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AAIA

Air Accident Investigation Authority

Engine Fire

Serious Incident Investigation
Preliminary Report and
Public Notice

Airbus A350-1041, B-LXI,
Hong Kong International Airport
2 September 2024

PLR-2024-03

1. Purpose

(1) This preliminary report provides factual information established in the investigation's early evidence collection phase. Its purpose is to provide timely information to both the aviation industry and the general public.

(2) This report is released in accordance with the Hong Kong Civil Aviation (Investigation of Accidents) Regulations (Cap. 448B) and the requirements of Annex 13 to the Convention on International Civil Aviation – Aircraft Accident and Incident Investigation (ICAO Annex 13).

(3) The Air Accident Investigation Authority (AAIA)'s understanding of the serious incident will be enhanced as the investigation progresses and potential new evidence becomes available. As such, no analysis or findings are included in this report.

(4) Should safety recommendations be considered necessary during the course of the investigation, they will be promulgated to the parties concerned immediately before the final Investigation Report is published.

(5) The Investigation Report will be released at the conclusion of the investigation, which will provide a comprehensive overview of this serious incident, its causes, and any recommendations to improve air safety.

2. General Details

2.1 Occurrence details

Date and time (see Note):	2 September 2024, 00:24 hours
Occurrence category:	Serious Incident
ICAO occurrence type:	Fire/Smoke (F-NI)
Location:	Hong Kong International Airport (VHHH)
Position:	22°18'16.5"N 113°55'25.5"E

2.2 Pilot in Command details

Licence details:	Hong Kong Airline Transport Pilot's Licence (Aeroplanes)
Medical certificate:	Class 1
Type ratings:	B747-200, B747-400, B777, A330, A350
Total all types	20,250 hours
Command time on type (A350)	2,552 hours

2.3 Aircraft details

Manufacturer and model:	Airbus A350-1041	
Registration:	Hong Kong, B-LXI	
Serial number:	262	
Year of Manufacture:	2019	
Number / type of engines:	Two Rolls-Royce Trent XWB-97 turbo-fan engines No. 1 Engine (ESN: 26033) / No. 2. Engine (ESN:26043)	
Operator:	Cathay Pacific Airways	
Type of Operation:	Scheduled Public Transport of Passengers	
Departure:	Hong Kong International Airport (VHHH)	
Destination:	Zurich Airport (LSZH)	
Persons on board:	Crew – 4 + 12	Passengers – 332
Injuries:	Crew – 0	Passengers – 0
Aircraft damage (primary):	1. Damage of secondary fuel manifold hoses 2. Temporary engine fire and heat damage to the exterior and interior of the No. 2 engine – aft core compartment (Zone 3), nacelle, thrust reverser C-ducts.	

Note: All times are local Hong Kong time that is Coordinated Universal Time (UTC) plus eight hours.

3. Synopsis

(1) The serious incident involved a passenger flight operated by Cathay Pacific Airways (ICAO[1] code: CPA / IATA[2] code: CX) Airbus A350-1041, (Flight CX383, aircraft registration B-LXI) from Hong Kong International Airport (VHHH) to Zurich Airport (LSZH), Switzerland, at 00:24 on 2 September 2024 Hong Kong Local Time (UTC+8).

(2) The aircraft was carrying a total of 348 persons, including 332 passengers and 16 crew members (4 flight crew and 12 cabin crew). The total take-off weight was 306 tons.

(3) The aircraft took off from runway 07R at VHHH at 00:24:10. Shortly after lift-off, with the landing gears retracting at 00:24:52 (radio altimeter height: 34 ft / airspeed: 191 kts), the flight crew observed an 'ENG FIRE' warning for the No. 2 engine. The crew immediately executed the ECAM[3] procedures, shutting down the No. 2 engine and discharging one fire extinguisher bottle (Agent 1). The fire warning for the No. 2 engine was cleared after 59 seconds.

(4) The flight crew initially declared a MAYDAY[4] but later downgraded the status to PAN[5]. To meet landing weight limits, they initiated fuel jettison after coordinating with HKG ATC. The aircraft landed on runway 07L at 01:40:29. No crew or passengers were injured.

(5) The post-flight examination of the No. 2 engine conducted by the AAIA revealed that the steel braided sheath of the fuel hose (secondary fuel manifold hose) connecting to the No.17 fuel spray nozzle had a rupture, evidenced by a discernible hole in the hose. Additionally, black soot was observed on the aft section of the core engine, indicating signs of a fire. Burn marks were also noted on the underside of the two thrust reverser cowls.

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1 ICAO – International Civil Aviation Organization

2 IATA – International Air Transport Association

3 Electronic Centralized Aircraft Monitor (ECAM) is a system on Airbus aircraft for monitoring and displaying engine and aircraft system information to the pilots. In the event of a malfunction, it will display the fault and may also display the appropriate steps of the remedial action.

4 “MAYDAY” is an emergency procedure word used in aviation as a distress signal in voice-procedure radio communications. It is used to signal a life-threatening emergency. Convention requires the word be repeated three times in a row during the initial emergency declaration ("MAYDAY MAYDAY MAYDAY").

5 A "PAN PAN" call is a radio urgency call used in aviation to indicate an urgent situation that is not immediately life threatening. It is used to communicate that the aircraft or its occupants require assistance or have an urgent problem that does not pose an immediate danger to the safety of the aircraft or its passengers. “PAN PAN” calls are typically made when there is an urgent situation that requires attention but does not require the full-scale emergency response that would be triggered by a "MAYDAY" call.

(6) In addition to the anomaly identified on the No. 17 secondary fuel manifold hose, five additional secondary fuel manifold hoses were found to have either frayed metal braids or collapsed structures inside the hose.

(7) Further inspection suggested that fuel directed to the fuel spray nozzle could leak through the ruptured secondary fuel manifold hose. Coupled with other contributing factors, such as the presence of oxygen and an ignition (heat) source, this could result in a fire that could spread to the surrounding area. If not promptly detected and addressed, this situation, along with further failures, could escalate into a more serious engine fire, potentially causing extensive damage to the aircraft.

4. Instigation of Investigation

(1) The AAIA received an Aircraft Accident / Incident Reporting Form from the operator after the incident. After validating the collected information, the Chief Inspector (CI) of AAIA classified this occurrence as a Serious Incident, and instigated an investigation into its circumstances, causes and contributing factors, in accordance with Cap. 448B and the requirements of ICAO Annex 13.

(2) In accordance with ICAO Standards, the Bureau of Enquiry and Analysis for Civil Aviation Safety (BEA) of France (representing the State of Design and State of Manufacture of the Airbus A350), the Air Accidents Investigation Branch (AAIB) of the United Kingdom (representing the State of Manufacture of the Rolls-Royce Trent XWB engines), and the German Federal Bureau of Aircraft Accident Investigation (BFU) of Germany (representing the State of Design of the Rolls-Royce Trent XWB engines) have been notified and have appointed their Accredited Representatives to participate in the investigation led by the AAIA.

(3) The Transport Safety Investigation Bureau (TSIB) of Singapore and the National Transportation Safety Board (NTSB) of the United States have also been informed to assist the AAIA in overseeing the examination of engine parts in Singapore and the United States, respectively.

(4) These investigation authorities have also appointed their Advisers to participate in this investigation, including representatives from Rolls-Royce (United Kingdom), Airbus (France), the European Union Aviation Safety Agency – EASA (European Union), the Federal Aviation Administration – FAA (United States), and Parker Hannifin (United States).

(5) ICAO was also notified of this serious incident.

5. Investigation Progress

(1) To date, the AAIA have:

- hosted multiple cross-stakeholder meetings with the relevant investigation authorities (Accredited Representatives) and Advisers to coordinate and prioritize the various investigation workstreams;
- completed a thorough inspection of the aircraft's condition and secured all pertinent photographic evidence;
- downloaded and decoded data from the onboard Digital Flight Data Recorder (DFDR), Quick Access Recorder, and Cockpit Voice Recorder (CVR);
- conducted interviews with the flight crew;
- collected air traffic control (ATC) operational records and system footage;
- retrieved all relevant non-volatile memory (NVM) data from the aircraft;
- collected fuel samples from different engine sections and initiated the fuel testing process;
- performed an initial fire damage inspection and sampling, including the collection of soot samples from the affected engine and the connecting airframe sections;
- removed the subject hoses from the engine while conducting alignment checks and break torque value examinations;
- initiated a heat damage assessment of the subject engine and its connections to the airframe;
- begun a technical investigation of the relevant parts removed from the engine, including preliminary laboratory testing and examination of the hoses through X-ray scanning, borescope analysis, and residual testing;
- developed a master examination plan for the subject engine; and
- initiated collation of other relevant information from the operator, the engine's original equipment manufacturer (OEM), and the engine repair & overhaul organization.

(2) At the time of this preliminary report publication:

- a comprehensive examination and analysis of the retained aircraft parts, including the secondary fuel manifold hoses in question, is being conducted at an overseas testing facility, with AAIA investigator present to oversee the activities.

(3) As the investigation progresses, AAIA will:

- investigate the fire dynamics and the spread of fire within the engine;
- analyze the factors that contributed to the fire in the No. 2 engine;
- assess all relevant operational safety risks that emerged following the engine fire;
- examine the technical factors and failure modes that led to the rupture of the secondary fuel manifold hose, taking into account various environmental variables;
- review the service history and maintenance program for the subject hoses;
- analyze all systemic factors and issues associated with the design, manufacture, installation, and maintenance of the hoses; and
- evaluate the operator's procedures and crew responses during the engine fire and subsequent recovery operations.

(4) The detailed analysis of the data and information collected will enable the investigation team to determine the circumstances, causes and contributing factors of this serious incident. It will also aid in identifying areas that need further investigation and/or lines of investigation to be pursued.

6. AAIA Safety Recommendation Report

(1) When a safety issue is identified at any stage of the investigation, the AAIA issues Safety Recommendation Report to relevant organization(s) to recommend preventative action(s) to be taken promptly to enhance aviation safety.

(2) This serious incident illustrates the potential for fuel leaks through the ruptured secondary fuel manifold hose, which could result in engine fires. Therefore, swift action is warranted.

(3) On 3 September 2024, the AAIA issued a Safety Recommendation Report SRR-2024-04 to the European Union Aviation Safety Agency (EASA). The SRR contained Safety Recommendation SR-2024-07, detailed as follows.

6.1. Safety Recommendation SR-2024-07

It is recommended that the European Union Aviation Safety Agency (EASA) requires Rolls-Royce Deutschland Ltd & Co KG to develop continuing airworthiness information, including but not limited to, inspection requirements of the secondary fuel

manifold hoses of Airbus A350 Aircraft Rolls-Royce Trent XWB Engines to ensure their serviceability.

Safety Recommendation Owner: European Union Aviation Safety Agency

6.2. Response to Safety Recommendation SR-2024-07

(1) The EASA informed the investigation team that the following safety actions had been taken to address Safety Recommendation SR-2024-07.

(2) In accordance with Regulation (EU) 748/2012, Part 21.A.3B, EASA identified an unsafe condition and subsequently mandated corrective action by issuing an Emergency Airworthiness Directive (EAD) [EASA AD No.: 2024-0174-E] on 5 September 2024.

(3) The EAD was issued in reference to the Rolls-Royce Non-modification Service Bulletin (NMSB) Alert Trent XWB 72-AL165 dated 5 September 2024, which provides inspection and corrective action instructions.

(4) The EAD requires a one-time fleet inspection applicable to a portion of the A350 fleet to identify and remove from service any potentially compromised secondary fuel manifold hoses.

(5) EASA may consider further actions based on the findings of the AAIA investigation and the results of the fleet inspection mandated by the EAD.

7. Public Notice

This Report also serves as a public notice under Regulation 10(1) of Cap. 448B. Any person who wishes to make representation as to the circumstances or causes of the serious incident should do so by letter, facsimile, telephone, or email to the Chief Inspector (Address: Air Accident Investigation Authority, Level G & 2, Facility Building, 1 Tung Fai Road, Hong Kong International Airport, Lantau, Hong Kong; Telephone: (+852) 2910 6079; Facsimile: (+852) 2910 6049 (local), (+852) 3912 4848 (international); or Email: ACCID@tlb.gov.hk within 14 days of this notice.

19 September 2024 K. C. MAN *Chief Inspector*

About the Air Accident Investigation Authority

The AAIA is an independent investigation authority under the Transport and Logistics Bureau (TLB) of the Government of the Hong Kong Special Administrative Region of the People's Republic of China.

The AAIA is established in compliance with the Standards and Recommended Practices (SARPs) of ICAO Annex 13 requiring Contracting States to set up an independent investigation authority to ensure the independence and impartiality of the investigations.

The AAIA is responsible for the investigation of civil aircraft accidents and incidents in Hong Kong in accordance with the Hong Kong Civil Aviation (Investigation of Accidents) Regulations (Cap. 448B) and the SARPs of ICAO Annex 13.

The sole objective of the investigation shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

Check the AAIA website for information, reports and updates:

https://www.tlb.gov.hk/aaia/eng/index.html

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