

**FINAL REPORT OF RUNWAY EXCURSION ACCIDENT OF AIR BAGAN
AIRCRAFT ATR-72 (XY-AIH) AT YANGON INTERNATIONAL AIRPORT ON
JULY, the 24th, 2015**

SYNOPSIS

At 18h54 (Local time) on July, the 24th, 2015, ATR - 72 aircraft, registered (XY-AIH) operated by Air Bagan Airlines veered off the runway when it landed on runway-21 of the Yangon International Airport (VYYY). On board the aircraft were the Pilot in command (PIC), first officer (FO), 3 cabin crew and 49 passengers. ATR72 (XY- AIH) aircraft was substantially damaged. One passenger was seriously injured because of the accident.

Aircraft Details

Registered owner and operator	: Air Bagan Airlines
Aircraft type	: ATR-72
Nationality	: Republic of the Union of Myanmar
Registration	: XY- AIH
Place of Occurrence	: Yangon International Airport N 16°54' 59.54", E 96 8' 25.23"
Date& Time	: 24 July 2015 at 24h 54 Local time (UTC + 6h 30)
Type of operation	: Scheduled Passenger Domestic Flight
Phase of operation	: Landing on Runway- 21
Persons on Board	: Crew- 5 Passengers- 49

1. FACTUAL INFORMATION

1.1 History of the flight

The route of the aircraft on that day was MDL- MYT- PBU- MYT- MDL- RGN. From Mandalay (MDL) on the way back to Yangon International Airport, the plane took off at 17:20. On the way the weather was not significant. For weather reason, seat belt sign was turned on the way to Yangon International Airport only one time. From Mandalay Airport up to landing phase to Yangon International Airport, first officer took control of the aircraft. At 1730 visibility was 6Km as per ATC verbal information. About 4 Km to Mingalardone Tower, clearance was obtained **"Air Bagan 424 ,wind calm ,runway 21,clear to land, caution landing Runway wet, after landed vacate via Charlie"**

At decision height (250ft), runway was insight, runway lightings were able to be seen so the aircraft continued though there was light rain. At about 50 ft, more rain was falling suddenly consequently visibility became poor. So the pilot took over control of the aircraft. A few seconds later the aircraft made hard landing and skidded and veered off the left side of the runway to the muddy strip, came to rest about 2800ft from the threshold and 75ft from the runway edge.

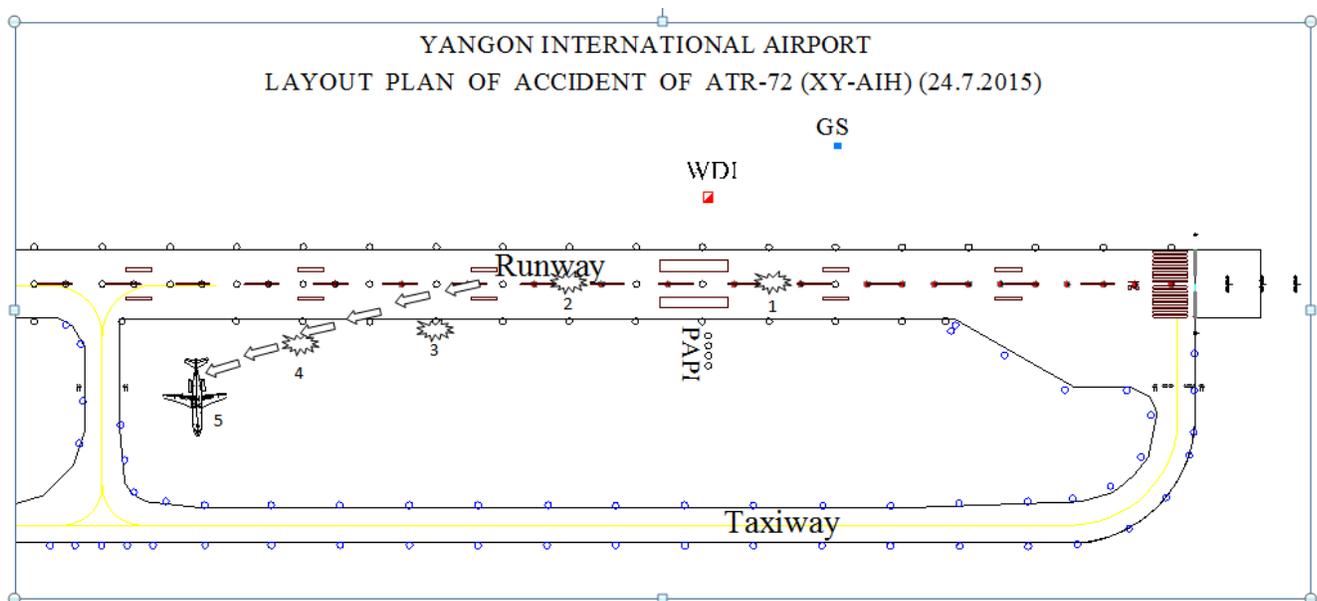


Figure 1. Layout of Accident Site

1.2 Injuries to Persons

Injuries	Crew	Passengers	Other	Total
Fatal	0	0	0	0
Serious	0	1	0	1
Minor/ None	0\5	0\48	0	0\53
Total	5	49	0	54

1.3 Damage to Aircraft

- (a) L/H main landing gear collapsed and broken (**Figure 2**)
 - (i) its trunnion leg broken into pieces
 - (ii) left hand shock absorber broken into pieces
- (b) R/H main landing gear's shock absorber broken (**Figure 3**)
- (c) Nose landing gear collapsed and folded (**Figure 4**)
- (d) Aircraft fuselage skin (between frame no.46 and 47, between frame 28D and 29) deformed, wrinkled and torn (**Figure 5**)
- (e) Left hand propeller's blades broke into pieces (**Figure 6**)
- (f) PSU (Passenger Service Unit) Panels fell down



Figure 2 Broken L/H main landing gear



Figure 3 Broken R/H main landing gear

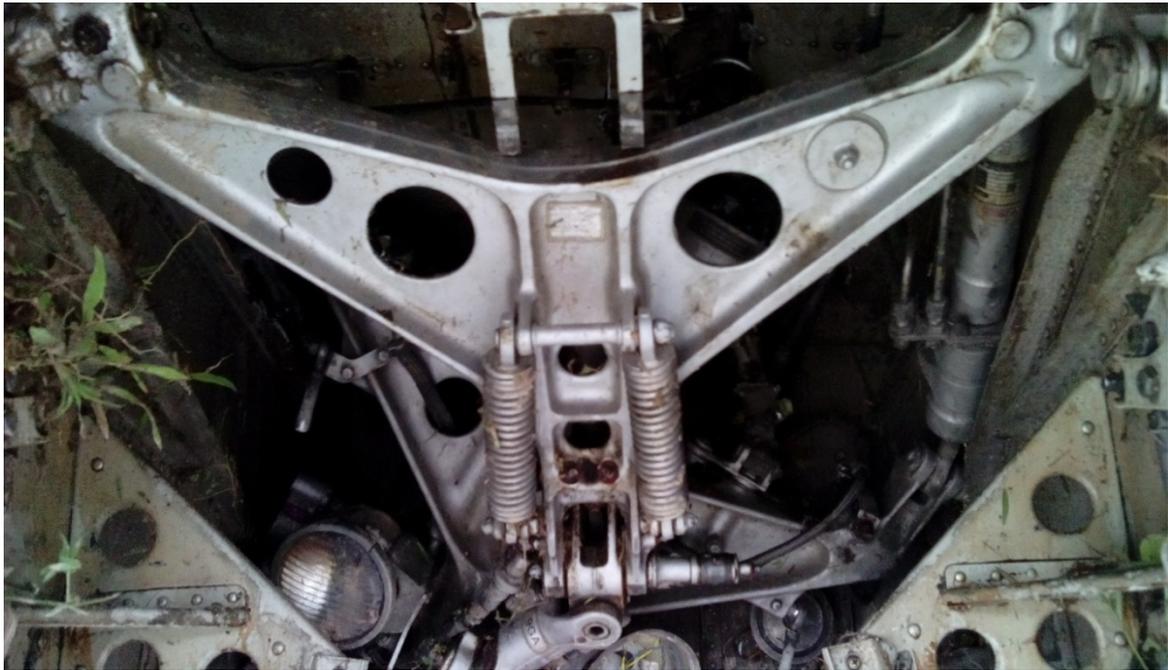


Figure 4 Collapsed Nose landing gear



Figure 5 Wrinkled and deformed fuselage skin



Figure 6 Broken propeller's blades

1.4 Other Damage

There was no other damage due to the runway excursion accident.

1.5 Personnel Information

Pilot in Command

Age	: 39
Licence	: Air Transport Pilot Licence
Licence issued date	: 24 May 2011
Total hours	: 6603:03hrs
On type	: 513:22 hrs
Medical expire	: January 2016
Line check date	: 09 December 2014
Type rating check date	: 18 December 2014
Last 90 days	: 133:22 hrs
Last 30 days	: 55:39 hrs

Co-Pilot

Age : 33
 Licence : Air Transport Pilot Licence
 Licence issued date : 25 March 2015
 Total hours : 2650:00hrs
 On type : 2650 hrs
 Medical expire : 31 January 2016
 Line Check date : 11 July 2014
 Type rating check date : 16 July 2015
 Last 90 days : 59:23
 Last 30 days : 34:11

Air Traffic Control

- (1) Age : 41(male)
 Licence : Air Traffic Controller Licence, (Valid)
 Designation : ATCO II (in charge)
 Work scheduled : 12- hour shift, 0700 hours 24 July 2015 to 1900 hours 24 July 2015
 Medical : valid
- (2) Age : 34(male)
 Licence : Air Traffic Controller Licence, (Valid)
 Designation : ATCO II
 Work scheduled : 12-hour shift, 0700 hours 24 July 2015 to 1900 hours 24 July 2015
 Medical : valid
- (3) Age : 27 (female)
 Licence : Air Traffic Controller Licence, (Valid)
 Designation : ATCO I
 Work scheduled : 12-hour shift, 0700 hours 24 July 2015 to 1900 hours 24 July 2015
 Medical : valid

1.6 Aircraft information

1.6.1 General

Air Bagan Aircraft

Manufacture	: France
Type	: ATR 72-212
Serial number	: MSN 469
Date of Manufacture	: 16 November 1995
Total flight hours	: 40827.23(FH)/ 43954(CY)
Certificate of Registration	: XY- AIH
C of A issue date	: 20 January 2015
AOC issue date	: 04 Nov 2014
Engine type	: PW 127F (Derating PW127)
Periodical inspection, A check	: 09 May 2015
Periodical inspection, C check	: 26 Jul 2014

1.7 Meteorological Information

The METAR reported at Yangon Airport on the 24th at 11h 00 (UTC) was a wind speed 08 kt from 250°, visibility 6000 meters, cloud amount 3 to 4, Temperature 28° C, Dew point 25 C , QNH 1009hPa.

The METAR reported on the 24th at 12h 00(UTC) was a wind speed 05kt from 310, visibility 6000 meters, broken at 1200ft, few 15 cb, overcast at 9000ft, Temperature 26 C, Dew point 25 C, QNH 1009 CB.

The special weather report (SPECI) at 12h15(UTC) was a wind speed 04kt from 320, visibility 4000 meters,

Ra BKN 012, Few 015cb OVC 090, Temperature 25C, Dew point 25 C, QNH 1010 CB.

1.8 Aid to Navigation

Yangon International Airport has been equipped with the following facilities:

VYYY AD 2.19 RADIO NAVIGATION AND LANDING AIDS

Type of aid, CAT of ILS/MLS	ID	Frequency	Hours of operation	Site of transmitting antenna coordinates	Elevation of DME transmitting antenna	Remarks
1	2	3	4	5	6	7
VOR/DME	BGO	112.6 MHz CH 73X	H24	171906.58N 0963111.55E	Antenna Hgt: 38FT	Coverage: 180 NM Em: A9W
VOR/DME	HGU	112.3 MHz CH 70X	H24	170449.87N 0961502.49E	Antenna Hgt: 49FT DME co-located with VOR	12 NM from THR 21 Coverage: 130 NM Em: A9
NDB	YGN	265 kHz	H24	170442.54N 0961418.18E	-	11.5 NM from THR 21 Coverage: 130 NM Em: NON/A2A
NDB	MDS	397 kHz	H24	165205.78N 0960621.54E	-	1.5 NM from THR 03 Coverage: 50 NM Em: NON/A2A
ILS/LLZ	IYGN	109.9 MHz	H24	165347.14N 0960733.09E	-	Coverage 12 NM RWY21 Em: R3E
ILS/GP/DME	IYGN	333.8 MHz CH 36X	H24	165519.5N 0960830.9E	Antenna Hgt: 50FT DME co-located with GP	Coverage 10 NM RWY21 Em: R3E

1.9 Communication

Communication facilities are as follows:

VYYY AD 2.18 ATS COMMUNICATION FACILITIES

Service designation	Call sign	Frequency	Hours of operation	Remarks
1	2	3	4	5
APP	Mingaladon Approach	119.7 MHz	H24	Nil
TWR	Mingaladon Tower	118.1 MHz	H24	
GMC	Mingaladon Ground	121.9 MHz	H24	

As per record the communication on that day was normal.

1.10 Aerodrome Information

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

It is a certificated aerodrome, and aerodrome manual has been developed and implemented since 2010. The operation hours are 24 hours around. However, there was some deficiency in exercising aerodrome plan and procedure as well as disabled aircraft removal at the time of the said accident.

The disabled aircraft, which was on the strip of the runway 75 feet from runway edge, was able to move to the safer place to the apron A 12 hours after the accident. Because of this accident the aerodrome operation had to stop for about two hours and then reopened with some restriction and some aircraft had to divert to adjacent airports and some were cancelled and delayed.

1.11 Recorders

The aircraft's cockpit voice recorder and flight data recorder were removed and read out in the AAIB recorder laboratory, Singapore.

1.11.1 Flight Data Recorder

The 25- hour solid state flight data recorder (FDR) was FAIRCHILD MODEL F1000, PN S800-2000-00, SN 00653.



Figure 7 Flight Data Recorder

1.11.2 Cockpit Voice Recorder

The 2-hour cockpit voice was FA 2100, PNR 2100-2010-02, SER 000367785.



Figure 8 Cockpit Voice Recorder

1.12 Wreckage, Site and Impact Information

The coordinates of accident site is Latitude N 16 °54' 59.54", Longitude E 96 8' 25.23". When Myanmar Aircraft Investigation Bureau (MAIB) investigators arrived at the occurrence site, the aircraft was on the runway muddy strip. It was raining, sometimes heavily and the runway was wet. On the runway were some debris and broken pieces from the aircraft, vegetation, and mud scattering. Fire Fighters, airport and airlines personnel were busy with their respective activities for the reopening the airport operation and necessary action.

Measurements and photographs were taken of the site and casual interviews were conducted among witnesses.

1.13 Medical and Pathological Information

One passenger was seriously injured and he had been hospitalized for 18 days and there had been operation, after discharge from the hospital there were follow up visits to hospital .There was medical examination for pilots after the occurrence and the medical result was normal.

1.14 Fire

There was no fire before and after the accident.

1.15 Survival Aspects

The cabin crew initiated an emergency evacuation as soon as the aircraft came to rest. All the aircraft doors were able to open and nothing blocked on the passage and exits. The aerodrome category for rescue and fire fighting in YIA was CAT 9, having three fire engines. Those vehicles deployed to the scene immediately after getting accident information from the control tower. The vehicles arrived at the scene within 10 minutes.

DCA personnel, the airport personnel, the aviation police, the airline personnel, and the ATC personnel arrived at the scene and provided care and assistance as necessary. The passengers were transported to the terminal. One injured passenger was taken to the Yangon General Hospital.

1.16 Organizational and Management Information

1.16.1 Air Bagan Airlines

Air Bagan, the very first private airline in Myanmar, 100 % owned Myanmar national airline, was established in 2004. It is operating in 19 domestic destinations and a regional charter flight to Chiang Mai with its fleet. Chairman is the dean of the organization and a managing director is acting on his behalf. There are two managing directors under which are Engineer Department, Flight operations Department, HR, Admin, Ground operation, Commercial, and Finance &Accounts.

Air Bagan stated adopting the Safety Management System (SMS) in line with ICAO as well as Myanmar Civil Aviation Requirement (MCAR) in 2006.

1.17 Additional Information

1.17.1 Testimony of Air Bagan Pilot

He stated the plane took off at 11:00 (UTC) from Mandalay to Yangon on the 24th July, 2015. Then he was a pilot non flying and the first officer was a pilot flying. The plane was on the ILS on Runway- 21 and got permission of **clear to land** 6miles to touch down. The landing weight was 19.6 tons, Flap 30', V_{app} 133 kts. While the plane was at the decision height (250ft), approach lightings and runway were able to be visible. He took control of the plane and became a pilot flying. The rain was falling continually. At about 50ft, above the ground, the heavy rain suddenly was falling mixed with gust wind and the visibility became poor. At that moment the plane was about to touch down, so he made all out effort to control the plane. However, the plane made hard landing and bounced, veered off the runway, and came to rest on the runway strip. So he carried out the on ground emergency evacuation procedure. Landing gears were damaged. Passengers on board and all crew were safe and sound.

1.17.2 Testimony of Air Bagan First Officer

She stated that the route on that day was MDL- MYT- PBU- MYT- MDL- RGN. From Mandalay to Yangon W₉-424 flight was smooth even though the weather was a bit bad and cloudy. As per the weather forecast at 11:00 (UTC), the visibility was 6 Km. According to the procedure, she made approach on ILS. At 4 Km to the touch down she made report to the tower and got the clearance "**wind calm, clear to land, expect via Charlie**" It was raining but not heavy. She set the wiper at maximum. She continued approach at decision height 250ft since the runway lightings and runway were able to be visible. Then she stated that the pilot took over control of flying from her. The plane continued approach; the weather was favourable. At about 50 ft the visibility became poor so suddenly and the runway was not able to be seen. In that respect, the best they could do was to control the plane. The plane made hard landing and veered off the runway. On ground evacuation procedure was executed and 49 passengers and 5crew were safe and sound. Aircraft landing gears were found damaged.

1.17.3 Testimony of Duty Air Traffic Controller

The duty air traffic controller stated that she gave clearance to land when the plane was 4DME to touch down runway-21 by instructing "**JAB 424, wind calm, runway-21, clear to land, caution landing runway wet, after landed vacate via Charlie, JAB 424.**" Before Air Bagan aircraft (JAB 424) landed, another aircraft (AXM-504) had landed and vacated taxiway- B. At that time there was light rain. She was monitoring the radar watch. When another controller (IC) made contact to JAB 424, he heard the copilot said, "**Evacuate, Evacuate**". That's why another controller pressed the alarm bell to contact and inform the airport fire station. Also ATC controller contacted the airport fire station via Ground Frequency. The controller in charge took the necessary action immediately to response the situation.

1.17.4 Testimony of Air Traffic Controller in Charge

He stated that he was the tower in charge on that day. He made contact that aircraft (JAB 424) when the plane was landing roll on the runway. He heard the first officer replied "Evacuate, Evacuate, we drifted". As soon as he got this information, he got them taken necessary actions such as activating the alarm bell to alert the airport fire station, informing the tower supervisor, the respective airlines so on and so forth. He gave all the necessary instructions to aircraft to be the safe operations.

Meanwhile BKP 704 flight, which was taxiing, reported that there were some people walking on the active runway-21. He made contact again to JAB 424, however it was out of reach.

1.17.5 Testimony of Fire Fighter in Charge

He stated that he got information an aircraft veered off the runway 21 from the Tower via RT at about 18:59 (Local time). Once he got this information, three fire engines rushed to that spot. There was no fire. So he asked some of his men to get ready to put out the fire in case of fire, and some of them to carry out the rescue the passengers, check the cabin and cockpit thoroughly.

The fire fighters led the passengers and crew to the safer place in the airfield. One monk was injured and cold. So one of the fire fighters handed his fire suit to the monk to relieve the cold. Meanwhile, the Director General of DCA arrived at the crash site and gave the necessary instructions. The fire fighters removed the FOD and debris rambling on the runway.

Some time later, two coaches reached the accident site and carried the passengers and crew to the terminal. After that the fire fighters went back to the station and stood by.

1.17.6 Testimony of Aircraft Engineer

He stated that he has belonged to Air Bagan Engineering Department since 2012 as a licensed aircraft engineer. At Mandalay station he conducted the transit inspection check and walk around check at about 12:00 (Local). According to the visual inspection the main wheel tires, nose wheel tires, main landing gears and nose landing gears were in sound condition.

1.17.7 Testimony of Cabin Crew

She stated that the route of W₉-424 was MDL- MYT- PBU- MYT- MDL- RGN. Reporting time was 11:30 am and departure time was 12:30pm. From Mandalay to Yangon the plane took off at 17:20. On the way the weather was a bit bad; not so severely. The seat belt sign was turned on just one time on the way to Yangon. After cabin check, she asked the other cabin crew to take the seat at the respective crew station and reported to Captain "Cabin ready for landing" and then as per procedure performed her duty. She felt the feeling of unstable landing in a bit bad weather. She thought the first impact of the landing plane was harder than as usual, thinking because of bad weather. And she felt the plane jumping a bit and the second impact. She noticed the plane was going to uneven, and rough surface. As soon as she noticed that there was an emergency, she started "Emergency Command". The other CA₂ and CA₃ were also giving "Emergency Command to sit in brace position. After the plane had complete stopped, she reviewed the outside condition, opened the aircraft door and evacuated the passengers. But she didn't know where they were. She checked and ensured whether the passengers left in the cabin or not. And she rechecked the total number of passengers with the help of others.

2 ANALYSIS

2.1 Introduction

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

- a) Individual/ team action
- b) Weather condition
- c) Flight recorder data analysis
- d) Runway Condition
- e) Standard Operation Procedures and Crew response

2.2 Individual/ Team Action

2.2.1) Flight Crew

Both the pilot-in-command (PIC) and co-pilot had operated into Yangon Airport many times and were familiar with the runway condition and airport facilities. The PIC had (513:00) hours on type and total flying hours (6603:03) and the co-pilot (2650:00) hours on type ATR respectively. Their licenses were valid.

2.3 Weather Condition

The METAR reported on the 24th at 12h 00(UTC) was a wind speed 05kt from 310, visibility 6000 meters, broken at 1200ft, few 15cb, overcast at 9000ft, Temperature 26 C, Dew point 25 C, QNH 1009 CB.

The special weather report (SPECI) at 12h15 (UTC) was a wind speed 04kt from 320, visibility 4000 meters,

Ra BkN 012, Few 015cb ovc 090, Temperature 25C, Dew point 25 C, QNH 1010 CB.

2.4 Flight Recorder Data Analysis

There was no damage observed to the flight recorders. The interface pins for both recorders were checked and they appeared to be in good condition.

The CVR contained two hours of 4 channel recordings. Channels 1 and 3 were of good quality. Channel 2 had a continuous tone at a frequency range of 400 Mhz through the recording. However this did not affect the transcription of the CVR. The Cockpit Area Microphone was of poor quality. The microphone appears to be too sensitive too noisy.

The FDR was recorded using ARINC 573 standards. The Flight Data Acquisition Unit (FDAU) part number is ED 34A330. As such, according to ATR service letter number ATR72-31-6010, the data frame for the aircraft is the ATR72,64 words per second V₂(a) data frame.

The recording quality of the FDR data was of good quality. The FDR contained the last 57 hours and 41minutes of aircraft operation. The data frame had 289 parameters.

Flight data

The analysis has been carried out from data extracted from the digital flight data recorder. Based on the data reviewed there does not appear to be any technical problems with the aircraft, i.e. all engine related parameters appear to function normally and there were no Master caution or Master warning alerts during the Take-off, Climb, Cruise and Descent phases of flight. The Master Warning did annunciate during the time of the event.

The aircraft was fully configured with gears down and flaps consistent for landing with the auto-pilot coupled.

The Yangon ILS approach for runway-21 was flown on autopilot until 215 feet radio height. The aircraft was crabbing to the right, i.e. the heading way around 217deg whereas the runway track was 214 deg. This might indicate a crosswind from the right side of the aircraft.

At 215 feet when the autopilot was disconnected, the aircraft drifted to the left and descended below the glide slope. The vertical speed during the initial part of the final approach was approximately 700 ft/ min descent rate. After the autopilot was disconnected the rate of descent increased from 700 ft/ min to more than 1000 ft/min. Two seconds prior to touchdown the vertical speed reached 1140 ft/min. The aircraft

touched down with a pitch of -1.3 deg (pitch down) and a roll angle of 2.46 deg (right wing down). The aircraft then bounced and touched down the second time with a pitch angle of 1.23deg (pitch up) and a roll angle of -8.75deg (left wing down). During the bounce the aircraft drifted to the left on the runway center line. The aircraft continued down the runway with a negative roll angle, i.e. left wing down. The aircraft's left-hand main landing gear was substantially damaged however the point at which the landing gear was damaged could not be conclusively determined from the flight data.

2.5 Runway Condition

The runway of Yangon International Airport was a single one with (11200ft x 200ft). The runway designation numbers were **03/21**. There were runway edge lightings, runway centerline lightings, threshold lightings, runway end lighting, precision approach lighting system on the runway-21, simple approach lighting system on the runway -03 and PAPIs on both sides. On the runway-21 was provided with Localizer and glide slope.

At the time of accident, it was raining heavily and the runway was wet and contaminated with rubber debris especially on the runway-21 side.

2.6 BEA Comments

- a) The airlines flight operational documentation regarding approach stabilization and go-around policy, flight crew performance should be reviewed.
- b) A CVR transcript and translation should be analysed for flight crew CRM regarding call-outs, briefing, decision making, transfer of control.
- c) Though CVR and FDR analysis, regarding go-around decision making and bounce landing, the appropriate recommendation should be made for the findings.

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 two pilots were experienced ones and familiar with Yangon Airport.
- b) The pilot in command took over the control of the plane from the co-pilot (14) seconds just before the first impact.
- c) The pilot was reluctant to perform a go-around while the plane was unstable and bouncing at landing .
- d) As per the special weather report (SPECI) at 12h15(UTC) was a wind speed04kt from 320, visibility 4000 meters, Ra BkN 012, Few 015cb ovc 090, Temperature 25C, Dew point 25 C,QNH 1010 CB. However, the aviation weather report system was semi-manual and the data transfer process was delayed. The duty ATC controller did not seem to notice the Special Weather Report (SPECI) immediately and the pilots did not receive it either.
- e) All engine related parameters appeared to function normally and there were no Master caution or Master warning alerts during the Take-off, Climb, Cruise and Descent phases of flight.
- f) The radiotelephony communication during the time of accident, the co-pilot was not able to use distressed message in the right way according to ICAO Radiotelephony phraseology.
- g) On the other hand, the duty ATC controller did not appear to understand the plain language easily.
- h) As a consequence, the duty ATC controller was not able to give definite information and instruction to the Airport Fire Station to response the emergency condition. Therefore, the aircraft rescue and fire fighters reached the accident site during about (8) minutes.

- i) The Emergency Operation Center (EOC) was not able to be initiated in a planned and effective manner even though Airport Emergency Plan and Procedures were in place.
- j) Disabled aircraft removal plan was not able to be executed in a planned, systematic and effective manner in spite of the fact that it was in place.

3.2 Primary Cause

During the final landing phase, the pilot was reluctant to perform a go-around while the plane was unstable and of bounce landing in low visibility condition.

3.3 Contributing Factors

- a) The visibility was very low and the runway centerline lightings were not able to be seen intermittently.
- b) The runway was wet and it was raining heavily.
- c) The pilot in command took over the control of the plane from the copilot (14) seconds just before the first impact.

4 SAFETY RECOMMENDATIONS

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

4.1 The pilots should request and be careful to the updated weather report from the Tower and be aware of current weather condition when on landing phase.

4.2 The pilots should be encouraged to be “go-around minded” for operational safety and Pilot go-around training needs to be fully integrated with the airline operator’s SMS.

4.3 The pilots should focus more on distressed and urgency messages in simulator exercises.

4.4 The aviation weather observation system should be fully automated.

4.5 ICAO English Language Proficiency Test should be fully taken into account in a more effective and more systematic manner and implemented in licensing process of Air Traffic Controllers and Pilots.

4.6 The Airport Operator should implement the emergency plan and procedure in a more efficient and effective ways as well as disabled aircraft removal plan with close coordination with airport communities and outsources.

A handwritten signature in blue ink, consisting of a stylized 'A' followed by 'mo' and a long horizontal stroke.

Investigator -in -charge

Appendices

Appendix A-	Drawing of Damage to Aircraft
Appendix B-	CVR Transcript
Appendix C-	FDR Animation Photos
Appendix D-	FDR Graph (Engine)
Appendix E-	FDR Graph (Pitch)
Appendix F-	Weather Report
Appendix G-	Load and Trim Sheet
Appendix H-	Instrument Approach Chart
Appendix I-	Organizational Chart of the airlines
Appendix J-	Standard Operating Procedures of ATR 72