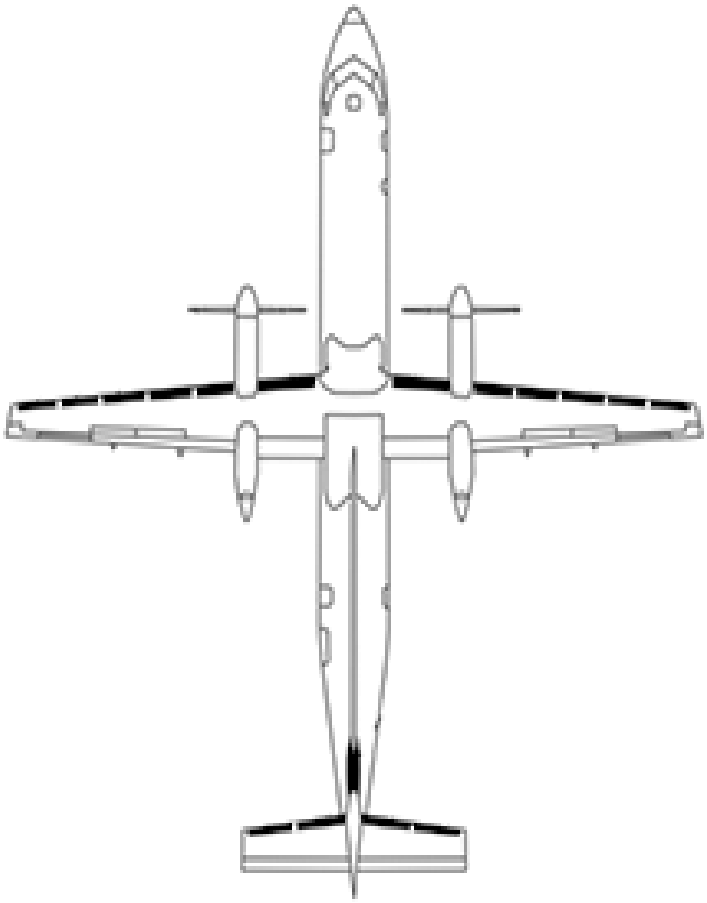
(i)

FINAL REPORT

INVESTIGATION INTO INCIDENT OF DHC-8 SERIES-400 AIRCRAFT REG NO S2-AJW
OF BIMAN BANGLADESH AIRLINES OCCURRED ON 16 MAY 2025 AT VGCB, COX'S BAZAR AIRPORT
BANGLADESH.



PUBLISHED BY
THE OFFICE OF THE AIRCRAFT ACCIDENT AND SERIOUS INCIDENT INVESTIGATION COMMITTEE OF BANGLADESH

(ii)

CONTACT DETAILS OF AIRCRAFT ACCIDENT AND SERIOUS INCIDENT INVESTIGATION COMMITTEE (AASIIC-BD)

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INTRODUCTION

This incident investigation is being conducted by the Aircraft Accident and Serious Incident Investigation Committee of Bangladesh (AASIIC-BD), in accordance with Rule 6 (c) of Aircraft Accident and Serious Incident Investigation Rules 2023 (AASIIR-2023) and in conformity with Annex 13 to the Chicago Convention on International Civil Aviation.

This Final Investigation Report issued in order to present an updated status of the investigation on the aforementioned Incident of the 'draft Final Report' by incorporating the comments from states an organization, as applicable. The Final Report has been complied in accordance with the requirement of ICAO Annex 13. The information contained in this Final Report has been derived from the factual information, evidences so far gathered during the ongoing investigation and the shop reports with comments from Wheel Manufacturer.

On 16 May 2025, the Head of AASIIC-BD learnt from Civil Aviation Authority of Bangladesh that one of the Dash-8-400 of Biman Bangladesh Airlines, Registration No S2-AJW got airborne with one main wheel detached during take-off roll at VGCB, Cox's Bazar Airport. The ATC Tower Controller of VGCB informed the flight crew about the wheel detachment from the aircraft during take-off roll. The PIC of the aircraft decided to continue the flight to Dhaka for better emergency and maintenance facility.

Having learnt about the occurrence, the Head of AASIIC-BD advised two-member 'Go-team' to move to the airport at VGHS Airport, Dhaka. Upon reaching at the airport, the go-team member found that the aircraft had already landed safely with one left main wheel (inner) missing. The aircraft cleared the active runway and was switched off at South Alpha taxiway. All passengers were disembarked without any injury/ harm.

Pursuant to Rule 33 of the AASIIR-2023 and Standard 4 of Annex 13 the Office of the AASIIC-BD issued a 'Notification' on 17 May 2025 for information of all concerned (National and International). To conduct the investigation, the Head of AASIIC-BD designated the Member of Engineering of the AASIIC-BD as the Investigator-in-Charge (IIC) with one-member (Operations) to form the Aircraft Accident Investigation Team (AAIT), which was issued through a 'Memorandum'.

The AASIIC-BD conceives that any investigation and analysis which would be made thereof, should focus on identifying the root cause(s) and/or contributing factor(s) rather than indicating on some human omissions for the occurrence.

As per Rule 16 (1) of AASIIR-2023 and ICAO Annex 13, the sole objective of this investigation is to prevent aircraft accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

Pursuant to Rule 29 (1) of AASIIR-2023 and Standard 6.5 of ICAO Annex, in the interest of accident prevention, the AASIIC-BD has made this 'Final Report' publicly available within twelve months from the date of the occurrence.

Head
Aircraft Accident and Serious Incident Investigation Committee
Bangladesh

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List of Acronyms

AASIIC	Aircraft Accident and Serious Investigation Committee
AASIIC-BD	Aircraft Accident and Serious Investigation Committee of Bangladesh
AAIT	Aircraft Accident Investigation Team
AAIO	Aircraft Accident Investigation Order
ATL	Aircraft Technical Log
ACCREP	Accredited Representative
AASIIR	Aircraft Accident and Serious Incident Investigation Rules
AME	Aircraft Maintenance Engineer
ATC	Air Traffic Control
ATPL	Airline Transport Pilots License
Biman	Biman Bangladesh Airlines
CAA	Civil Aviation Authority
CEO	Chief Executive Officer
CAAB	Civil Aviation Authority of Bangladesh
CPL	Commercial Pilot License
CVR	Cockpit Voice Recorder
DME	Distance Measuring Equipment
FDR	Flight Data Recorder
FSR	Flight Standard & Regulations
ICAO	International Civil Aviation Organization
IIC	Investigator-In-Charge
LH	Left hand
LT	Local Time
Ltd	Limited
MB	Millibar
N/A	Not Applicable
NDB	Non-Directional Beacon
N NE	North, Northeast
NM	Nautical mile
NSC	No Significant Cloud
NDT	Non-Destructive Test
OEM	Original Equipment Manufacturer
OPS	Operations
PIC	Pilot in command
PFI	Pre-flight Inspection
PPL	Private Pilot License
REG	Registration
RWY	Runway
SOP	Standard Operating Procedure
TSB	Transport Safety Board
US	United States
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VGCB	Cox's Bazar Airport
VGHS	Hazrat Shahjalal International Airport, Dhaka
VOR VHF	Omnidirectional Radio Range
SB	Service Bulletin

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1. TITLE

1.1 Composition of Title

1.1.1 Name of the Operator	Biman Bangladesh Airlines Ltd.
1.1.2 Name of the Manufacturer	De Haviland Aircraft Canada
1.1.3 Aircraft Model	DHC-8 Series-400
1.1.4 Aircraft Nationality	Bangladesh
1.1.5 Aircraft Registration Marks	S2-AJW
1.1.6 Place of Accident/ Serious Incident/ Investigable Incident	VGCB, Cox's Bazar Airport
1.1.7 Date of Accident/ Serious Incident/ Investigable Incident	16 May 2025

2. SYNOPSIS

2.1 Details of Synopsis

2.1.1 Notification of accident/ serious incident/ investigable incident to national and foreign authorities	Office of the Aircraft Accident and Serious Incident Investigation Committee-Bangladesh notified to all relevant Authorities and Agencies as per Standard 4.1 of ICAO Annex 13
2.1.2 Identification of the Accident/ Serious Incident/ Investigable Incident Investigation Authority	Aircraft Accident and Serious Incident Investigation Committee-Bangladesh (AASIIC-BD)
2.1.3 Accredited Representation	Having received the notification from the AASIIC-BD, the Air Investigation Transportation Safety Board of Canada responded immediately and appointed one non-travelling accredited representative and confirmed that he would remain standby for any kind of support, should the AASIIC-BD require. The investigator-in-charge, designated by the Head of AASIIC-BD, established communication with the accredited representative of TSB Canada for necessary information and cooperation. After completion of field phase investigation, the AAIT felt to send the damaged wheel, axle and damaged items to wheel manufacture for the shop/lab test to find out the cause of the incident. Accordingly, damaged wheel and items were sent to Wheel manufacturer as per the advice of the accredited representative. Recently AAIT received report of axle from the OEM. This report helped AAIT to find out the cause of this incident. The active participation by the accredited representative helped the AAIT to conclude this incident report.
2.1.4 Organization of the Investigation	Aircraft Accident and Serious Incident Investigation Committee-Bangladesh (AASIIC-BD)
2.1.5 Authority releasing the report	Aircraft Accident and Serious Incident Investigation Committee-Bangladesh (AASIIC-BD)
2.1.6 Date of publication or dispatch of report	10 March 2026
2.1.7 Brief resume of the circumstances leading to the accident/ serious incident/ investigable incident.	During take-off from Cox's Bazar Airport, the ATC controller, having found that one wheel rolled over the runway and went west of the runway abeam Tower/ Runway Centre area, informed the flight crew about the occurrence.

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3. BODY

3.1 FACTUAL INFORMATION

3.1.1 History of the flight:

3.1.1.1 Flight number	BG-436
3.1.1.2 Type of operation	Commercial (Passenger)
3.1.1.3 Last point of departure	VGCB, Cox's Bazar airport
3.1.1.4 Time of departure (Local time or UTC)	0713 UTC
3.1.1.5 Point of intended landing	Dhaka
3.1.1.6 'Flight preparation'	As per company procedure
3.1.1.7 Description of the flight and events leading to the accident/ serious incident/ investigable incident, including reconstruction of the significant portion of the flight path, if appropriate.	On 16 May 2025, the aircraft S2-AJW operated as passenger flight from Dhaka to Cox's Bazar with Call-sign BG 435 and landed at approximately 0642 UTC at Cox's Bazar. The aircraft had no technical defects. The riding engineer performed the PFI check as per the checklist and declared the aircraft serviceable for next flight to Dhaka (BG 436). The PIC accepted the aircraft and departed Cox's Bazar at 0713 UTC (Take-off 0721 UTC). According to the flight crew the take-off was uneventful. However, the ATC controller found that during take-off roll, one wheel of the aircraft got detached from the landing gear assembly and rolled over the runway resting aside on ground. When the aircraft was climbing normally, the ATC Controller informed the flight crew about the detachment of the wheel. The PIC decided to continue the flight to Dhaka. During the final approach at Dhaka, the PIC extended the landing gear and requested the riding engineer to confirm the status of the main landing gear. The riding engineer moved to the mid-section of the cabin to get a clear view of the landing gears, especially about the missing wheel. He observed that the right main landing gear had both wheels intact, whereas the inboard main wheel (no. 2) of the left main landing gear was missing. The riding engineer informed the flight crew accordingly. The flight crew declared emergency and landed safely at VGHS at about 0820 UTC. The aircraft cleared the active runway and was switched off and parked at South Alpha taxiway. All passengers were disembarked without any injury/ harm.
3.1.1.8 Location (Latitude, longitude, elevation)	VGCB Airport Cox's Bazar (21^{0}27'07"N, 091^{0}57'50"E, Elevation: 12 ft)
3.1.1.9 Time of the accident (Local or UTC)	0721 UTC
3.1.1.10 Whether day/night	Day

3.1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
3.1.2.1 Fatal	None	None	None
3.1.2.2 Serious	None	None	None
3.1.2.3 Minor	None	None	None

3.1.3 Damage to Aircraft (Brief Description)

3.1.3.1 Destroyed	No
3.1.3.2 Substantially damaged	Brief description of the Damage:

(a) Damage Parts:

SL No.	Part Name	Part No
1.	Outer Bearing Grease Seal Metal Part	39-189
2.	Inner Bearing Grease Seal Metal Part	39-188
3.	Cone Bearing (Inner)	28685-20629
4.	Cone Bearing (Outer)	29675-20629
5.	Bearing Cup (Inner & Outer)	29620-20629
6.	Bearing Roller (Qty-02) (Inner & Outer Bearing)	29685-20629 & 29675-20629
7.	Metal Chips	
8.	Axle Nut	46127-3
9.	Saddle	46135-1

(b) Missing Parts:

SL No.	Part Name	Part No
1.	Retainer Grease (Inner Bearing)	56-1075
2.	Retainer Grease (Outer Bearing)	56-1074
3.	Bearing Cage (Inner & Outer Bearing)	29685-20629 & 29675-20629
4.	Non-Metal part (Inner & Outer grease seal)	39-188 & 39-189
5.	Bearing Roller (Inner & Outer Bearing)	29685-20629 & 29675-20629

3.1.3.3 Slightly damaged	Nil

3.1.4 Other Damage:

3.1.4.1 Brief Description of other Damage	Nil

3.1.5 Personnel information

3.1.5.1 Pertinent information concerning each of the flight crew members regarding age, validity of licenses, ratings, mandatory checks, flying experience (total and on type) and relevant information on duty time	**Pilot in Command (PIC)** Date of Birth : 15-09-1978 Age : 46+ Nationality : Bangladesh License : ATPL (A) 320 Ratings : DHC-8- 400 Flying Experience (Total) : 11000: 00 + Flying Experience on type : 900+ License Validity : Non- Expiry Medical Status : Class 1(validity 31/01/2026	**First Officer (FO)** Date of Birth : 16/05/1994 Age : 31 Nationality : Bangladesh License : CPL 792 Ratings : DHC-8 -400 Flying Experience (Total) : 1207:05 Flying Experience on type : 1066:55 License Validity : Non-Expiry Medical Status : Class 1(validity 01/05/2026)
3.1.5.2 Brief statement of qualifications and experience of other crew members		N/A

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3.1.5.3 Pertinent information regarding other personnel, such as air traffic services, maintenance, etc., when relevant	**3.1.5.3.1 Air Traffic Services:** **At VGCB**: The aircraft S2-AJW took-off from Cox's bazar at approximately0642 UTC. Immediately after take-off, the ATC controller, having found one wheel rolled over the runway and went west of the runway, abeam tower/ runway centre area, informed the PIC about the occurrence. The PIC decided to continue the flight to Dhaka. The Controller on duty at VGCB informed Chittagong Dhaka tower about the occurrence. **At VGHS:** After getting the information from Cox's bazar, the duty controller at VGHS came to know about the occurrence. The PIC confirmed by lowering the landing gear that No. 2 wheel of left landing gear was missing, informed the tower and declared emergency. The duty controller at VGHS took all necessary actions for emergency landing including positioning of fire vehicles, ambulance in taxiway. The ATCO with operation vehicle poisoned at holding point of RWY 14. After safe landing, the runway was inspected and declared fit for operation. **3.1.5.3.2 Aircraft Maintenance Engineer:** **At VGHS:** The aircraft was pre-flighted by authorized engineer as per PFI checklist, declared fit to carryout flight to Cox's bazar. **At VGCB:** The aircraft landed at Cox's bazar with nil defect. The riding engineer carried out the PFI as per checklist and declared the aircraft for onward flight to Dhaka.

3.1.6 Aircraft information

3.1.6.1 Brief statement on airworthiness and maintenance of the aircraft (indication of deficiencies known prior to and during the flight to be included, if having any bearing on the accident/ serious incident/ investigable incident)	(a) As per ATL records and Airworthiness documents available at Engineering production and planning department of Biman, Dash-8-400 aircraft, Reg. S2-AJW was serviceable before departure from Dhaka for respective flights on 16 May 2025. (b) Dash-8-400 aircraft, Reg. S2-AJW was on transit certification at Cox's Bazar with nil defect and was duly certified by the authorized riding engineer for next flight to Dhaka. (c) Immediately after take-off, the ATC controller at VGCB informed the PIC that one wheel was detached from aircraft. (d) The PIC decided to continue the flight to Dhaka. Prior to landing the PIC extended the landing gears and got confirmation from riding engineer that the inboard wheel (No.2) was missing. (e) The PIC declared emergency and landed safely, demonstrating his high professional capability. (f) The aircraft was towed to hangar and carried a detail inspection of the whole left landing gear with special attention to detached No.2 wheel. The history of

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	the detached wheel is given below: 1. Wheel assembly Part no.415-117-1(wheel Part no.3-1573-1) 2. Serial no. D0165 3. TSN: 04 years 4. CSN: Total no of tyre consumed: 20 5. No of overhauled carried out:04 6. No of tyre change inspection done16 7. Date of last overhaul: 13 March 2025. 8. Date of last release from shop:04 May 2025. 9. Installation date of the wheel to the aircraft:07 May 2025 10. Removal date from aircraft:16 May 2025. 11. Day consumed after installation:09 12. Total no of landing carried out: 62
3.1.6.2 Brief statement on performance, if relevant, and whether the mass and centre of gravity were within the prescribed limits during the phase of operation related to the accident/ serious incident/ investigable incident. (If not and if of any bearing on the accident give details)?	All parameters were within the prescribed limits during take-off.
3.1.6.3 Type of fuel used	**JET-A1**

3.1.7 Meteorological information

3.1.7.1 Brief statement on the meteorological conditions appropriate to the circumstances including both forecast and actual conditions, and the availability of meteorological information to the crew	**VIS: 4000 M QNH: 1005.7 FEW: 1000 ft**
3.1.7.2 Natural light conditions at the time of the accident/ serious incident/ investigable incident (sunlight, moonlight, twilight, etc.)?	**During Sunlight**

3.1.8 Aids to Navigation

3.1.8.1 Pertinent information on navigation aids available, including landing aids such as ILS, MLS, NDB, PAR, VOR, visual ground aids, etc., and their effectiveness at the time?	**VOR: 112.7 NDB: 298 KHz Visual ground aids: Windsocks,**

3.1.9 Communications.

3.1.9.1 Pertinent information on aeronautical mobile and fixed service communications and their effectiveness?	**VHF: 129.5(VGCB) VHF1: 118.3 MHz (VGHS) VHF2: 121.8 MHz**

3.1.10 Aerodrome information

3.1.10.1 Pertinent information associated with the aerodrome, facilities and condition, or with the take-off or landing area if other than an aerodrome?	VGCB- Single Runway, adequate to meet the operational requirements. VGHS: - Single Runway, adequate to meet the operational requirements.

3.1.11 Flight recorders

3.1.11.1 Location of the flight recorder installations in the aircraft, their condition on recovery and pertinent data available therefrom?	The Flight Data Recorder (FDR) is installed in the tail section of the aircraft, within the Environmental Control System (ECS) compartment. The FDR was found to be in good condition, securely mounted in its designated location. Data was successfully retrieved from the FDR while it

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	remained installed in the aircraft. The downloaded data was sent to OEM (DeHavilland aircraft of Canada limited). After reading out, the OEM informed as follows:' **The FDR data has been reviewed, and no anomalies have been noted. The last landing and the one prior to it appeared normal.'**

3.1.12 Wreckage and impact information

3.1.12.1 General information on the site of the accident/ serious incident/ investigable incident and the distribution pattern of the wreckage, detected material failures or component malfunctions. Details concerning the location and state of the different pieces of the wreckage are not normally required unless it is necessary to indicate a break-up of the aircraft prior to impact. Diagrams, charts and photographs may be included in this section or attached in the appendices

(a) The inboard wheel (no. 2) of left main landing gear got detached during take-off roll.
(b) The detached wheel was found beside the west of runway.
(c) The PIC continued flight to Dhaka, declared emergency and landed safely.
(d) The aircraft was towed to Biman hangar and thorough inspections were carried out to find out the details of damage. The following damaged were found:

(1) The brake assembly and the wheel axle of the affected wheel were found intact with the landing gear.
(2) The wheel axle had scratches and rubbing marks.
(3) The outer bearing grease seal metal part was broken into two pieces.
(4) The inner bearing outer grease seal metal part was found damaged.
(5) The inner race of outer bearing was found damaged.
(6) The inner race of inner bearing was found damaged.
(7) The outer hub bearing cup (bottom position) was found damaged.
(8) The axle nut was found with two cross bolts attached.
(9) The inner bearing cup was found damaged.
(10) A portion of saddle was found damaged.
(11) Only 2 rollers of bearing were found with carbon deposit.

(e) The detached wheel was checked and found minor scratch marks without any substantial damage.
(f) The photographs of the detached wheel, brake assembly with axle nut, damaged parts are shown below:

Figure 1: Detached left main inboard (no.2) wheel.

Figure 2: After parking at south alpha.

Figure 3: Missing wheel area.

Figure 4: Damaged parts of the detached wheel.

Figure 5: Carbon deposit on axle

Figure 6: Damaged axle

Figure 7: Axle Nut

Figure 8: Damaged Outer Wheel with protective cover

3.1.13 Medical and pathological information

3.1.13.1 Brief description of the results of the investigation undertaken and pertinent data available therefrom?	Considered not relevant to this incident.

3.1.14 Fire

3.1.14.1 If fire occurred, information on the nature of the occurrence, and of the firefighting equipment used and its effectiveness?	No fire occurred, hence considered not relevant to this incident.

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3.1.15 Survival aspects

3.1.15.1 Brief description of search, evacuation and rescue, location of crew and passengers in relation to injuries sustained, and failure of structures such as seats and seat-belt attachments	All the passengers including flight crew were unhurt and disembarked safely.

3.1.16 Tests and research

3.1.16.1 Brief statements regarding the results of tests and research

During the initial phase of investigation, the AAIT felt that some of the damaged parts needed to be tested at OEM laboratory. The damaged wheel, axle and damaged parts were put into two boxes and sent to Colins Aerospace, the wheel manufacturer by FedEx. The box containing axle was received by the OEM but the box containing the damaged wheel and damaged parts did not reach the OEM as those were not cleared by the US Customs**. The items were returned back to Biman by FedEx. The damaged items were kept at FedEx store in Dhaka import cargo village for custom clearance: Meanwhile, a severe fire broke out in import cargo village, and all the damaged items were severely burned.**

(a) The OEM carried out the inspection of the subject axle, studied the photographs of the wheel, tire and axle and send the report to AAIT on 21 January 2026. The followings are the salient points of the report as mentioned below.

a. Below are the Main Wheel Cross section and photographs received by the OEM.

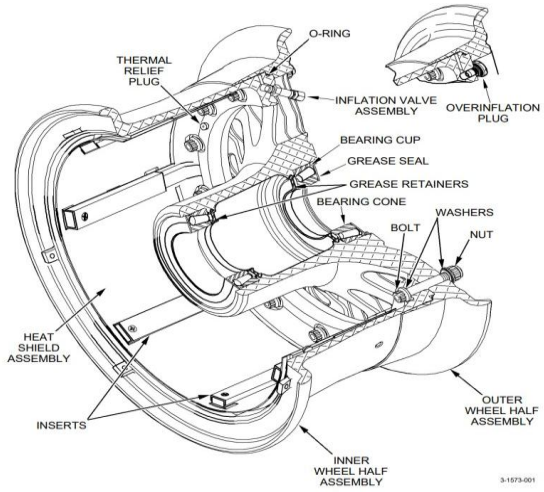

Figure 1: Main Wheel – Cross section

Figure 2: Wheel from Position #2

Figure 3: Wheel #2, Loss of Inboard Bearing and Hub Damage

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Figure 4: Wheel #2, Outboard Wheel Half

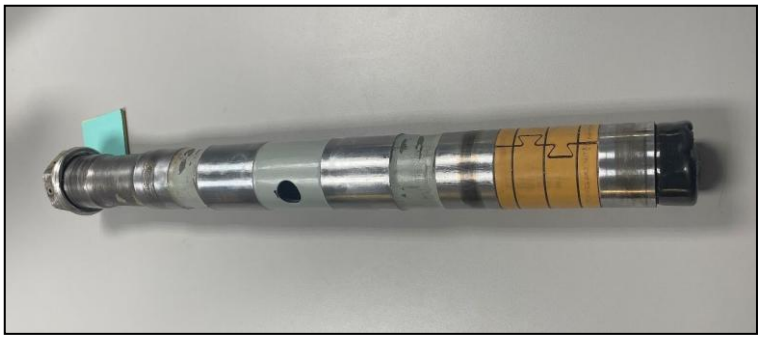

Figure 5: Axle, Removed from Aircraft Wheel Position #2 (Left)

Figure 6: Axle, Wheel Position #2

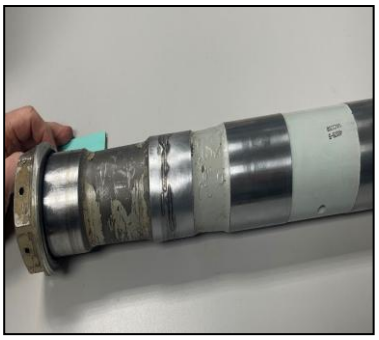

Figure 7: Axle, Wheel Position #2

(b) Analysis

The only the wheel axle was sent to wheel manufacturer; some observations were made based on photographic evidence.

The wheel's inboard bearing cup is completely absent from the wheel half and there is substantial damage to the wheel hub in the area of the bearing cup, Figure 2 and Figure 3. This suggests an inboard bearing structural failure.

Typical reasons for bearing failure include:

- Improper setting of the axle nut. A loose operating setting can result in improper roller contact with the cage resulting in rapid cage wear. The rollers can subsequently trap the cage on the cup race resulting in the cage rupture and / or lockup of the rollers within the bearing cone.

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	• Deformation of the bearing's cage from handling or improper installation. Any handling damage that results in the cage becoming out of round, having excessive cage movement, or pinching of the rollers should not be put into service. • Insufficient amount or the use of incorrect bearing grease. Lack of or incorrect grease increases internal friction and operating temperatures of the bearing rollers which can result in localized welding or other deformation of the bearing and subsequent bearing lockup. Figure 5 and Figure 6 show damage to the axle nut which is indicative of wheel bearing failure (rounded corners). This damage also indicates the axle nut was present at the time of bearing failure and wheel departure. However, the manufacturer could not determine the axle nut pre-load (torque value) at the time of the incident. The damaged axle nut was free turning on the axle threads as determined by manufacturer's personnel. Figure 5 and figure 6 also indicate significant rotational scoring at wheel position #2 and overheat in the areas of the bearing lands at position #1 and #2. It is possible the overheat at position #1 resulted after the wheel at position #2 departed the aircraft. Wheel position #1 would have experienced an overload condition and perhaps significant vibration during the subsequent landing event without the presence of wheel #2. The exact sequence of events resulting in the departure of wheel #2 from the aircraft cannot be determined from the available evidence. However, the evidence does suggest a failure of the inboard bearing resulted in the destruction of the bearing cone, bearing cup, and significant damage to the wheel hub. This would have resulted in the wheel wobbling on the axle during ground operation. The wheel wobble likely resulted in an off-design condition of the outboard bearing resulting in its structural failure. With both bearings destroyed, or substantially damaged, they could no longer retain the wheel on the axle.

3.1.17 Organizational and Management Information

3.1.17.1 Pertinent information concerning the organizations and their management involved in influencing the operation of the aircraft. The organizations include, for example: the operator; the air traffic services; airway, aerodrome and weather service agencies; and the regulatory authority. The information could include, but not be limited to, organizational structure and functions, resources, economic status,	a. Biman Bangladesh Airlines Ltd is a CAAB approved Air Operator, Certificate No. 2 and operates both wide & narrow-body aircrafts for domestic and international flights. It has a total of 21 aircraft in its fleet. With regard to technical information, Biman is a CAAB approved Continuing Airworthiness Management Organization (CAMO) i.e. CAAB.MG.012 (Ref. AOC No.-2) under its AOC. b. The AAIT has learnt that all continued airworthiness management tasks are managed by Biman CAMO. The CAMO manager of Biman is known to ensure maintenance of its aircraft by its own

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management policies and practices, and regulatory framework?	CAAB approved 145 organization, duly approved by CAA Bangladesh. The area of maintenance encompasses all maintenance checks of 737-800 Aircraft, up to "C" Checks of B777-300ER & B787-8/9 Aircrafts and "A" Check of DHC-8-402 Aircrafts. At times, however, the maintenance activities are done by outside organization with CAAB approval.

3.1.18 Additional information

3.1.18.1 Relevant information not already included in 3.1.1 to 3.17.1	**3.1.18.1** The followings are the relevant information: a. The similar type of incident took place in October 2017 with D 8 Q 400 aircraft Registration no. S2-AGR, performing flight from Saidpur to Dhaka. During initial climb from Saidpur, the outboard right hand main wheel got detached from the aircraft. The crew continued the flight to Dhaka and landed safely. b. One United Technologies Aerospace systems (UATS) Field service Engineer (FSE) visited Biman to check the maintenance practices and provide recommendations to prevent future bearing failure events. The visit was divided in two phases: (1) Wheel Shop visit and (2) Aircraft wheel removal and installation procedure to aircraft at line maintenance. **3.1.18.2 Wheel shop visit**. The followings were the observation: a. During visit found that Biman did not have dedicated checklist for the bearing inspection sub task. Due to the importance of the bearing inspection, FSE suggested Biman to add an extra stamp-able operation for this task as this would give added awareness to the importance of bearing inspection. b. The FSE did not find any displayed examples of bearing defects in the bearing inspection area, as such suggested to display the examples of bearing defects so that the inspector can compare the condition of inspected bearing for any defects. c. Biman engineers were aware of the inspection criteria of the grease seal but did not have appropriate column in the checklist to record the actual size of grease seals. The FSE suggested to record the actual size of the grease seal to ensure the seals are measured and compliant as per CMM. d. Biman technicians were aware of the assembly task. The tie-bolt torquing procedure was completed manually but correctly. There was a poster in the assembly listing the final torque. It was suggested to display the preliminary and final torque to be listed in the check list. e. The FSE closely monitored the procedure to install the bearings. The greasing was done correctly, and grease seals were installed correctly. the FSE questioned regarding bearing orientation, witnessed that part no. of the bearings was checked. It was suggested to use

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	GO-NOGO gauge to check the correct bearings are installed and include this in the checklist of assembly check. f. Biman technicians were questioned regarding the orientation of grease seals and found that they know and understand the instruction on the seal orientation that are hard stamped on the seals **3.1.18.3 Aircraft wheel removal and installation in the line maintenance**. The followings were observed: a. The FSE viewed the wheel removal and installation to the aircraft by Biman technicians in the line maintenance. b. On closer inspection it was noted by the FSE that the orientation of the outer bearing Was incorrect. It could have been the case that the grease seal had been incorrect since it had left the shop however, based on subsequent findings, it could also be the case that the bearing was knocked out during installation and hastily re-installed without care of orientation. c. It was also observed by the FSE that during installation of the wheel, two mechanics lifted the wheel with a third mechanic lining up the wheel and axle while aligning the outer bearing was dislodged. However, due to presence of third mechanic the bearing did not drop on the floor. To make the job easier and minimize the risk of damaging bearings, it was recommended to procure wheel dolly to carry out this task in future. **3.1.18.4 Training:** Based what was viewed in the wheel shop and during removal and installation of the wheel to aircraft in the line maintenance, the FSE conducted the bearing training module as well as the Dash-8-400 specific training module for the wheels. The training also provided a good platform to present the findings and discuss the recommended improvements to avoid bearing failures in future. **3.1.18.5 Summary:** The primary finding was the incorrect installation of grease seal, and this could contribute to contamination and degradation/migration of grease which in turn could contribute bearing damage that could lead to bearing failure. **3.1.18.6 Recommendations:** Based on the findings, the FSE made the following recommendations that may help to reduce the risk of bearing failure: a) Wheel shop to add additional paperwork and add this to the checklist for bearing and grease seal inspection. b) Display examples of bearing damage in bearing inspection area. c) Use of GO-NOGO gauge and include this in the checklist. d) Use wheel dolly during installation and removal of wheel from the aircraft. e) Verify correct grease seal orientation during wheel installation.
3.1.18.2 Service Bulletin No.84-32-176	The relevant information regarding **Service Bulletin** is given below: **3.1.18.2.1** A Service Bulletin no.84-32-176 was issued by the manufacturer on 15 February 2024 to improve bearing sealing and retention to reduce possible bearing damage and bearing failure.

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	a. The subject title is Landing Gear- Main Wheel-introduction of wheel Part No.3-1573-4- MoD sum 4-114060 b. The aircraft affected are: DHC-8 Aircraft Models 401 and 402 serial numbers 401, 4003, 4004,4006,4008 thru 4668. c. The reason is mentioned as: Operators have reported bearing damage and bearing failure in the main wheel and tire assembly 415-117-1. Investigation reveals that that the most failures occur due to bearing cage damage during the wheel installation. d. The solution to the problem is mentioned as: This Service Bulletin remove and replace 415-117-1 wheel and tire assembly with: 1. The new main wheel and tire assembly 415-117-3, which incorporates new wheel assembly 3-1573-4. 2. Gives instructions to convert the existing main wheel assembly 3-1573-1 to 3-1573-4 with a new outer wheel assembly 300-1148 and conversion kit 380-213 for improved bearing sealing and retention to reduce possible bearing damage and bearing failures. Incorporating this change will also convert main wheel and tire assembly 415-117-1 to 415-117-3. In the conversion kit two retaining ring part no. 245-817 was introduced and outer seal and inner seal was introduced. with new part no.39-275 and39-276. The introduction of new retaining ring and new outer and inner seal will improve the bearing sealing and retention to reduce the possible bearing damage and bearing failures. e. It is stated in compliance column as: De Havilland Aircraft of Canada (OEM) highly recommends the accomplishment of this inspection and rectification service bulletin at the earliest opportunity unless otherwise directed by the Operator's airworthiness authority. f. In approval column, mentioned as: The technical of this service bulletin has been approved under the Authority of the Transport Canada Civil Aviation (TCCA) Design Approval Organisation No: DAO#19-Q-01. This service bulletin does not affect Airworthiness Limitations (AWLs) or Design Tolerance Inspections (DTIs).

3.1.19 Useful or effective investigation techniques

3.1.19.1 When useful or effective investigation techniques have been used during the investigation, briefly indicate the reason for using these techniques and refer here to the main features as well as describing the results under the appropriate subheadings 3.1.1 to 3.18.1?	The AASIIC-BD uses the investigation technique which is compatible to Annex 13 and associated DOCs of ICAO.

3.2 ANALYSIS

3.2.1 Details on the Analysis	**3.2.1 Technical and Operational Sequence** **3.2.1.1** This section analyses the factual information to identify **human, (Man), technical operational (Machine), environment, motivational and**

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organizational factors that led to the occurrence, without apportioning blame or liability. The analysis focuses on the sequence of events, maintenance practices, and known risk factors associated with wheel bearing failures.

3.2.1.2 During the take-off roll, the inboard wheel of the left main landing gear detached form the aircraft. Examination of the recovered components revealed significant damage to the wheel bearing assembly, consistence with progressive bearing degradation rather than a sudden overload failure. Evidence of heat discoloration, lubrication loss, and bearing surface distress indicated that the bearing had been operating under abnormal conditions prior to failure.

3.2.1.3 The bearing damage characteristics indicate progressive degradation, consistent with improper bearing retention or grease seal installation. Such degradation would not be expected within 62 landings, making material defect less probable and pointing toward maintenance-induced failure mechanism.

3.2.1.4 Maintenance records showed that the affected wheel assembly had been installed nine days before and completed 62 landings, prior to the occurrence. The damage pattern was consistent with incorrect installation and/or incorrect orientation of the wheel bearings and grease seals, which likely resulted in inadequate sealing contamination ingress, and insufficient lubrication. This condition would have led to increased frication, heat generation, and eventual bearing failure.

3.2.1.5 The wheel's inboard bearing cup is completely absent from the wheel half and there is substantial damage to the wheel hub in the area of the bearing cup. This suggests an inboard bearing structural failure

3.2.1.6 Typical reasons for bearing failure include:

- Improper setting of the axle nut. A loose operating setting can result in improper roller contact with the cage resulting in rapid cage wear. The rollers can subsequently trap the cage on the cup race resulting in the cage rupture and / or lockup of the rollers within the bearing cone.
- Deformation of the bearing's cage from handling or improper installation. Any handling damage that results in the cage becoming out of round, having excessive cage movement, or pinching of the rollers should not be put into service.
- Insufficient amount or the use of incorrect bearing grease. Lack of or incorrect grease increases internal friction and operating temperatures of the bearing rollers which can result in localized welding or other deformation of the bearing and subsequent bearing lockup.

3.2.1.7 During inspection it was found that axle nut was damaged, which is indicative of wheel bearing failure (rounded corners). This damage also indicates the axle nut was present at the time of bearing failure and wheel departure.

3.2.1.8 During inspection also found significant rotational scoring at wheel

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position #2 and overheat in the areas of the bearing lands at position #1 and #2. It is possible the overheat at position #1 resulted after the wheel at position #2 departed the aircraft.

3.2.1.9 The exact sequence of events resulting in the departure of wheel #2 from the aircraft cannot be determined from the available evidence. However, the evidence does suggest a failure of the inboard bearing resulted in the destruction of the bearing cone, bearing cup, and significant damage to the wheel hub. This would have resulted in the wheel wobbling on the axle during ground operation. The wheel wobble likely resulted in an off-design condition of the outboard bearing resulting in its structural failure. With both bearings destroyed, or substantially damaged, they could no longer retain the wheel on the axle

3.2.2 Human and organizational factors

3.2.2.1 Flight crew: The PIC and Co-Pilot were adequately qualified. The flight crew were unaware of the wheel detachment until informed by the Air Traffic Control after departure. Their subsequence actions, including flight continuation and landing, were appropriate and in accordance with applicable procedure.

3.2.2.2 Air traffic Control: Controller at both VGHS and VGCB acted professionally, providing timely alerts and coordinating emergency services.

3.2.2.3 Maintenance Engineer: Both the Engineer at VGCB and VGHS were adequately qualified and had licence on the type, pre-flighted the aircraft as per the checklist.

3.2.2.4 organizational Delay: The non-implementation of **Service Bulletin SB 84-32-176,** although issued by the manufacture in February 2024 to mitigate known bearing failure risks though improved sealing and retention kits, the operator had not yet embodied the modification at the time of occurrence.

3.2.2.5 Human factors and Training: Gaps in maintenance documentation and a lack of structed recurrent training for personnel regarding specific wheel bearing installation techniques, despite similar fleet occurrence in 2017.

3.2.3 Machine: The incident was caused by failure of inboard wheel bearing of the left landing gear, resulting in loss of bearing integrity and subsequent detachment of the wheel during take-off roll. Post-occurrence inspection confirmed that the brake assembly and axle remained attached to aircraft, while damage to the wheel bearings and grease seals was evident. The nature of the damage indicates progressive bearing degradation rather than a sudden overload failure. Such degradation is consistence with incorrect bearing installation, inadequate bearing retention, or compromised grease sealing. As such the more probable reason of the incident could be incorrect installation of the grease seal and this could contribute to the contamination and degradation of the grease which in turn could contribute to bearing damage that could lead to bearing failure.

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	3.2.4 Environment: It was not a factor to this incident. **3.2.5 Motivational aspect:** The AAIT interviewed the employee of Biman; found them to be motivated for the organization.

3.3 CONCLUSIONS

Appended below are the **Findings, Causes and/or Contributing factors** established in the investigation.

3.3.1.1 Findings	**3.3 CONCLUSIONS** **3.3.1 Findings** The investigation established the following findings. These findings are not listed in any order of priority and do not imply fault or liability. **General** 1. The aircraft DHC-8-402, Registration S2-AJW, was airworthy prior to the occurrence flight. 2. The flight crew were properly licensed, qualified, medically fit, and current on type. 3. Meteorological conditions were not contributory to the incident. 4. Air Traffic Services at both VGCB and VGHS acted promptly and professionally. 5. The aircraft maintenance engineer both at VGHS and VGCB was qualified and had licence on the type, pre-flighted the aircraft as per checklist. **Aircraft and Systems** 6. During the take-off roll from VGCB, the inboard (No. 2) wheel of the left main landing gear detached from the aircraft. 7. The detached wheel was later recovered near the west side of the runway at VGCB with no substantial damage. 8. The brake assembly and axle remained attached to the landing gear after wheel separation. 9. The exact sequence of events resulting in the departure of wheel #2 from the aircraft cannot be determined from the available evidence. However, the evidence does suggest a failure of the inboard bearing resulted in the destruction of the bearing cone, bearing cup, and significant damage to the wheel hub. This would have resulted in the wheel wobbling on the axle during ground operation. The wheel wobble likely resulted in an off-design condition of the outboard bearing resulting in its structural failure. With both bearings destroyed, or substantially damaged, they could no longer retain the wheel on the axle. 10. Evidence indicated progressive bearing degradation prior to complete bearing failure, rather than a sudden overload failure. 11. The damaged bearing components were consistent with bearing distress caused by improper installation and/or inadequate bearing retention.

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Maintenance and Continuing Airworthiness

12. The wheel assembly had undergone overhaul on 13 March 2025 and was installed on the aircraft on 07 May 2025.
13. The wheel assembly accumulated 62 landings over a period 9 days prior to the occurrence.
14. Maintenance documentation showed no recorded defects related to the wheel or landing gear prior to the incident.
15. A manufacturer Service Bulletin (SB 84-32-176) addressing known bearing failure risks had been issued in February 2024.
16. The Service Bulletin had not been embodied on the subject aircraft prior to the incident.
17. Previous similar wheel detachment events had occurred within the same operator's fleet in 2017.
18. The investigation identified gaps in wheel shop and line maintenance inspection documentation, particularly for bearing and grease seal verification.

Operational Response

19. The flight crew were informed of the wheel detachment by ATC shortly after take-off.
20. The decision to continue the flight to Dhaka was operationally appropriate considering aircraft controllability, fuel state, weather, and available emergency facilities.
21. The flight crew declared an emergency and conducted a safe landing without injury to occupants or further damage to the aircraft.

3.3.2 Causes

The primary cause of the incident was the failure of the inboard (No.2) wheel bearing of the main landing gear. This failure resulted in a loss of bearing integrity, which led to the subsequent detachment of the wheel assembly during the take-off roll at Cox's Bazar Airport.

Post-occurrence inspections and analysis indicate that the detachment was the result of progressive bearing degradation rather than a sudden overload failure. The investigation established that the most probable catalyst for this degradation was incorrect installation and/or orientation of the grease seal during the wheel assembly/ installation process. This improper installation facilitated the contamination and migration of grease, leading to bearing distress, heat buildup, and eventual mechanical failure.

The bearing damage characteristics indicate progressive degradation, consistent with improper bearing retention or grease seal installation. Such degradation would not be expected within 62landings, making material defect less probable and pointing toward maintenance-induced failure mechanisms.

The incident could take place due to dropping of bearing on the floor, which could contribute to contamination and degradation, which led to bearing failure.

3.3.3 Contributing Factors

The following factors contributed to the occurrence:

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	a. **Maintenance practices**: Incorrect installation and/or orientation of wheel bearings and grease seals during wheel assembly or aircraft installation. b. **Inadequate Retention:** Compromised bearing retention and sealing, which allowed bearing degradation to progress unnoticed. c. **Organization Delay**: Non-implementation of manufacture **Service Bulletin SB 84-32-176,** although issued in February 2024 to improve bearing sealing and retention, the operator had not embodied the modification despite a known history of similar failures within the fleet. d. **Training Gaps:** Limited recurrent and structured training for maintenance personnel on specific wheel bearing installation and inspection procedures following previous similar events.

3.4 SAFETY RECOMMENDATIONS

3.4.1. Details of Safety Recommendations	**3.4.1 Safety Recommendations** As a result of this investigation, the following **Safety Recommendations** are issued in accordance with ICAO Annex 13 to prevent recurrence of similar incidents: **To the Operator (Biman Bangladesh Airlines Ltd.)** 1. Implement Service Bulletin SB 84-32-176, across the applicable fleet at the earliest practicable opportunity. 2. Revise the wheel shop checklist and **modify** in serial no. 06 in **assembly check** as mentioned below '' **Assembly check:** verify correct bearing installation using too PN 114-1493 as described in CMM assembly section page 7026-7027, paragraph 10. Ensure that, the Grease Seal face 'THIS SIDE AWAY FROM BEARING; is visible after installation.'' 3. Add a **duplicate inspection** preferably by another licenced engineer to ensure the correct installation of grease seals as mentioned below: 'Grease seals to be checked for correct installation ('THIS SIDE AWAY FORM BEARING' visible). This check to be added at ATL. 4. Ensure retuning back of the wheel and bearing to the wheel shop, in case bearing drops on the floor during installation. An entry is to be made in ATL, in case the bearing drops on the floor. 5. Introduce the use of wheel dollies during wheel installation and removal to reduce the risk of bearing displacement or damage. 6. Establish a recurrent training program for maintenance personnel focusing on: • Wheel bearing installation • Grease seal orientation • Human factors in maintenance 7. Develop and implement a system to track and analyse repetitive component failures for proactive safety action.

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	To the Civil Aviation Authority of Bangladesh **1. Enhanced Oversight:** Increase surveillance of operator maintenance regarding wheel and landing gear assemblies. **2. Service Bulletin Compliance:** Enforce timely risk assessments and embodiment of safety-critical manufacture service bulletins.

4. APPENDICES

4.1 Details of Appendices	Preserved in a systematic manner in the 'Investigation Folder' held in the office of AASIIC-BD.

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