AIRCRAFT SERIOUS INCIDENT

FINAL REPORT

SI 04/23

Air Accident Investigation Bureau (AAIB)

Ministry of Transport Malaysia

Incident Involving Fixed Wing Aircraft

TBM 700A, Registration N188SJ

at Kota Bharu Airport, Kelantan

on the 4th August 2023

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FINAL REPORT SI 04/23

AIR ACCIDENT INVESTIGATION BUREAU (AAIB)
MALAYSIA

REPORT NO : SI 04/23

OPERATOR	**: DXN HOLDINGS BHD**
AIRCRAFT TYPE	**: SOCATA TBM 700A**
NATIONALITY	**: UNITED STATES OF AMERICA**
REGISTRATION	**: N188SJ**
PLACE OF OCCURRENCE	**: KOTA BHARU AIRPORT, KELANTAN**
DATE AND TIME	**: 4 AUGUST 2023 AT 12:15 LT 04:15 UTC**

The sole objective of the investigation is the prevention of accidents and incidents. In accordance with Annex 13 to the Convention on International Civil Aviation, it is not the purpose of this investigation to apportion blame or liability.

All times in this report are Local Time (LT) unless stated otherwise. LT is UTC +8 hours.

INTRODUCTION

The Air Accident Investigation Bureau of Malaysia

The Air Accident Investigation Bureau (AAIB) is Malaysia's air accidents and serious incidents investigation authority and is responsible to the Minister of Transport. Its mission is to promote aviation safety by conducting independent and objective investigations into air accidents and serious incidents.

AAIB also conducts investigations into incidents when the occurrence shows evidence of safety issues.

AAIB conducts all accident and serious incident investigations in accordance with Annex 13 to the Chicago Convention and Civil Aviation Regulations of Malaysia 2016.

It is inappropriate that AAIB reports should be used to assign fault or blame or determine liability since neither the investigation nor the reporting process has been undertaken for that purpose.

In accordance with ICAO Annex 13 paragraph 4.1, notification of the serious incident was sent on 7th August 2023 to the National Transportation Safety Board of the United States of America (USA) (NTSB) as State of Design and State of Manufacturer. A copy of the Preliminary Report was subsequently submitted to the above organisation, the Civil Aviation Authority of Malaysia (CAAM), and the Aircraft Operator on 4th September 2023.

Unless otherwise indicated, recommendations in this report are addressed to the investigating or regulatory authorities of the State having responsibility for the matters with which the recommendations are concerned. It is for those authorities to decide what action is taken

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GLOSSARY OF ABBREVIATIONS

A

AAIB	Air Accident Investigation Bureau
ADARP	Aerodrome Disabled Aircraft Removal Plan
AFRS	Airport Fire and Rescue Services
AGL	Above Ground Level
ARC	Abnormal Runway Contact
ATC	Air Traffic Control/Controller

C

CAAM	Civil Aviation Authority Malaysia
CPL	Commercial Pilot Licence
CVR	Cockpit Voice Recorder
C of A	Certificate of Airworthiness
C of R	Certificate of Registration

F

FAA	Federal Aviation Administration, United States
FDR	Flight Data Recorder

I

ICAO	International Civil Aviation Organisation

L

LT	Local Time

M

MAHB	Malaysia Airports Holdings Berhad
MOR	Mandatory Occurrence Report

N

NTSB	National Transportation Safety Board, United States

O

OEM	Original Equipment Manufacturer

P

PIC	Pilot-in-Command
PIO	Pilot Induced Oscillation

S

SI	Serious Incident
SIC	Pilot Second-in-Command
SOP	Standard Operating Procedures

T

TWY	Taxiway

U

UTC	Coordinated Universal Time

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SYNOPSIS

On 4th August 2023 at 1155 LT (0355 UTC), a TBM 700A aircraft, registration number N188SJ, departed from Kota Bharu Airport (WMKC) for a flight test of the aircraft's transponder. However, the aircraft was not detected by Air Traffic Control (ATC) radar. Consequently, the aircraft was not permitted to return to Sultan Abdul Aziz Shah Airport, Subang (WMSA), and the pilot-in-command (PIC) decided to return to Kota Bharu Airport.

Upon landing, the aircraft's nose began to bounce up and down as soon as the landing gear touched the runway. This bouncing caused the aircraft's propeller to strike the runway surface. The aircraft came to a stop on the runway approximately 70 metres from intersection C. After shutting down the engine, the aircrew inspected the aircraft and discovered that the nose landing gear tire had burst. Additionally, all the propeller tips were bent and chipped. This incident occurred at approximately 1215 LT (0415 UTC).

The Aircraft Operator submitted a Mandatory Occurrence Report (MOR) to the Civil Aviation Authority of Malaysia (CAAM) and the Air Accident Investigation Bureau of Malaysia (AAIB) to notify them of the incident.

1.0 FACTUAL INFORMATION

1.1 History of Flight

On 4th August 2023, at 0940 LT (0140 UTC), a TBM 700A aircraft, with the registration number N188SJ, departed from Subang Airport for Kota Bharu Airport. During the descent into Kota Bharu, the pilot was informed by Kota Bharu Radar control that the aircraft's transponder was intermittently visible on the ATC radar screen. After safely landing in Kota Bharu at 1043 LT (0243 UTC), Air Traffic Control (ATC) asked the pilot to identify the problem with the aircraft's transponder before being allowed to take off again for Subang Airport. After offloading the passenger, the aircraft took off again around 1155 LT (0355 UTC) for a flight test. However, the aircraft was still not detected on the ATC radar screen. Consequently, the aircraft was not permitted to fly back to Subang, so the pilot-in-command (PIC) decided to return to Kota Bharu.

After receiving permission to return to Kota Bharu, the PIC made a right turn to enter the right base position, then another right turn to enter the final approach position, and configured the aircraft for landing. As soon as the landing gear touched the runway surface, the aircraft's nose started bouncing up and down. As a result of the bouncing, the aircraft’s propeller struck the runway surface. The aircraft stopped on the runway approximately 70 meters from intersection C. After shutting down the engine, the aircrew disembarked to inspect the situation and found that the nose landing gear tire had burst. All the propeller tips were bent and chipped. They contacted the ATC to request assistance in towing the aircraft off the runway. This incident occurred around 1215 LT (0415 UTC).

The aircraft was cleared from the runway and towed to the GA02 apron near the Weststar Aviation Services Sdn Bhd hangar by 1350 LT. It was impounded for investigation by the Air Accident Investigation Bureau (AAIB). After completing a runway inspection at 1415 LT, the runway resumed normal operations.

1.2 Injuries to Persons

There was no reported injury to the crew.

Injuries	Crew	Passengers	Others	Total
Fatal	NIL	NIL	NIL	NIL
Serious	NIL	NIL	NIL	NIL
Minor/None	2	Nil	Nil	2

Table 1: Injuries to persons

1.3 Damage to Aircraft

1.3.1 Post-Accident Damage Assessment Report

All four propeller blade tips were chipped. The nose landing gear tire had burst, and the rim was damaged. A damage assessment report was not made available to the investigation team.

Figure 1: All four propeller blades were chipped off

Figure 2: Damage to the propeller blade

Figure 3: Damage to the tyre and rim

1.4 Other Damage

There no reported damage to aerodrome facilities or other properties.

1.5 Personnel Information

1.5.1 Pilot-in-Command (PIC)

Nationality		Malaysian
Age		32
Gender		Male
License Type		FAA Commercial Pilot License
License Expiry		21/3/2024
Medical Expiry		21/3/2024
Aircraft Rating		CE 650, LR60, HS-125, G-V, TBM 700
Instructor Rating		Nil
Flying Hours	Total Hours	600 hours
	Total on Type	50 hours

Table 2: Personnel Information – PIC

1.5.2 Pilot Second-in-Command (SIC)

Nationality		Malaysian
Age		54
Gender		Male
License Type		FAA Commercial Pilot License
License Expiry		27/6/2024
Medical Expiry		3/2024
Aircraft Rating		PC-7, C172, C152, GRUMAN AA-5A, PA-28, PA-34, CE 550 BRAVO
Instructor Rating		Nil
Flying Hours	Total Hours	3173:37 hours
	Total on Type	Nil hours

Table 3: Personnel Information – Second in Command

1.6 Aircraft Information

1.6.1 General

The SOCATA TBM 700A is a single-engine turboprop light business and utility aircraft manufactured by Daher-Socata. The TBM 700A is a six- to seven-seat, low-wing monoplane constructed mainly of aluminium and steel, with tail surfaces made of Nomex honeycomb. It features retractable tricycle landing gear and is powered by a Pratt & Whitney Canada PT6A-64 engine, delivering 700 hp (522 kW), driving a four-bladed constant-speed Hartzell propeller.

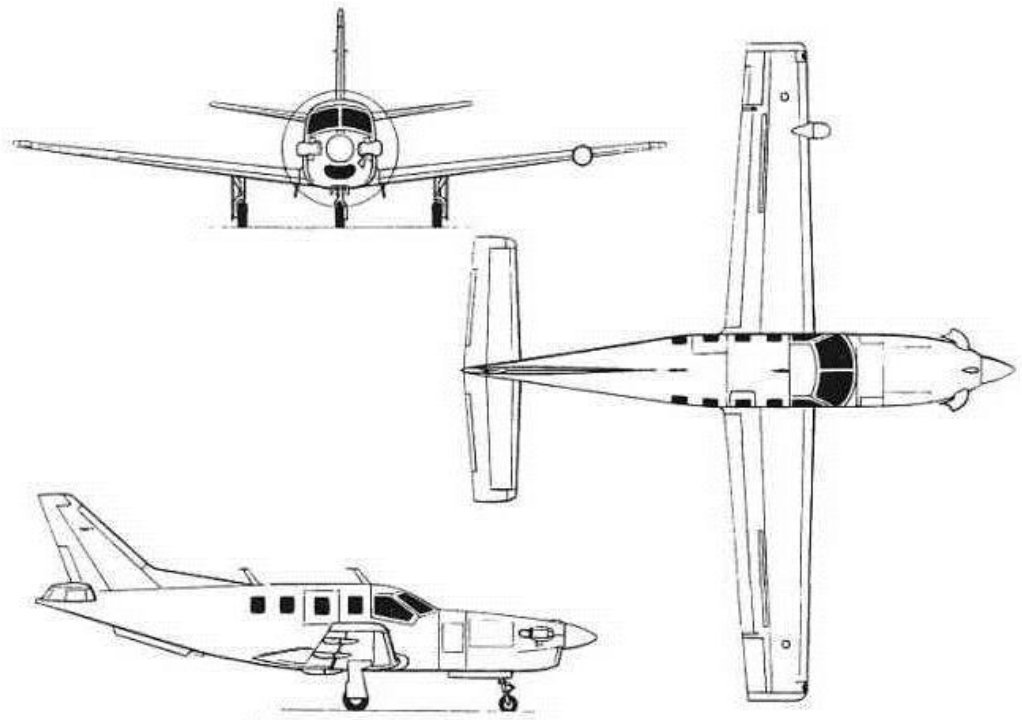

Figure 4: Three views of the aircraft

General characteristics (TBM 700 A):

- Crew: One or two pilots
- Passengers: Standard version: 5
- Length: 10,64 m
- Wingspan: 12,675 m
- Height: 4,36 m
- Empty weight: 1965 kg

- Max. take-off weight: 2987 kg (6579 lb)
- Powerplant: 1 x Pratt & Whitney Canada PT6A-64 turboprop, 515 kW (700 hp)

Engine:

- Manufacturer: Pratt and Whitney Canada
- Type: PT6A-64
- Total flight hours: 1992.6 FH
- Serial number: PCE-111078

Propeller:

- Manufacturer: Hartzell Propellers
- Type: HC-E4N-3 / E9083SK
- Total flight hours: 57.2 Hrs
- Serial number: HH5432
- Installed date: 13 Aug 2021.

1.6.2 Aircraft Data

The aircraft flown that day was in airworthy condition. The pilot did not report abnormalities or malfunctions before and during the flight.

Aircraft Type	TBM 700A
Manufacturer	EADS SOCATA
Year of Manufacture	1993
Owner	DXN HOLDINGS BHD
Registration No.	N188SJ
Aircraft Serial No.	69
Certificate of Airworthiness Issue / Expiry date	17 Sep 2020 / NA
Certificate of Registration Issue / Expiry date	8 May 2019 / 31 May 2025
Total Flight Hours	1992.6
Total Cycles Hours	2194 FC

Table 4: Aircraft Data

1.7 Meteorological Information

The incident happened at 1215 LT. The actual weather was fine, visibility was reported as more than 10 kilometres, and the wind was 040° at 05 knots.

1.8 Aids to Navigation

All navigation aids were operating normally.

1.9 Communications

All the communication operating normally and the ATC controller did not activate the Crash Alarm. The ATC Tower transmitted the crash information to the MAHB Duty Officer via telephone.

1.10 Aerodrome Information

Airfield	Kota Bharu Airport
Runway	10/28
Length	7874ft
Width	148ft
ICAO Designator	WMKC
IATA Designator	KBR
Elevation	16ft

Table 5: Kota Bharu Aerodrome Information

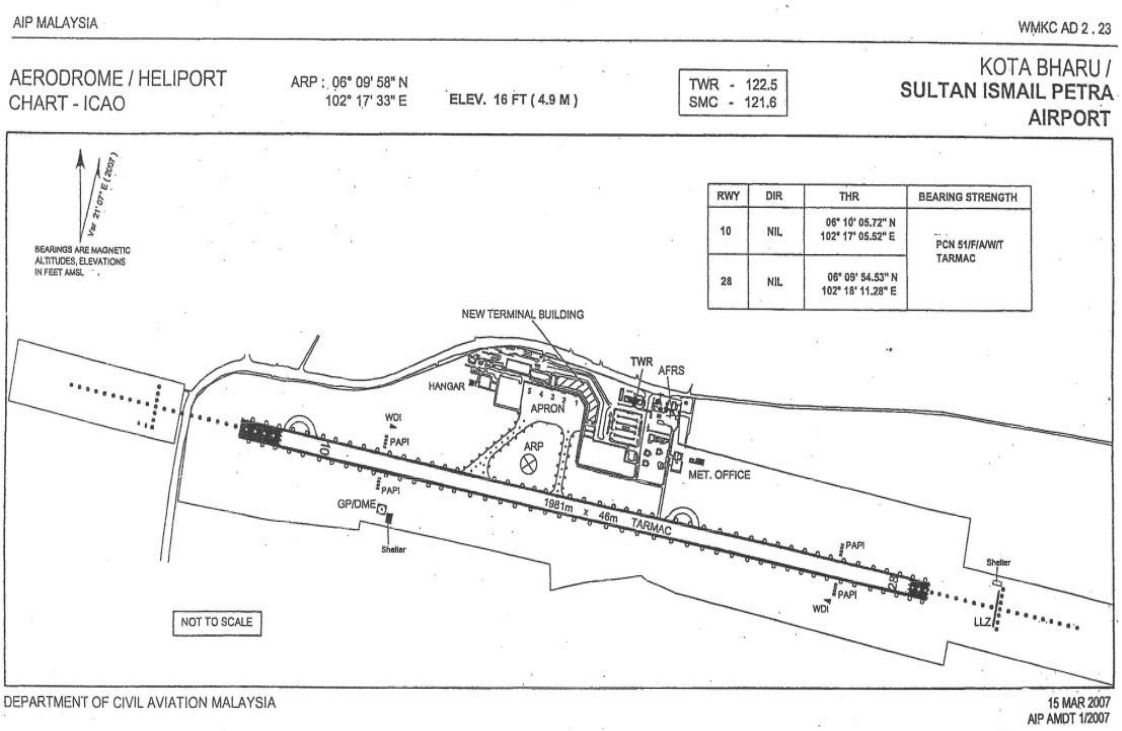

Figure 5: Kota Bharu Airport

1.11 Flight Recorders

The aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR); neither was required by regulations.

1.12 Wreckage and Impact Information

The following figure is an aerial view of the runway, showing the approximate location where the aircraft's landing gear touched down, and the nose of the aircraft began bouncing up and down. As a result of the bouncing, the aircraft's propeller struck the runway surface. The aircraft came to a stop approximately 70 meters from intersection C. After shutting down the engine, the aircrew disembarked to inspect the situation and found that the nose landing gear tire had burst and all the propeller tips were bent and chipped.

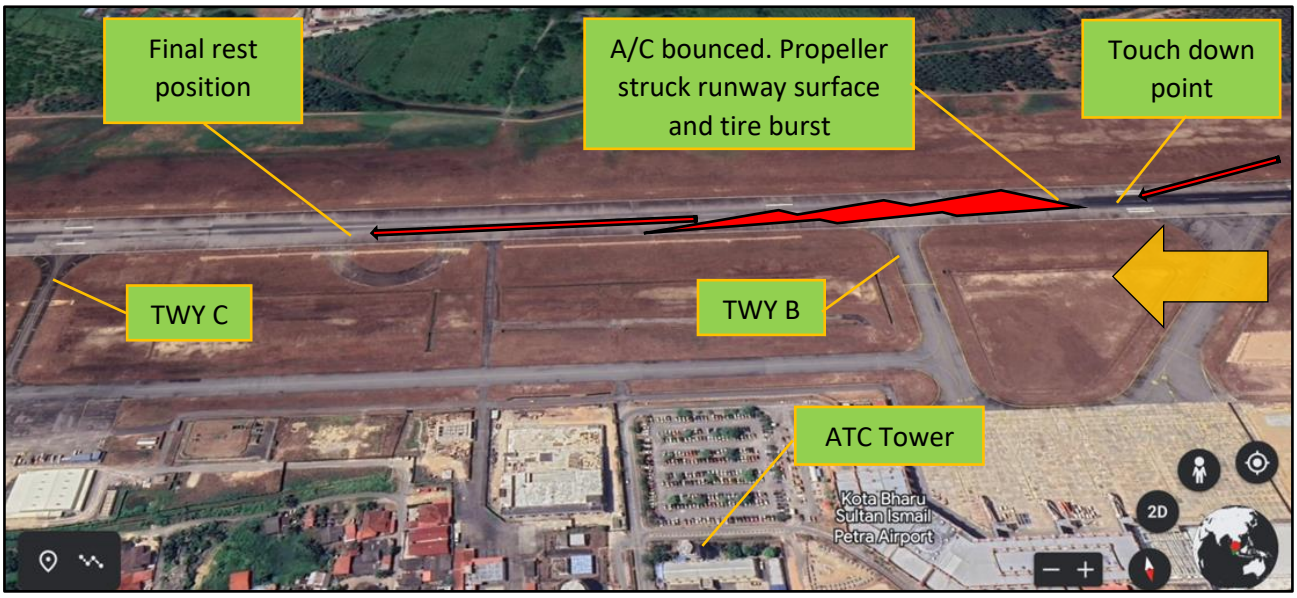

Figure 6: Landing path and final position of aircraft (diagram not to scale)

1.13 Medical and Pathological Information

There were no injuries to the PIC and SIC. No post-accident medical examination was conducted on the PIC and SIC. The pilots were unaware of the CAAM procedure to report the serious incident to the authority through a Mandatory Occurrence Report (MOR). Although the accident occurred on 4th August 2023, the MOR was submitted only on 11th August 2023. This delay in communication resulted in no post-accident medical examination or drug test being conducted.

1.14 Fire

There were no reported pre- and post-impact fires.

1.15 Survival Aspects

Not applicable.

1.16 Tests and Research

1.16.1 Post-Accident Inspection

The post-accident inspection conducted by the investigation team did not reveal any abnormalities in the aircraft's steering and braking systems. The checks confirmed that the aircraft was in an airworthy condition.

1.16.2 Nose Wheel Tire

The tire was sent to the NTSB for testing to determine the cause of the burst. However, due to the severity of the run-flat damage, a definitive root cause could not be determined **(Appendix A)**.

1.17 Organisational and Management Information

Not applicable

1.18 Additional Information

1.18.1 Interview and Statements

The investigation team conducted separate interview sessions with the PIC, SIC, Malaysia Airports Holdings Berhad (MAHB) Duty Officer, Airport Fire and Rescue Services (AFRS) officers, ATC controllers on duty, and Maintenance Engineer. The interview sessions were all recorded under the express knowledge of all the parties.

1.19 Useful or effective investigation techniques

Not applicable.

2.0 ANALYSIS

2.1 On-Site Investigation

The aircraft was not equipped with an FDR or a CVR. The on-site investigation aimed to find evidence to help reconstruct the probable chain of events leading to the occurrence. Aircraft propeller strikes on the runway typically leave very obvious marks. Tire track marks and impact marks, or the absence of such marks, provide crucial evidence and information about the incident. The sequence of events can be traced and reconstructed as described in paragraph 1.12 above.

Unfortunately, the Duty Officer from MAHB did not conduct an immediate inspection or take photographs of the runway after being notified by the ATC tower. The Duty Officer cleared the runway for operation without informing or requesting assistance from the AAIB as required. Consequently, when the AAIB inspectors arrived at the accident site a few days later, all important evidence had vanished. The propeller strike marks were no longer visible on the runway. In his statement, the Duty Officer mentioned that he was not aware that all the aircraft propeller tips were bent and chipped. He assumed the aircraft only had a tyre burst and could be removed immediately to reopen the runway for operation.

Figure 10: Aircraft tire debris

Some rubber debris was found scattered 100 to 150 meters, mostly on the left side of the runway behind the position where the aircraft stopped. The debris was collected by the Duty Officer while clearing the runway on that day.

2.1.1 Propeller Strike Runway Surface

The ATC controllers on duty observed that the aircraft experienced a hard landing on Runway 10 and bounced three to four times. The PIC and SIC reported noticing four bounces on landing. Since there is no closed-circuit television (CCTV) recording, flight data recorder, propeller strike marks, or eyewitnesses who can describe the incident in detail, it cannot be determined exactly when the aircraft propeller blades struck the runway surface during the multiple bounce sequence.

2.1.2 Tire Track Marks

Figure 11: Aircraft tyre track marks were observed on the runway at the landing area or exiting the runway centreline towards the stopping point.

Figure 12: Aircraft's final stop position to the left of the runway centreline

2.2 On-Site Investigation Analysis

The investigation determined that the PIC did not adhere to standard operating procedures (SOP) following the initial bounce. After the first bounce, the PIC should have executed a go-around manoeuvre to ensure a safe recovery and avoid further instability. Instead, the PIC attempted to regain control of the aircraft, stabilise its direction, and bring it to a stop. This decision likely resulted in pilot-induced oscillations (PIO), a phenomenon well-documented in aviation literature.

PIO are sustained or uncontrollable oscillations caused by the pilot's attempts to control the aircraft. These oscillations occur when the pilot inadvertently makes a series of corrective inputs in opposite directions, each overcompensating for the aircraft's reaction to the previous input. This creates a cycle of increasing instability, leading to a "porpoising" motion of alternating upward and downward movements. PIO is a coupling of the pilot's input frequency with the aircraft's natural frequency. According to literature on human pilot dynamics, PIO can occur when there is a mismatch between the pilot’s control input frequency and the aircraft’s response frequency, exacerbated by the pilot's efforts to correct the aircraft’s attitude.

The aircraft in this incident bounced four times, resulting in the propeller striking the runway surface. Such occurrences are typically associated with significant impacts that can damage the aircraft's landing gear and other critical components. However, in this case, there is no conclusive evidence to determine when or how the aircraft's tyre burst. The lack of definitive evidence is consistent with findings in previous accident investigations, where physical evidence can be obliterated or obscured by subsequent events or inadequate immediate response protocols.

Additionally, the PIC did not make a distress call to ATC. According to the current guidelines on emergency operations, a timely distress call can be crucial in ensuring immediate assistance and facilitating a more comprehensive response. The absence of such communication might have delayed potential emergency measures and the subsequent investigation process.

Literature on air accident investigations emphasises the importance of immediate and precise actions following an abnormal event. The ICAO Annex 13 outlines the need for thorough documentation and timely reporting of all incidents to facilitate effective investigation and enhance aviation safety. The delay in communicating the incident and the failure to preserve on-site evidence, as observed in this case, hinder the investigation process and compromise the ability to determine root causes and implement corrective measures.

The combination of the PIC’s deviation from SOP, the occurrence of PIO, and the subsequent failure to communicate effectively with ATC underscores the need for rigorous adherence to established protocols and immediate response strategies in aviation operations. This incident highlights the critical role of pilot training, the importance of real-time decision-making, and the necessity for comprehensive post-incident procedures to ensure the safety and integrity of flight operations.

3.0 CONCLUSION

3.1 Findings

3.1.1 Aircraft Condition:

3.1.1.1 The aircraft was airworthy when dispatched for the flight.

3.1.1.2 The aircraft was not equipped with an FDR or a CVR, limiting the available data for the investigation.

3.1.2 Pilot Qualifications and Health:

3.1.2.1 The PIC was qualified and licensed to operate the TBM 700 aircraft.

3.1.2.2 The PIC's medical certificate was valid at the time of the incident.

3.1.2.3 Post-accident medical examination was not conducted for both the PIC and SIC. However, there was no evidence of physical incapacitation or physiological factors that affected the flight crew performance.

3.1.3 Environmental Conditions:

3.1.3.1 The incident occurred during the daytime with reported clear visibility and fine meteorological conditions.

3.1.4 Pilot Actions:

3.1.4.1 The PIC did not follow the SOP after the first bounce by failing to execute a go-around manoeuvre.

3.1.4.2 The PIC attempted to regain control and stop the aircraft instead of opting for a safer go-around, leading to further instability.

3.1.4.3 The PIC did not transmit any distress calls but only reported to the ATC Tower requesting a tow truck due to a nose wheel tire burst.

3.1.5 Pilot-Induced Oscillations (PIO):

3.1.5.1 The aircraft experienced PIO due to the PIC's efforts to control the aircraft after the initial bounce.

3.1.5.2 PIO led to a "porpoising" motion, with the aircraft bouncing four times on the runway.

3.1.6 Propeller Strike:

3.1.6.1 During the bounces, the aircraft's propeller struck the runway surface, causing damage to the propeller blades.

3.1.7 Tire Burst:

3.1.7.1 The aircraft's nose landing gear tire burst, but there is no conclusive evidence to determine when or how this occurred during the sequence of events.

3.1.8 Lack of Immediate Inspection and Evidence Preservation:

3.1.8.1 The Duty Officer from MAHB did not conduct an immediate inspection or take pertinent photographs of the runway after the incident.

3.1.8.2 The runway was cleared for operation without informing or requesting assistance from the AAIB.

3.1.8.3 Crucial evidence, including propeller strike marks, was not preserved and had vanished by the time AAIB inspectors arrived.

3.2 Causes/Contributing Factors

3.2.1 The accident was primarily caused by the PIC's attempt to regain control and stop the aircraft after the initial bounce on landing, resulting in PIO. These oscillations caused the aircraft to bounce multiple times, leading to a propeller strike on the runway surface. Additionally, the absence of an immediate inspection and proper evidence preservation by airport authorities hindered the investigation process and obscured critical details, such as the exact timing and cause of the tire burst.

Despite the aircraft being airworthy and the PIC being qualified and medically fit to operate the flight, the combination of pilot actions and the failure to preserve on-site evidence significantly impacted the investigation and overall understanding of the incident. This serious incident is categorised as an **Abnormal Runway Contact (ARC)**.

4.0 Safety Recommendations

4.1 Review and Enhance Pilot Training:

4.1.1 Recommendation: The aircraft operator should review and enhance pilot training programs to emphasise the importance of adhering to SOP, particularly the execution of go-around manoeuvres following an unstable approach or bounce on landing.

4.1.2 Rationale: The PIC's attempt to regain control and stop the aircraft after the initial bounce contributed significantly to the occurrence of PIO and subsequent damage.

4.2 Closer Scrutiny of Foreign Aircraft Operations:

4.2.1 Recommendation: CAAM is recommended to implement appropriate measures that provide closer scrutiny on foreign-registered aircraft operations by foreign-licensed aircrew in Malaysia to ensure safe operations.

4.2.2 Rationale: Ensuring that foreign-registered aircraft and their aircrew meet Malaysian safety standards is essential for maintaining high levels of operational safety.

4.3 Familiarisation with ADARP Procedures:

4.3.1 Recommendation: MAHB is recommended to implement measures to ensure that its airport Duty Officers are familiar with the Aerodrome Disabled Aircraft Removal Plan (ADARP) procedure.

4.3.3 Rationale: Ensuring that Duty Officers are well-versed in ADARP procedures is crucial for the efficient and safe removal of disabled aircraft, preserving critical evidence and maintaining airport operations.

CONCLUDING STATEMENT

This investigation has revealed instances of non-compliance and errors; however, it is crucial to emphasise that these findings are not intended for the purposes of apportioning blame or liability. Rather, they are solely for the purpose of preventing accidents in the future and improving aviation safety on the whole. Addressing the identified findings and implementing the recommended safety measures will enhance aviation safety and mitigate risks associated with operational lapses and regulatory gaps. It is imperative that all stakeholders prioritise safety and commit to implementing the necessary measures to prevent recurrence.

INVESTIGATOR IN CHARGE (IIC)
Air Accident Investigation Bureau (AAIB)
Ministry of Transport, Malaysia

APPENDIX A

Michelin Aircraft	*Tire Analysis Report*	Date: 27-Oct-23 Ref: TAR 823-106 G0A Issue: A Page: 1/2

Customer, Flight operation and Tire identification			
Customer	**NTSB**	Operator	**Misc. GA Operator NAM**
A/C type	**Daher Socata TBM 700A**	A/C number	**N188SJ**
Date of event	**4-Aug-23**	Place of event	**Kota Bahru Airport Malaysia**
Casing Manufacturer	**Michelin Nong Khae**	Part Number	**071-311-0**
Tire size	**5.00-5 / 10 / 120**	RGA No.	**823-106v0**
Wheel Position	**NLG #**	Tire received at Michelin	**19-Oct-23**
Serial / R-level	**8338S00126 / R00U**	Retread Center / Date	**N/A**

Problems reported by Customer

Upon landing the nose of the plane started bouncing causing a prop strike. The nose tire was found to be "broken" and all propeller tips were bent and chipped.

Visual Inspection

Photos were provided by the customer showing damages to the tire and positioning of the tire/wheel assembly on the aircraft. The Serial Side sidewall is shown installed on the inboard side (see Photos A&B).

We received a box containing the tire and wheel assembly on 19-Oct-2023 (see Photos C&D). The date of the investigation with NTSB personnel occurred on 26-Oct-2023.

We removed the tire from the wheel to thoroughly inspect the tire and check the wheel for any damages or abnormalities. The O-ring was found to be in good condition with no lubricant applied. The three wheel bolts and hardware appeared to be in good condition. Both wheel bearings were greased, and the Serial Side wheel bearing showed some looseness/play. We found heavy abrasion on the Serial Side wheel flange 360°. The Serial Side wheel flange appears slightly deformed/bent in one area. The Opposite Serial Side wheel flange shows light abrasion 360° (see Photos E&F).

An 8-ply test tire was mounted on the wheel to conduct an air retention test; inspection tire is 10ply. The standard rated pressure (unloaded) for the 8-ply test tire is 70psi. The test tire was seated to the wheel at 70 psi and left to “grow” for 15 minutes. After 15 minutes the pressure was checked and found to have dropped to approximately 45-48psi; we suspect an inflation device valve leak as the cause. We reinflated the assembly to 52psi and disconnected it from the inflation station.

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Visual Inspection

A leak check was conducted using leak detection fluid on the inflation valve tip/base and at both wheel flange/tire flange interfaces. No leaks were detected. Next, the assembly was submerged in a water tub for approximately 30 seconds and no leaks were detected.

For this report, the tire is divided into 12 equidistant sectors beginning at the inner-liner splice (see Photo G). Due to the severity of run-flat damage on the Serial Side sidewall, we were unable to confirm the serial number molded into the sidewall.

This tire is used (R00U) and shows a severe run-flat condition. On the Serial Side (inboard) sidewall in sectors 11-2 and 4-7, there is a large circumferential rupture through all of the casing plies and inner liner. The casing ply cord ends are broken and heavily frayed. The remaining Serial Side sidewall rubber shows severe abrasions, chunking, and rubber tear-outs (see Photo H). On the Opposite Serial Side (outboard) sidewall in sectors 1-2 and 8-9, there is a large rupture through all of the casing plies and inner liner. The casing ply cord ends are also broken and heavily frayed. The remaining Opposite Serial Side sidewall rubber shows severe abrasions, chunking, rubber tear-outs, and wrinkling (see Photo I).

In the crown area of the tire, portions or all of the Serial Side intermediate tread rib are missing in sectors 1,3,4,10,11,&12. Portions of the center tread rib are missing in sectors 3,4,10,&11. In the area of the missing tread rubber in sector 3, no evidence of heat buildup, contamination, or unsticking was found. The remaining tread rubber shows severe abrasions, chunking, rubber tear outs, and longitudinal scratches at various locations around the tire (see Photos J&K).

In sectors 1&2, the Opposite Serial Side bead flat shows a small amount of reverted rubber buildup (see Photo L). The bead flat in the remaining sectors on the Opposite Serial Side and all sectors on the Serial Side show no abnormal conditions.

To enable a thorough visual inspection of the interior of the tire, approval was given to Michelin to make a cut in the lower sidewall area in sectors 2-4 (see Photo M).

The interior of the tire shows severe abrasions, exposed/broken/frayed ply cord, and wrinkling at various locations around the tire (see Photos N&O).

No punctures through the casing or other abnormal conditions were found on this tire.

Usage Level

Skid depth new	0.19”	Skid depth returned	0.14" / 0.13" / 0.13" / 0.08"
Percent worn	26% / 32% / 32% / 58% OSS SS	No. of landings reported	Not reported

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Air Needle Test			
Vent holes operating properly	N/A	Liner or bead flat leaks	N/A
		Location	N/A

Static 24-hour Air Retention Test			
Start (psi)	N/A	End (psi)	N/A
Percent loss	N/A	Result	N/A

Manufacturing Records

The manufacturing records were reviewed and found no process deviations.

Microscopy Analysis / Decorticage

N/A

CONCLUSION

There are no bias or X-type ruptures to indicate a pressurized blow out. The sidewall ruptures with broken and frayed cord ends indicate run-flat damage as does the abrasion/wrinkling on the inner-liner. These types of damages are consistent with a slow loss of pressure.

The loss of portions of the center tread rib and Serial Side intermediate tread rib are damages caused by the run-flat condition and are post failure damages. The severe abrasions, chunking, and rubber tear outs found on the remaining tread rubber at various locations around the tire are also damages caused by the run-flat condition and are post failure damages.

We did not find a puncture through the casing that would have resulted in a loss of tire pressure. Due to the severity of run-flat damages on this tire, a definitive root cause could not be determined.

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Tire Disposition

- ☑ Scrap
- ☐ Hold for further review by Michelin
- ☑ Hold for return to Customer
- ☐ To be retreaded

Signatures

Author:
Al Fisher
Aircraft Tire Analyst

Digitally signed by Al Fisher
DN: cn=Al Fisher, o=Michelin, email=al.fisher@michelin.com, c=US
Date: 2023.11.03 10:36:21 -04'00'

Validator:
Julien Lemarchand
Customer Support Engineering Director

Signature numérique de Julien LEMARCHAND
Nom unique :cn=Julien LEMARCHAND, o=Michelin, ou=DORD/B2B/ZEU/AV, email=julien.lemarchand@michelin.com, c=FR
Date : 2023.11.06 08:50:59 +01'00'

Approver:
Christophe Choplin
Quality Director

Photo A

Photos were provided by the customer showing damages to the tire and positioning of the tire/wheel assembly on the aircraft. The Serial Side sidewall is shown installed on the inboard side.

Photo B

Serial Side (inboard)

Opposite Serial Side (outboard)

Photo C

We received a box containing the tire/wheel assembly on 19-Oct-2023.

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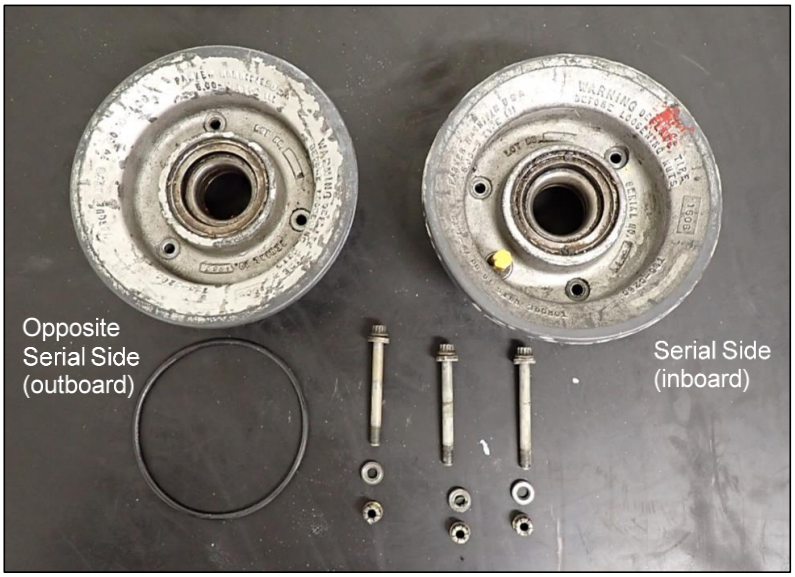
Photo D

The tire/wheel assembly was removed from the shipping box.

Photo E



We removed the tire from the wheel to thoroughly inspect the tire and check the wheel for any damages or abnormalities. The O-ring was found to be in good condition with no lubricant applied. The three wheel bolts and hardware appeared to be in good condition. Both wheel bearings were greased, and the Serial Side wheel bearing showed some looseness/play.

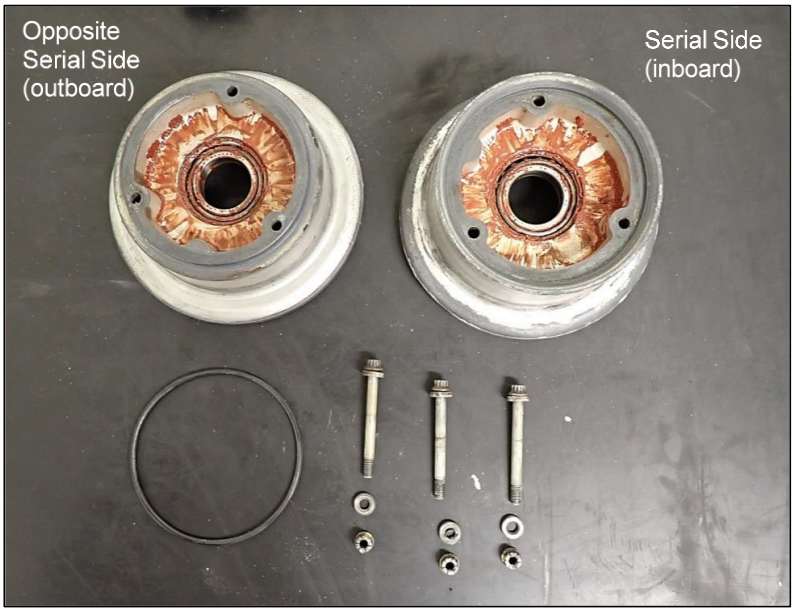


Photo F

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Photo G

For this report, the tire is divided into 12 equidistant sectors beginning at the inner-liner splice.

Photo H

On the Serial Side (inboard) sidewall in sectors 11-2 and 4-7, there is a large circumferential rupture through all of the casing plies and inner liner. The casing ply cord ends are broken and heavily frayed. The remaining Serial Side sidewall rubber shows severe abrasions, chunking, and rubber tear-outs.

Photo I

On the Opposite Serial Side (outboard) sidewall in sectors 1-2 and 8-9, there is a large rupture through all of the casing plies and inner liner. The casing ply cord ends are also broken and heavily frayed. The remaining Opposite Serial Side sidewall rubber shows severe abrasions, chunking, rubber tear-outs, and wrinkling.

Photo J

In the crown area of the tire, portions or all of the Serial Side intermediate tread rib are missing in sectors 1,3,4,10,11,&12. Portions of the center tread rib are missing in sectors 3,4,10,&11. In the area of the missing tread rubber in sector 3, no evidence of heat buildup, contamination, or unsticking was found. The remaining tread rubber shows severe abrasions, chunking, rubber tear outs, and longitudinal scratches at various locations around the tire.

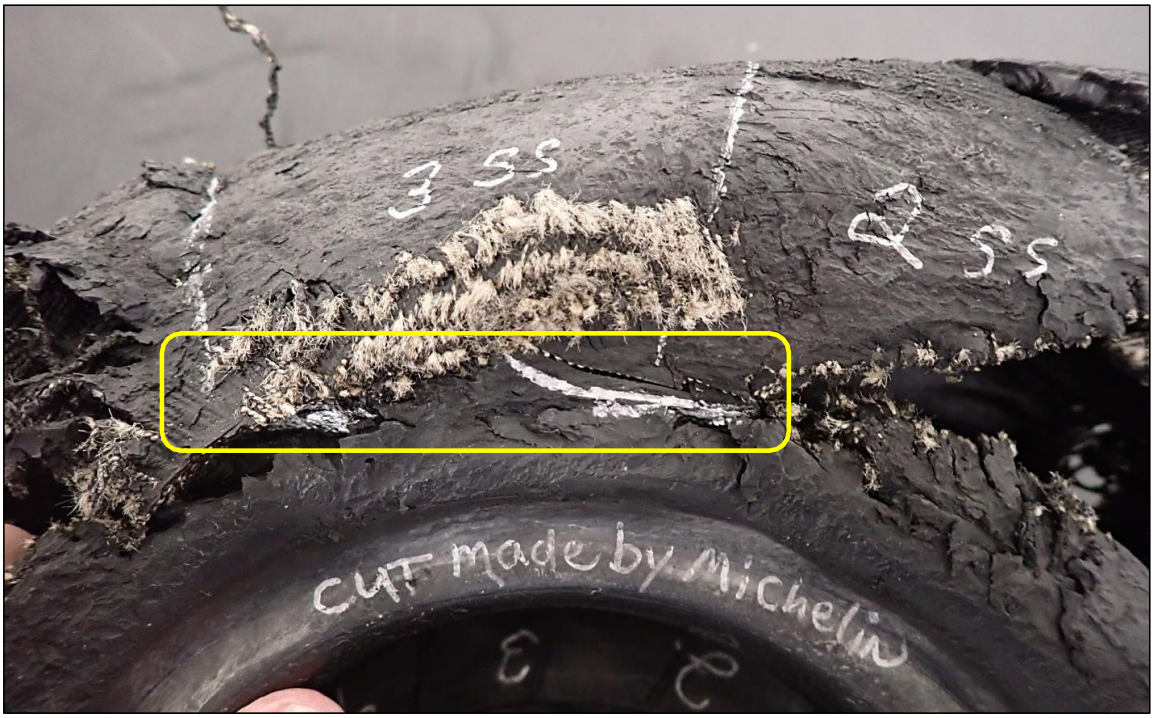
Photo K

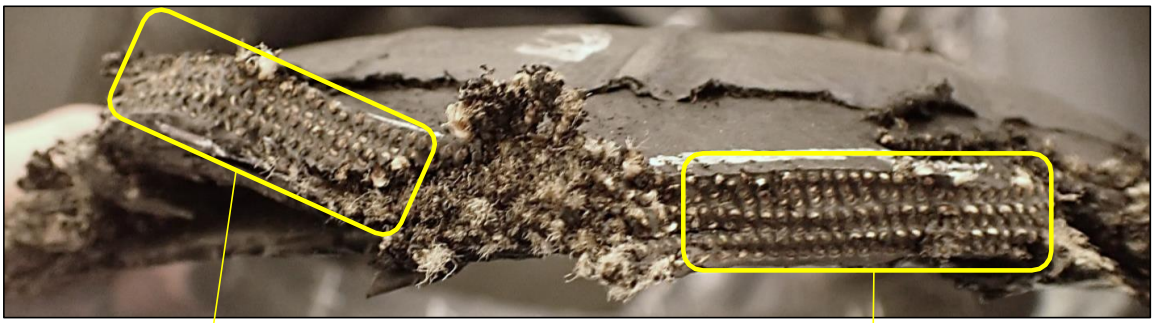
In the crown area of the tire, portions or all of the Serial Side intermediate tread rib are missing in sectors 1,3,4,10,11,&12. Portions of the center tread rib are missing in sectors 3,4,10,&11. In the area of the missing tread rubber in sector 3, no evidence of heat buildup, contamination, or unsticking was found. The remaining tread rubber shows severe abrasions, chunking, rubber tear outs, and longitudinal scratches at various locations around the tire.

Photo L

In sectors 1&2, the Opposite Serial Side bead flat shows a small amount of reverted rubber buildup

Photo M





Area cut by Michelin

Area cut by Michelin

Photo N

The interior of the tire shows severe abrasions, exposed/broken/frayed ply cord, and wrinkling at various locations around the tire.

The interior of the tire shows severe abrasions, exposed/broken/frayed ply cord, and wrinkling at various locations around the tire.

Michelin LBAV Central functions		Form reference	STD_AV_107_FOR03	Retention	WA+12
Form author	C. BONNARD DORD/B2B/ZEU/AV/CES	Form edition date	February 15, 2021	Classification	D3