

# Flight Safety News Letter

- **In Focus** – Lightning Strike
- **Case Study** – Loss of LH outer wheel assembly
- **Upcoming Event** – Pilot/Crew Engineer Interactive Meet on 15<sup>th</sup> July 2024
- **Meeting and Engagement** - SRBM (Safety Review Board Meeting) in July 2024 & Table Top Meeting for ERP in August 2024

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## In Focus

## Lightning Strike

**Definition :** Lightning is an atmospheric discharge of electricity. A lightning strike can be very distressing to passengers and crew but damage to an aircraft in flight which is sufficient to compromise the safety of the aircraft is rare.

**Description:** Lightning occurs as a result of a build up of static charges within a Cumulonimbus (Cb) cloud, often associated with the vertical movement and collision of ice particles (Hail), which result in a negative charge at the base of the cloud and a positive charge at the top of the cloud. Beneath the cloud, a "shadow" positive charge is created on the ground and, as the charge builds, eventually a circuit is created and discharges takes place between the cloud and the ground, or between the cloud and another cloud. An aircraft passing close to an area of charge can initiate a discharge and this may occur some distance from a Thunderstorm.

Lightning strikes on aircraft commonly occur within 5,000 feet of the freezing level.

Lightning is accompanied by a brilliant flash of light and often by the smell of burning, as well as noise. A lightning strike can be very distressing to passengers (and crew!) but significant physical damage to an aircraft is rare and the safety of an aircraft in flight is not usually affected. Damage is usually confined to aerials, compasses, avionics, and the burning of small holes in the fuselage. Of greater concern is the potential for the transient airflow disturbance associated with lightning to cause engine shutdown on both Full Authority Digital Engine Control (FADEC) and non-FADEC engines with close-spaced engine pairs.

## In Focus

## Lightning Strike

Lightning may also occur in Volcanic Ash clouds formed in the immediate vicinity of eruptions because the vertical movement and collision between solid particles within the cloud generates static charges.

### Effects

- **Aircraft Damage.** Structural damage to aircraft from Lightning strikes is rare and even more rarely of a nature that threatens the safety of the aircraft. Nevertheless, there have been many incidents of lightning strikes leaving puncture holes in the radomes and tail fins of aircraft (entry and exit holes) and damage to control mechanisms and surfaces (see Further Reading).
- **Crew Incapacitation.** Momentary blindness from the lightning flash, especially at night, is not uncommon.
- **Interference with Avionics.** A lightning strike can effect avionics systems, particularly compasses.
- **Engine Shutdown.** Transient airflow disturbance associated with lightning may cause engine shutdown on both FADEC and non-FADEC engines on aircraft with close-spaced engine pairs. See separate article on Lightning Strike Risk to Engines.

### Defences

- **Avoidance.** Standard advice to pilots is to remain at least 20 nautical miles displaced from any Cumulonimbus (Cb) cloud. The dangers from Turbulence, Low Level Wind Shear, and In-Flight Icing associated with Cumulonimbus clouds are far greater than the threat of Lightning.

# In Focus

# Lightning Strike

## Accident & Incident Reports Including Lightning as a Factor

### **AS3B, en-route, northern North Sea UK, 2008**

On 22 February 2008, a Eurocopter AS332 L2 Super Puma flying from an offshore oil platform to Aberdeen was struck by lightning. There was no apparent consequence and so, although this event required a landing as soon as possible, the commander decided to continue the remaining 165nm to the planned destination which was achieved uneventfully. Main rotor blade damage including some beyond repairable limits was subsequently discovered. The Investigation noted evidence indicating that this helicopter type had a relatively high propensity to sustain lightning strikes but noted that, despite the risk of damage, there was currently no adverse safety trend.

### **SU95, Moscow Sheremetyevo Russia, 2019**

On 5 May 2019, a Sukhoi RRJ-95B making a manually-flown return to Moscow Sheremetyevo after a lightning strike caused a major electrical systems failure soon after departure made a mismanaged landing which featured a sequence of three hard bounces of increasing severity. The third of these occurred with the landing gear already collapsed and structural damage and a consequential fuel-fed fire followed as the aircraft veered off the runway at speed. The subsequent evacuation was only partly successful and 41 of the 73 occupants died and 3 sustained serious injury. An Interim Report has been published.

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## Lightning Strike

### **A332, Perth WA Australia, 2014**

On 26 November 2014, an Airbus A330-200 was struck by lightning just after arriving at its allocated stand following a one hour post-landing delay after suspension of ramp operations due to an overhead thunderstorm. Adjacent ground services operatives were subject to electrical discharge from the strike and one who was connected to the aircraft flight deck intercom was rendered unconscious. The Investigation found that the equipment and procedures for mitigation of risk from lightning strikes were not wholly effective and also that perceived operational pressure had contributed to a resumption of ground operations which hindsight indicated had been premature.

### **E145, vicinity Manchester UK, 2001**

On 25 September 2001, an Embraer 145 in descent to Manchester sustained a low power lightning strike which was followed, within a few seconds, by the left engine stopping without failure annunciation. A successful single engine landing followed. The Investigation concluded that the cause of failure of the FADEC-controlled AE3007 engine (which has no surge recovery logic) was the aero-thermal effects of the strike to which all aircraft with relatively small diameter fuselages and close mounted engines are vulnerable. It was considered that there was a risk of simultaneous double engine flameout in such circumstances which was impossible to quantify.

## In Focus

## Lightning Strike

### **SB20, vicinity Sumburgh, UK 2014**

On 15 December 2014, the Captain of a Saab 2000 lost control of his serviceable aircraft after a lightning strike when he attempted to control the aircraft manually without first disconnecting the autopilot and despite the annunciation of a series of related alerts. The aircraft descended from 4,000 feet to 1,100 feet at up to 9,500 fpm and 80 knots above Vmo. A fortuitous transient data transmission fault caused autopilot disconnection making it possible to respond to EGPWS 'SINK RATE' and 'PULL UP' Warnings. The Investigation concluded that limitations on autopilot disconnection by pilot override were contrary to the type certification of most other transport aircraft.

### **D228, vicinity Bodø Norway, 2003**

On 4 December 2003, the crew of a Dornier 228 approaching Bodø lost control of their aircraft after a lightning strike which temporarily blinded both pilots and damaged the aircraft such that the elevator was uncontrollable. After regaining partial pitch control using pitch trim, a second attempt at a landing resulted in a semi-controlled crash which seriously injured both pilots and damaged the aircraft beyond repair. The Investigation concluded that the energy in the lightning had probably exceeded certification resilience requirements and that up to 30% of the bonding wiring in the tail may have been defective before lightning struck.

# Case Study

## Loss of LH outer wheel assembly (ARTICLE BY M/s ATR)

The ATR42 operated a ferry flight from Shah Amanat (VGEG) to Cox's Bazar (VGCB) airport in Bangladesh. The outer wheel assembly detached from the left main landing gear during take-off. The chapters 1 to 5 are factual elements from the published report. Chapter 6 is the ATR additional comments.

### 1. SERIOUS INCIDENT DESCRIPTION

On 05 June 2022, the ATR 42-300 took-off at 0535 UTC to Cox's Bazar airport. After take-off, Airport staff informed the Tower that a wheel was found at the end of RWY 05 at 0539 UTC. Meanwhile, the air traffic controller informed the PIC at 0540 UTC that they found a wheel beside the runway 05 after the departure of the flight. The landing gear of the aircraft retracted normally during take-off and there was no abnormality felt during the take-off. The flight crew decided to proceed to Cox's Bazar airport as the maintenance base of the company was there. Meanwhile, the tower communicated the event about finding the wheel to Cox's Bazar tower. At this stage, the flight crew were in a doubt as to whether the mentioned wheel belonged to their aircraft or not. The flight crew carried out two low passes with the aircraft landing gear in down position to confirm the status of the landing gear. Tower controller confirmed that the outer wheel (No.1) of left main landing gear was missing but inner (No.2) wheel of the left landing gear was intact. At this stage, pilot expressed their intention to land at Cox's Bazar airport and requested to arrange for all emergency assistance available for landing. The aircraft made a safe landing at 0636 UTC.

# Case Study

## Loss of LH outer wheel assembly

### 2. SERIOUS INCIDENT DESCRIPTION

Damage was observed on:

- Hub Locking bolt broken into 2 pieces.
- Roller Bearing.
- Left wheel axle (Scratch marks were found on the shinning portion)



(Detachment of the outer wheel assembly from the wheel axle)



# Case Study

## Loss of LH outer wheel assembly

### 3. FINDINGS

The aircraft was kept under storage with limited preventive maintenance, from September 2016 to May 2018. The wheel assembly was removed from aircraft as serviceable condition and was kept in store from April 2018 until June 2020. No documentation was found about the wheel bearing greasing during this period. This wheel was installed in the aircraft on June 2020 and was removed from the aircraft as unserviceable on August 2020 and was returned to store. The store could not produce any document as to how this unserviceable wheel was made serviceable. The aircraft maintenance organization could not show any document asked by the investigation board as to how this wheel was made serviceable, when it was installed in the aircraft and in which date.

### 4. CONTRIBUTING FACTORS

Improper or no maintenance was carried out 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 contributed to this serious incident.

# Case Study

## Loss of LH outer wheel assembly

### 5. SAFETY RECOMMENDATIONS (FROM THE FORMAL INVESTIGATION)

#### **Intermediate Safety recommendation to the operator:**

- i. 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 ... This is applicable to all operators of Bangladesh using ATR aircraft in their fleets.
- ii. 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),...This is applicable to all aircraft operating in Cox's bazar.

#### **Safety recommendation to the operator:**

- i. 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.
- ii. 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.

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## Loss of LH outer wheel assembly

- iii. 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.
- iv. If there is a high number of cycles performed between MLG wheel replacement or long lead time between tire changes, perform the lubrication of the wheel axle by performing the task card Ref. MP ATRA-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.
- v. 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.

# Case Study

## Loss of LH outer wheel assembly

- vi. 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:
  - 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;
  - 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;
  - c) An additional task card may be introduced for clarity and understanding of the maintenance personnel.
- vii. 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.
- viii. The store is to be maintained as per the procedures laid down in Maintenance Organization Exposition.
- ix. The aircraft component is to be procured from authentic sources with back to birth history and as per provision of Maintenance Organization Exposition.

# Case Study

## Loss of LH outer wheel assembly

### 6. ATR RECOMMENDATIONS

#### A. LUBRICATION:

##### (i) Wheel Bearing:

The lubrication of wheel bearing is usually carried out in shop and it is under wheel manufacturer responsibility, covered by the CMM.

Main and nose wheel bearings failure due to inappropriate maintenance action performed.

##### (ii) Wheel Axle:

The lubrication of the wheel axle is carried out by performing the task Ref. MP ATR- A- 12-37-32-00ZZZ-720Z-A.

Main and nose wheel loss due to improper installation of the nose wheel.

#### B. STORAGE:

##### (i) Preparation for immobilization of aircraft:

The aircraft is considered IMMOBILIZED and not STORED when it is immobilized but stays available for use.

- Scheduled immobilization period cannot be more than one month.
- The immobilization clock starts the day of the last flight, and the tasks of this procedure must be performed no later than 7 days from last flight unless differently specified.

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## Loss of LH outer wheel assembly

When the aircraft is under maintenance/repair status for a duration scheduled lower than one month, it should be put in immobilization status.

### **(ii) Temporary storage:**

It is accomplished when scheduled or chosen aircraft immobilization time (including aircraft under maintenance/repair status) is less or equal to 6 months.

The transition from temporary to extended storage should follow the complete extended storage procedure.

### **(iii) Extended storage:**

It is done when scheduled or chosen aircraft immobilization time (including aircraft under maintenance/repair status) is more than 6 months. It must be decided from the first month of storage.

A part (as a wheel) that is considered "serviceable", is a part which is in airworthy condition. In the Maintenance procedure, it is instructed to remove the wheel/tire assy and to install "Serviceable" MLG Wheel/Tire Assembly.

It means that ATR as well wheel manufacturers, requires that wheel/tire assy that are installed for six months and over (including aircraft storage) should return to the repair loop and re-certification.

# **Upcoming Event**

**Pilot/Crew Engineer Interactive Meet**  
**on**  
**15<sup>th</sup> July 2024**

# Meeting and Engagement

SRBM (Safety Review Board Meeting)  
on  
31<sup>st</sup> July 2024  
(Tentative)



# **Upcoming Event**

**Table Top Exercise for ERP  
in  
28<sup>th</sup> August 2024**

# Our Fleet

ATR 72-600



ATR 42-600



HAL Do-228





**सादर/ Regards,**

**विकास शर्मा / Vikas Sharma**

**उड़ान संरक्षा प्रमुख / Chief of Flight Safety, Head-ERP**

**एलाइंस एअर / Alliance Air**

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