FINAL REPORT

SERIOUS INCIDENT TO AIRBUS A320-216, REGISTRATION 9M-AQA, RUNWAY EXCURSION

7 JULY 2014

[AAIB BRUNEI 001/2014]
Air Accident Investigation Team
Brunei Darussalam
Ministry of Communication
21 May 2015

The Conduct of the Investigation

The investigation was carried out jointly by Brunei AAIT as Lead Investigator and the AAIB Singapore who was assisting the Brunei AAIT through the activation of the MOU on (Air Accident Investigation) between Brunei Darussalam and the Republic of Singapore.

Consistence with the ICAO mission and objectives of promoting aviation safety, the investigation has been conducted by an independent body which carried out objective investigations into air accidents and incidents.

The investigations were carried out in accordance with Annex 13 to the Convention on International Civil Aviation, which governs how member States of the International Civil Aviation Organisation (ICAO) conduct aircraft accident investigations internationally.

The investigation process involves the gathering, recording and analysis of all available information on the accidents and incidents; determination of the causes and/or contributing factors; identification of safety issues; issuance of safety recommendations to address these safety issues; and completion of the investigation report.

In carrying out the investigations, the team adhered to the 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 or incidents. It is not the purpose of this activity to apportion blame or liability."

Accordingly, it is inappropriate that the report 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.

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GLOSSARY OF ABBREVIATIONS

AGL	Above Ground Level
ATC	Air Traffic Control
ATIS	Automatic Terminal Information System
CVR	Cockpit Voice Recorder
DA	Decision Altitude
FDR	Flight Data Recorder
FO	First Officer
LT	Local Time
PF	Pilot Flying
PIC	Pilot-in-command
UTC	Coordinated Universal Time

SYNOPSIS

On 7 July 2014 at around 15:33 (Local Time), an Airbus A320 (registration 9M-AQA) veered off the right Runway 03 while making a landing at the Brunei International Airport. The ATC reported there was an intense shower at the runway threshold. After veering off, the Pilot-in-command attempted to steer the aircraft back to the runway to no avail.

The aircraft came to a halt on the grass patch about 1.3 Kilometre from the runway threshold. After the engines were shut down, an emergency evacuation was performed at the order of the Pilot-in-command.

The aircraft sustained damages to its right engine intake and thrust reverser cowl, fan blades in the left and right engines, tyres on all the landing gears.

One passenger sustained minor abrasion on the left elbow during the emergency evacuation.

The Aircraft Accident Investigation Team (AAIT) Brunei Darussalam has classified this occurrence as a serious incident.

AIRCRAFT DETAILS

Aircraft type	:	Airbus A320-216
Operator	:	Air Asia Berhad
Aircraft registration	:	9M-AQA
Engine details	:	2 x CFMI CFM56-5B6/3
Date and time of incident	:	7 July 2014, 15:33(Local Time)
Location of occurrence	:	Brunei International Airport, Runway 03
Type of flight	:	Scheduled passenger flight
Persons on board	:	109

1 FACTUAL INFORMATION

All times used in this report are in Brunei Darussalam Local Time (LT). Brunei Darussalam LT is eight hours ahead of Coordinated Universal Time (UTC).

1.1 Sequence of Events

1.1.1 On 7 Jul 14, an Airbus A320 was performing flight AK278 from Kuala Lumpur, Malaysia to Bandar Seri Begawan, Brunei. This was part of a four sectors flight (Kuala Lumpur - Bandar Seri Begawan – Kuala Lumpur – Singapore – Kuala Lumpur) which the flight crew was performing.

1.1.2 The Pilot-in-command (PIC) assigned the First Officer (FO) to operate flight AK278 and the following Bandar Seri Begawan – Kuala Lumpur sector as the Pilot Flying (PF). The PIC would then operate the remaining two sectors as PF. Therefore, during the incident flight, the FO was the PF and the PIC was the Pilot Monitoring (PM).

1.1.3 At 15:15:48,the aircraft established contact with a Brunei radar controller. The flight crew requested for the latest aerodrome weather information and asked if there were any showers around the airfield. They were informed that there were no showers at that moment, the visibility was 5 Kilometre and wind information was 210 Degree, 10 Knot.

1.1.5 At 15:28:26, the aircraft established contact with the Brunei aerodrome controller. Clearance to land on Runway 03 was granted and information on surface wind of 270Degree, 7 Knot was provided to the flight crew.

1.1.6 At 15:30:05, the aerodrome controller updated the flight crew of the surface wind at **210**Degree, 7 Knot up to a maximum of 10 Knot. According to the PIC, he observed that it started to rain in the vicinity of the runway. The PIC then asked the aerodrome controller if it was raining over the airfield. The aerodrome controller replied that there was rain only at the threshold[1] of Runway 03.

1.1.7 The sequence of events as the aircraft was approaching the runway (based on data retrieved from the flight recorders) was as follows:

Table 1: Sequence of Events

Time	Height Above Ground Level (Feet)	Event
15:31:19	1000	Aircraft was stabilised for approach in the correct configuration and landing gears were extended.
15:31:24	965	PIC briefed the FO to perform ago-around if

[1] This runway threshold refers to the marking across the runway that denotes the beginning of the designated space for landing.

		the visual reference with the runway cannot be established, which the FO acknowledged.
15:31:48	637	PF called out that he could see the runway approach lighting system.
15:31:54	581	PIC mentioned that the Precision Approach Path Indicator (PAPI)[2] was in sight.
15:32:10	316	PF called out that he will continue the approach to land the aircraft, which the PIC acknowledged, and disconnected the autopilot system to perform a manual landing.

1.1.8 According to the aerodrome controller, at around 15:32 when the aircraft was approximately 1 Nautical Mile from the runway, the shower intensified and extended up to the area around the E4 taxiway (See Figure 1)

1.1.9 At 15:32:15, "Minimum[3]" (DA) was annunciated by the aircraft system. Shortly before, the Autopilot was disconnected and the PF started to provide control input to the side stick.

1.1.10 As the aircraft approached the runway, it encountered rain and at 15:32:17,the PIC switched on the windshield wipers to the "Fast" setting[4].

1.1.11 According to the aerodrome controller, he received a weather update from the meteorological station where the visibility was 3000 Metre South-East to South at around 15:32. However, he did not pass this information to the flight crew as the aircraft was very close to touching down on the runway and he did not want to interrupt the flight crew's operation.

1.1.12 At 15:32:23,when aircraft was 157 feet Above Ground Level (AGL), the FO called out for the PIC to take over control of the aircraft, which the PIC acknowledged verbally, "Okay I have control". Almost immediately after the handover, the FO said, "I can't see anything" which the PIC verbally acknowledged by saying, "Check". This series of exchange ended at this point.

1.1.13 According to the PIC, he saw a row of white runway lights[5] and continued with the approach steering the aircraft towards the lights. Data from the

[2] The PAPI is a visual aid that provides guidance information to help a pilot acquire and maintain the correct approach path (in the vertical plane) to a runway.

[3]The Decision Altitude is a specific altitude in a precision approach or approach with vertical guidance at which a missed approach must be initiated if the required visual reference to continue the approach has not been established. The DA was set to 309 Feet by the PIC.

[4] The windshield wipers have three settings: Off, Slow and Fast.

[5] There are three rows of white lights on the runway to indicate the centreline, left edge and right edge of the runway. The PIC mentioned during the interview with the investigation team that he saw only one row of white lights and believed it was the centreline lights.

flight data recorder shows that the aircraft heading was 031 Degree when the FO handed over controls to the PIC. After taking over control of the aircraft, the PIC provided right roll input through the control stick and the aircraft heading increased to 034 Degree.

1.1.14 At 15:32:36, both main gears of the aircraft touched downon the runway pavement, close to the right edge of the runway. (About three seconds later, ambient noises corresponding to the aircraft veering off the runway was recorded on the Cockpit Voice Recorder (CVR))

1.1.15 The PIC applied left rudder input (as recorded in FDR, rudder position 7° increased reaching 22.5° in less than one second), however, he was unable to bring the aircraft back to the runway.

1.1.16 After the nose gear touched down on the grass patch at 15:32:47, the aircraft travelled across taxiway E4 onto another grass patch before coming to a stop (See Figure 1). Subsequently, the PIC requested for all the cabin crew members to be at their assigned stations.

Figure 1: Yellow line shows path of aircraft

1.1.17 According to the aerodrome controller, he activated the crash alarm to declare an air crash shortly after seeing the aircraft veer off the runway[6]. Once the aircraft came to a stop, the aerodrome controller established contact with the flight crew to ask how the situation was and requested for the number of persons on board.

1.1.18 The PIC requested for fire services and informed the aerodrome controller that there were 109 persons on board.

[6] The emergency service vehicles arrived at the occurrence site one minute after the cash alarm activation, Brunei DCA's requirement is for emergency service vehicles to arrive at the occurrence site within two minutes after activation.

1.1.19 Upon completing the emergency evacuation checklist, the PIC ordered for an emergency evacuation to be carried out. The emergency slides of the four main cabin doors (two doors on each side of the forward and aft of the passenger cabin) were successfully deployed when the cabin crew opened the doors. All occupants in the aircraft evacuated through these four emergency slides.

1.1.20 The hatches of four over-wing emergency exits were not removed and the emergency slides at these locations were not deployed in this evacuation[7].

1.1.21 According to the flight crew, they inspected the passenger cabin to ensure that there was no one left on board the aircraft before evacuating the aircraft.

1.2 Injuries to Persons

1.2.1 There were no serious injuries however one passenger suffered minor abrasion on the left elbow during the evacuation process.

1.3 Damage to Aircraft

1.3.1 The damages to the aircraft are as follows:

- Deflated tyres on the nose and right main landing gear
- Damage to hydraulic pipeline and electrical harness on right main landing gear
- Scratches on the side of the left main landing gear tyre
- Multiple gouges, cracks and scratches on the fuselage skin
- Puncture on left pylon aft moveable fairing
- Puncture to right engine inlet cowl
- Crack on right engine thrust reverser cowl
- Tip curl and nicks of fan blades in the right and left engines

1.4 Other Damage

1.4.1 The damages to the aerodrome are as follows:

- Several damaged transformer pits and transformer pit covers
- Several damaged and broken light fixtures on runway and taxiway
- One damaged signage
- Damaged airfield cablings
- Damaged grass areas

1.5 Personnel Information

[7]Although not mandatory, the aircraft manufacturer strongly recommends that all over-wing emergency exits to be utilised in an evacuation.

1.5.1 Pilot-in-command and First Officer

	Pilot-in-command	First Officer
Gender	Male	Male
Age	29	23
Licence	Airline Transport Pilot Licence issued by the Department of Civil Aviation Malaysia with A320 rating (expiry on 31 May 2015) Medical Approval (expiry on May 2019)	Commercial Pilot Licence issued by the Department of Civil Aviation Malaysia with A320 rating (expiry on 31 Dec 2014) Medical Approval (expiry on Jun 2015)
Total flying experience	6100 hr	970 hr
Total on A320	2554 hr 20 min	640 hr
Total flight hours in current capacity on type	340 hr	640 hr
Flying in last 24 hours	0 hr	8 hr 35 min
Flying in last 28 days	75 hr	55 hr
Flying in last 90 days	205 hr 12 min	222 hr 28 min

1.5.1.1 The PIC was promoted to Captain on 23 Jan 14 while the FO started flying in his capacity on 14 Dec 13.

1.5.1.2 Toxicology tests performed on both flight crew members did not show any anomaly.

1.5.2 Air Traffic Controllers

1.5.2.1 All the air traffic controllers involved in this occurrence held a valid air traffic controller license with the appropriate rating issued by the Brunei Darussalam Department of Civil Aviation.

6. Meteorological Information

1.6.1 As the flight crew began their approach, the weather information they received from the Automatic Terminal Information System (ATIS) was surface wind at 280 Degree, 11 Knot and visibility was 8000 Metre.

1.6.2 The last weather information received by the flight crew, from the aerodrome controller, was surface wind at 210 Degree, 7 Knot up to a maximum of 10 Knot.

1.6.3 The aerodrome controller received updated weather information where visibility was 3000 Metre South East to South from the meteorological station. He did not pass this information to the flight crew ashe saw that the aircraft was close to touch down.

1.7 Aerodrome Information

1.7.1 The Air Traffic Services provision at Brunei International Airport are in accordance with Standard Operation Procedure (SOP).

1.7.2 Air Navigation and Aerodrome Systems operations are in compliance with International Civil Aviation Organisation Standards and Recommended Practices (ICAO SARPs).

1.8 Recorded Data

1.8.1 The aircraft was installed with a Cockpit Voice Recorder (CVR) and a Flight Data Recorder (FDR). Data from both recorders were downloaded successfully and useful for the investigation.

1.9 Other Information

1.9.1 Training on Go-around below minima

1.9.1.1 According to the operator's training syllabus, go-around below minima[8]simulator trainings for its pilots are conducted during:

- Full flight simulator trainings where pilots practise rejected landing at 30 Feet AGL with one engine inoperative

- During simulator landing proficiency checks for new captains, where low and high flare scenarios require go-around to be performed, when the aircraft is 50 Feet AGL

1.9.1.2 During any simulator training, the instructor may administer rejected landing or go-around below minima trainings on an ad hoc basis.

1.9.1.3 Training records provided by the operator indicated that the last go-around below minima simulator training accomplished by the PIC and FO was on 8 May 14 and 25 Aug 13 respectively.

1.9.2 Low visibility operation training

1.9.2.1 In the low visibility operation portion of the full flight simulator training, pilots are required to perform low visibility go-around. In this training, the pilots are required to perform the low visibility go-around before minima.

1.9.3 Human performance limitation and human factors

1.9.3.1 An aviation medical examiner assisted the investigation team in the analysis of the human performance limitation and human factor aspects of the PIC after he took over control of the aircraft from the FO.

[8] Minima refer to the height or altitude where an approach should not be continued unless the visual references for the runway are distinctly visible and identifiable.

1.9.4 Runway Lighting

1.9.4.1 An inspection performed after the incident did not reveal any anomaly with the runway lighting system other than damages to the lighting installations and fixtures due to contact by the aircraft.

1.9.4.2 The runway lighting system is inspected twice a day, once in the morning and once before night fall in the evening. The repair team would repair and note down the defective runway lights in the daily maintenance logs and submit to the authority daily. A review of the runway maintenance logs by the investigation team for a period of a week before the incident did not reveal any anomaly with the runway lighting system, except for the routine replacement of isolated defective runway edge light bulbs.

2 ANALYSIS

a. Weather condition during approach
b. Decision to hand over control of aircraft
c. Human factor surrounding occurrence
d. Simulator trainings

2.1 Weather Condition during approach

2.1.1 As the aircraft approach the runway, the flight crew were aware of the likelihood of rain affecting their approach as they asked the aerodrome and radar controller on several occasions if there was rain in the airfield.

2.1.2 The operator's policy restricts the FO to perform a landing only in cross wind conditions not more than 15 Knot. During the interview, the FO indicated that the weather information received through the ATIS and controllers showed that the weather condition were within his landing limits. According to the PIC, he had assessed that the FO was able to land in that weather condition and allowed him to continue as PF for the approach.

2.1.3 According to the PIC, he had to switch on the wipers for both the left and right windshield to the "Fast" setting only after DA because they encountered the heavy rain which affected their visibility.

2.1.4 To the extent that the PIC had to switch on the wipers to the "Fast" setting when it was previously switched off suggests that the crew encountered a sudden intense rain, which severely reduced visibility of the runway, only after passing DA.

2.2 Decision to hand over control of aircraft

2.2.1 Seven seconds after the wipers were switched on; the FO handed over control of the aircraft to the PIC when he lost visual reference with the runway due to the intense rain, instead of performing a go-around as briefed by the PIC earlier.

2.2.2 According to the FO, he did not consider performing a go-around at that point in time. This was despite the PIC's instruction that was given one minute earlier, to perform a go-around if the runway was non-visual. During the interview after the occurrence, the FO mentioned that the thought of performing a go-around at that point did not cross his mind. Instead, he believed that the PIC, being more experienced, would be able to land the aircraft.

2.2.3 In handing over the controls of the aircraft, the FO appears to be not confident in executing a go-around after losing visual reference with the runway and that he had greater confidence in the PIC landing the aircraft.

2.2.4 A handover of controls after DA poses these likely safety risks:

- The pilot receiving control of the aircraft may have insufficient time to react appropriately and establish positive control: and

- Should the pilot receiving control of the aircraft decide to perform a go-around, valuable time and altitude lost during the handover would have increased the challenge to execute a safe go-around.

2.3 **Human factors**

2.3.1 The aircraft was 157 Feet AGL and 13 seconds away from touchdown when the handover of control occurred.

2.3.2 Studies on human (reaction document) indicate (that) the average human reaction time is about five to six seconds from perceiving to reacting. In the context of this occurrence, this process of perception to reaction would include:

- The PIC heard that the FO had handed over control to him
- The PIC understood that he had control of the aircraft
- Established situational awareness
- To provide input to the flight controls to control the aircraft

2.3.3 With 13 seconds to touch down, the PIC would have had enough time to maintain control of the aircraft. From the CVR recordings, the PIC acknowledged the handover without hesitation. However, he was unable to establish proper situational awareness to ensure that the row of lights he saw was the runway centreline lights.

2.3.4 From the FDR data, prior to the FO handing over controls of the aircraft, he had maintained the aircraft heading at 031 Degree with direct tailwind of 210 Degree and it was tracking along the extended runway centreline.

2.3.5 After taking over control of the aircraft, the PIC provided right roll input through the control stick, approximately one second after the handover, and the aircraft heading increased to 034 Degree. With no change of wind direction the aircraft started tracking to the right of the runway centreline until touchdown. From the CVR recordings, it is noted that the aircraft went onto the grass patch area about three seconds after touching down.

2.3.6 The PIC mentioned during the interview that when he took over the controls of the aircraft, he saw only one row of landing lights, instead three row of landing lights, and piloted the aircraft towards that row of lights. On hindsight, the PIC indicated that he was not sure if that row of lights was the centreline or edge lights of the runway. It is evident that the row of lights which he saw was the runway right edge lights and piloted the aircraft towards it.

2.3.7 Human factor analysis of the PIC's actions in the final phase of approach suggests that the coning of attention[9]occurred. The handover of controls occurred so close to touchdown that it would have placed the PIC under increased stress level to land the aircraft safely. This resulted in the PIC not considering that the row of lights could be the runway edge lights and made the decision to steer the aircraft towards what he believed was the runway centreline lights, to land the aircraft.

2.3.8 This serious incident highlights the need for a go-around to be performed when the approach is destabilised below minima. The decision may be difficult to take but remains the proper one in such circumstances.

2.4 Simulator trainings

2.4.1 The operator provides simulator training for go-around below minima where the scenario is the aircraft having one engine inoperative.

2.4.2 The operator also provides low visibility operation simulator training to its pilots where the low visibility go-around is performed above minima.

2.4.3 On the day of occurrence, the pilots encountered the weather only after passing minima. This was different from the scenarios in the simulator trainings. Therefore, this might have resulted in the FO not considering the option of, or not being confident in, performing a go-around when he encountered the weather, which resulted in the loss of visual reference to the runway.

2.4.4 The operator's flights are in a region where the weather can change quickly resulting in a rapid reduction, or even the loss of visibility, of the runway visual reference during landing. The pilots would have been better prepared to pilot the aircraft, in weather conditions which they encountered, had they accomplished simulator trainings for go-around below minima in response to weather conditions that result in the rapid reduction or loss of visual reference to the runway.

[9]The "coning of attention" refers to the mechanism where instead of gathering a broad spectrum of data to make a good decision, one concentrates on a single source of information. This mechanism results in the breakdown of performance under stress.

3 CONCLUSIONS

3.1 From the information gathered, the following findings are made. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

3.1.1 The flight crew flying into Brunei International Airport was aware of the likelihood of encountering weather on their approach. The crew was proactive in requesting for weather information and the air traffic controllers provided frequent updates on the aerodrome's weather condition.

3.1.2 During the approach, to the point where the flight crew descended to DA, they did not encounter any weather condition that required a go-around to be performed. The PIC monitored the FO and assessed that the FO was able to land the aircraft in the reported weather conditions, which were within the limitations imposed by the operator.

3.1.3 51 seconds before reaching DA, the PIC briefed the FO to perform a go-around if the visual reference with the runway cannot be established, which the FO acknowledged.

3.1.4 Two seconds after passing DA, the flight crew encountered intense rain to the extent that the PIC had to switch the wiper on to the "Fast Setting".

3.1.5 Five seconds later, at 157 Feet AGL, the FO lost visual reference with the runway and decided to hand over control of the aircraft to the PIC instead of performing a go-around.

3.1.6 When the PIC took over controls of the aircraft, he saw only a row of white runway edge lights, which he believed to be the runway centreline lights. He provided inputs through the control stick and piloted the aircraft towards that row of lights which was the right runway edge lights.

3.1.7 The aircraft touched down on the runway pavement, close to the right edge of the runway. Shortly after, the aircraft veered onto the grass patch to the right of the runway edge.

3.1.8 Unable to bring the aircraft back to the runway, the PIC brought the aircraft to a stop on the grass patch and ordered an emergency evacuation.

4 SAFETY ACTIONS

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

4.1.1 The operator had issued a reminder to its pilots on the following:

- Proper handing and taking over control of aircraft
- Rejected landing procedures
- Operator's criteria of the required visual reference to the intended landing runway
- Associated risk of cross wind conditions during landing and the recovery techniques

4.1.2 The operator provided a critical incident stress management programme for the flight and cabin crew members of the occurrence flight.

5 SAFETY RECOMMENDATIONS

5.1 It is recommended that:

5.1.1 The operator consider introducing simulator training for go-around below minima in response to weather conditions that result in the rapid reduction or loss of visual reference to the runway.