

Aircraft Accident Investigation Bureau of Myanmar

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For aviation related investigations, the AAIB conducts the investigations in accordance with Myanmar Aircraft Act and Myanmar Aircraft Accident and Incident Investigation Rules and Annex-13 to the Convention on International Civil Aviation.

In carrying out the investigations, the AAIB adheres to ICAO's stated objective, which is as follows:

"The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability."

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

**FINAL REPORT OF SERIOUS INCIDENT OF THE NOSE LANDING GEAR
AXLE RUPTURE INVOLVING GOLDEN MYANMAR AIRLINES,
ATR 72-600 AIRCRAFT (REG: XY-AJM) AT YANGON INTERNATIONAL
AIRPORT, ON 2nd AUGUST, 2019**

SYNOPSIS

At 16:40 local time (LT) on 2nd August 2019, Golden Myanmar Airlines ATR72-600 aircraft, registered (XY-AJM) performing flight Y5-506 from Mandalay to Yangon encountered a nose landing gear axle rupture when the aircraft landed at Yangon International Airport. On board the ATR 72-600 aircraft were the Pilot-in - command (PIC), Co-pilot, 3 cabin crew and 72 passengers. There were no injuries and the aircraft sustained substantial damages. The Aircraft Accident Investigation Bureau of Myanmar classified the occurrence as a serious incident.

Aircraft Details

Registered owner and operator	: Golden Myanmar Airlines
Aircraft type	: ATR 72-600
Nationality	: Myanmar
Registration	: XY-AJM
Place of Occurrence	: Yangon International Airport (VYYY), N 16° 54' 42", E 96° 07' 57"
Date & Time	: 2 nd August 2019 at 16:40 LT
Type of operation	: Scheduled Passenger Flight
Phase of operation	: Landing on Runway 21
Persons on Board	: Five Crew and Seventy-two passengers

1 FACTUAL INFORMATION

All times used in this report are Myanmar local times. Myanmar local time is six hours and thirty minutes ahead of Coordinated Universal Time (UTC).

1.1 History of the flight

At 16:40 on 2nd August 2019 an ATR 72-600 aircraft (XY-AJM), 77 persons onboard flew the Mandalay -Yangon sector. The flight crew comprised a Pilot-in-command (PIC), and a Co-pilot. The Co-pilot was a pilot flying all the way up to 60nm before HGUVOR.

They received the aerodrome information from Yangon Control Tower, "**Heavy rain on the runway, visibility less than 1.2 nm**". Thereafter the PIC took the control of the aircraft from the Co-pilot.

Because of heavy rain, the aerodrome operations were suspended. Consequently, the aircraft made the holding over HGUVOR at attitude 10000ft for about 25 min as per ATC's instruction.

After about 25 min holding, the visibility over the Yangon International Airport improved and aircraft were permitted to land. The incident aircraft made a descent to 3000ft and cleared for ILS approach to Runway 21.

The ATC instructed the aircraft to report back when **the approach lights were insight**. When the aircraft was about 3.5nm from the runway, the approach lights were visible and the flight crew reported to the ATC that **the approach lights were insight**.

When the aircraft was about 1.5 nm from the runway, the rain intensity increased. The Co-pilot asked the PIC whether to **go around or stabilized**. The PIC replied that the runway was insight, so he continued to land the aircraft.

The aircraft landed with a nose down attitude on the runway 21. It bounced four times forward and came to stop about 7000 ft from the threshold of runway 21. The aircraft encountered a nose gear axle rupture and the right nose wheel broke off.

All the passengers on board disembarked from the aircraft following normal disembarkation procedures, with the help of the cabin crew. There were no injuries and no fire broke out in this serious incident.

The aircraft reported to the ATC and requested for passenger transportation and disabled aircraft removal. A few minutes later airport fire engine approached the aircraft and took the necessary measures. In the wake of the incident, the authorities concerned and airport emergency team arrived to the scene and removed the disabled aircraft from the runway. The passengers were transported to the airport terminal safe and sound.



Figure (1) Layout of Serious Incident Site

1.2 Injuries to Persons

1.2.1 Golden Myanmar Airlines

Injuries	Crew	Passengers	Other	Total
Fatal	0	0	0	0
Serious	0	0	0	0
None	5	72	0	77
Total	5	72	0	77

1.3 Damage to Aircraft

- (a) Nose landing wheels hub broken off
- (b) LH lower skin perforated and dented
- (c) RH lower skin 2 small dents
- (d) Forward panel edge with superficial scratch
- (e) Nose landing gear (NLG) doors damaged
- (f) Both NLG tires burst
- (g) Torque link broken
- (h) NLG doors stop fittings damaged



Figure (2) Final position of the aircraft on the runway



Figure (3) Nose landing gear damage



Figure (4) Both nose wheels thrown off from the axle with the no.(1) nose wheel tire hanging attached to the torque link



Figure (5) Both nose wheels thrown off from the axle with the no.(1) nose wheel tire hanging attached to the torque link



Figure (6) Broken pieces from the aircraft



Figure (7) Impact marks on the runway



Figure (8) Impact marks on the runway



Figure (9) Disabled aircraft removal action

1.4 Other Damage

There was no other damage due to this serious incident.

1.5 Personnel Information

Pilot in Command (Golden Myanmar Airlines)

Age : 57 years
 Licence : Airline Transport Pilot Licence
 Licence issued date : 8 September 2011
 Total hours : 19929:38hrs
 On type : 4635:07hrs
 Medical expire : 30 September 2019
 Line check date : 2 June 2019
 Type rating check date : 10 March 2019
 Last 90 days : 184:50hrs
 Last 30 days : 61:55hrs
 Last 24 hours : Nil
 Rest before duty : 24hrs

Co-Pilot (Golden Myanmar Airlines)

Age : 42 years
 Licence : Airline Transport Pilot Licence
 Licence issued date : 2 June 2011
 Total hours : 6219:10hrs
 On type : 2327:20hrs
 Medical expire : 31 January 2020
 Line Check date : 5 July 2019
 Type rating check date : 5 July 2019
 Last 90 days : 207:53hrs
 Last 30 days : 63:07hrs
 Last 24 hours : Nil
 Rest before duty : 24hrs

1.6 Aircraft information

Golden Myanmar Airlines

Manufacture	: Avions de transport regional
Type	: ATR 72-600
Serial number	: 1148
Date of Manufacture	: 9-05-2014
Total Airframe hours	: 12985:42hrs
Certificate of Registration	: XY-AJM
C of A issue date	: 20-05-2014
Last Time Check	: Daily Check
Total flying hours	: 11470:04hrs

1.7 Meteorological Information

The METAR weather reported at Yangon International Airport on 2nd August 2019 at 16:30 was variable winds direction at 9 knots, visibility 3000 meters, broken clouds at 1300ft, few clouds at 1800ft with cumulonimbus, temperature 26°C, dew point 26°C and regional atmospheric pressure 1004hpa and light rain.

1.8 Aid to Navigation

The availability and use of navigation aids were not relevant to this incident.

1.9 Communication

Radio communications between the aircraft and Yangon Tower were normal and were not a factor in this incident.

1.10 Aerodrome Information

Yangon International Airport has one main runway 03/21 with a length of 11200ft at an elevation of 110ft above mean sea level and is certified for both VFR and IFR flight. Runway strength is 230000kg and the airport has an ATC control tower, controlling Class B airspace with radar surveillance facilities.

It is a certificated aerodrome and the associated aerodrome manual has been developed and implemented since 2010. The aerodrome operation hours are 24 hours. The aerodrome category for the firefighting is CAT-9. The aerodrome operations had to be stopped for about two hours after this incident.

1.11 Recorders

The aircraft's Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) were removed and read out in Transport Safety Investigation Bureau of Singapore (TSIB).

1.11.1 Flight Data Recorder

Flight Data Recorder (FDR), Part Number 2100-4045-00 and Serial Number 000977799.

The recording quality of the FDR data was of good quality. The FDR contained 63 hours and 50 minutes and 48 seconds of flight data that included recorded data of the incident flight. The FDR had 749 parameters in the data frame file.

1.11.2 Cockpit Voice Recorder (CVR)

Cockpit Voice Recorder (CVR), Part Number 2100-1020-02 and Serial Number 001026431.



Figure (10) Flight Data Recorder



Figure (11) Cockpit Voice Recorder

1.12 Wreckage, Site and Impact Information

The coordinates of accident site are Latitude N 16°54' 42", Longitude E 96° 07' 57".When the Aircraft Accident Investigation Bureau (AAIB), Myanmar investigators arrived at the occurrence site the aircraft was on the runway near exit taxiway A3. It was raining heavily and windy and the runway was wet. Some broken pieces from the aircraft were found . Authorities concerned, firefighters, airport and airlines personnel were busy with their respective activities for the reopening the airport operations and disabled aircraft removal action.

Measurements and photographs were taken of the occurrence site, ground markings and tracks were inspected and informal interviews were conducted among witnesses.

1.13 Medical and Pathological Information

The pilots underwent a medical and toxicological test after the occurrence. The tests revealed no abnormality.

1.14 Fire

There was no fire before and after the incident.

1.15 Survival Aspects

As soon as the aircraft came to stop on the runway near exit taxiway A3, the flight crew and cabin crew checked outside condition of the aircraft. When they confirmed that there was no risk or hazard, they let all the passengers on board disembark as the normal procedure.

DCA personnel, the airport personnel, the aviation police and the airline personnel arrived at the scene and provided care and assistance as necessary.

1.16 Organizational and Management Information

1.16.1 Golden Myanmar Airlines

Golden Myanmar Airlines is an airline in Myanmar currently offering domestic flights. It was established in August 2012. Its main base is Mandalay International Airport. The airline launched operations in January 2013 with one Airbus A320. The airline operated a leased Airbus A320 from 2012 and 2016. A further leased Airbus A320 was operated from 2013 to 2014 until damaged beyond repair. Currently, it has a fleet of three ATR 72-600. Golden Myanmar Airlines served 11 domestic destinations.

The airline operator has established and maintained a flight data analysis program as part of its safety management program since 2015. The Safety Action Group (SAG) meeting is held once a month and the Safety Review meeting every two months.

2 ANALYSIS

2.1 Introduction

The analysis by the investigation team has focused on the following areas:

- a) Flight Recorder Data Analysis
- b) Weather Condition
- c) Testimony of Witnesses
- d) Stabilization Criteria
- e) The Operator's Go Around Policy

2.2 Flight Recorder Data Analysis

The nose landing gear of the aircraft reportedly collapsed when the aircraft landed in Yangon International Airport on Runway 21 on 2nd August 2019.

For the incident flight, the autopilot was engaged for the entire descent and approach. The landing gears were extended at 16:31:18 when the aircraft was at 3241ft (pressure altitude). The autopilot was disengaged at 16:37:07, at 120 ft above ground level (AGL). At that point of autopilot disengagement:

- Magnetic heading was 218.1degrees
- Indicated airspeed (IAS) was 129.8knots (VAPP+13kt), and varied along the approach, from 1000ft to AP disconnection, between 113kt (VAPP-4kt), and 135kt (VAPP+18kt).
- Pitch angle was -2.91 degrees
- Main and nose gears remained extended
- Flaps were in the 33degrees position
- Power lever (PL) 1 and 2 angle positions were at 55 and 58 degrees respectively
- Fuel flow for Engine 1 and 2 was 467kg/h and 450kg/h respectively
- Torque developed by Engine 1 and 2 was 75.2% and 68.8%

respectively

- Wind direction and speed was 271.9 degrees and 17knots respectively

The following were observed in the subsequent 15 seconds:

- Wind direction varied between 269.8 to 271.2 degree and wind speed gradually decreased from 17 to 12 knots just prior to touch down
- IAS varied within the range of 125 knots and 129.7 knots
- Left control column inputs ranged from -3.14(nose up order) to +1.67 degrees (nose down order)
- Between 120ft RA and 15ft RA descent rate decreased from around -600ft/min to -130ft/min
- The recorded pitch angle during this period was predominately of negative value, indicating a slight nose down attitude, while the maximum pitch angle of +0.30 degrees(nose up) was momentarily recorded at 16:37:14
- At 16:37:17 and 16:37:18, two successive nose down orders led the pitch angle to decrease from -0.2° to -1.8° (nose down attitude). Before touchdown, descent rate was recorded increasing
- Left rudder input was applied, consistent with the action to de-crab and align the aircraft with the runway centre axis
- Parameters relating to the engine and propeller were as follows:

After Autopilot disengagement	At 16:37:20 (13.2 feet AGL)	At 16:37:22 (3.4 feet AGL)
PL 1 and 2 angle positions continued to be at 13.9 and 14.6 degrees respectively	PL 1 and 2 angle positions moved to 12.9 and 13.5 degrees respectively	PL 1 and 2 angle positions further movement to 11.2 and 11.9 degrees respectively
Fuel flow reduced and stabilized at approximately to 393kg/h and 385kg/h for Engine 1 and 2 respectively	Fuel flow continuously decreased to 300kg/h and 301kg/h for Engine 1 and 2 respectively just prior to touchdown	
Torque developed by Engine 1 and 2 was reduced and stabilized at 61.9% and 59.2% respectively	Torque developed by Engine 1 and 2 continuously decreased to 38.6% and 41.4% respectively just prior to touchdown	

At 16:37:23, the first weight-on-wheels (WOW) Ground signal was recorded, indicating the first instance where landing gear made contact with the surface of the runway. At this first instance of touchdown, the aircraft heading was 214.5 degrees, IAS was 128.8 knots, and torque developed by Engine 1 and 2 was 38.6% and 31.4% respectively. The highest vertical acceleration recorded shortly after was +1.833 G.

As only the main landing gear position was recorded and the nose gear position was not recorded, the sequence which the landing gears made contact with the runway cannot be conclusively ascertained. However, the pitch angle at the point of touchdown was approximately -1.58 degrees, which is consistent with a nose down attitude and consistent with nose gear first impact with the runway, instead of the

main gears.

In the following 7s, three sequences of Ground-Air-Ground WOW signal transition was recorded. This coincided with three cycles of positive-negative-positive pitch angle oscillations and vertical accelerations. The sequence of recorded data is consistent with a porpoise landing and the recorded radio height during this period varied between -0.9 to -6.8 feet. In the third cycle of porpoise, the fuel flow for both Engine 1 and 2 were observed to be further reduced to 88kg/h and 90kg/h respectively and the torque for both engines decreased to 0%.

During the first ground contact, a nose down order was applied and maintained. Between the different impacts with the ground, pitch angle decreased down to 5.5° (nose down attitude). PL retard to flight idle (PLA = 35°) was performed at 16:37:27 during the 3rd touch. PL were then retarded to ground idle (20°) during the 4th ground contact (16:37:30) when low pitch light for both engines illuminated. At time of the 4th ground contact, IAS was 119kt, ground speed was 121kt.

The final Air to Ground WOW signal transition was recorded at 16:37:31.

In the period between the autopilot disengagement and until the aircraft came to a complete stop on the runway, no TAWS windshear caution and sink rate warning was recorded. The last valid data was recorded at 16:37:01 where the groundspeed was 0kt at GPS coordinates of N16.907425 E96.133296, consistent with final position of the aircraft on Runway 21.

The CVR contained four audio tracks with three tracks of duration 2 hours and 4 minutes and 15seconds while the fourth tracks, which were recordings of the cockpit area microphone, was of duration 2 hours and 3minutes and 54 seconds. The CVR stopped recording at 16:51:18.

2.3 Weather Condition

The METAR weather reported at Yangon International Airport on 2nd August 2019 at 16:30 was variable wind direction at 9 knots, visibility 3000 meters, broken clouds at 1300ft , few clouds at 1800ft with cumulonimbus, temperature 26°C, dew point 26°C and regional atmospheric pressure 1004 hpa and light rain.

2.4 Testimony of Witnesses

2.4.1 Testimony of Pilot-in-command

The PIC stated that on 2nd August 2019 he was a pilot flying performing the flight 505 for Yangon-Mandalay-Myitkyina-Putao sector. For the flight 506, Putao-Myitkyina-Mandalay-Yangon sector, the Co-pilot was the pilot flying.

The flight from Mandalay to Yangon the Co-pilot was a pilot flying and he was a pilot monitoring. The aircraft flew at flight level 17000ft to avoid the cloud. Near CTA the aircraft requested the ATC to fly at flight level 19000ft to further avoid the cloud. Arising from potential icing condition, the aircraft requested the ATC to descent to flight level 17000ft. About 60nm to HGUVOR the aircraft received the update information from the ATC that heavy rain on the runway, visibility less than 1nm. Therefore, the PIC took control of the aircraft performing a pilot flying duty. There was some turbulence on the way to Yangon. The aircraft made holding at flight level 10000ft over HGUVOR.

Thereafter the aircraft made an ILS approach to runway 21. They reported to the ATC of approach light insight at about 3nm away from the airport as per the ATC instruction. At 2.5nm from the airport the aircraft received the landing permission from the ATC. About 1.5nm from the airport, the Co-pilot asked the PIC to go around or stable. The PIC replied that he would continue to land because the aircraft was stable. At about 200ft AGL, rain was falling harder and harder. The PIC increased the engines torque from 28% to 63% as the aircraft was passing through an updraft and engine speed was low. The aircraft landed in the touchdown

zone and bounced a few times and eventually it came to halt on the runway near exit taxiway A3. He came down and scrutinized the situation. He found that the nose landing gear was broken and no fire broke out.

Therefore he instructed the cabin crew to disembark the passenger in a normal way. Thereafter he handed over the aircraft to the disabled aircraft removal team.

2.4.2 Testimony of a Co-pilot

The Co-pilot stated that he was a pilot flying performing flight 506 for Mandalay-Yangon sector taking off at 14:40. About 60 nm to HGUVOR it was raining heavily, visibility was less than 1.2 nm. Therefore the PIC took control of the aircraft and he became a pilot monitoring. Because of heavy rain, the aerodrome operation for Yangon airport was closed. The aircraft made holding over HGUVOR for about 25 minutes. Thereafter the weather situation improved over Yangon aerodrome. The aircraft made an ILS approach to runway 21. The ATC instructed the aircraft NEXT CALL APPROACH LIGHT INSIGHT. At about 3.5 nm to the airport and therefore the aircraft report to the ATC the APPROACH LIGHTS INSIGHT. At about 2.5 nm to the airport the aircraft received a landing clearance CLEAR TO LAND. At that moment more and more rain was falling hard. Even though the wipers were switched on, they could not see ahead clearly. He advised to the PIC to go around. At 50ft AGL the engine torque was about 60%.The visibility deteriorated. The aircraft continued with the landing and touched down in the touchdown zone. It bounced two times. He though the aircraft landed on nose wheel first. When the aircraft came to a stop on the runway, he reported to the ATC about the aircraft incident.

2.5 Stabilization Criteria

Approaches must be stabilized:

- 1000ft Above Aerodrome Level (AAL) in IMC conditions
- 500ft AAL in VMC conditions
- 300ft AAL following circle-to-land

An approach is considered stabilized when all of the following criteria are met:

- Lateral path (Loc, Radial or RNAV path) is tracked
- Landing configuration is established
- Energy management:
 - Vertical path (Glide, Altitude versus Distance or RNAV path) is tracked
 - Power setting is consistent with appropriate aircraft weight, Head/Tail wind component and vertical guidance requirements
 - Speed and pitch attitude are relevant to actual conditions
- Briefing and checklists are completed

2.6 The Operator's Go Around Policy

All go-around shall be carried out promptly to ensure minimum loss of height. A go-around shall be executed when any active flight crew member announces "Go-Around". This is particularly important whenever:

- The required visual reference for landing has not been achieved, or
- The aircraft is not stabilized, or
- The go around is carried out from the MDA/H or below 200ft AAL, whichever is the higher, or
- Following a Ground Proximity Warning.

Discontinued approaches initiated at or below 1000ft AAL should be carried out using the normal go around procedure.

Above this height the procedure is at the commander's discretion. If, in marginal weather conditions, two go-around have been carried out at an airport, consideration should be given to diverting or holding until an improvement in the weather occurs.

The decision to attempt a third approach immediately should normally only be made if a significant improvement in the weather conditions has been reported or observed from the flight deck.

The options of diverting or holding will be affected by fuel considerations and by forecast weather conditions at the destination and at the alternate.

Go-around, especially multiple go-around, can be distressing to passengers. Commanders should, when workload permits, use the PA to give reassurance appropriate to the situation.

An instrument approach shall be discontinued:

- If the identification of the prime aid ceases to be received in instrument conditions;
- If a navigation radio or flight instrument failure occurs which affects the ability to safely complete the approach in instrument conditions
- When on ILS final approach, in instrument conditions below MSA, and either the localizer and / or glide slope indicator shows full deflection;
- When the navigation instruments show significant disagreement and visual contact with the runway has not been made
- Visual contact is not established at DA or the aircraft is in a position from which a normal approach to the runway of intended landing cannot be made or adequate visual reference cannot be maintained.

3 CONCLUSIONS

3.1 Findings

From the evidence available, the following findings are made. These findings should not be read as apportioning blame or liability to any particular organization or individual:

- (a) The maximum permissible landing weight of ATR 72-600 is 22350 Kg (49273 lb) as per the Airplane Flight Manual (AFM). On 2nd August 2019 the actual landing weight for that sector was 21199 Kg (46735 lb). Therefore it was within limit.
- (b) The aircraft engines, control surfaces, navigation system and brake system were normal.
- (c) The FDR contained 63 hours and 50 minutes and 48 seconds of flight data that included recorded data of the incident flight. The FDR had 749 parameters in the data frame file.

- (d) For the incident flight, the autopilot was engaged for the entire descent and approach. At 16:31:18 the landing gears were extended when the aircraft was at 3241ft (pressure altitude).
- (e) At 16:37:07 the autopilot was disengaged at 120ft above ground level (AGL).
- (f) At 16:37:23, the first weight-on-wheels (WOW) Ground signal was recorded, indicating the first instance where landing gear made contact with the surface of the runway. At this first instance of touchdown, the aircraft heading was 214.5 degrees, Integrated Air Speed (IAS) was **128.8 knots**, and torque developed by Engine 1 and 2 was 38.6% and 41.4% respectively. The highest vertical acceleration recorded shortly after was **+1.833G**. Both PLs were retarded at time of the 3rd touchdown.
- (g) Review of the five previous landings prior to the incident flight showed that on the first instance of touchdown, the torque of both engines were close to 0%.
- (h) In the previous five sectors flown by the same set of crew on the same day, it was observed that the approach speeds and vertical accelerations upon touchdown were 92.5 knots, 103 knots, 114 knots, 116.5 knots, 106.5 knots and 1.057G, 1.332G, 1.190G, 1.467G and 1.272G respectively.
- (i) It was determined that the aircraft was not stabilized on approach to runway 21 of the Yangon International Airport. The flare was not initiated, in addition, and before touchdown, a nose down order was applied on the control column. The aircraft bounced 4 times along the runway during 7 seconds. During the successive bounces, nose down effort was maintained.

3.2 Primary Cause

- When the aircraft was on short finals, the power setting was inappropriate and the approach speed exceeded the stabilized approach speed criteria.
- The PIC decided to continue with the landing despite the destabilized approach and being advised to conduct a go-around by the Co-pilot.
- Due to insufficient flare, the nose gear of the aircraft contacted the runway first instead of the main gears in a normal landing. The excessive load on the nose gear as a result of the aircraft's abnormal landing attitude resulted in the nose gear collapsing.

4 SAFETY ACTIONS

During the course of the investigation and through discussions with the investigation team, the following safety actions were initiated by the aircraft operator:

- (a) Including exercises during flight crew recurrent simulator training pertaining to normal landing, go around and landing in strong, gusty and varying crosswind conditions;
- (b) Including discussions at monthly safety meeting regarding not to taking a risk to land aircraft in severe weather condition and encouraging to execute a go around; and
- (c) In respect of all its aircraft, using Flight Data Monitoring programme to monitor for trends in deviation from the Standard Operating Procedures during the approach and landing phases.

5 SAFETY RECOMMENDATION

To reduce and eliminate of accidents and serious incidents, AAIB recommended the followings:

5.1 The operator to ensure that its pilots comply to the procedures which require a go-around to be executed when any active flight crew member announces “Go-Around”.

Investigator-in-charge