AA2022-1

AIRCRAFT ACCIDENT
INVESTIGATION REPORT

SKYMARK AIRLINES INC.
J A 7 3 N M

March 24, 2022

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 determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

TAKEDA Nobuo
Chairperson
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.

《Reference》

The terms used to describe the results of the analysis in "3. ANALYSIS" of this report are as follows.

i) In case of being able to determine, the term "certain" or "certainly" is used.
ii) In case of being unable to determine but being almost certain, the term "highly probable" or "most likely" is used.
iii) In case of higher possibility, the term "probable" or "more likely" is used.
iv) In a case that there is a possibility, the term "likely" or "possible" is used.

AIRCRAFT ACCIDENT INVESTIGATION REPORT

DAMAGE TO AIRFRAME FROM BIRD STRIKE

SKYMARK AIRLINES INC.

BOEING 737-800, REGISTERED JA73NM

AT ALTITUDE OF 8,500 FT OVER APPROX. 17 KM EAST-NORTHEAST

OF TOKYO INTERNATIONAL AIRPORT, TOKYO

AT 17:34:16, AUGUST 29, 2020

February 4, 2022
Adopted by the Japan Transport Safety Board
Chairperson TAKEDA Nobuo
Member MIYASHITA Toru
Member KAKISHIMA Yoshiko
Member MARUI Yuichi
Member NAKANISHI Miwa
Member TSUDA Hiroka

1. PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Accident	A Boeing 737-800, registered JA73NM and operated by Skymark Airlines Inc., with 76 persons on board, consisting of the captain, 5 crew members, and 70 passengers, took off at Tokyo International Airport to Fukuoka Airport as its scheduled flight 21 at 17:30 JST (JST: UTC+9 hours, unless otherwise noted, all times are indicated in JST in this report on a 24-hour clock) on August 29, 2020, and sustained damage to the airframe from bird strike in climbing.
1.2 Outline of the Accident Investigation	Upon receipt of the notification of occurrence of the accident, the Japan Transport Safety Board designated an investigator-in-charge and two other investigators to investigate the accident on August 30, 2020. An accredited representative of the United States of America as the State of Design and Manufacture of the aircraft involved in the accident participated in the investigation. Comments were invited from the parties relevant to the cause of the accident and from the relevant state.

2. FACTUAL INFORMATION

2.1 History of the Flight

According to the statements of the captain and first officer (FO), flight data recorder (hereinafter referred to as "the FDR"), and cockpit voice recorder (hereinafter referred to as "the CVR"), the history of the flight is summarized as follows:

A Boeing 737-800, registered JA73NM and operated by Skymark Airlines Inc., took off from runway 16R at Tokyo International Airport to Fukuoka Airport as its scheduled flight 21 at 17:30 on August 29, 2020. The captain sat in the left seat as PM*1 and the FO sat in the right seat as PF*1.

The aircraft was uneventful after leaving the apron until the accident and was climbing toward cruising altitude of FL*2400 following the instructions from the air traffic controller after take-off by the assigned Standard Instrument Departure. As a sound of an impact generated at the left lower part of the captain seat at 17:34:16 followed by abnormal smell in the cockpit, which was like when plastics were burned, when the aircraft was climbing at an altitude of 8,500 ft at the speed of 240 kt in the vicinity of PLUTO, flight crew checked the system with instruments to confirm that there was nothing abnormal in every respect including both engines and pressurization, etc.

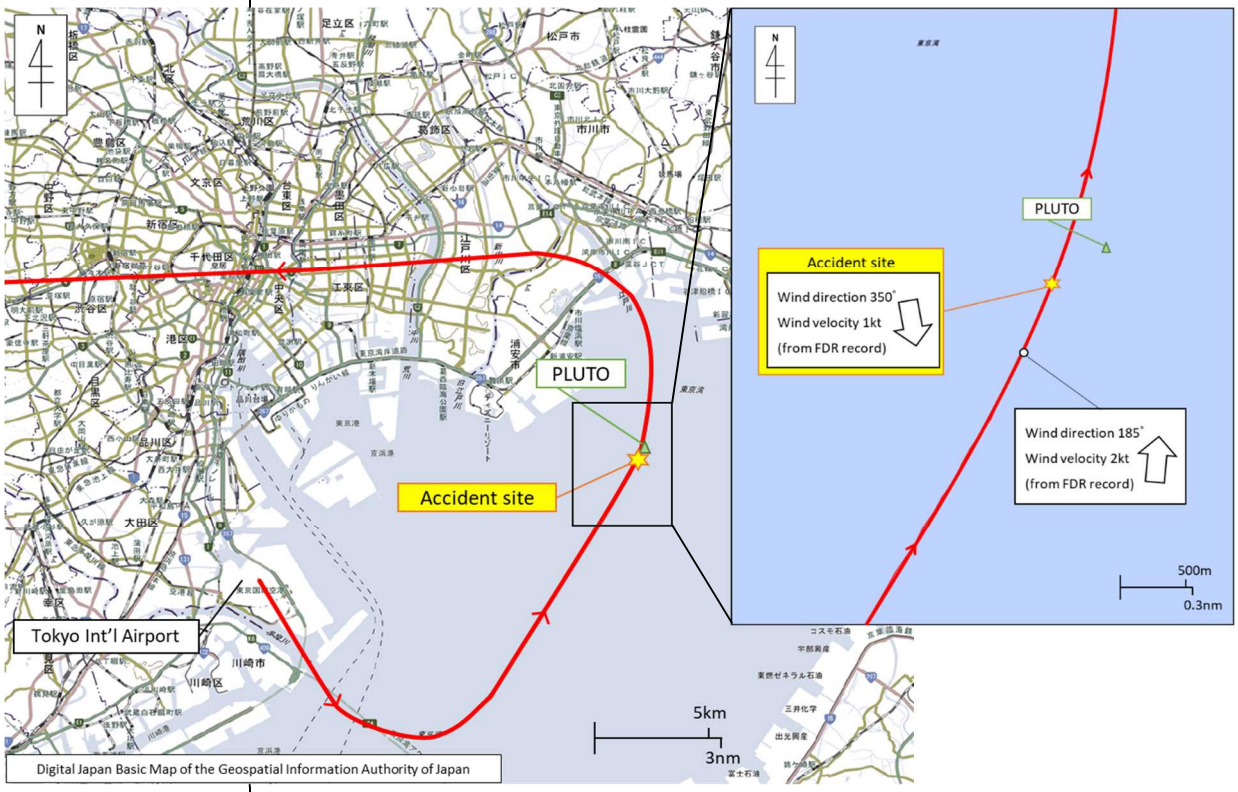


Figure 1 Estimated flight route map

*1 "PF" and "PM" are terms used to identify pilots with their different roles in aircraft operated by two persons. The PF abbreviates Pilot Flying and is mainly responsible for maneuvering the aircraft. The PM abbreviates Pilot Monitoring and mainly monitors the flight status of the aircraft, cross checks operations of the PF, and undertakes other non-operational duties.

*2 "FL" means a pressure altitude in the standard atmosphere and is expressed in the value obtained by dividing the reading on the altimeter (unit: ft) by 100 when the altimeter is set to 29.92 inHg. Flight altitude over 14,000 ft is generally expressed in FL in Japan. For instance, FL400 stands for an altitude of 40,000 ft.

	Since the aircraft was climbing following vectoring from the air traffic controller when the impact sound generated, which imposed a high workload situation on flight crew, the captain and FO discussed about a probable cause of the impact sound and abnormal smell after having been transferred to Tokyo Area Control Center (hereinafter referred to as "the Tokyo ACC") at 17:36. The abnormal smell generated was transitory and on the level of being slightly felt at that time. The captain reported the situations to the company with the company radio, asked postflight inspection of the airframe after arrival, and discussed with the FO several times reaching the conclusion that the cause of the impact sound and abnormal smell was "probably a bird strike." Flight crew judged that there existed nothing to hinder the flight and continued the flight at flying altitude of FL340 in cruising and flying speed set at a turbulent air penetration speed. Flight crew did not notify the probable bird strike to the Tokyo ACC. The aircraft continued an uneventful flight thereafter and landed at Fukuoka Airport at 18:47. Airframe examination by mechanics of the company after landing revealed that the left outer skin of the nose was adhered by something like a bloodstain and the surrounding outer skin was damaged. The company notified the bird strike event to the Civil Aviation Bureau. The accident occurred at an altitude of 8,500 ft (approximately 2,590 m) over approximately 17 km east-northeast of Tokyo International Airport (35'36"23 N, 139'57"20 E) at 17:34:16 on August 29, 2020.
2.2 Injuries to Persons	None

2.3 Damage to the Aircraft	Extent of damage to the aircraft: Substantially damaged Left outer skin of the nose: Dent with 16.5 cm long, 16.5 cm wide, and 0.95 cm deep Dent with 10.2 cm long, 6.35 cm wide, and 0.16 cm deep Inner frame and stiffener: Flections were recognized As a result of the visual inspection inside the engines, damage or a residue of the bird so seemed was not found.

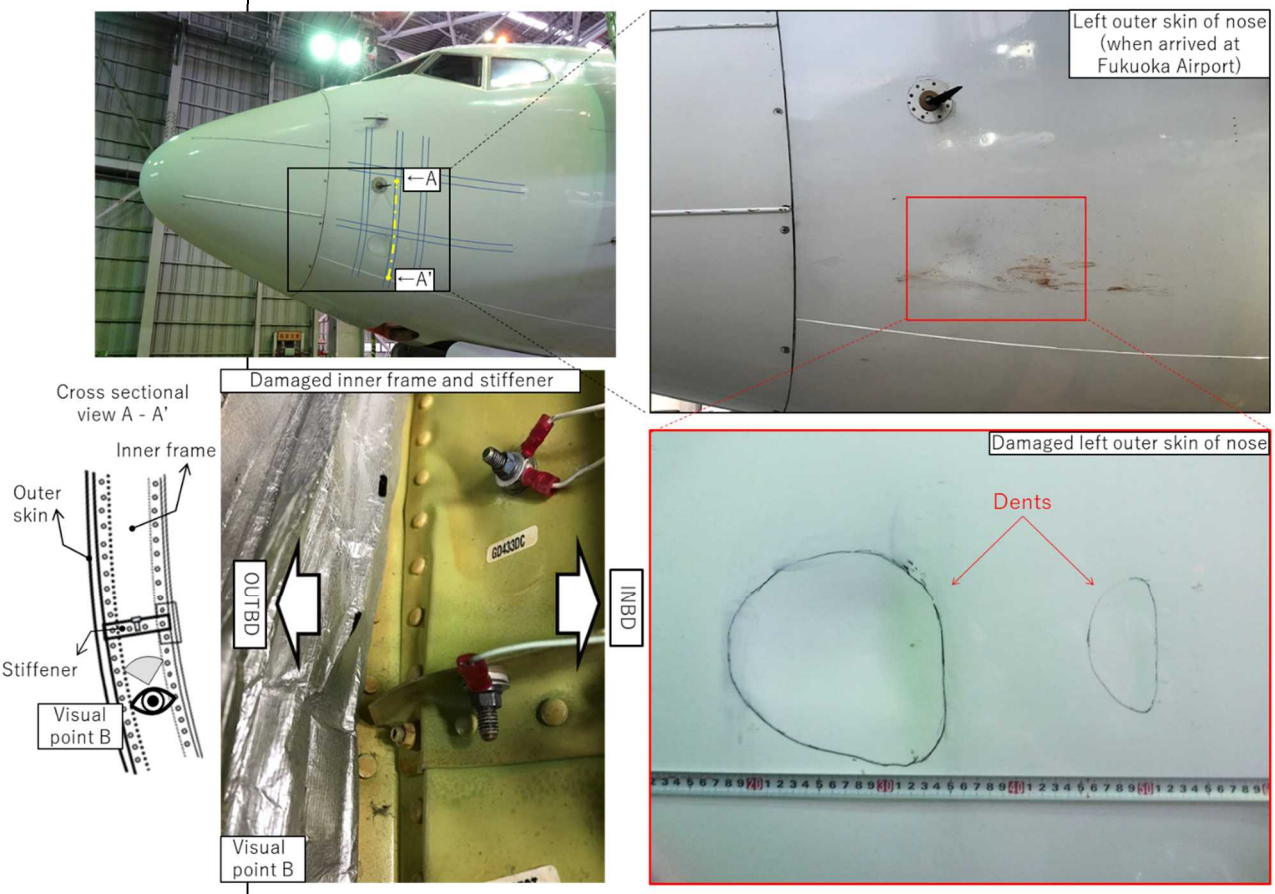
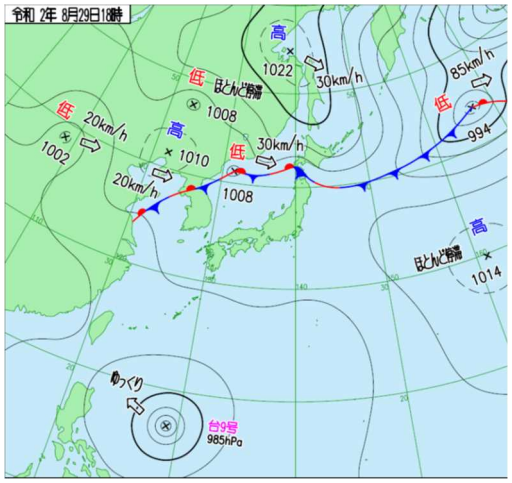


Figure 2　Conditions of damaged airframe

2.4 Personnel Information	(1) Captain: Age 50	
	Airline transport pilot certificate (airplane)	June 8, 2012
	Type rating for Boeing 737	June 8, 2012
	Class 1 aviation medical certificate	
	Validity	June 18, 2021
	Total flight time	15,013 hours 55 minutes
	Flight time on the type of the aircraft	6,314 hours 10 minutes
	(2) First Officer: Age 28	
	Commercial pilot certificate (airplane)	February 16, 2018
	Type rating for Boeing 737	March 28, 2019
	Instrument flight certificate (airplane)	June 19, 2018
	Class 1 aviation medical certificate	
	Validity	March 11, 2021
	Total flight time	1,179 hours 23 minutes

	Flight time on the type of the aircraft 842 hours 12 minutes
2.5 Aircraft Information	(1) Aircraft type Boeing 737-800 Serial number 39421 Date of manufacture February 15, 2012 Certificate of airworthiness TO-2019-528 Validity: During the period from February 28, 2020, until the aircraft is maintained in accordance with the maintenance manual (Skymark Airlines Inc.) (2) The aircraft was installed with the FDR and the CVR. The FDR did not contain a record pertaining to changes in acceleration speed, attitudes and the situation of engine operation that are supposed to have related to the accident. The CVR recorded the impact sound at 17:34:16 and did not record voice of the captain and FO that indicated their visual recognition of the bird.
2.6 Meteorological Information	Meteorological data at the time of the accident occurrence (1) General aviation weather conditions and forecast Commentaries on regional aviation weather conditions for the Kanto and Chubu areas in the main island of Japan issued by the Tokyo Aviation Weather Service Center at 18:30 on the day of the accident were as follows: As of 18 o'clock, high pressure centered in the east far away from Japan was almost stationary. Radar echo mainly along the mountains was observed and thunder was detected. The vicinity of the Honshu (the main island of Japan) was covered by high pressure over a period of August 30. Warm and humid air in the lower layer entered eastern Japan causing unstable atmospheric conditions mainly in the afternoon added by influence of daytime temperature rise. Be vigilant against development of convection clouds and thunderstorm mainly along the mountains.  Figure 3 Spot weather chart (at 18 o'clock on August 29, 2020) (2) Aviation Routine Weather Report (METAR) for Tokyo International Airport 17:30 Wind direction 200°; Wind velocity 13 kt; Prevailing visibility 10 km or more Cloud amount 1/8 (cumulus); Cloud base 2,500 ft; Temperature 32° C; Dew point 24° C; QNH 29.80 inHg (3) Data recorded in the FDR Minus 4 seconds of the accident occurrence: Wind direction 185°; Wind velocity 2 kt At the time of the accident occurrence: Wind direction 350°; Wind velocity 1 kt

2.7 Additional Information	(1) Information on the bird collided At the time of arrival at Fukuoka Airport, something, which was seemingly a bloodstain, was adhered to the damaged portion of the outer skin of the aircraft and the species of the bird collided could not be identified since the substance adhered was discarded after having been wiped out to verify the conditions of the damage to the airframe. Request for analysis of an approximate size of the bird collided from the flight record data of the aircraft, data of size and deformation amount of the damaged portion of the fuselage, and design data of the type of the aircraft was made to the accident investigation authority of the United States of America (NTSB) as the State of Design and Manufacturing of the type of the aircraft. The result of the numerical simulations the NTSB performed under the condition that objects that simulated the bird weighing 2 lb (0.9 kg), 4 lb (1.8 kg) and 8 lb (3.6 kg) were struck against an airframe structure at the speed of 242 kt from an altitude of 8,600 ft suggested that the weight of the bird collided was possibly between 4 lb and 8 lb (1.8 kg and 3.6 kg). (2) Bird strike precautionary measures at the Civil Aviation Bureau of the Ministry of Land, Infrastructure, Transport and Tourism For the purpose of preventing collisions between an aircraft and bird, the Civil Aviation Bureau of the Ministry of Land, Infrastructure, Transport and Tourism established the Committee for Exploring Measures against Bird Strikes consisting of ornithologists and flight operators in January 2002 and has periodically invited opinions and advice widely from various fields, analyzed the situations of bird strike occurrences, shared bird strike precautionary measures being taken at respective airports in Japan, and explored measures to mitigate bird strikes in the future. In the seventh meeting held in February 2009, a policy was decided to identify species of birds collided, and to develop precautionary methods and establish precautionary plan according to the ecology of the birds. It was decided that an organization engaged in airport management forwards a residue, which was collected in runway inspection or from an arriving aircraft based on a bird strike notification from a flight operator, to an examination organ to identify species of birds by DNA profiling, etc. As handling of a residue requires appropriate measures to prevent from an infectious disease, etc. and properly conduct judgment of specimens, the organization engaged in airport management has been collecting specimens. Besides, to take effectual precautionary measures against bird strikes mainly at airports and their surroundings, captains of all aircraft and flight operators have been required to notify bird strike occurrences since August 1, 2020, for building up data base. (3) Pressurizing control of the aircraft Airplane Operating Manual stipulated by the company contain following descriptions. Cabin pressure controller maintains a lowest possible cabin altitude (highest differential pressure) in cruising based on the differential pressure

	restrictions shown in the table below: Selected FLT ALT / Differential Pressure Limit At or below 28,000 ft / 7.45 psid 28,000 ft to 37,000 ft / 7.80 psid Above 37,000 ft / 8.35 psid

3. ANALYSIS

3.1 Involvement of Weather	None
3.2 Involvement of Pilot	None
3.3 Involvement of Aircraft	None
3.4 Analysis of Findings	(1) Collision with the bird From the impact sound in the left lower part of the captain seat at an altitude of 8,500 ft over approximately 17 km east-northeast of Tokyo International Airport while the aircraft was in takeoff-climb from the airport, the substance that was seemingly a bloodstain adhered to the left side of the nose of the aircraft and dents in the surrounding outer skin found in postflight inspection of the airframe, the JTSB concludes that it is highly probable that the airframe was damaged by the collision with the bird at the relevant portion at this moment. The abnormal smell transitorily felt after the impact sound is probable to have been a stink, which generated when fragments of the bird were sucked into the compression of the left engine and heated, penetrated the aircraft. The captain and FO are highly probable to have been unable to maneuver for avoidance since they were not aware of approach of the bird. Besides, the altitude of 8,500 ft is high as birds fly at and birds climb higher than normal in some cases depending on species of birds and weather conditions. (2) Response by flight crew The JTSB concludes that it is probable that flight crew decided to continue the flight based on their judgement that there probably occurred a bird strike and it did not hinder the flight after having confirmed that abnormal indication of instruments and vibration of the aircraft did not occur after occurrence of the impact sound and abnormal smell. Considering possible damage to the airframe at that time, the cruising altitude is probable to have been lowered than originally planned and flight speed set at the speed for passing through turbulence so that transition to the safety altitude could promptly be made in case of emergency and the load to the airframe structure in cruising mitigated. By lowering the cruising altitude, the time for the aircraft to descend to the safety altitude (10,000 ft) in case of emergency was shortened by 46 seconds from approximately 3 minutes 48 seconds to approximately 3 minutes 2 seconds, given the maximum descent rate feasible to be set in onboard

	instruments (minus 7,900 fpm), and the differential pressure the aircraft received reduced by 0.55 psid from 8.35 psid to 7.80 psid. (3) The species of the bird collided From the result of the numeric simulation performed by the NTSB, the JTSB concludes that it is possible that the bird weighing between 1.8 kg and 3.6 kg collided. On the other hand, all residues adhered to the airframe were wiped out and discarded to verify the conditions of the damage after the mechanics of the company had confirmed the traces of the bird strike in examining the airframe after arrival at Fukuoka Airport. Due to this, the species of the bird could not be identified. It is possible that the supposed species of the bird was a hawk family or heron family from the possible weight between 1.8 kg and 3.6 kg and the accident site.

4. PROBABLE CAUSES

In this accident, the JTSB concludes that it is highly probable that the aircraft collided with the bird in take-off climb from Tokyo International Airport and sustained damage to the airframe at an altitude of 8,500 ft over approximately 17 km east-northeast of the airport.