AIRCRAFT ACCIDENT INVESTIGATION REPORT

October 11, 2024
Adopted by the Japan Transport Safety Board
Chairperson TAKEDA Nobuo
Member SHIMAMURA Atsushi
Member MARUI Yuichi
Member SODA Hisako
Member NAKANISHI Miwa
Member TSUDA Hiroka

Company	Privately owned
Type, Registration Mark	Cessna T303, JA5309
Accident Class	Fire
Date and Time of the Occurrence	At about 11:32 Japan Standard Time (JST: UTC+9 hours), June 16, 2023
Site of the Accident	Naha Airport

1. PROCESS AND PROGRESS OF THE ACCIDENT INVESTIGATION

Summary of the Accident	On Friday 16 June 2023, while the aircraft was on the apron at Naha Airport undergoing an engine function check in preparation for departure, white smoke was seen coming from around No. 1 engine (left) and a warning light indicating a possible engine fire came on, thus the captain shut down both engines. Only the captain was on board the aircraft, no injuries. There was evidence of a fire in the engine cowl housing No.1 engine (left) of the aircraft.
Outline of the Accident Investigation	The Japan Transport Safety Board (JTSB) designated an investigator-in charge and an investigator on June 16, 2023 to investigate this accident. An accredited representative and an adviser of the United States of America, as the State of Design and Manufacture of the aircraft and engine, participated in the investigation. Comments on the draft Final Report were invited from the parties relevant to the cause of the accident. Comments on the draft Final Report were invited from the Relevant State.

2. FACTUAL INFORMATION

Aircraft Information
Aircraft type: Cessna T303

Serial number: T30300299 Date of manufacture: February 3, 1984
Airworthiness certificate: No. Dai-2022-525 Validity: November 29, 2023
Total flight time: 5,934 hr 07 min
Flight time since last periodical check (50-hour Check on November 10, 2022) 24 hr 11 min

(2) Engines

No. 1 engine (left side)
Type: Continental TSIO-520-AE
Serial number: 246233-R Date of manufacture: July 2, 2006
Total time in service: 382 hr 07 min

No. 2 engine (right side)
Type: Continental LTSIO-520-AE
Serial number: 246734-R Date of manufacture: April 1, 2006
Total time in service: 474 hr 02 min

Personnel Information

Captain : Age 49
Commercial pilot certificate (Airplane) March 27, 2008
Rating for multiple-engine (Land) August 10, 2007

Meteorological Information

The observation data in the aviation routine weather report at Naha Airport around the time of the accident were as follows:

11:30 Wind direction: 130°, Wind velocity: 7 kt, Visibility: 10 km or more
Temperature: 28°C, Dew point 24°C

Event Occurred and Relevant Information

(1) Progress of Events Up to the Occurrence of the Accident

To depart for Yao Airport via Amami Airport for the periodic inspection of the aircraft, the captain started engine No. 1 (left) and then engine No. 2 (right) on the apron (Figure 1) at Naha Airport. After starting both engines, the captain confirmed that the instrument displayed normal. While increasing power on engine No. 1 for a functional check, the captain smelled something burning, looked outside the aircraft and noticed white smoke coming from the vicinity of engine No. 1. Looking at the instrument, the captain noticed that an "L ENG FIRE" warning light was illuminated, indicating a possible engine fire. Therefore, the captain shut down both engines.

Figure 1: Accident Site

After confirming that the propellers had stopped and taking a portable fire extinguisher that was equipped on board the aircraft, the captain went out of the aircraft and noticed that the amount of white smoke coming from around No. 1 engine was increasing, therefore the captain informed an Air Traffic Services Flight Information Officer at the Naha Airport Office about the situation by telephone. The captain then sprayed a portable fire extinguisher toward the left engine cowling, but the fire was not extinguished. About seven minutes later, the fire track arrived on the scene, sprayed water on the left engine cowling and extinguished the fire.

(2) Damage to the Aircraft

Examination of the damage to the aircraft revealed that the left engine cowling was partially burnt (Figure 2). Inside the engine cowling, the turbine part of the exhaust turbocharger was detached from the exhaust tailpipe at their connections, and the coupling that joins the connections was damaged. In addition, the wastegate valve, which bypasses the flow of exhaust gas to the turbine part in order to control boost pressure, was detached from the exhaust tailpipe at the connections (Figure 3, 4 and 5). Besides, the heat shield in close proximity to the exhaust tailpipe on the turbine side and two vacuum system hoses were burnt out (Figure 6).

Figure 2:
Left Engine Cowl

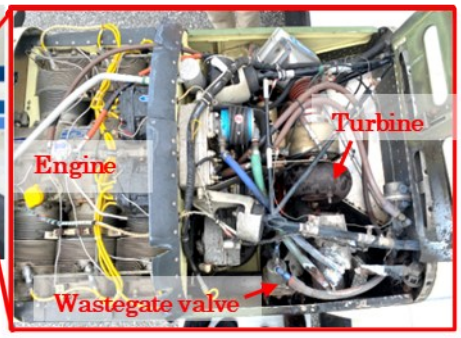
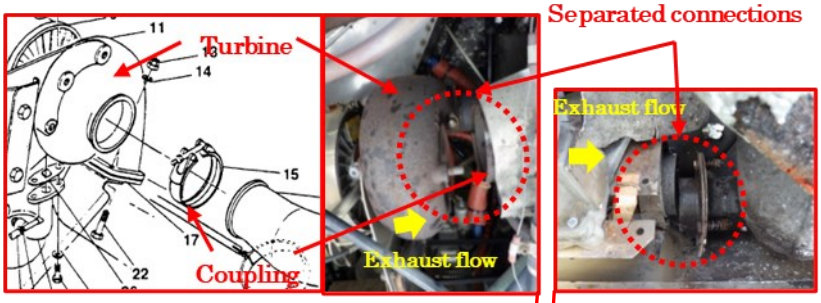


Figure 3: Inside the Left Engine Cowl



Turbine side　　Wastegate valve side

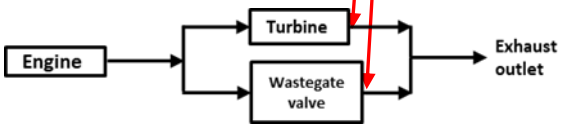


Figure 4: Exhaust Pipe Joint and Engine Exhaust Flow

(3) Damage to the Coupling and Others

The coupling is a single integrated structure consisting of the outer band and v-retainer segments that are attached via spot welds.

By tightening the outer band, the inner v-retainer segment is joined in contact with the connection of the exhaust tailpipe. After removing the coupling and checking, it was found that there was corrosion found throughout the coupling. In addition, fractures in the outer band and cracking in the v-retainer segment were found around the spot weld areas (Figure 5).

According to the aircraft manufacturer, the part number and/or maximum tightening torque value is marked on an approved coupling. However, only the number that differed from the part number in the aircraft manufacturer's parts list was marked on the coupling.

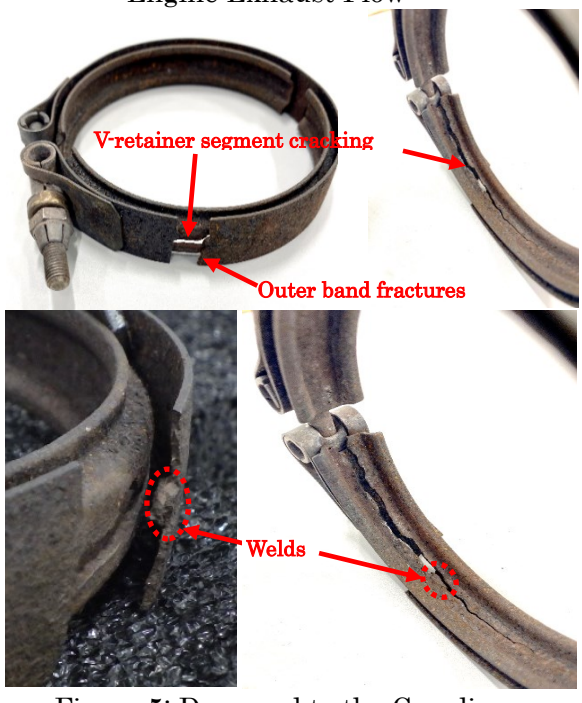


Figure 5: Damaged to the Coupling

(4) Technical Information on Coupling

With regard to the coupling used to connect the turbine part and the exhaust tailpipe of the exhaust turbocharger, as being prompted by multiple failures confirmed in the past, the Federal Aviation Administration (FAA) in the United States of America, the State of Design of the aircraft issued an Airworthiness Directive (AD2023-09-09) for certain turbocharged, reciprocating engine-powered aircraft, on June 12, 2023, prior to the occurrence of this accident, and directed the

establishment of a 500-hour time-in-service (TIS) replacement interval for spot-welded couplings (It became into effect on July 17, 2023). The Civil Aviation Bureau, Ministry of Land, Infrastructure, Transport and Tourism issued a Technical Circular Directive (TCD-10180-2023) on September 4, 2023, directing the same actions.

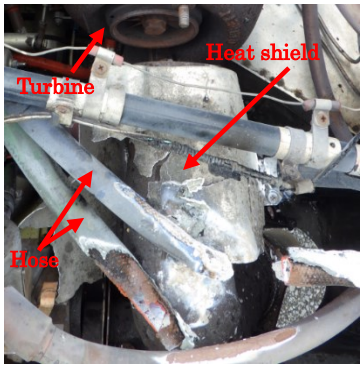


Figure 6: Heat shield and Hoses

(5) Maintenance History of the Aircraft

The aircraft was purchased by the captain as a second-hand aircraft in July 2022, and had a periodic inspection in November 2022. The aircraft's latest maintenance manual (revised in September 2011) requires the periodic inspection of the engine exhaust system to be performed every 50-hour time-in-service (TIS) or every six months, whichever occurs first, in order to visually inspect the installation condition of the connections, cracks, corrosion and the damage to welds. According to the maintenance company that conducted the periodical inspection, the damaged coupling was inspected in accordance with the said maintenance manual, but no anomalies were found.

The captain did not confirm the latest version of the relevant maintenance manual and was unaware that the inspection was required every six months after the previous inspection, therefore, the aircraft had not had undergone the inspection required every 50-hour TIS or every six months, whichever occurs first, since November 2022, and more than seven months had passed since the last inspection.

There was no description about the installation of the coupling in the aircraft's logbook, nor was the date and time of the first installation or the number of hours in-service unclear.

On 12 June 2023, during the exterior inspection of the aircraft prior to the second flight of the day, the captain found foreign objects on the left engine cowling that looked like melted plastic. The inspection conducted the next day, June 13, 2023, before the flight immediately prior to the accident, revealed that the surface of the access door at the rear of the left engine cowling had a black discoloration. The access door was therefore opened to inspect the inside of the cowling but could not find any abnormalities. In addition, according to the Flight Manual of the aircraft, the inspection inside the engine cowling at the time of the pre-flight check shall be performed by opening the access door to visually inspect the installation of the engine accessories and the condition of the exhaust turbocharger, but the coupling is installed in a position which would not be visible even when the access door is opened.

3. ANALYSIS

(1) Events Leading up to the Fire

The JTSB concludes that, based on the damage to the aircraft and the coupling, the fire on the aircraft was most likely caused by the damage to the coupling that connects the turbine part in the left engine cowling to the exhaust tailpipe, which caused first the turbine side connection and then the exhaust tailpipe connection on the wastegate valve side, connected by insertion into the wastegate valve, to separate, allowing the hot exhaust gases to escape from the connections, resulting in a fire on the heat shield installed around the connections and hoses and part of the engine cowling.

(2) Damage to the Coupling

The JTSB concludes that because cracking was found at or near a spot weld for the outer band and the v-retainer segment, cracking that originated at the spot weld were more likely to

have progressed, resulting in the fracture of the outer band and cracking of the v-retainer segment. In addition, during the exterior inspection on June 13, 2023, as the captain noticed that the surface of the access door at the rear of the left engine cowling had a black discoloration, possibly indicating that the coupling had already been damaged at that time and that exhaust gases had been emitted from the tailpipe connection.

(3) Maintenance of the Aircraft

The JTSB concludes that it is possible that damage to the coupling could have been detected if an inspection of the coupling had been carried out within six months of the last periodic inspection (in November 2022) in accordance with the aircraft's maintenance manual.

The method for inspecting the inside of the engine cowling during pre-flight inspection in the aircraft's flight manual is to open the access door and visually inspect the installation of the engine accessories and the condition of the exhaust turbocharger. On the other hand, as the coupling is installed in a position which would not be visible even when the access door is opened, it would have been most likely difficult for the captain to check the condition of the coupling before the flight. However, it is possible that during the exterior inspection of the aircraft on June 12 and 13, 2023, when the captain confirmed that there were melted foreign objects and that the surface of the access door at the rear of the left engine cowling had a black discoloration, if a detailed inspection of the engine coupling had been carried out, damage to the coupling could have been detected.

It is essential that aircraft users should properly inspect and maintain the aircraft in accordance with the latest version of the manufacturer's manual. In addition, it is important to take appropriate actions such as carrying out a detailed inspection when some changes and others that are different from the usual are detected during the daily inspection.

(4) Use of Non-specified Parts

The JTSB concludes that the number marked on the coupling was different from the part numbers approved by the aircraft's manufacturer. In addition, the part number or maximum tightening torque value that should have been marked on the coupling approved by the aircraft's manufacturer was not found, thus it is certain that the damaged coupling was a non-specified part, not approved by the aircraft's manufacturer. Non-specified parts have not been certified to meet airworthiness standards when used, and proper maintenance procedures have not been established. The use of the coupling, which was a non-specified part, was likely to have contributed to the cause of the coupling damage.

It is important that aircraft users should use the specified parts that are certified to meet airworthiness standards.

4. PROBABLE CAUSES

The JTSB concludes that the probable cause of this accident was that the fire on the aircraft was most likely caused by damage to the coupling that connects the turbine part in the left engine cowling to the exhaust tailpipe, which caused the exhaust tailpipe to detach, allowing the hot exhaust gases to be ejected, resulting in a fire from the burning of the heat shield installed at the vicinity of the connections, and hoses and part of the engine cowling.

It is possible that the use of the coupling, which was a non-specified part, was likely to have contributed to the cause of the coupling damage.

5. SAFETY ACTIONS

Safety Actions Required

As explained in ANALYSIS, it is essential that aircraft users should properly inspect and maintain the aircraft in accordance with the latest version of the manufacturer's manual. In addition, it is important to take appropriate actions such as carrying out a detailed inspection when some changes and others that are different from the usual are found during the daily inspection. Besides, it is important that aircraft users should use the specified parts that are certified to meet airworthiness standards.

Furthermore, in order to prevent the recurrence of similar accidents, it is essential to carry out regular replacement and others of the coupling in accordance with the Technical Circular Directive (TCD-10180-2023) issued by the Civil Aviation Bureau, Ministry of Land, Infrastructure, Transport and Tourism on September 4, 2023.