AI2017-6

AIRCRAFT SERIOUS INCIDENT
INVESTIGATION REPORT

JAPAN TRANSOCEAN AIR CO., LTD.
J A 8 5 2 5

October 26, 2017

Japan Transport Safety Board

The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board (and with Annex 13 to the Convention on International Civil Aviation) is to prevent future accidents and incidents. It is not the purpose of the investigation to apportion blame or liability.

Kazuhiro Nakahashi
Chairman
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

AIRCRAFT SERIOUS INCIDENT INVESTIGATION REPORT

ABNORMAL DECOMPRESSION INSIDE AN AIRCRAFT OPERATED BY JAPAN TRANSOCEAN AIR CO., LTD. BOEING 737-400, JA8525 AT ABOUT 55 KM EAST-NORTHEAST OF TANEGASHIMA AIRPORT AT AN ALTITUDE OF APPROXIMATELY 37,000 FT AT ABOUT 8:20 ON JUNE 30, 2015

October 13, 2017

Adopted by the Japan Transport Safety Board

Chairman Kazuhiro Nakahashi

Member Toru Miyashita

Member Toshiyuki Ishikawa

Member Yuichi Marui

Member Keiji Tanaka

Member Miwa Nakanishi

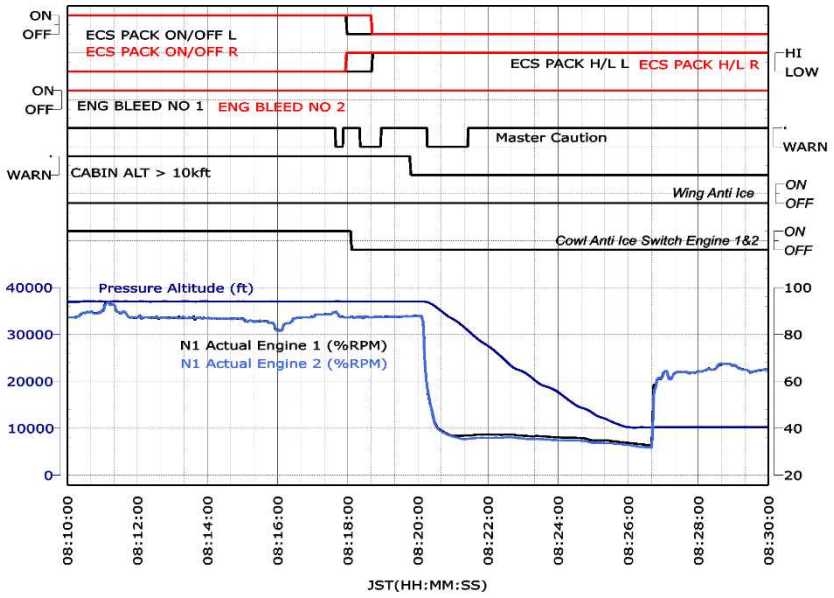
1. PROCESS AND PROGRESS OF INVESTIGATION

1.1 Summary of the Serious Incident	On Tuesday, June 30, 2015, a Boeing 737-400, registered as JA8525, operated by Japan Transocean Air Co., Ltd., during a flight as the scheduled Flight 002 from Naha Airport to Kansai International Airport, at about 55 km east-northeast of Tanegashima Airport, made emergency descend to the altitude of about 10,000 ft due to decompression inside the aircraft. After that, the aircraft continued the flight and landed at Kansai International Airport.
1.2 Outline of the Serious Incident Information	This event fell under the category of "Abnormal decompression inside an aircraft" as stipulated Item (xi), Article 166-4 of Ordinance for Enforcement of the Civil Aeronautics Act, which was classified as an aircraft serious incident. The Japan Transport Safety Board designated an investigator-in-charge and two investigators on June 30, 2015, to investigate

	this serious incident. An accredited representative of United States of America, as the State of Design and Manufacture of the aircraft involved in the serious incident, participated in this investigation. Comments were invited from parties relevant to the cause of the serious incident and the relevant State.

2. FACTUAL INFORMATION

2.1 History of the Flight	The history of the flight is summarized below, based on the statements of the Pilot in Command (PIC) and the first officer (FO), the records of the flight data recorder (FDR) and the cockpit voice recorder (CVR); At 7:26, on June 30, 2015, a Boeing 737-400, registered JA8525, operated by Japan Transocean Air Co., Ltd. (hereinafter referred to as "the Company") as scheduled Flight 002, took off from Naha Airport for Kansai International Airport. At 8:18 of after about 30 minutes from a time when the aircraft had reached a cruising altitude FL370, a left-side BLEED TRIP OFF light was illuminated to indicate malfunction of left-side (No.1) BLEED AIR and the supply from the left side bleed air were stopped. At that time, WING ANTI ICE was not in use, but ENGINE ANTI ICE was in use. When starting a checklist for BLEED TRIP OFF, a right-side (No.2) BLEED TRIP OFF light was illuminated and the both sides of bleed air systems stopped. Checking DUCT PRESSURE which indicates a bleed air pressure, both of left- and right-side were approximately 0 psi. When flight crew were checking a cabin altitude which indicates a cabin pressure, the cabin altitude was gradually rising. At 8:20, the cabin altitude was exceeding 10,000 ft, then the CABIN ALTITUDE WARNING was operated. The flight crew stopped to perform the checklist of BLEED TRIP OFF and immediately executed emergency descent, following the checklist of CABIN ALTITUDE WARNING or Rapid Depressurization and a checklist of Emergency Descent. Following the checklist, the PIC and the FO used oxygen masks and operated to drop oxygen masks for cabin. The PIC confirmed that the cabin altitude was reaching

	approximately 16,000 ft. At the time for the aircraft to execute the emergency descent, a state of emergency to the Air Traffic Control was declared. Because the aircraft did not have any other abnormalities after descending to approximately 10,000 ft, the PIC cancelled the state of emergency and continued the flight and landed at Kansai International Airport. This serious incident occurred at the point about 55 km east-northeast of Tanegashima Airport (30°51'39"N, 131°34'43"E) at the time about 8:20 on June 30, 2015.  Figure 1 Records of FDR
2.2 Injuries to persons	None
2.3 Damage to Aircraft	None
2.4 Personnel information, etc.	(1) The Pilot in Command — Male, Age 48 Airline transport pilot certificate (Airplane) — May 28, 2007 Type rating for Boeing 737 — February 2, 1995 Class 1 aviation medical certificate — Validity: June 20, 2016 Total flight time — 12,213 hours 31 minutes Total flight time on the type of aircraft — 8,721 hours 06 minutes Flight time in the last 30 days — 26 hours 35 minutes

	(2) First Officer Male, Age 30 Commercial pilot certificate (Airplane) June 19, 2009 Type rating for Boeing 737 January 10, 2012 Instrument flight certificate June 29, 2009 Class 1 aviation medical certificate Validity: August 31, 2015 Total flight time 2,630 hours 58 minutes Total flight time on the type of aircraft 2,403 hours 58 minutes Flight time in the last 30 days 60 hours 02 minutes
2.5 Aircraft information	(1) Aircraft Boeing 737-400 Serial Number: 26605, Date of Manufacture: September 1, 1995 Certificate of airworthiness No. Dai-11-210 Validity: Period during which the Maintenance Manual has been effective Total flight time 46,550 hours 05 minutes Flight time after Periodic Inspection (13C Check, on June 8, 2014) 2,971 hours 59 minutes (2) The weight and the position of the center of gravity (C.G.) of the aircraft were within the allowable range at the time of the serious incident.
2.6 Additional information	(1) Bleed Air System Bleed air system supplies to Environmental Control System Pack (ECS PACK) and others by controlling the temperature and pressure of the high temperature / high pressure bleed air supplied from the engines. The bleed air bled from High Pressure Compressor (hereinafter referred to as "HPC") of engine goes through Pressure Regulator and Shutoff Valve (hereinafter referred to as "PRSOV") and sends to the pre-cooler. The pre-cooler cools the high temperature and high pressured bleed air to about 390°F by using a cooling air taken from an engine fan. Pre-cooler control valve controls the cooling air flow sent to pre-cooler from engine fan by pre-cooler temperature sensor.

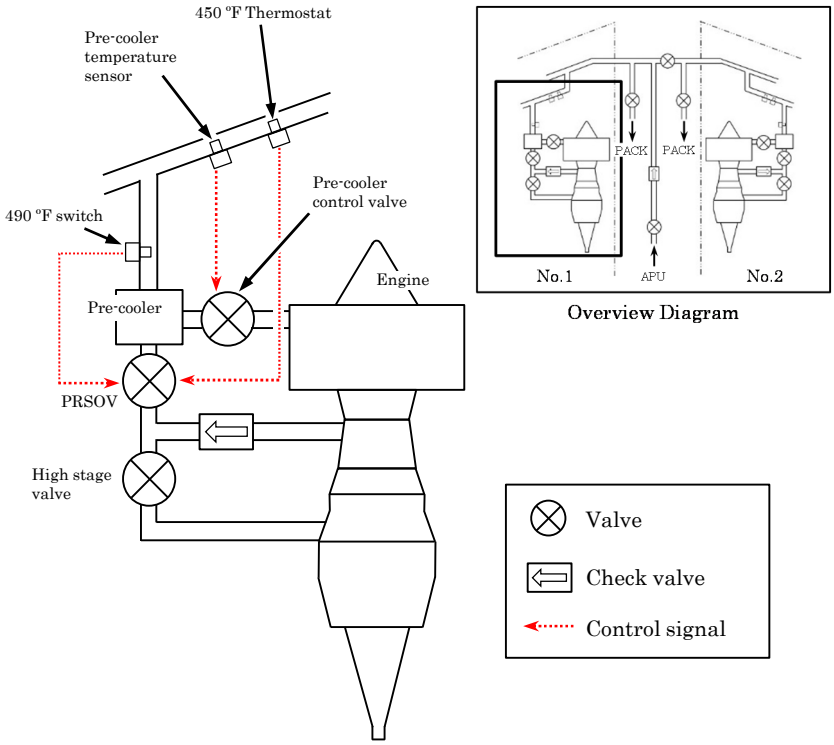


Figure2 Bleed Air System Diagram

PRSOV controls the temperature of downstream Bleed Air from pre-cooler below 450 °F by using 450 °F Thermostat. Moreover, when downstream bleed air of pre-cooler exceeds 490 °F, 490 °F switch would close the PRSOV to shut down the bleed air from engine.

(2) Records of Cabin Pressure Controller (hereinafter referred to as "CPC")

The memory of the CPC has a record that the Cabin Altitude had reached over 14,500 ft.

(3) Investigation of parts for the Bleed Air System and others

Parts and the like for the Bleed Air System equipped at the time of serious incident were investigated at the manufacturer of the parts.

(i) 450 °F Thermostat

On the both of No.1 and No.2 systems of 450 °F Thermostats, the malfunctions that the output does not response to the change of temperature were found.

Later on, cracks were found on the sensor section at the time of teardown inspection.

If the output of 450 °F Thermostat did not change corresponding to the temperature change of bleed air, PRSOV could not adjust the valve for the opening/closing corresponding to the temperature change.

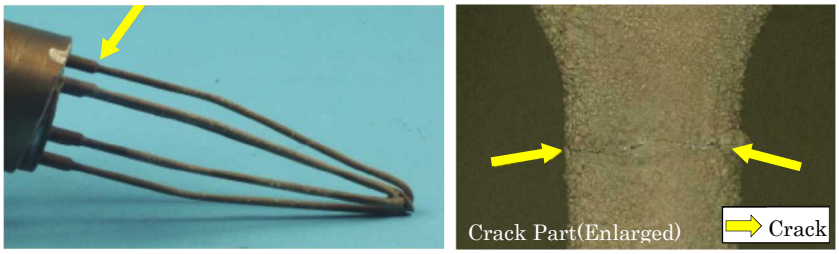


Photo 1 Cracks at 450 °F Thermostat

(ii) Pre-cooler Control Valve

On the both of No.1 and No.2 systems of Pre-cooler Control valves, malfunctions were confirmed, which the valve had moved to the position where it generated less cooling air flow than the flow required corresponding to the input from the pre-cooler temperature sensor due to the deterioration.

(4) Service Bulletin by manufacturer of parts

On 2008, there was a report regarding 450 °F Thermostat which had been removed in short time use, and as the results of the investigation by the Parts Manufacturer, because cracks were found within, the Service Bulletin was issued to improve the 450 °F Thermostat to the improved type. The level of urgency was "Recommended".

Furthermore, due to the same reasons, the Service Bulletin for Pre-cooler Temperature Sensor with the same contents to improve was issued.

(5) 450 °F thermostat and pre-cooler control valve equipped on the aircraft

The both of No.1 and No.2 systems of 450 °F Thermostats were not the improved type.

The use results of 450 °F thermostat and pre-cooler control valve equipped on the aircraft were as follows;

	Part Name	Loading Position	Total Use Time	Use Time after loading on the aircraft
	450 °F Thermostat	No. 1	34,943	6,730
		No. 2	46,425	42,304
	Pre-cooler Control Valve	No. 1	39,259	1,544
		No. 2	46,508	5,965

3. ANALYSIS

3.1 Involvement of weather	None
3.2 Involvement Of pilot	None
3.3 Involvement of equipment	Yes
3.4 Analysis of known items	(1) Occurrences of Malfunction at Bleed Air System It is probable that the Bleed Air temperature rose because the cooling air flow taken out of the engine fan at the left side of Bleed Air System while flying at FL370.was insufficient because of the malfunction due to the deterioration of the pre-cooler control valve, the bleed air could not be sufficiently cooled. It is highly probable that the temperature of the bleed air was rising to exceed 450 °F, but due to the 450 °F thermostat failure, the PRSOV could not control the temperature. It is highly probable that 490 °F switch closed PRSOV, stopped the supply of the bleed air and illuminated the light of the left-side BLEED TRIP OFF which indicates the anomaly of the left side bleed air because the temperature of the bleed air was rising to exceed 490 °F. It is probable that the load to the right-side bleed air increased because the left-side bleed air supply was stopped. Then it is highly probable that as same as the malfunction of the left-side bleed air system, the malfunction due to the deterioration of the pre-cooler control valve and 450 °F thermostat failure, because the temperature of bleed air was rising to exceed 490 °F, the 490 °F switch closed PRSOV and stopped the supply of the right-side bleed air.

	(2) 450°F thermostat failure When the cooling air cools the Bleed Air sufficiently at Pre-cooler, 450 °F Thermostat would not be activated, therefore, even if a failure exists, the failure could not be found. It is probable that the malfunction of 450 °F Thermostat was existed prior to the occurrence of this incident, based on the contents of the Service Bulletin by Parts Manufacturer and use results. (3) Prevention of similar incident Failures of 450 °F Thermostat could not be found during a normal flight or at a maintenance work, therefore it is desirable for operators to improve based on the Service Bulletins from Parts Manufacturer as soon as possible.

4. PROBABLE CAUSES

It is highly probable that the serious incident occurred because the supply from the both Bleed Air systems were stopped, abnormal decompression was occurred in the cabin.

As for the stoppage of the both Bleed Air supply, it is highly probable that PRSOV was closed because the Bleed Air temperature was rising and exceeding the specified values in a state of occurrence of failures due to the cracks in the both systems of 450 °F Thermostat, and malfunctions were generated due to deteriorations at the both systems of Pre-cooler Control Valve.

5. SAFETY ACTION

The company implemented the repairs according to the Service Bulletin regarding 450 °F Thermostat and soundness confirmation of Pre-cooler control valve on the type of aircraft operated by the company. Furthermore, the company decided to implement the soundness confirmation of Pre-cooler Control Valve at every periodic inspection (C check) repeatedly, replace 450 °F Thermostat at every 16,000 flight hours and inspect it.