Aviation Investigation Preliminary Report

Location:	Kenner, LA	**Incident Number:**	DCA24LA330
Date & Time:	December 20, 2023, 14:14 Local	**Registration:**	N8830Q
Aircraft:	Boeing 737-8	**Injuries:**	
Flight Conducted Under:	Part 121: Air carrier - Scheduled		

On December 20, 2023, about 1414 central standard time, Southwest Airlines flight 554, a Boeing 737-8 airplane, N8830Q, was departing from the Louis Armstrong New Orleans International Airport (MSY), Kenner, Louisiana, and a bird ingestion occurred in the left engine during the initial climb out. The airplane returned to the airport. None of the 139 occupants aboard the airplane were injured, and the airplane sustained minor damage. The regularly scheduled passenger flight was operating under the provisions of Title 14 *Code of Federal Regulations* (*CFR*) Part 121 from MSY to Tampa International Airport (TPA), Tampa, Florida.

According to the National Transportation Safety Board's current regulations, (Title 49 *CFR* 830.5, Immediate Notification), which were in effect at the time of the incident, the operator was not required to report the incident to the NTSB. The Federal Aviation Administration (FAA) notified the NTSB in November 2024 about its ongoing investigation of this incident, and, in learning of the similarities to a previous event, the NTSB began an incident investigation.

As part of the investigative process, the NTSB invited the following parties to participate in the investigation: the FAA, The Boeing Company, CFM International, Southwest Airlines, and the Southwest Airlines Pilots Association. Investigative groups led by the NTSB were formed in the areas of operational factors, powerplants, systems, medical, and digital flight data recorder (DFDR).

History of Flight

The captain was the pilot flying for the incident flight, and the first officer (FO) was the pilot monitoring. The flight crew reported that, after an uneventful takeoff and while climbing through about 1,000 ft, the FO heard the captain say "bird," which was followed immediately by a "thump" on the left side of the airplane. The airplane began to "shake violently with a distinct loss of thrust" in the left (No. 1) engine. The left engine master caution fire warning light and the engine fire switch illuminated, and the fire bell sounded.

The captain called for Engine Fire or Engine Severe Damage checklist on the Quick Reference Card. After the FO started the checklist, the flight deck began to fill with “acrid white smoke.” The FO stated that he could not clearly see the captain. The FO called out “masks,” the pilots donned their masks, and performance of the checklist resumed.

The flight crew declared an emergency to air traffic control and asked airport rescue and firefighting (ARFF) to roll the trucks in preparation for the airplane’s return to MSY. The captain stated that visibility in the cockpit was restricted and that he could see nothing beyond the FO, who was holding the Quick Reference Handbook. The captain also stated that his instrument panel was difficult to see and that he thought he might need to fly the airplane by solely using the heads-up guidance system. The captain further stated that, after the engine fire switch had been pulled, the smoke began to rapidly dissipate.

The flight crew notified the flight attendants about the emergency and made a public address announcement to notify the passengers that fire trucks would be meeting the airplane. After landing at the airport, the airplane came to a full stop on the arrival runway, and ARFF inspected the airplane before the flight crew taxied the airplane to the assigned gate under its own power. The passengers deplaned normally, and no injuries were reported.

Flight Data Recorder Data

Data from the airplane’s DFDR was sent to the NTSB’s Vehicle Recorder Laboratory in Washington, DC, for analysis. A preliminary review of the data has been completed, and a graph with the incident flight parameters is shown in figure 1.

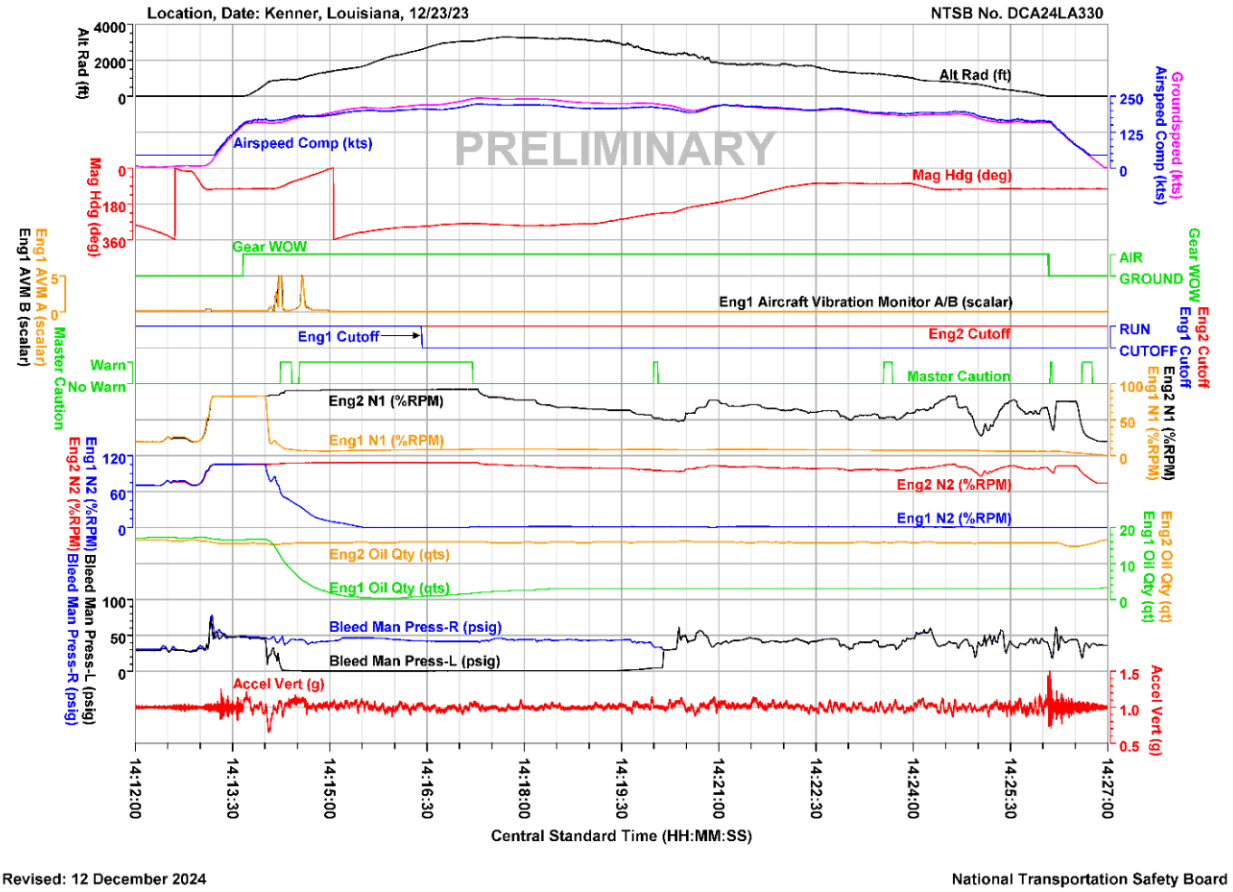

Figure 1. FDR data from the accident landing.

The data showed that, after takeoff, while the airplane was climbing through about 600 ft, both the left and right engine fan speed (N1) values were about 83 percent rpm. About 2 seconds later, the left engine's N1 decreased to 75 percent rpm. Subsequently, the airborne vibration monitor (AVM) began to increase, and the left engine's oil tank quantity began to decrease from 16.25 quarts. About 15 seconds after the bird ingestion, the left engine's core speed (N2) was below 62 percent rpm which would have de-energized the engine's running relay and subsequently closed the pressure regulating shutoff valve (PRSOV). About 28 seconds later, the left engine's N1 stabilized at 6 percent rpm with an oil tank quantity of 3.5 quarts.

System Description

The airplane was equipped with two CFM International LEAP-1B engines, which incorporate a load reduction device (LRD) designed to minimize aircraft and engine damage during a significant fan imbalance. The design was intended to enable the fan to be mechanically disconnected from the turbomachinery, thus reducing the severity of the vibration that is transmitted into the airframe. LRD devices are a mechanical design feature and do not require any pilot intervention. When the LRD activates due to excessive vibration, engine oil enters the

compressor upstream of the pneumatic bleed ports, which supply bleed air to the cabin and flight deck.

Pressure Regulating Shutoff Valve

Engine bleed air from the high-pressure compressor travels from the engine to the pressure regulating shutoff valve (PRSOV, see figure 2) and then to the left and right air conditioning packs. When closed, the PRSOV prevents bleed air from the affected engine from entering the airplane. The valve closes automatically if the engine running relay is de-energized (the affected engine spools down below 62% minimum N2), the engine start switch is moved to cutoff, or the engine fire switch is pulled.

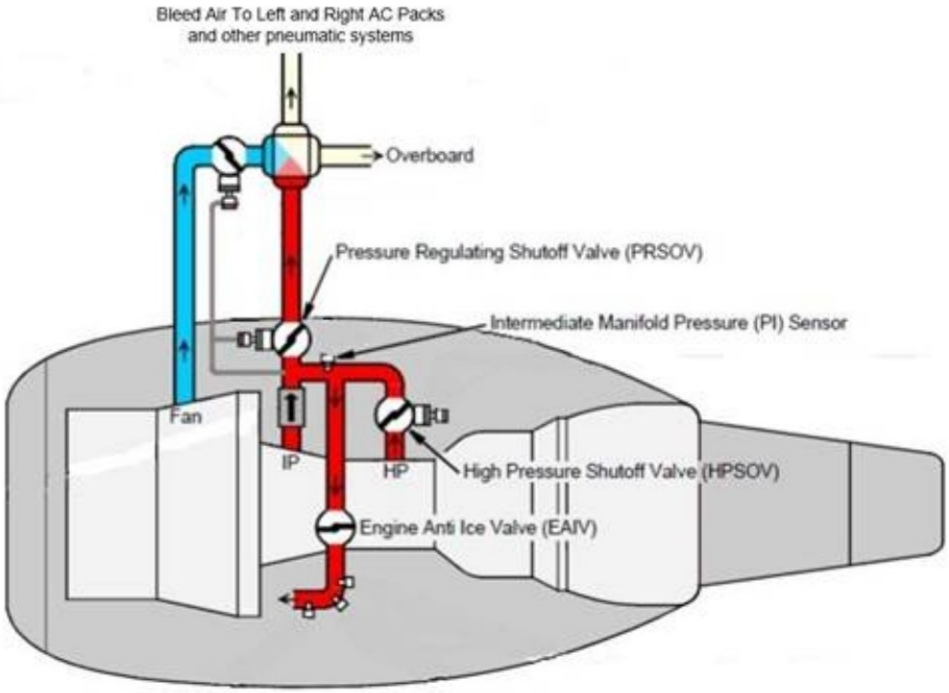

Figure 2. Simplified engine bleed air diagram with PRSOV depicted. (Copyright © Boeing. Reprinted with permission of Boeing.)

Conditioned air from the left air conditioning pack (supplied by left engine) is normally distributed to the flight deck. Conditioned air from the right air conditioning pack (supplied by right engine) and excess air from the left air conditioning pack, and recirculated air are combined in the mixing manifold and is normally distributed to the cabin (see figure 3).

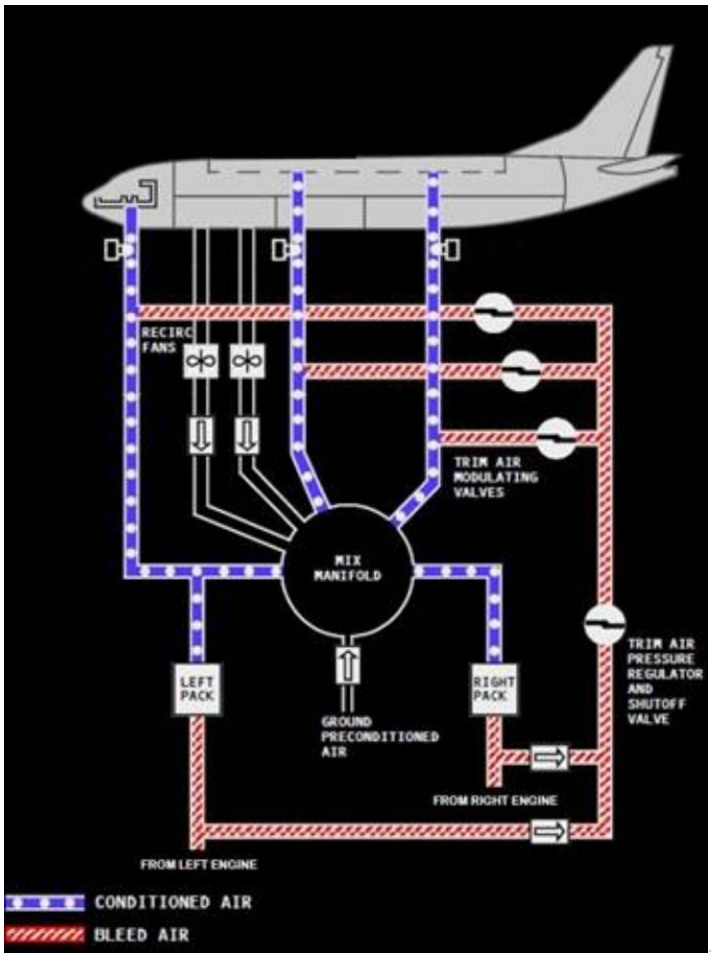

Figure 3. The air conditioning graphic referenced is a simplified system description. (Copyright © Boeing. Reprinted with permission of Boeing.)

Note: The figure does not show the location of the pack flow control valves, which are upstream of the trim air supply.

Previous Related Event

On March 5, 2023, Southwest Airlines flight 3923 struck birds shortly after departure from Havana, Cuba. The birds struck the airplane nose and the right engine, and vapor fog entered the passenger cabin. After making an emergency landing at the airport, the airplane was evacuated; one passenger sustained a minor injury. The Instituto de Aeronautica Civil de Cuba is investigating this serious incident, and the NTSB is participating in the investigation and has assigned an Accredited Representative as the State of manufacturer, design, operator and registry.

Safety Actions

After the MSY event, Boeing released a *Flight Crew Operations Manual* Bulletin and made updates to the systems description in the *Flight Crew Operations Manual (FCOM), and the Quick*

Reference Handbook. CFM International, in collaboration with Boeing, has begun work on a software design update. In addition, Southwest Airlines notified their pilots of the MSY and Havana events and incorporated Boeing's updates.

The investigation continues.

Aircraft and Owner/Operator Information

Aircraft Make:	Boeing	**Registration:**	N8830Q
Model/Series:	737-8	**Aircraft Category:**	Airplane
Amateur Built:			
Operator:	SOUTHWEST AIRLINES CO	**Operating Certificate(s) Held:**	Flag carrier (121)
Operator Designator Code:			

Meteorological Information and Flight Plan

Conditions at Accident Site:	VMC	**Condition of Light:**	Day
Observation Facility, Elevation:	KMSY,0 ft msl	**Observation Time:**	14:31 Local
Distance from Accident Site:	1 Nautical Miles	**Temperature/Dew Point:**	16°C /9°C
Lowest Cloud Condition:	Few / 3000 ft AGL	**Wind Speed/Gusts, Direction:**	10 knots / None, 50°
Lowest Ceiling:		**Visibility:**	10 miles
Altimeter Setting:	30.32 inches Hg	**Type of Flight Plan Filed:**	IFR
Departure Point:	Kenner, LA	**Destination:**	Tampa , FL (KTPA)

Wreckage and Impact Information

Crew Injuries:	N/A	**Aircraft Damage:**	Minor
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	N/A	**Latitude, Longitude:**	29.997399,-90.261693

Administrative Information

Investigator In Charge (IIC):	Banning, David
Additional Participating Persons:	Heidi Kemner; FAA; Washington , DC Erin Carroll; Southwest Airlines; Dallas, TX Eric East ; Boeing ; WA Craig Jakubowski; SWAPA Alvaro Hernandez; CFM International
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this incident.