:25, the flight level was changed from FL320 to FL340, and at 00:45, the flight level was increased to FL380. After the climb, the flight crew estimated the available landing fuel to be approximately 800 kg and declared a Pan-Pan situation.



At 00:56, when the aircraft was about to reach 60° North, the flight crew contacted Reykjavik Control (Figure 2). They explained the situation to the Air traffic controller and declared an emergency.

Figure 2: Location of the aircraft when the crew declared an emergency.

The flight crew tried to analyse the situation further by resetting the fuel quantity indication system and checking if any circuit breakers (C/Bs) had tripped, they used flashlight to search but found none tripped. The flight crew followed proper procedures according to the QRH.

At 01:15, when the aircraft was approximately 25 minutes from landing at Keflavik Airport, the right outer tank quantity started to decrease from 670 kg to 0 kg. At 01:20, the left outer tank quantity also reduced from 670 kg to 0 kg. The amount in the left and right inner tanks increased, respectively.

The crew was unsure if the valves opened due to the reset procedures that they had performed or if they opened normally and automatically. The aircraft landed uneventfully at 01:39. At that time, 1,074 kg of fuel was in the left inner tank and 1,248 kg in the right inner tank. The total fuel on board after landing was 2,322 kg.

After landing and while taxiing, the same advisory messages reappeared on the ECAM.

Personnel information

Commander (Pilot Monitoring)	
Age:	44 years
Certificate:	ATPL/A
Ratings:	A320/IR
Medical Certificate:	Class 1, valid
Experience:	Total flight hours: 5,293 hours Total flight hours as Commander: 2,848 hours Total flight hours on type: 4,929 hours Last 90 days on type: 93 hours Last 24 hours on type: 11 hours

First Officer (Pilot Flying)	
Age:	35 years
Certificate:	ATPL/A
Ratings:	A320/IR
Medical Certificate:	Class 1, valid
Experience:	Total flight hours: 2119,7 hours Total flight hours on type: 1870,8 hours Last 90 days on type: 117,9 hours Last 24 hours on type: 9,7 hours

Aircraft Information

Aircraft TF-PPA is an Airbus A320-251N with a production delivery date of 22 November 2021. It has a manufacturer serial number (MSN) of 9357 and two LEAP-1A26 engines. The fuel system, related to the incident, is as follows:

Fuel tanks

The aircraft has five fuel tanks and two vent tanks. In each wing there is one outer tank, one inner tank and one vent tank. In the centre wing box, there is one centre tank (Figure 3). Each inner wing tank holds 5,396 kg usable fuel, while each outer wing tank holds 678 kg usable fuel. The center tank holds 6,474 kg usable fuel, so the total usable fuel capacity is 18,623 kg. Fuel is fed to the engines from the inner wing tanks.

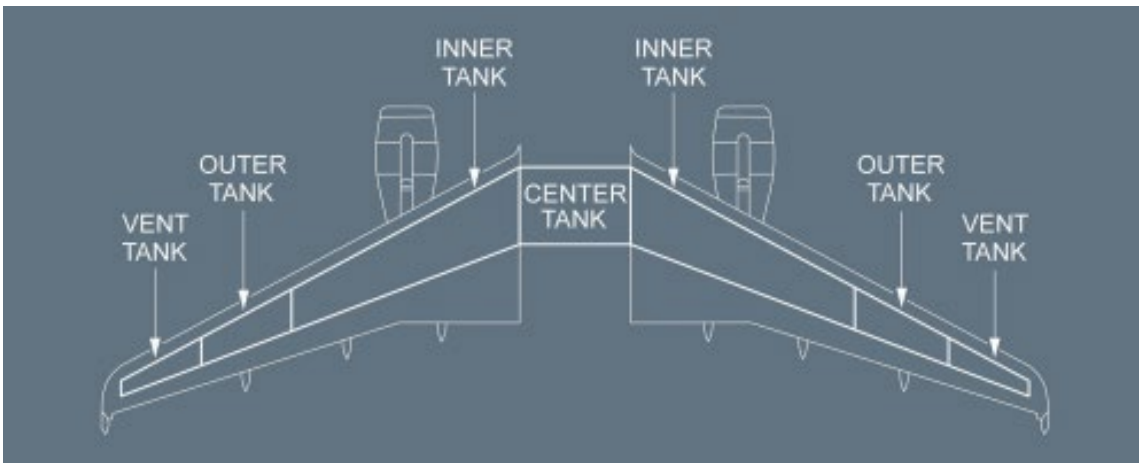


Figure 3: Fuel tanks.

The tanks empty in the following sequence:

1. The center tank - Fuel is transferred from the centre tank to fill the inner tanks each time they deplete by 500kgs
2. The inner wing tanks - Each inner tank depletes down to 750 kg
3. The outer wing tanks - When the fuel in the inner tanks is down to 750 kg, – Fuel transfers from the outer wing tanks to the inner wing tanks

As stated above, the valves for the transfer of fuel from the outer tanks to the inner wing tanks open automatically when the fuel reaches 750 kg in the inner wing tanks (Figure 4).

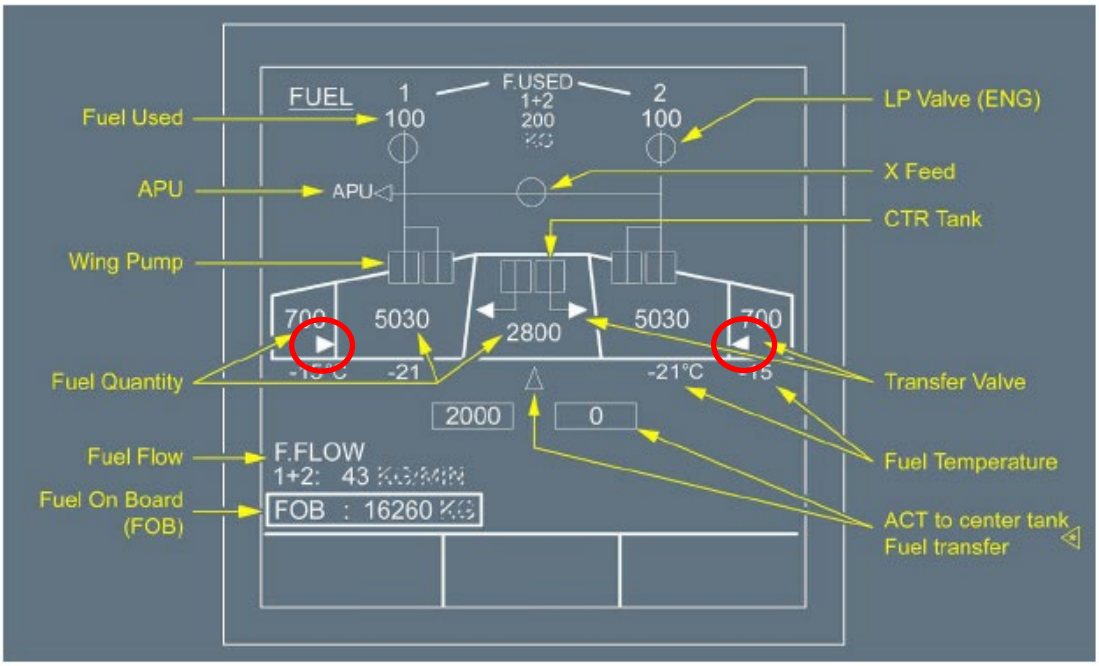


Figure 4: Operational aspects.

2. ANALYSIS

Fuel transfer from outer wing tanks to inner wing tanks

Each wing has two Inter Cell Transfer Valves (ICTVs) between the inner and outer tanks, one forward (FWD) and one AFT (Figure 5). When the inner tank fuel reaches a low level (approx. 750 kg), the two ICTVs in each wing automatically open, enabling fuel to transfer by gravity from the outer to the inner tanks.

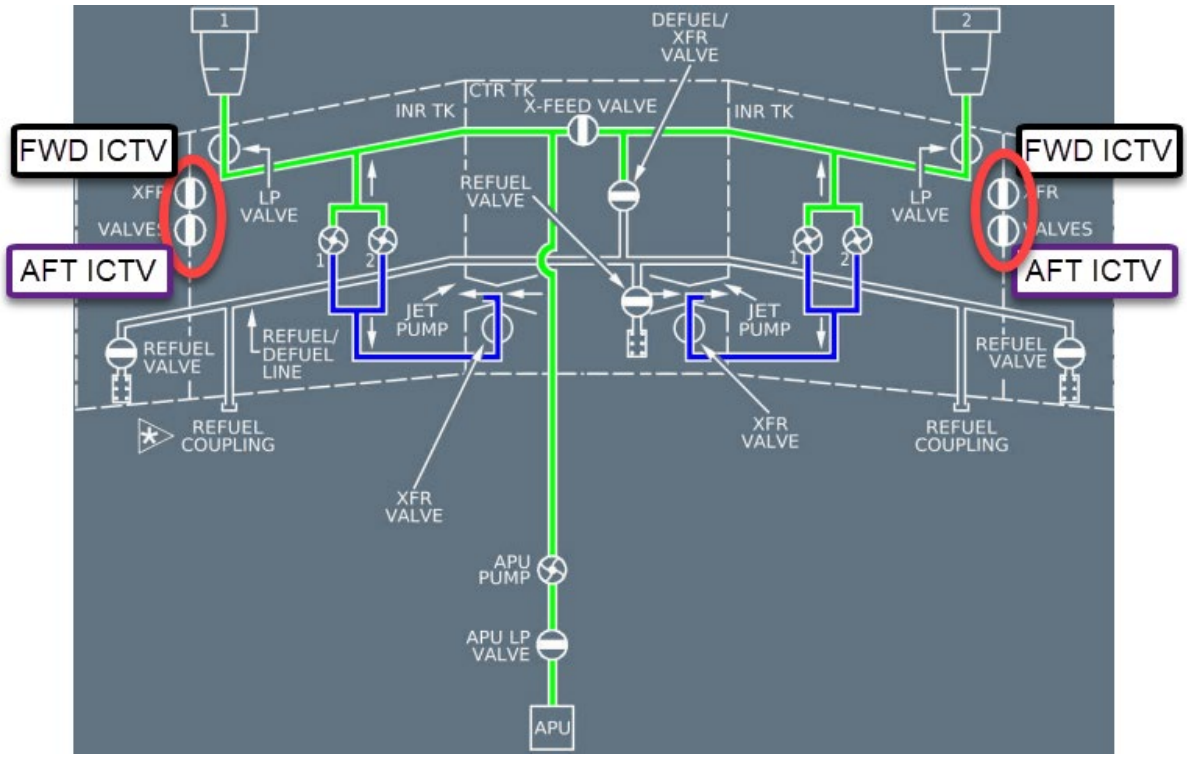


Figure 5: Fuel system schematic.

The four ICTVs are paired into left and right FWD and left and right AFT. Each pair is commanded open when one of the two low fuel level sensors becomes dry, and both ICTVs in that pairing (FWD or AFT) open. Once open, the valves are latched open and automatically close during the next refuelling operation.

The FWD ICTV actuators are powered by busbar 206PP, and the AFT ICTV actuators are powered by busbar 801PP.

The operation of the FWD and AFT ICTV fuel valve pairs, i.e. the transfer of fuel from outer wing tank-to-inner wing tank, is fully automatic and does not require manual control.

On the fuel page, a triangle indicates the status of the two ICTV in each wing. Five different positions indicate the transfer valve position (Figure 6):

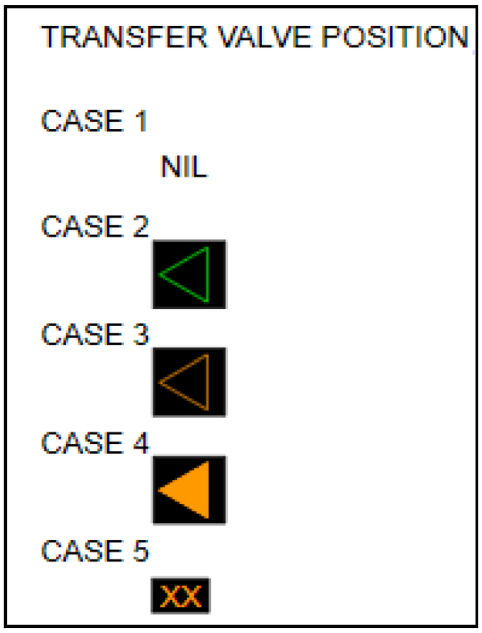


Figure 6: Transfer valve positions.

Case 1: Valve normally closed.

No triangle is displayed when both ICTVs are normally closed.

Case 2: Valve normally open.

When at least one ICTV is normally fully open.

Case 3: Valve in transit.

When a rear or forward ICTV is neither fully open nor fully closed and DC2 BUS is ON.

Case 4: Valve open.

When at least one ICTV is fully open when commanded closed.

Case 5: Valve replaced by amber XX.

When the ICTV status is not known with no position feedback and DC2 BUS is OFF or, one received ICTV status is inconsistent (valve fully closed and valve fully open at the same time).

The hollow amber triangle on the ECAM (see Case 3 in Figure 6) appeared at 22:26, or at the same time as the seven advisory messages from the ECAM System. This went unnoticed on the following two fuel checks but was picked up by the flight crew on the third fuel check after the advisory messages appeared.

Tripped circuit breaker

The field investigation revealed that one circuit breaker, FIN 6PN, of P/N NSA931321-500, for the 206PP and the 208PP busbars was tripped. This is located on the wall behind the first officer, behind the observer seat (Figure 7).

As stated in Chapter 1, the flight crew did not see that this circuit breaker was tripped during the flight.

During the maintenance after the flight, no fault was found, which could have caused the circuit breaker to trip. The circuit breaker was replaced, and the aircraft continued its scheduled flights.

Figure 7: Circuit breaker FIN 6PN

Test of the circuit breaker

The circuit breaker was tested with the assistance of the accredited representative of the Safety Investigation Authority of France (BEA[3]) and technical advisors from Airbus. Functional tests revealed that the circuit breaker was still functional and found no major electrical discrepancies compared with the NSA931321 technical specification. The tripping ability was also tested and found to be satisfactory.

[3] Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile

Panel and observer seat on the flight deck

The observer seat on the flight deck is near the panel where the circuit breaker that tripped is located (Figure 8 and Figure 9). The seat and seatbelt can be moved to the left and right, depending on whether they are being used. While moving the seat, the seatbelt can reach the circuit breaker panel, get caught on the circuit breaker and trip it.

Figure 8: Observer seat close to C/B panel.

Figure 9: Seat belt reaches C/B FIN 6PN.

SIA-Iceland believes that the observer seat movement from its stowed position may have tripped circuit breaker FIN 6PN, thereby cutting the power off from busbar 206PP, which prevented the FWD Inter Cell Transfer Valves (ICTVs) and Fuel Quantity Indicating Computer from operating normally.

Figure 8 and Figure 9 are taken at the operator aircraft and show an erroneous layout of the shoulder harness on the observer seat. On Figure 10, the correct routing is shown on the right.

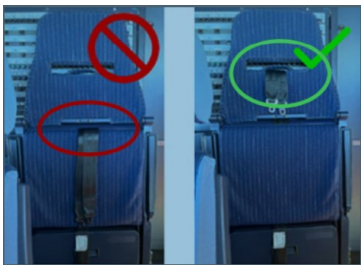


Figure 10: Green circle shows correct routing of seatbelts

Airbus, the aircraft manufacturer, has published an optional Service Bulletin (SB), SB A320-25-1590, which permits installing a transparent protection cover in front of part of panel number 123VU. This protection cover prevents inadvertent tripping of the circuit breaker (Figure 11 and Figure 12). However, this protection cover does not extend far enough to fully cover panel 123VU, nor does it cover panel 124VU, where circuit breaker FIN 6PN is located.

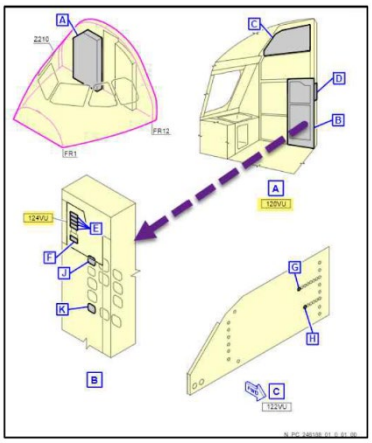


Figure 12: Location of observer seat.

Figure 11: Protection in front of part of panel 123VU.

Fault messages

The pilots cleared the advisory messages after discussing the situation and decided to continue the flight. After landing and while taxiing, the same advisory messages reappeared on the ECAM. As per FWS design, once the ECAM messages are cleared by the flight crew, by using the CLR pushbutton on ECP (ECAM Control Panel), if the fault persists, the messages reappear after landing. The messages can be recalled by the flight crew by using the RCL pushbutton on ECP.

According to the flight crew, they thought there was no relation between the fault indication and the operation of the fuel valves. Since the transfer valve position (Figure 6) was indicating a hollow amber[4] triangle, and seven advisory messages were displayed on

[4] When a rear or forward ICTV is neither fully open nor fully closed and DC2 BUS is ON.

ECAM at the same time, the flight crew was unsure if the transfer valves would operate normally and allow fuel transfer from the outer tanks to the inner tanks.

Following the incident, the aircraft manufacturer reviewed the fuel system description within the Flight Crew Operating Manual and launched a study to improve the outer-to-inner tank fuel transfer system description. The manufacturer highlighted that the other ICTV pair remains available if one should fail.

CVR and FDR synchronization

The Cockpit Voice Recorder and Flight Data Recorder (FDR) data were downloaded and analysed at the Safety Investigation Authority of France (BEA). The synchronisation of the CVR and the FDR provides a good timeline of the events, as well as technical information regarding the operation of the flight, such as altitude, messages, fuel QTY, etc.

Human factors

The unnoticed hollow amber triangle on the ECAM (see Case 3 in Figure 6) causes latent technical conditions as the flight crew was not aware that circuit breaker FIN 6PN was OFF, causing the loss of signal from the ICTV.

These latent technical conditions can result in misleading system cues, with implications for situation awareness, fault analyzing, and operational safety (declaring PAN-PAN and then declaring an emergency).

3. CONCLUSION

During the investigation it was determined that the most probable cause of the C/B FIN 6PN tripping was due to contact with the seat belt from the observer seat, while the seat was being moved from its stowed position, causing the fault messages from the ECAM (power loss on 206PP and 208PP). No malfunction of the C/B FIN 6PN was identified during the investigation.

During the flight, the flight crew's message from ECAM did not reassure them that fuel would still transfer from the outer wing tanks to the inner wing tanks.

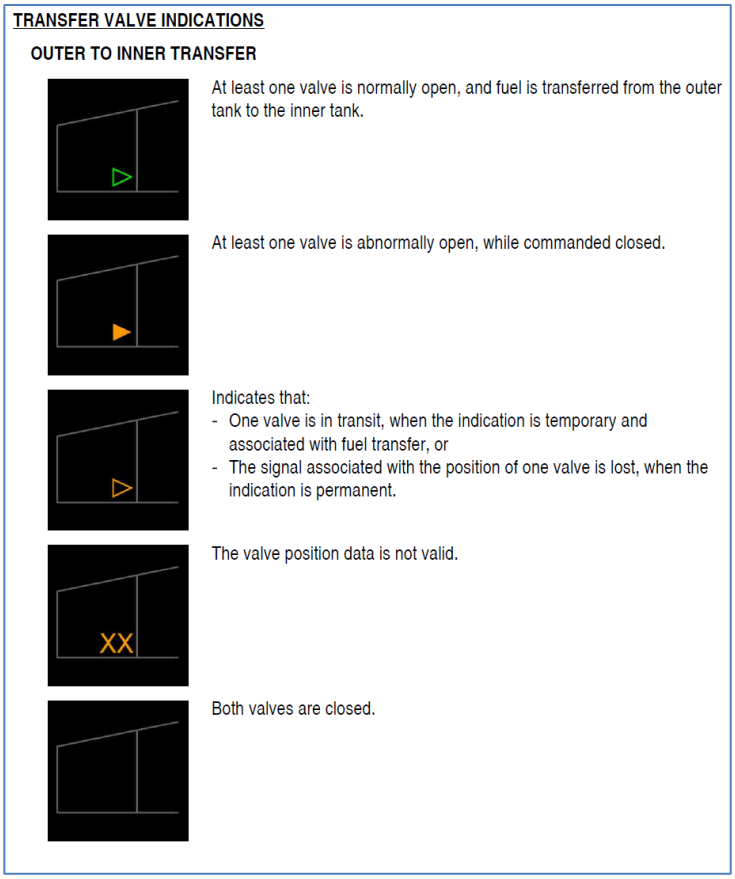


Figure 13: Outer to inner wing tank fuel transfer indications.

During the investigation of this incident, the manufacturer changed the explanation text in the FCOM to prevent misunderstandings about the different transfer valve indications. Figure 13 shows how the explanation text in Figure 6 has been improved. The outer to inner transfer valve hollow amber triangle indication text has been updated to state that when displayed permanently, the signal associated with the position of one valve has been lost.

With regards to circuit breaker panel protection covers, the manufacturer has already published an optional Service Bulletin (SB A320-25-1590) which permits the installation of a protection cover in front of part of the 123VU panel to prevent inadvertent tripping of the circuit breakers due to contact during movement in the cockpit.

Further improvement is in progress with regards to circuit breaker panel protection covers. The partial protective cover for the 123VU panel, available upon operator's request on A320 family aircraft, will be extended to fully cover the 123VU panel as well as the 124VU panel. Therefore, it will also cover other circuit breakers that can be affected by a moving the observer seat, including panel 124VU, where C/B FIN 6PN is located. This improvement will be incorporated by issuing a new Service Bulletin (SB). The SB A320-25-1590 will be either OPTIONAL or RECOMMENDED.

Airbus, the aircraft manufacturer, has launched an improvement to the panel protection in SB A320-25-1590 so it will fully cover panel 123VU and panel 124VU, thereby protecting all the circuit breaker panels that can be affected.

4. SAFETY RECOMMENDATIONS

22-042F006T01

SIA-Iceland recommends to Airbus to issue new/revised Service Bulletin to allow installation of the panel protection to cover panel 123VU and panel 124VU, to all already produced A320 family aircraft.

22-042F006T02

SIA-Iceland recommends to EASA to make the new/revised Service Bulletin listed in safety recommendation 22-042F006T01 (when issued) mandatory, by issuing an Airworthiness Directive.

The following board members approved the report:

- Guðmundur Freyr Úlfarsson
- Geirþrúður Alfreðsdóttir
- Bryndís Lára Torfadóttir
- Gestur Gunnarsson
- Hörður Arilíusson
- Tómas Davíð Þorsteinsson

Reykjavík, 5. December 2025

On behalf of the Safety Investigation Board of Iceland

Thorkell Agustsson
Investigator-In-Charge