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**Important Information and Instruction for Recipients**

1. Appended, in the upcoming pages, is the 'Final Report', together with the Safety Recommendations, of Investigation of Serious Incident of ATR 42-300 Aircraft, Reg S2-AHI of NXT Air Ltd, occurred on 05 June 2022 at VGEG Airport, Chattogram, Bangladesh.
2. The undersigned designated the Member Engineering of the Aircraft Accident Investigation Committee of Bangladesh (AAIC-BD) as the Investigator-in-Charge (IIC) and formed '2-members Aircraft Accident Investigation Team (AAIT) to conduct the investigation. Bangladesh is the State of occurrence as well as the State of Registry and the State of Operator of the aircraft, hence the AAIC-BD has instituted, conducted the investigation and prepared this Final Report.
3. Earlier on 06 June 2022 the AAIC-BD had sent to all concerned, the Notification of the Serious Incident which was in conformity with Standard 4.1 of Annex 13 and thereafter, dispatched the 'Preliminary Report' on 30 June 2022, in conformity with Standard 7.4 of Annex 13.
4. This serious incident took place due to detachment of the outer wheel assembly from the left landing gear during take-off at Chattogram VGEG airport on 05 June 2022. To find out the cause of the detachment of the left landing gear wheel assembly, the AAIT sought the Accredited Representative's help to get the expert opinion from the wheel assembly manufacturer. Recently the AAIT has received two reports from wheel bearing and wheel assembly manufacturer respectively, hence this report has been made identifying the root cause of detachment of the wheel assembly.
5. As per standard 6.3 of ICAO Annex 13, the AAIC-BD had sent to all concerned, the draft Final Report on 28 March 2023 and requested to provide 'Comments' (if intended) on the draft Final Report within sixty (60) days from the date of the transmittal of correspondence. The AAIC-BD received comments from the Accredited Representative from BEA, France. All the relevant comments received from have been incorporated in the final report as per the provision of ICAO Annex 13.
6. The AAIC-BD is dispatching this 'Final Report' as per standard 6.5 of Annex 13.
7. This Final Report will soon be available in the website [www.caab.gov.bd](http://www.caab.gov.bd) (Menu: AAIC-BD) for public view.
8. To comply with the requirements of Standard 6.8 of Annex 13, soon the AAIC-BD will send the Safety Recommendations, listed in Subject Sub-Head 3.4 of this report, to applicable States/ Organizations for effective corrective actions for the purpose of safety in aviation and prevention of accident/ serious incident/ investigable incident.

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## FINAL REPORT

### INVESTIGATION INTO SERIOUS INCIDENT OF ATR 42-300 AIRCRAFT, REG NO. S2-AHI OF NXT AIR LTD, OCCURRED ON 05 JUNE 2022 AT VEGE AIRPORT, CHATTOGRAM, BANGLADESH



PREPARED BY  
OFFICE OF THE AIRCRAFT ACCIDENT INVESTIGATION COMMITTEE OF BANGLADESH

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### **FOREWORD**

#### **Final Report of Investigation into Serious Incident of ATR 42-300 Aircraft, REG NO. S2-AHI of NXT AIR Ltd, Occurred on 05 June 2022 at VEGE Airport, Chattogram, Bangladesh**

This Serious Incident investigation has been conducted by the Aircraft Accident Investigation Committee of Bangladesh (AAIC-BD) in accordance with Civil Aviation Act 2017 and in conformity with Annex 13 to the Chicago Convention of International Civil Aviation organization.

The Head of AAIC-BD received a Telephone call on 05 June 2022 from VEGE Tower informing that an inflated wheel assembly was found near the end of runway 05 of VEGE after the departure of Flight Number NXT 210, ATR 42-300 Reg. No. S2-AHI of NXT Air Ltd. The tower controller further stated that this message was intimated to the flight crew of NXT Air. The Pilot-in-Command (PIC) decided to proceed to VGCB, Cox's Bazar. The aircraft landed safely at VGCB at 0636 UTC. Following the information of occurrence, the Head of AAIC-BD formed a 'Go-Team' comprising one investigator from Engineering and advised him to proceed to VGCB availing the fastest available means to inspect and protect the necessary evidences. The 'Go-Team' left Dhaka for Cox's Bazar by the commercial flight at 09:00 Hrs LT on 06 June 2022 and reached Cox's bazar aircraft site at 10:00 hrs on the same day.

This has been in pursuance to Standard 3.3 of Annex 13, wherein the AAIC-BD has taken all reasonable measures to protect the evidence and to maintain safe custody of the aircraft and its contents for such a period as may be necessary for the purposes of investigation. Earlier the Head of AAIC-BD also advised the Airport/Aerodrome Authority and Operator on telephone for ensuring adequate protection of all the evidences and safe custody of the aircraft and its contents until the arrival of the 'Go-team' at the site.

The Office of the AAIC-BD, on the next day following the occurrence (06 June 2022), issued the necessary 'Notification' for the information of all concerned (National and International) as per the requirements of Annex 13. Subsequently the Head of AAIC-BD formed a two-member Aircraft Accident Investigation Team (AAIT) which was issued through a 'Memorandum' to conduct the full-length investigation. The two-member comprised of Member Engineering as Investigator-in-Charge (IIC) and the Member Operations of AAIC-BD as the Member of AAIT.

The AAIC-BD published the 'Preliminary Report' of the investigation of this serious incident on 30 June 2022. Earlier, corrective actions of two Intermediary Safety Recommendations were accomplished by the operator for further recurrence of similar occurrence.

Subsequently, it sent the draft Final Report on 28 March 2023 to relevant authorities, organizations and agencies for their significant and substantiated comments. The comments, so received, have been incorporated by the AAIT in this final report reflecting the significance and substances provided by the relevant authorities, organizations and agencies. This 'Final Report' has been compiled in accordance with the requirements of standard 6.4 of ICAO Annex-13.

This 'Final Report' has been compiled by the AAIT and is being dispatched to all applicable addressees in accordance with the requirement of Standard 6.4 of ICAO Annex-13 and in the interest of prevention of aircraft accident, serious incident and/or investigable incident, the report will also be publicly available soon to comply with the requirements of Standard 6.5 of ICAO Annex-13.

The AAIC-BD conceives that investigation of any aircraft occurrence should focus on identifying the true underlying causes and/or contributing factors rather than indicating on some human omissions for the occurrence.

As per the principle of AAIC-BD and that of ICAO Annex 13, the sole objective of this investigation has been perceived to prevent aircraft accidents and incidents. The purpose of this activity has not been comprehended to apportion blame or liability.

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## List of Acronyms

AAIC-BD	- Aircraft Accident Investigation Committee of Bangladesh.
AAIT	- Aircraft Accident Investigation Team
ACCREP	- Accredited Representative
AMP	- Aircraft Maintenance Programme.
AMO	- Aircraft Maintenance Organization
ATC	- Air Traffic Control
ATR	- Aerei da Trasporto Regionale; or "Regional Transport Airplanes"
BAF	- Bangladesh Air Force
BEA	- Bureau of Enquiry and Analysis for civil Aviation Safety, France
CAAB	- Civil Aviation Authority of Bangladesh
CAMO	- Continuous Airworthiness Maintenance Organization
CAME	- Continuous Airworthiness Maintenance Exposition
CGP	- Chattogram
CMM	- Component Maintenance Manual
CPCP	- Corrosion Prevention and Control Programme
CVR	- Cockpit Voice Recorder
DATCO	- Duty Air Traffic Controller
DME	- Distance Measuring Equipment
FDR	- Flight Data Recorder
IIC	- Investigator-In-Charge
ILS	- Instrument Landing System
LT	- Local Time
MD & CEO	- Managing Director and Chief Executive Officer
MOE	- Maintenance Organization Exposition
NDB	- Non-Directional Beacon
MLG	- Main Landing Gear
PIC	- Pilon-In-Command
PT No	- Part Number
QA	- Quality Assurance
REG	- Registration
RWY	- Runway
SN	- Serial Number
SMS	- Safety Management System
TC	- Task Card
UTC	- Coordinated Universal Time
VGCB	- Cox's Bazar Airport, Cox's Bazar
VGEG	- Shah Amanat International Airport, Chattogram
VGJR	- Jashore Airport, Jashore
VOR	- VHF Omnidirectional Radio Range

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**OFFICE OF THE AIRCRAFT ACCIDENT INVESTIGATION COMMITTEE OF BANGLADESH**  
**MINISTRY OF CIVIL AVIATION & TOURISM**  
**3<sup>RD</sup> FLOOR CAAB HEADQUARTERS (OLD BUILDING) KURMITOLA DHAKA-1229**



Ref: 30.00.0000.013.33.001.22 (ATR 42-300/S2-AHI- 05 June 2022)-70

Date: 30 May 2023

			regarding age, validity of licenses, ratings, mandatory checks, flying experience (total and on type) and relevant information on duty time
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## 1. TITLE

### 1.1 Composition of Title

1.1.1 Name of the Operator?	NXT AIR Limited
1.1.2 Name of the Manufacturer?	ATR
1.1.3 Aircraft Model?	ATR 42-300
1.1.4 Aircraft Nationality?	Bangladesh
1.1.5 Aircraft Registration Marks?	S2-AHI
1.1.6 Place of Accident/ Serious Incident/ Investigable Incident?	VGEG (Shah Amanat International Airport, Chattogram, Bangladesh)
1.1.7 Date Accident/ Serious Incident/ Investigable Incident?	05 JUNE 2022

## 2. SYNOPSIS

### 2.1 Details of Synopsis

2.1.1 Notification of accident/ serious incident/ investigable incident to national and foreign authorities?	The 'Office of the Aircraft Accident Investigation Committee of Bangladesh', on 06 June 2022, notified about this serious incident 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 Investigation Committee of Bangladesh (AAIC-BD). Ministry of Civil Aviation & Tourism, Govt of the People's Republic of Bangladesh. <a href="http://caab.portal.gov.bd/site/page/fa23248f-d09c-4645-aaec-74c1d246fb07">http://caab.portal.gov.bd/site/page/fa23248f-d09c-4645-aaec-74c1d246fb07</a> <a href="https://www.icao.int/safety/AIA/Pages/default.aspx">https://www.icao.int/safety/AIA/Pages/default.aspx</a>
2.1.3 Accredited Representation?	<p>(a) Having received the Notification from the AAIC-BD, the BEA responded immediately and appointed an accredited representative confirming that they would remain standby for any kind of support, should the AAIC-BD require.</p> <p>(b) After completion of the field investigation, the AAIT brought back the damaged items, mentioned herein, and kept under their custody. The IIC of AAIT contacted the accredited representative and requested for his help to conduct the necessary tests and comments from the original equipment manufacturer (OEM) on the damaged items. The damaged items namely left outer wheel assembly part no. 5006856-5R serial no. OCT89-96, outer bearing with axle nut (as the outer bearing cone could not be detached from the axle nut), inner bearing and sheared off two locking bolt parts no. AN3H5A were sent to Parker-Meggitt, the wheel manufacturer with the assistance of accredited representative. The accredited representative sent two reports from the Timken, the bearing manufacturer and Parker-Meggitt the wheel manufacturer on 17 February and 28 February 2023 respectively with their comments. These reports helped AAIT to find out the root cause of this serious incident. The active participation by the accredited representative helped the AAIT to conclude this Final Report.</p> <p>(c) The AAIT had sent to all concerned, the draft Final Report on 28 March 2023 and requested to provide 'Comments' (if intended) on the draft Final Report within sixty (60) days from the date of the transmittal of correspondence. The AAIT received comments from the Accredited Representative from BEA, France. All the relevant comments received from the ACCREP, France have been incorporated in the final report as per the provision of ICAO Annex 13. 'Nil' comment was received from the wheel manufacturer.</p>

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2.1.4 Organization of the Investigation?	Aircraft Accident Investigation Committee of Bangladesh (AAIC-BD)
2.1.5 Authority releasing the report?	Aircraft Accident Investigation Committee of Bangladesh (AAIC-BD)
2.1.6 Date of publication or dispatch of report?	30 May 2023
2.1.7 Brief resume of the circumstances leading to the Accident/ Serious Incident/ Investigable Incident?	<p>(a) On 05 June 2022, Aircraft ATR 42-300, Registration no. S2-AHI was carrying out a cargo mission of lifting baby shrimps from Cox's bazar (VGCB) to Jashore (VGJR). After offloading the cargo at VGJR, the aircraft landed at VGEG, Shah Amanat International Airport, Chattogram for refuelling. After refuelling the riding engineer carried out the transit check for onward flight to VGCB. The pilot-in-command (PIC) also carried out the transit check.</p> <p>(b) The aircraft took-off at 0535 UTC for VGCB. After take-off, the bird shooter on duty informed the CGP Tower that a wheel was found at the end of RW 05 at 0539 UTC. One Air Traffic Controller immediately went to the spot and found the wheel on the spot. The wheel was taken to the tower and kept under the custody of the ATC controller under the instruction of the AAIC-BD.</p> <p>(c) Meanwhile, the duty air traffic controller informed the PIC at 0540 UTC that the bird shooter on duty found a wheel beside the runway 05 after the departure of the flight.</p> <p>(d) According to the flight crew, the landing gear of the aircraft retracted normally during take-off from VGEG and there was no abnormality felt during the take-off. The flight crew decided to proceed to VGCB as the maintenance base of the company was at Cox's Bazar.</p> <p>(e) Meanwhile, the VGEG tower communicated the event about finding the wheel to VGCB tower. At this stage, the flight crew were in a doubt as to whether the mentioned wheel belonged to their aircraft or not.</p> <p>(f) Upon reaching VGCB, the flight crew carried out two low passes with the aircraft landing gear in down position to confirm by the ATC controller about the status of the landing gear as well as if any wheel was missing or not. Tower controller confirmed that the outer wheel (No.1) of left main landing gear was missing but inner (No.2) wheel was intact with the left landing gear.</p> <p>(g) At this stage, pilot expressed their intention to land at VGCB and requested to arrange for all emergency assistance available for landing.</p> <p>(h) The control tower alerted three crash tenders, two from CAA Bangladesh and one from Bangladesh Air Force and positioned them beside the runway for any emergency assistance.</p> <p>(i) The aircraft made safe landing at 0636 UTC. The pilot used reverse thrust for slowing down the aircraft, made 180° turn and followed the taxi instruction and finally parked the aircraft at the parking bay. After parking, the PIC went around the aircraft and made necessary entry into the maintenance logbook. It could be ascertained that the wheel in question, indeed, belonged to S-2 AHI.</p>

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### 3. BODY

#### 3.1 FACTUAL INFORMATION

##### 3.1.1 History of the flight:

3.1.1.1 Flight number?	NXT 202
3.1.1.2 Type of operation?	Ferry flight from VGEG to VGCB
3.1.1.3 Last point of departure?	VGEG
3.1.1.4 Time of departure (Local time or UTC)?	0535 UTC
3.1.1.5 Point of intended landing?	VGCB
3.1.1.6 'Flight preparation'?	The aircraft S2-AHI was scheduled to carry out the cargo flight following the route VGCB-VGJR-VGEG-VGCB on 05 June 2022. The aircraft was pre-flighted by the licensed engineer at VGCB, transit check was carried out by riding engineer at VGJR, refuelling and transit check was carried out at VGEG by the same riding engineer. The PIC carried out the transit check at VGEG. The aircraft was 'serviceable' prior to flight.
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?	<p>(a) Aircraft ATR-42-300 Reg No. S2-AHI of NXT Air Ltd departed from VGEG for VGCB at 0535 UTC on 05 June 2022.</p> <p>(b) After take-off DATCO of VGEG tower informed the PIC at 0540 UTC that the bird shooter on duty found a wheel near the end of runway 05 after their departure.</p> <p>(c) Considering the maintenance base at VGCB, the PIC decided to proceed to VGCB.</p> <p>(d) As per advice of the VGCB tower, the flight crew carried out two low-passes to confirm about the missing wheel. Tower confirmed that outer wheel (No.1) of left Main landing gear was missing but the inner wheel (No.2) was intact with the landing gear.</p> <p>(e) VGCB tower arranged 2 crash tenders of CAAB and one from BAF. All of them were positioned beside the runway for any emergency.</p> <p>(f) The aircraft landed safely at 0625 UTC uneventfully and was parked at the parking bay.</p> <p>(g) The left landing gear was resting on No.2 (Inner) wheel only, the maintenance engineer placed a bottle jack under the left landing gear to ensure the safety of the aircraft.</p> <p>(h) The 'Go-Team' reached Cox's Bazar on 06 June 2022 and initial briefing was given on the incident by Head of Safety and Head of SMS of NXT Air Ltd.</p> <p>(i) Thereafter, the team visited the aircraft which was kept at tarmac, found the No.1 outer wheel of left landing gear was missing and the aircraft was resting on No.2 wheel supported by a bottle jack under the left landing gear.</p> <p>(j) The team went around the aircraft, carried out visual check, found apparently no other damage.</p> <p>(k) The team checked the tech log and check the entry made by the flight crew after the incident.</p> <p>(l) The outer wheel assembly (No. 1) of left landing gear got detached from the wheel axle during take-off roll. This was found near the end of runway 05 at VGEG. Soon after the</p>

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Ref: 30.00.0000.013.33.001.22 (ATR 42-300/S2-AHI- 05 June 2022)-70

Date: 30 May 2023

	<p>recovery, the VGEG airport authority kept it under its custody.</p> <p>(m) As per the advice of the AAIC-BD, the affected wheel assembly was brought back to VGCB with proper packaging (wrapping) so that evidences were not lost.</p> <p>(n) The left wheel assembly PT No. 5006856-5R was handed over to the 'Go-Team' in wrapped condition.</p> <p>(o) The wrapped wheel was uncovered in front of the 'Go-Team'. During the inspection of the wheel assembly, it was found that the hub locking bolt PT No. AN3H5A (Quantity 2) sheared off/ broken into two pieces. The upper part of both the locking bolts were attached with the locking wire with the wheel assembly, the lower part of both the bolts were attached with wheel axle till the tip of the thread on the other end.</p> <p>(p) The outer roller bearing cone assembly PN. L610549 was found completely damaged with the outer race of the bearing broken and 8 rollers coming out from inside. Traces of corrosion were found in the roller and in the housing of the bearing.</p> <p>(q) Thereafter, the team inspected the left wheel axle PT No. D57259-2. Scratch marks were found on the shinning portion of the axle which was observed throughout the shinning part circumferentially.</p> <p>(r) The team also carried out the inspection of the inner (No.2) wheel assembly of left main landing gear; removed the wheel from axle, checked for the condition of both the hub locking bolts and outer and inner bearing, which apparently found no damage.</p> <p>(s) The team also checked for the technical logbook of one-year, looked for the history of left main wheel assembly PT No. 5006856-5R S/N: OCT89-96 and also visited the store, interviewed the pilots, engineers, ATC Controller, CAMO Manager, Chief of Safety, maintenance technicians and other related personnel.</p> <p>(t) The damaged outer bearing PT No. L610549 and hub locking bolt PT No. AN3H5A (Quantity-2) upper part was brought to the AAIC-BD office and kept under custody. The lower part of the locking bolt could not be taken out from the axle as forcible taking out could damage the part causing loss of valuable evidences.</p> <p>(u) Thereafter, the AAIT studied the documents, statements of concerned personnel, collected the ATC transcript, visually checked the damaged parts and came to a decision that the damaged parts (bearing and bolts) would be sent to manufacturer's laboratory for necessary test to find out the reason of failure.</p> <p>(v) The Flight Data Recorder (FDR) PT No. S800-2000-00 SN: 01342 and Cockpit Voice Recorder (CVR) PT No. 93-A100-83 SN: 50613 were secured by the AAIT and were sent to Sabena Technics, DNR, France for decoding.</p>
<p>3.1.8 Location (latitude, longitude, elevation)?</p>	<p>VGEG, Shah Amanat International Airport, CHATTOGRAM.</p> <p>(a) Latitude: 221446 N</p> <p>(b) Longitude: 914852 E</p> <p>(c) Elevation: 14 Feet</p>
<p>3.1.1.9 Time of the accident/serious incident/ investigable incident (Local or UTC)</p>	<p>0535 UTC</p>
<p>3.1.1.10 Whether day/night?</p>	<p>Day</p>

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### 3.1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
3.1.2.1 Fatal	No	N/A	N/A
3.1.2.2 Serious	No	N/A	N/A
3.1.2.3 Minor	No	N/A	N/A

### 3.1.3 Damage to Aircraft (Brief description)

3.1.3.1 Damaged to Aircraft?	<p>(a) Left wheel assembly PT No. PN 5006856-5R S/N: OCT89-96 was found damaged.</p> <p>(b) Hub Locking Bolt PN: AN3H5A (Qty 02) was found broken into two pieces. The upper part of both the locking bolts were attached with the locking wire with the wheel assembly, the lower part of both the bolts were attached with wheel axle till the tip of the thread on the other end.</p> <p>(c) Roller Bearing, Cone Assembly PN: L610549 (Outer Bearing Roller Cone) was found damage; 8 rollers came out from inside; Traces of corrosion was found in the roller and in the housing of bearing.</p> <p>(d) Scratch marks were found on the shinning portion of the left wheel axle PT No. D57259-2. Which was observed throughout the shinning part circumferentially.</p>
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### 3.1.4 Other Damage:

3.1.4.1 Other Damage?	Nil
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### 3.1.5 Personnel information (Flight Crew and Cabin Attendant)

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?	<p><b>3.1.5.1 Pilot-in-command:</b></p> <p>Age : 57 Years Nationality : Bangladeshi ATPL(A) : 258 Ratings : LET-410, DASH-8, ATR-42 Mandatory Checks : PPC/IR carried out 02 April 2022, Valid 31 December 22 Route Check carried out 11 May 2022, Valid 31 May 2023 Flying Experience (Total) : 11579 hrs (until 15 May 2022) Flying Experience (On type) : 450:00 (Appx) on ATR-42 License : ATPL(A) # 258, Valid: 10 March 2023 Medical Status : Class-I, Valid till-31 October 2022</p>
	<p><b>3.1.5.2 Co-pilot:</b></p> <p>Age : 49 Years Nationality : Bangladeshi ATPL(A) : 408 Ratings : HS-748, DASH-8, ATR-42/72 Mandatory Checks : PPC/IR carried out 20 November 2021, Valid 30 June 22 Route Check carried out 11 May 2022, Valid 09 May 2022 Flying Experience (Total) : 3026 hrs (until 31 May 2022) Flying Experience (On type) : 153:00 (Appx) ATR-42 License : ATPL(A) # 258, Valid: 31 August 2023 Medical Status : Class-I, Valid till-30 April 2023</p>
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?

- (a) The air traffic controller of both VGEG and VGCB were qualified and handled the situation proficiently.
- (b) The AME had valid licence on the type and was well experienced in aircraft maintenance.

### 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) The aircraft ATR Model 42-300 Registration No. S2-AHI was first registered on 12 April 2016 in Bangladesh, operated by Hello Air Limited. The last flight was carried out on 27 September 2016 and the aircraft was stored with limited preventive maintenance from 27 September 2016 – 06 May 2018 at Cox's Bazar.
- (b) The aircraft went for shop visit at GMR Aero Technic, Hyderabad, India on 25 October 2018. Keel beam was repaired due to corrosion, both engines was removed and installed after shop visit, replacement of LH No.1, No.4 and RH No.1 propellor was carried out. Test flight was carried out and released to service was issued by GMR Aero Technic on 30 October 2019.
- (c) The aircraft returned back to Cox's Bazar on 06 December 2019, kept in short term storage till 25 January 2020. Aircraft started regular flight from 25 January 2020.
- (d) Before 13 June 2022, the Maintenance of the aircraft was contracted to CAAB Approved Part 145 AMO 'Hello Air Limited'.
- (e) The Certificate of Registration was changed due to change of operator, that is, the name of NXT AIR Limited was endorsed as new operator on 11 March 2022.
- (f) The Certificate of Airworthiness was renewed on 25 April 2022 after 2 years inspection and the Airworthiness review certificate (ARC) was issued on 25 April 2022.
- (g) The aircraft was manufactured on 04 June 1993, flew total 42116.33 hrs since new. Following 2 years inspection, the aircraft flew 49:00 hrs and cycle 64.
- (h) The aircraft was grounded due to No.1 wheel assembly detached during take-off roll on 05 June 2022 at VGEG.
- (i) Maintenance history of the detached left wheel assembly PN: 5006856-5R SN: OCT89-96; The team visited the airlines store on 07 June 2022 to find out the history of the affected wheel; checked the receiving and issuing register, also checked the bin card, the summary of which are given below;
  - (1) The aircraft ATR 42-300 S2-AHI has flown to Bangladesh on 20 March 2016 with this wheel installed in no.4 position.
  - (2) The same wheel assembly was removed from aircraft in serviceable condition and kept in the store on 07 April 2018.
  - (3) This was again installed on S2-AHI on 23 June 2020.
  - (4) The wheel assembly was again removed from S2-AHI as unserviceable due to

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	<p>ply worn out on 19 August 2020.</p> <p>(5) The 'bin card' was maintained by the store-keeper who did not have any information on the removal, installation or maintenance of this wheel assembly.</p> <p>(6) When asked by the IIC, the operator/ AMO was unable to reply as to how this unserviceable wheel assembly was installed in the aircraft, at what position and in which date. The AMO also could not show any document as to what maintenance task was carried out to make it serviceable. Hence, the installation of this wheel to the aircraft remains a question about the maintenance task performed, by the AMO on this wheel to make it serviceable.</p> <p>(7) The 'bin card' maintained in store did not have any information on the receipt and issue date to-and-from store and maintenance history of this wheel assembly.</p> <p>(8) While checking the Aircraft maintenance log (AML), found that one defect on No # 01 main wheel was logged on 24 January 2021 at Jessore (VGJR). The aircraft was released to service after maintenance on 25 January 2021. No other entry was found about this wheel assembly to aircraft maintenance log (AML) from 19.08.2022 till 05.06.2022.</p>
<p>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. (In not and if of any bearing on the Accident/ Serious Incident/ Investigable Incident give details.)?</p>	<p>The mass and centre of gravity of the aircraft didn't have any bearing on the accident.</p>
<p>3.1.6.3 Type of fuel used?</p>	<p>JET A-1</p>

### 3.1.7 Meteorological information of VGEG

<p>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?</p>	<p>(a) Surface Wind: 170 Degree, 12 Knots (b) Vis: 6 Km; (c) QBB: Few, 1800 ft (d) QNY: Cloudy Sky (e) QNH: 1006.2 Hpa (f) Temp: TT-32° C, Td Td-25° C</p> <p>N.B: Metrological condition was not a factor in the incident.</p>
<p>3.1.7.2 Natural light conditions at the time of the Accident/ Serious Incident/ Investigable Incident (Sunlight, Moonlight, Twilight, etc.)?</p>	<p>Sunlight.</p>

### 3.1.8 Aids to Navigation of VGEG

<p>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?</p>	<p>(a) DVOR – Serviceable (b) DME – Serviceable (c) NDB – Unserviceable (d) ILS – Serviceable (e) ILS/LLZ – Serviceable (f) ILS/GP – Serviceable (g) TDME – Serviceable</p>
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### 3.1.9 Communications of VGEG

3.1.9.1 Pertinent information on aeronautical mobile and fixed service communications and their effectiveness?	ATC two-way communication was satisfactory. Other communication equipment's were also serviceable.
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### 3.1.10 Aerodrome information of VGEG

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?	Adequate runway length with direction for take-off and landing were 23-05. Runway condition was dry and take-off was executed from runway 23.
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### 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?	<p>(a) The following equipment were installed at the rear section of the aircraft. Both were found intact and were sent to Sabena technics for Decoding:</p> <p>(1) Flight Data Recorder (FDR) Part No. S800-2000-00, SL No. 01342. (2) Cockpit Voice Recorder (CVR) Part No. 93-A100-83, SL No. 50613.</p> <p>(b) Comments from the Sabena Technics, DNR on FDR decoding:</p> <p>(1) "The flight data transcription was obtained, read out was carried out with ref doc: service letter ATR 42-31-5011, Rev. 9, Jan 03/18. The decoding was carried out on last 6 flights, the date and flight number was not correctly updated. The report contained the detail of analysed parameters. The operator is responsible for the assessment of these results and determination that the FDR system is functioning correctly."</p> <p>(2) The parameters were analysed by the operator and it was confirmed that all parameters were within limit.</p> <p>(3) The decoding report and parameters information are preserved in the appendices.</p> <p>(c) Comments from MUIRHEAD AVIONICS on decoding of cockpit voice recorder:</p> <p>(1) "No audio recorder from boom microphones (if used?), channel 4 (Area microphone) inaudible during flight." (2) The decoding of CVR with report is preserved in the appendices.</p>
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### 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	<p>(a) The left wheel assembly (No.1) PT No. PN: 5006856-5R got detached from wheel axle during take-off roll of aircraft S2-AHI on 05 June 2022, which was found near the end of runway 05 at VGEG. This wheel assembly was sent to VGCB with proper packaging and wrapping so that evidences were not lost.</p> <p>(b) The affected wheel was unpacked in front of the 'Go-Team', the photographs are shown below;</p>
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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?



Figure-1: Detached wheel assembly in packed condition.



Figure-2: Un-packing the wheel in front of 'Go-Team'



Figure-3: Inner side of the damaged wheel assembly.



Figure-4: Outer side of the damaged wheel assembly.

(c) The team carried out a detail inspection of the left wheel assembly and found the followings:

- (1) Locking bolt PT No. AN3H5A (Quantity 2) got broken/sheared off into two pieces. The upper part of both the locking bolts were attached with locking wire with the axle nut of the wheel assembly.



Figure-5: Upper part of the locking bolt attached with the locking wire of the wheel assembly



Figure-6: Upper part of the locking bolt with locking wire after removal from the wheel assembly.

(d) The outer bearing cone assembly PN. L610549 was found damaged, the outer race of the bearing got broken and 8 rollers came out from inside. Found traces of corrosion in rollers and housing of the bearing.

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Figure-7: Damaged outer bearing.



Figure-8: Damaged Roller.



Figure-9: Traces of corrosion of roller and bearing.

- (e) The team inspected the No.1 left wheel axle PT. No. D57259-2; found lower part of sheared off locking bolts were attached with the axle till the tip of the thread to the other end.



Figure-10: Lower part of the shearing locking bolt attached to wheel axle (Upper View)



Figure-11: Lower part of the shearing locking bolt attached to wheel axle (Lower View)

- (f) Scratch marks were found on the shinning portion of the axle which was observed throughout the shinning part circumferentially.



Figure-12: Scratch marks on the shinning portion of the axle throughout the shinning part circumferentially





### 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?	Medical examinations for pilots or any other personnel were not conducted as they were not required.
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### 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?	There was no evidence of fire.
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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?	The VGCB tower positioned 3 crash tenders for any emergency but aircraft landed safely and taxied back to parking area. Nobody was injured. As such, evacuation and rescue were not involved.
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### 3.1.16 Test and research

3.1.16.1 Brief statements regarding the results of tests and research?	<p>(a) The damaged items namely, left outer wheel assembly part no. 5006856-5R serial no. OCT89-96, outer bearing with axle nut (as the outer bearing cone could not be detached from the axle nut), inner bearing and sheared off two locking bolt parts no. AN3H5A were sent to Parker Meggitt, the wheel manufacturer. The AAIT has received the two reports from Timken, the bearing manufacturer and Parker-Meggitt, the wheel manufacturer, which are appended below:</p> <p><b>(1) Parker-Meggitt Report:</b> The salient points of the report are mentioned below:</p> <p><u>Pictures provided prior to examination:</u></p>  <p>Parker Meggitt comments: General location and orientation of bearing contact marks on axle bearing land area indicate bearing was likely located properly on axle. The sheared locking bolt shaft is visible in the wheel axle bolt hole.</p>
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Parker Meggitt comments: The sheared locking bolt heads are still lock wired to the axle nut. The lock wire at the "5 o'clock" bolt head position might be in the improper direction. The axle nut is still attached to the wheel, after the wheel exited the axle. The retaining ring is still in place, keeping the outboard bearing in the wheel.



Parker Meggitt comments: Loose and visibly damaged bearing rollers; damaged and missing portions of cage indicate severe bearing damage.

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Parker Meggitt comments: The damaged cage and skewed orientation of bearing rollers indicate severe bearing damage.

Timken examination/report:

Timken visited Parker Meggitt in Akron, OH on February 2, 2023 to inspect the wheel bearings returned with Main Wheel 5006856-5R; Serial OCT89-96. Timken provided the attached report which includes the statement "The outboard bearing had evidence of extreme corrosion etching on all rollers and raceways." The report also includes a likely scenario of events that could explain the outboard bearing cone and axle nut welding together, shearing the locking mechanism and exiting the wheel.

Pictures and Parker Meggitt observations during examination:

The package arrived in Akron, Ohio and remained sealed until the Parker Meggitt and Timken engineers gathered on-site for the examination.

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The wheel and bearing parts were adequately packaged to prevent further damage during shipping. Both bearing cups appeared to have fresh grease applied to preserve the bearing race surfaces. The overall condition of the wheel surfaces (dirt/missing paint/corrosion) indicate the wheel was not recently overhauled.



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Identification on both sides matched the reported wheel assembly as "5006856-5R", with Serial Number "OCT89-96". The visual appearance of the assembly identification characters "5006856-5R", the serial number production date of October 1989 and a cross-reference with the production drawing date, all support the conclusion that this wheel was field modified to the "-5R" configuration. According to the reference CMM, the "R" character indicates this wheel was reworked from either a 5006856-4 or 5006856-4R. The difference in paint (or primer) color at the serial number is unusual. The CMM does not identify any paint differences in this area. There is additional stamped identification on the wheel which is unfamiliar to Parker Meggitt (not applied during production). The characters "TG 983306 S/N 6515" appear on both flanges.



The elastomer grease retaining rings (back side of bearing cups) on both the inboard and outboard side look normal (no signs of distortion or damage). Visual examination indicates no looseness or cup movement (rotational or lateral) within wheel hubs. The bearing cups have corrosion on the roller contact races. The outboard bearing cup corrosion is more severe and over a larger surface area (see Timken report for additional information).

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The inboard bearing cone has the correct part number and appears to be in good condition except for light corrosion on the cage (see Timken report for more information).



The inboard bearing seal has the correct part number but has a localized cut area. A measurement from the metal face to the seal lip indicates the seal does not meet the reference CMM dimensional requirement for return to service.

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The outboard bearing cone could not be separated from the axle nut without concern of damaging the axle nut. The bearing cone and bearing seal part numbers could not be confirmed; however, a dimensional check of the seal outside diameter and review of visible features matches the drawing.

Summary

The bearing failure was corrosion induced. The Timken report describes the corrosion etching which indicates the damage occurred when the bearing was stationary. As mentioned by Timken, it is important to properly clean, dry, inspect and coat the bearings (cone and cup) with a rust preventative immediately afterwards to avoid corrosion. Inspection of the bearing grease retainers and seals per the CMM is equally important to avoid contamination or condensation within the bearings.

The Timken report also includes a likely scenario of events that could explain the outboard bearing cone failure, leading to the welding together with the axle nut, followed by the shearing of the locking mechanism and exiting of the wheel from the axle.

Correspondence indicates the maintenance history of this wheel is not readily available, therefore no specific comments can be made relative to maintenance activity. However the level of corrosion found in the outboard bearing suggests a review of maintenance activity, shop practices and/or storage conditions might be helpful.

Yours sincerely

**William (Bill) Ward** Digitally signed by William (Bill) Ward  
Date: 2023.02.27 17:47:45 -05'00'

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**(2) Timken Report:** The salient points of the report are mentioned below:

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Inboard | L812148 | Lincolnton, NC, USA | mfg: March 2011

Inboard bearing



Very light frosting on roller bodies. Light corrosion on cage.

Figure 1



Roller ends in good condition  
Figure 2



Grease is discolored, but appears to be in good condition  
Figure 1



Cone raceway in good condition  
Figure 2



Light corrosion on cup raceway  
Figure 3

**TIMKEN**

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Outboard Bearing | L610549

Outboard Bearing



Cone and locknut welded together. Signs of corrosion and flaking paint near interface  
 Figure 4



Cage bridges non-existent on half of cone  
 Figure 5



Cage and rollers skewed on half of cone. Fractured roller bodies  
 Figure 6



Corrosion on cone front face. Heavy scoring on roller ends  
 Figure 7

**TIMKEN**

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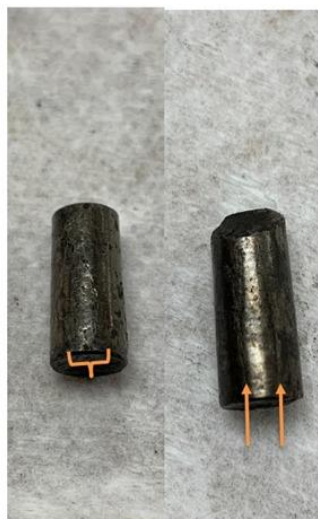
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Roller spaced etching on cone raceway  
 Figure 1



Etching along roller bodies  
 Figure 2



As received. Covered in fresh grease to reduce corrosion during shipping.  
 Figure 3



Etching and smearing around entire cup raceway  
 Figure 4

**TIMKEN**

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Heavy etching beneath smearing damage  
 Figure 5

**Conclusion:**

The outboard bearing had evidence of extreme corrosion etching on all rollers and raceways. This is typically a result of water or condensation collecting in the bearing. The most advanced etching appeared to be roller spaced on the cone raceway and along the roller body which indicates the damage occurred when the bearing was stationary. It is important to regularly inspect for damaged, worn, or inadequate seals. It is also important to note that bearings should be properly washed and dried during the inspection process. After cleaning and drying thoroughly, the bearings should be coated with a rust preservative and wrapped in protective paper. Once protected, always store bearings in a dry area until installation to reduce the risk of static corrosion.

Excessive etching on a bearing can dramatically affect the fatigue life of the bearing. The voids created from corrosion etching can progress into spalling and eventually roller fracturing. It is likely that once the rollers began to spall and fracture from the etching damage, they were no longer rolling and began to slide along the raceways. The sliding of the rollers created an excessive amount of heat in the bearing and destruction to the cage. At this point, the bearing had an extreme amount of drag, so it is possible the cone locked to the cup and wheel, where it began to turn on the shaft. Once spinning on the shaft, rotating relative to the locknut, it welded to the locknut and sheared the locking mechanism. The cone and locknut were then free to exit from the wheel.

**IMPORTANT NOTE:** The accuracy of this technical review is dependent upon the validity and completeness of information supplied to the Timken Corporation. Actual product performance is affected by many factors beyond the control of The Timken Corporation. Therefore, the suitability and feasibility of all designs and product selection should be validated by you. For the above reasons, this review is submitted solely to provide you, a customer of The Timken Corporation or its parent or affiliates, with data to assist you in your design. No warranty, expressed or implied, including any warranty of fitness for a particular purpose, is made by Timken by the submission of this review. Timken products are sold subject to the Limited Warranty which is set forth in Timken's terms and conditions of sale.



**3.1.17 Organizational and Management Information**

<p>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,</p>	<p>(a) The NXT Air Ltd is a CAAB approved cargo airlines, operates from Cox's bazar to Jessore and fully engaged in carrying baby shrimps.</p> <p>(b) The MD &amp; CEO is the accountable manager, who is assisted by CAMO manager, maintenance manager, head of flight operation, chief of safety, chief of training, head of SMS, chief of training, QA manager and others to operate, maintain the aircraft to ensure the safer flying.</p> <p>(c) NXT Air limited currently operates ATR 72 and ATR 42 aircraft under its AOC and is managed by its own CAMO scope of approval by CAAB. NXT Air limited obtained its initial AOC on the 20 January 2022 with ATR 72 is the ops specification while ATR 42 was included into its AOC in February 2022.</p> <p>(d) Both the aircraft are being managed by NXT Air limited CAMO to ensure the airworthiness aspect of the aircraft. NXT Air CAMO manager has the role to</p>
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**OFFICE OF THE AIRCRAFT ACCIDENT INVESTIGATION COMMITTEE OF BANGLADESH**  
**MINISTRY OF CIVIL AVIATION & TOURISM**  
**3<sup>RD</sup> FLOOR CAAB HEADQUARTERS (OLD BUILDING) KURMITOLA DHAKA-1229**



Ref: 30.00.0000.013.33.001.22 (ATR 42-300/S2-AHI- 05 June 2022)-70

Date: 30 May 2023

*economic status, management policies and practices, and regulatory framework?*

ensure that all schedule and unscheduled maintenance of the aircraft are being carried out within the time limit as per the maintenance organization exposition (MOE) by the part 145 CAAB approved AMO. CAMO department is directly in communication with CAAB approved part 145 AMO to carry out these tasks to ensure the airworthiness of the aircraft.

- (e) Part 145 AMO of NXT Air limited obtained its approval on the 13 June 2022 and has been maintaining both the aircraft under its scope of approval up to 2.5 years check. The maintenance manager has the role of overseeing that all the maintenance works are carried out by appropriate maintenance engineer following the updated Aircraft maintenance Programme (AMP).
- (f) Spare parts provisioning is being managed by the Department of purchase and all the aircraft components/ consumables/ POL/ rubberized items are kept at company stores at Cox's Bazar.
- (g) Both the operation and line maintenance base are at Cox's bazar. But the periodic maintenance is carried out at Dhaka.
- (h) Both CAMO and Part 145 organization are under the quality system of NXT Air limited and are being audited as per the published audit schedule from the quality assurance department. The quality assurance manager plays the role of continuous monitoring and ensuring all applicable procedures are being followed in aircraft maintenance.
- (i) The accountable manager plays the pivotal role of ensuring that all departments are running smoothly in terms of manpower, facilities and finance. The quality assurance manager reports directly to accountable manager for any discrepancy or short fall of both CAMO and AMO. This ensures that the aircraft are being maintained as per the approved AMP issued by the manufacturer.
- (j) Before 13 June 2022, the maintenance of the aircraft was contracted to CAAB approved part 145 AMO 'Hello Airlines Limited.' The AAIT has the following comments on the performance of the AMO, which were observed during the field level investigation:
  - (1) The AMO did not record the removal and installation of the wheel assembly in the aircraft maintenance log (AML). The aircraft did not fly from 27 September 2016 till 06 May 2018 and was kept in storage with limited preservation. Nothing specific was mentioned about wheel bearing greasing, main landing gear and main landing gear doors lubrication during this period.
  - (2) The same wheel assembly was removed from aircraft as serviceable condition and was kept in store from 07 April 2018 until 23 June 2020. Nothing specific was mentioned about the maintenance of the wheel while it was kept in store. The 'bin card' did not have sufficient information on the date of receipt, date of issue and maintenance history of this wheel. The store was not maintained as per procedures laid down in the MOE part-2.
  - (3) This wheel was installed in the aircraft on 23 June 2020 and was removed from the aircraft as unserviceable on 19 August 2020. No further tracing of this wheel could be detected as to how this unserviceable wheel was made serviceable, was installed to the aircraft, at which position and in which date.

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This reflects the poor performance of the maintenance organization in aircraft maintenance and violation of procedures mentioned in the 'Maintenance Organization Exposition' (MOE).

### 3.1.18 Additional Information

3.1.18.1 Relevant information not already included in 3.1.1 to 3.1.17?

(a) While asking the operator/ AMO about the maintenance task card on wheel bearing and wheel axle lubrication (greasing), the operator informed that there was no task card issued by ATR on the lubrication of bearing, axle etc. Nothing was mentioned specifically about any task card for the lubrication of the MLG and the MLG doors. In this regard the AAIT gathered the following information:

(b) ATR introduced two task cards in lubrications of the MLG doors, issue date 01 July 2022 with additional information as follows:

Note: In some cases, the removal of the MLG wheels from the wheel axle will possibly not be easy if aircraft operations lead to:

- (1) High number of cycles between tires changes
- (2) Long lead time between tires changes

In such case, in order to prevent possible wheel seizer on axle, it is recommended to remove and install the MLG wheels Ref. MP ATR-A-12-37-32-00ZZZ-520Z-A and Ref. MP ATR-A-12-37-32-00ZZZ-720Z-A for the wheel axle lubrication.

(c) Following the above task card issued by the ATR, the operator has been performing the lubrication of MLG, including greasing of wheel axle at an interval of 3 months or 600 landings, whichever occurs first, from July 2022 onwards.

(d) The aircraft manufacturer has sent their comments on the reason of non-issuance of task card by ATR on wheel bearing lubrication (greasing) and long term preservation.

(e) Relevant portion are mentioned below:

(1) "The wheel bearing shall be considered as under the responsibility of the bearing manufacturer and therefore is covered by the CMM. That's the reason why no task card is present in the ATR documentation for the wheel bearing lubrication.

(2) On the other hand, the wheel axle is part of the aircraft and its maintenance is detailed in the AMM. ATR Maintenance program requests to lubricate the wheel axle at each wheel installation as specified in the Maintenance Procedure ATR-A-12-37-32-00ZZZ-720Z-A.

(3) In environmental conditions, in particular in the North of Europe, some operators reported a wheel replacement cycle of more than 1000 cycles (average cycle for the ATR fleet is around 650 cycles), which could be performed through two years. This level of cycle in combination with calendar period and climate zone could potentially lead to grease deterioration and possible seizure of the wheel bearings on axle. ATR therefore introduced a Note in the Maintenance Procedure ATR-12-22-32-00ZZZ-240Z-A, to call attention to the operational aspects. This note is mentioned in the Final Report. However, the introduction of the Note is not relative to the

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serious incident of the ATR42-300 registered S2-AHI, contrary to what is written in the Final Report. The note does not refer to wheel bearing lubrication but to the frequency of MLG wheel replacement which has to be increased due to environmental conditions.

(f) **Long term storage**

(1) Long term storage is done when scheduled or chosen aircraft immobilization time (including aircraft under maintenance/repair status) is more than 6 months (MP Ref. ATR-A-12-34-30-00001-810A-A Long term storage (> 6 months)). Long term storage must be decided from the first month of storage.

(2) In the MP task MP ATR-A-12-34-30-00ZZZ-870Z-A (Return to Service of Aircraft External Components and Various Furnishings) it is requested to remove the wheel/tire assembly and to install "Serviceable" MLG Wheel/Tire Assembly.

NOTE: A part that is considered "serviceable", is a part which is in airworthy condition.

(3) It means that ATR as well wheel manufacturers, considers that wheel/ tire assembly that are installed for six months and over (aircraft stored) are no more serviceable (NOT in airworthy condition).

(4) During a long-term storage, the wheel bearing grease may lose its characteristics and corrosion may be present. It is therefore requested to replace the wheel with a serviceable one as mentioned in the MP. As reported above, ATR and wheel manufacturers retain that for a wheel that has been installed on aircraft, and for a similar wheel stored for a long period, the wheel airworthy condition are no more guaranteed, and it is required to replace the wheel with an airworthy one."

**Observation by AAIT:**

The AAIT concluded that there seemed to be some information or understanding gap by the operator on the question of lubrication/ greasing of the wheel bearing which should be as per the CMM and the lubrication of the wheel axle which should be as per the ATR task card.

**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 3.1.18?*

The investigation techniques used by the AAIT in conducting this investigation have been adopted as per the instructions provided in ICAO Annex-13, Appendix-1, Para-1.19 and that of Doc-9756, Part-4, Para-1.19.

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### 3.2 ANALYSIS

3.2.1 Man?	<p><b>Pilot-in-Command (PIC):</b></p> <ul style="list-style-type: none"> <li>(a) The PIC was adequately qualified and was current on the type.</li> <li>(b) The PIC carried out the transit check at VGEG after declaration of aircraft by maintenance engineer and found everything was normal.</li> <li>(c) To conduct the last flight leg of the day, the PIC took off from VGEG for VGCB at 0535 UTC on 05 June 2022.</li> <li>(d) After take-off, the DATCO of VGEG tower informed the PIC at 0540 UTC that the bird shooter on duty found a wheel near the end of runway 05 after their departure.</li> <li>(e) As there was no abnormal indication during take-off and the maintenance base was at VGCB, PIC decided to proceed to CXB as per flight plan. At this stage PIC and co-pilot were in doubt as to whether the mentioned wheel belong to their aircraft or not.</li> <li>(f) After coming to the contact of VGCB tower, the PIC made two low passes with the landing gear in down position to confirm by the ATC Controller about the status of the landing gear as well as if any wheel was missing or not. The VGCB tower confirmed that outer wheel (No.1) of left main landing gear was missing but the inner (No.2) wheel was intact with the landing gear.</li> <li>(g) At this stage VGCB controller wanted to know their intention whether they would like to proceed to VGEG or not for landing. The PIC expressed his intention to land at VGCB and requested to arrange for all emergency assistance available for landing.</li> <li>(h) The controller arranged three crash tenders and positioned them beside runway for any emergency.</li> <li>(i) The crew landed with extra precautions with slight pressure to right landing gear, used thrust reverser to slow down the aircraft, avoided braking as far as possible.</li> <li>(j) The aircraft made safe landing at 0636 UTC, made 180° turn and as there was no abnormality, continued taxiing and parked at the parking bay.</li> <li>(k) The PIC demonstrated the good airmanship throughout the flight from VGEG to VGCB and made a commendable safe landing without further damaged to the aircraft.</li> </ul> <p><b>Co-Pilot:</b></p> <ul style="list-style-type: none"> <li>(a) The co-pilot was adequately qualified and was current on the type. The co-pilot also demonstrated good airmanship throughout the flight in assisting the PIC to conduct the flight and land safely.</li> </ul> <p><b>Air-Traffic controller (VGEG):</b></p> <ul style="list-style-type: none"> <li>(a) Just after take-off of flight NXA-210, at 0535 UTC from VGEG for VGCB, the bird shooter on duty informed the tower that a wheel was found at the end of RW 05 at 0539 UTC. One controller immediately went to the spot, found the detached wheel, which was taken to the tower and was kept under their custody.</li> </ul>
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- (b) Meanwhile, DATCO of VGEG informed the PIC that a wheel was found near the end of RWY 05 after their departure. The PIC intended to continue and proceed to VGCB.
- (c) The DATCO of VGEG tower communicated the event of finding the wheel to VGCB tower.
- (d) The bird shooter on duty did a commendable job of finding the wheel and informed the same to the tower. The DATCO of VGEG tower took prompt action of sending one controller to the spot, confirmed about the detached wheel and informed the PIC and VGCB tower respectively. An example of good professionalism was demonstrated by the Bird shooter and DATCO, VGEG.

**Air Traffic Controller (VGCB):**

- (a) After coming to the contact of VGCB tower, the PIC carried out two low passes with the aircraft landing gear in down position to confirm by the ATC controller about the status of the landing gear as well as if any wheel was missing or not. The duty controller confirmed that outer wheel (No. 1) of left main landing gear was missing but inner (No. 2) wheel was intact with the landing gear.
- (b) At this stage, the duty controller wanted to know from the PIC about their intention whether they would like to proceed to VGEG or not for landing. The PIC expressed their intention to land at VGCB and requested to arrange all emergency assistance available for landing.
- (c) The duty controller arranged three crash tenders, two from CAAB and one from BAF and positioned them beside the runway for any eventuality. The aircraft landed safely at 0636 UTC at VGCB. The tower guided the aircraft for taxiing and helped to park the aircraft to a safer place.
- (d) The performance of duty controller of VGCB was satisfactory.

**Aircraft Maintenance Engineer:**

- (a) The aircraft maintenance engineer was adequately experienced and qualified with valid licence on the type.
- (b) The aircraft was pre-flighted at VGCB, transit check was carried out by riding engineer at VGJR, refuelling and transit check was carried out at VGEG by the same riding engineer. The aircraft was serviceable 'prior' to all flights of the day.
- (c) The aircraft landed safely with missing outer (No 1) wheel of left landing gear at VGCB at 0636 UTC. The riding engineer was 'on board' with the aircraft.
- (d) After parking, the aircraft was resting on (No.2) wheel of left landing gear. The maintenance engineer placed a bottle jack under the left landing gear to ensure the safety of the aircraft.
- (e) The maintenance engineer carried out the necessary checks and helped the investigation team to find out the damaged parts.
- (f) The maintenance engineer was interviewed; found him to be well experienced and familiar to the maintenance procedures and documentation.

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### 3.2.2 Machine

3.2.2 Machine?	<p>(a) The detachment of the outer (No. 1) wheel assembly from the wheel axle was the causal factor for this serious incident, which took place after take-off from VGEG at 0535 UTC on 05 June 2022.</p> <p>(b) The serious incident resulted damage of the outer (No. 1) wheel, outer bearing that was attached with axle nut, the inner bearing, the associated two locking bolts.</p> <p>(c) The root cause of the incident was the outer bearing failure which was induced due to severe static corrosion.</p> <p>(d) The outboard bearing had evidence of extreme corrosion etching on all rollers and raceway. This is typically a result of water or condensation collection in the bearing. The most advanced etching appeared to be roller spaced on the cone raceway and along the roller body which indicates the damaged occurred when the bearing was stationary.</p> <p>(e) Excessive etching on a bearing can dramatically affect the fatigue life of the bearing. The voids created from corrosion etching can progress into spalling and eventually roller fracturing. It is likely that once the rollers began to spall and fracture from the etching damage, they were no longer rolling and began to slide along the raceways. The sliding of the rollers created an excessive amount of heat in the bearing, causing the destruction to the cage. At this point, the bearing had an extreme amount of drag, so it is possible the bearing cone locked to the axle nut, where it began to turn on the shaft. Once spinning on the shaft, the two locking bolts could not withstand this rotational force, resulting shearing of the locking bolts and exiting of the wheel from the axle.</p>
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### 3.2.3 Environment

3.2.3 Environment?	Environment was not a factor to this incident.
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### 3.2.4 Organizational & Motivation aspect:

3.2.4.1 Organizational Aspect?	<p>(a) The present organizational structure of the NXT Air Limited covers all fields with experienced and qualified manpower and supervisors to meet the present CAAB requirements of continuing airworthiness maintenance organization (CAMO) and part 145 aircraft maintenance organization (AMO). The key appointment holders like CAMO manager, AMO manager, QA manager, Chief of operation, Chief of safety are positioned in Dhaka but the main operational and maintenance (line maintenance) base is located at Cox's bazar. This might create a gap between supervisory and field level operation.</p> <p>(b) During the time of incident, the aircraft was maintained by CAAB approved AMO "Hello Airlines Limited". The aircraft did not fly much, it was kept under storage with limited preventive maintenance, particularly from 27 September 2016 to 06 May 2018. No documentation was found about the wheel bearing greasing, MLG and MLG doors lubrication during this period. Moreso, the wheel assembly was removed from the aircraft as unserviceable on 19 August 2020. The AMO could not show any document as to how this wheel was made serviceable, when it was installed in the aircraft and in which date. The AMO did not maintain the aircraft and required documentation was not carried out as per the procedures laid down in maintenance organization exposition (MOE).</p> <p>(c) The store was not maintained properly, in particular, the tracking of serviceable and</p>
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	unserviceable component, date of receipt and issue of the components, improper maintenance of bin card, absence of maintenance history of the component etc. The store could not produce any document as to how this unserviceable wheel was made serviceable, when it was issued to maintenance for installation. As such, the store was not maintained as per the provision and procedures of MOE.
3.2.4.2 Motivational aspect?	(a) The AAIT interviewed the employees of the NXT Air Limited; found them to be motivated for the organization.

### 3.3 CONCLUSIONS

Appended below are the finding, causes and or contributing factors established in the investigation.

#### 3.3.1 Findings

3.3.1 Findings?	<p><b>(a) Field Phase Investigation</b></p> <p>(1) The No # 1 wheel assembly part no. 5006856-5R, serial no OCT89-96 was detached from the left main landing gear during take-off at Shah Amanat International Airport (VGEG) on 05 June 2022.</p> <p>(2) The wheel assembly part no. 5006856-5R, serial no OCT89-96 along with outer bearing, inner bearing and two locking bolt parts no. AN3H5A were found damaged.</p> <p>(3) The aircraft maintenance was contracted to CAAB approved part 145 AMO 'Hello Airlines Ltd' till 12 June 2022, which did not maintain the aircraft and documents properly as indicated below:</p> <p>(i) The aircraft was not flown much; it was kept under storage with limited preventive maintenance, particularly from 27 September 2016 to 06 May 2018. No documentation was found about the wheel bearing greasing, MLG and MLG doors lubrication during this period. More so, the wheel assembly was removed from the aircraft as unserviceable part on 19 August 2020. The AMO could not show any document asked by the AAIT as to how this wheel was made serviceable, when it was installed in the aircraft and in which date.</p> <p>(ii) The AMO did not record the removal and installation of the wheel assembly in the aircraft maintenance log (AML). The AMO did not maintain the aircraft and required documentation was not carried out as per the procedures laid down in maintenance organization exposition (MOE).</p> <p>(iii) The store was not maintained properly, in particular, the tracking of serviceable and unserviceable component, date of receipt and issue of the components, improper maintenance of bin card, absence of maintenance history of the component etc.</p> <p>(iv) The same wheel assembly was removed from aircraft as serviceable condition and was kept in store from 07 April 2018 until 23 June 2020. Nothing specific is mentioned about the maintenance of the wheel while it was kept in store. The bin card did not have sufficient information on the maintenance history of this wheel.</p> <p>(v) This wheel was installed in the aircraft on 23 June 2020 and was removed from the aircraft as unserviceable on 19 August 2020 and was returned to store. The store could not produce any document as to how this unserviceable wheel was made serviceable,</p>
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when it was issued to maintenance for installation.

(vi) The store was not maintained as per procedures laid down in the MOE part-2.

**(b) Findings provided by the Wheel and Bearing Manufacturers**

- (1) The overall condition of the wheel surface (dirt/ missing paint/ corrosion) indicated that the wheel was not overhauled lately.
- (2) Identification marks on both sides matched the reported wheel assembly as “5006856-5R” with serial number “OCT89-96”. The visual appearance of the assembly identification characters “5006856-5R”, the serial number production date is of October 1989.
- (3) This wheel was field-modified to the “5R” configuration. According to the reference CMM, the “R” character indicated that the wheel was reworked from either a 5006856-4 or 5006856-4R.
- (4) The difference in paint (or primer) color at the serial number was unusual, which is contrary to CMM. There was additional stamped identification “TG 983306 S/N 65/5” on both sides of the wheel, which was unfamiliar to the wheel manufacturer.
- (5) The authenticity on the source of supply could not be verified as there was no back to birth history of this wheel.
- (6) The sheared locking bolts heads were still lock wired to the axle nut. The axle nut was still attached to the wheel, after the wheel was detached from the axle. The retaining ring was still in place, keeping the outboard bearing in the wheel.
- (7) The bearing contact marks on axle indicated that the bearing was located properly on axle. The two sheared locking bolt shafts were visible in the wheel axle bolt hole.
- (8) The inboard bearing cone had the correct part number and appeared to be in good condition except for light corrosion on the cage. The inboard bearing seal had the correct part number but had a localized cut area. A measurement from the metal face to the seal lip indicated that the seal did not meet the reference CMM dimensional requirement for return to service.
- (9) The outboard bearing had loose and visibly damaged rollers; damaged missing portion of cage indicated severe bearing damage; cage and rollers skewed on half of cone; corrosion was found on cone front face with heavy scoring on roller ends; roller spaced etching on cone raceway and etching was detected along roller bodies; heavy etching and smearing were found around entire cup raceway.
- (10) The outboard bearing cone could not be separated from the axle nut as it was jammed heavily. The bearing cone and bearing seal part number could not be confirmed; however, a dimensional check of the seal outside diameter and review of visible features matched the drawing.
- (11) The outboard bearing had evidence of extreme corrosion etching on all rollers and raceway. This was typically as a result of water or condensation collection in the bearing. The most advanced etching appeared to be roller spaced on the cone raceway and along the roller body which indicated the damage occurred when the bearing was stationary.
- (12) Excessive etching on a bearing can dramatically affect the fatigue life of the bearing. The

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voids created from corrosion etching can progress into spalling and eventually roller fracturing. It is likely that once the rollers began to spall and fracture from the etching damage, they were no longer rolling and began to slide along the raceways. The sliding of the rollers created an excessive amount of heat in the bearing, causing the destruction to the cage. At this point, the bearing had an extreme amount of drag, so it is possible the bearing cone locked to the axle nut, where it began to turn on the shaft. Once spinning on the shaft, the two locking bolts could not withstand this rotational force, resulting shearing of the locking bolts and exiting of the wheel from the axle.

### 3.3.2 Causes

3.3.2 Causes?	<p>(a) The detachment of the outer (No.1) wheel assembly from the wheel axle was the causal factor for this serious incident, which took place after take-off from VGEG at 0535 UTC on 05 June 2022.</p> <p>(b) The root cause of the incident was the outer bearing failure which was induced due to severe static corrosion.</p>
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### 3.3.3 Contributing Factors

3.3.3 Contributing Factors?	<p>(a) Improper or no maintenance was carried out by the AMO for the lubrication of the main landing gear wheel bearing, axle etc during the long/ short term preservation of the aircraft and when the wheel assembly was kept in the store for about 2 years. This improper/ no maintenance contributed to the formation of corrosion in static condition and ultimately attributed to this serious incident.</p> <p>(b) Information or understanding gap by the operator on the question of lubrication/ greasing of the wheel bearing which should be as per the CMM and the lubrication of the wheel axle which should be as per the ATR task card, which ultimately contributed to this serious incident.</p>
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### 3.4 Safety Recommendations

3.4.1 Intermediary Safety Recommendations?	<p>(a) The operator was advised two intermediary safety recommendations as below:</p> <p>(1) One time inspection is to be carried out to check the condition, especially the presence of corrosion, crack or any other abnormalities to all bearings (inner and outer and hub locking bolts in all main and nose landing gear wheel assemblies and necessary preventive action is to be taken as per the findings. An entry is to be made in the aircraft technical logbook. This is applicable to all operators of Bangladesh using ATR aircraft in their fleets.</p> <p>Corrective action by the operator:</p> <p>‘The operator carried out the above-mentioned check by carrying out the engineering order no. NXT/EO/32/002 dated: 06 June 2022.’</p> <p>(2) The aircraft operating at Cox’s Bazar are more susceptible to corrosion due to salinity. As such a preventive corrosion control program may be introduced in the Aircraft Maintenance Programme (AMP), which is to be carried out at a</p>
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	<p>regular interval as a measure to prevent corrosion, if not yet included the corrosion preventive program in the aircraft maintenance schedule. This is applicable to all aircraft operating in Cox's bazar.</p> <p>Corrective action by the operator:</p> <p>'The operator informed that the corrosion prevention and control program (CPCP) has been incorporated in the MPD and AMP to prevent corrosion.'</p>
<p>3.4.2 Safety Recommendations?</p>	<p><b>(a) Applicable for NXT Air Limited:</b></p> <p>(1) Pursuant to Para 3.2.4.1 (a) an effective supervision and monitoring for field level activities may be introduced by the operator in order to ensure that company policies and procedures are strictly adhered to minimize the gap between field and supervisory level and thereby ensuring safe operation of flight.</p> <p>(2) As advised by the aircraft manufacturer and/or bearing/ wheel manufacturer as well as the AAIT, the operator is required to:</p> <p>(i) Perform the lubrication of wheel bearing in accordance with instruction of CMM. To avoid the ambiguity and for more clarity the operator should introduce a local task card on wheel bearing greasing following the procedures in the CMM. This is applicable both for the line maintenance and store.</p> <p>(ii) Perform the lubrication of the wheel axle at each MLG wheel installation by performing the task Ref. MP ATR- A- 12-37-32-00ZZZ-720Z-A. While carrying out this task card, also perform the lubrication of wheel bearing as per the CMM. An additional task card for lubrication of wheel bearing may be introduced by the operator.</p> <p>(iii) If there is a high number of cycles performed between MLG wheel replacement or long lead time between tyre changes, perform the lubrication of the wheel axle by performing the task card Ref. MP ATR-A-12-37-32-00ZZZ-520Z-A and ref. MP ATR-A-12-37-32-00ZZZ-720Z-A at an interval of 3 months or 600 landing, whichever occurs earlier. While carrying out this task card, also perform the lubrication of wheel bearing as per the CMM. An additional task card for lubrication of wheel bearing may be introduced by the operator.</p> <p>(iv) Wash and dry properly the bearing during the inspection process followed by coating of proper grease to avoid corrosion. CMM must be followed during inspection of retaining ring and seals to avoid contamination or condensation within the bearing.</p> <p>(v) In case on the expiry of long-term storage of the aircraft (more than 6 months) in line maintenance or wheel assembly is kept in store with bearing installed condition, the task card MP ATR-A-12-34-30-00ZZZ-870Z-A is to be followed. In this regard, the operator is required to:</p> <p>a. Remove the wheel assembly and inspect the condition of relevant parts of the wheel assembly for defect detection, the condition of grease, corrosion or any other defect;</p>

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	<p>b. Replace the defective parts with serviceable one, in case, if inspection is found to be satisfactory, then lubricate the wheel bearing as per the procedures mentioned in CMM;</p> <p>c. An additional task card may be introduced for clarity and understanding of the maintenance personnel.</p> <p>(vi) In case if only bearing is preserved in store, the bearing should be cleaned, dried, coated with a rust preservative and wrapped in protective paper. Once protected, always store the bearing in a dry area until installation to reduce the risk of static corrosion.</p> <p>(3) The store is to be maintained as per the procedures laid down in MOE.</p> <p>(4) Pursuant to Para 3.3.1 (b) (4) and (5), the aircraft component is to be procured from authentic sources with back to birth history and as per provision of MOE.</p> <p><b>(b) Applicable to the Civil Aviation Authority of Bangladesh (CAAB)</b></p> <p>(1) The CAAB should monitor the compliance of aircraft maintenance as per the approved AMP, MOE, CAME and maintenance of the store with a special emphasis on procurement of aircraft components as per the provision of MOE part 2.</p> <p>(2) The CAAB should ensure the compliance of the safety recommendations mentioned in 3.4.2.1 (a) (2) by the operator with a special emphasis on 'Local Task Card'.</p>
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#### 4. APPENDICES

4.1 Details of Appendices?	All evidences, documents, photographs etc., preserved in 'File'
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END

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