KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA

FINAL

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Aircraft Serious Incident Investigation Report

PT. Garuda Indonesia

ATR 72-600; PK-GAG

Lombok International Airport

Republic of Indonesia

03 February 2015

2016

This final report was produced by the Komite Nasional Keselamatan Transportasi (KNKT), 3rd Floor Ministry of Transportation, Jalan Medan MerdekaTimur No. 5 Jakarta 10110, Indonesia.

The report is based upon the investigation carried out by the KNKT in accordance with Annex 13 to the Convention on International Civil Aviation Organization, the Indonesian Aviation Act (UU No. 1/2009) and Government Regulation (PP No. 62/2013).

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ABBREVIATIONSAND DEFINITIONS

ARFF	:	Airport Rescue and Fire Fighting
ATIS	:	Automatic Terminal Information Services
ATPL	:	Airline Transport Pilot License
ATR	:	Avions de Transport Regional
ATS	:	Air Traffic Service
BMKG	:	*Badan Meterologi Klimatologi dan Geofisika* (Metrological Climatology and Geophysical Agency)
BOM	:	Basic Operation Manual
°C	:	Degrees Celsius
CPL	:	Commercial Pilot Licence
CVR	:	Cockpit Voice Recorder
DGCA	:	Directorate general Civil Aviation
EGPWS	:	Enhanced Ground Proximity Warning Systems
FA	:	Flight Attendant
FCOM	:	Flight Crew Operation Manuals
FDR	:	Flight Data Recorder
IAF	:	Initial Approach Fix
ICAO	:	International Civil Aviation Organization
ILS	:	Instrument Landing System
Km	:	Kilometer(s)
Mbs	:	Millibars
MOS	:	Manual of Standard
ND	:	Navigation Display
KNKT	:	*Komite Nasional Keselamatan Transportasi* (National Transportation Safety Committee)
PF	:	Pilot Flying
PIC	:	Pilot in Command
PM	:	Pilot Monitoring
QNH	:	Height above mean sea level based on local station pressure
S/N	:	Serial Number
SIC	:	Second in Command
UTC	:	Universal Time Coordinate
VOR	:	VHF Omni-directional Range

INTRODUCTION

SYNOPSIS

An ATR 72-600, registration PK–GAG, on 03 February 2015, was being operated by PT. Garuda Indonesia as a passenger schedule flight with flight number GA7040 from Ngurah Ray International Airport of Bali to Lombok International Airport of West Nusa Tenggara.

The aircraft departed from Ngurah Ray Airport at 09:10 UTC. On board in this flight were 34 persons cosisting of three pilots, two flights Attendances and 29 passengers.

The Second in Command (SIC) who was under line training acted as Pilot Flying (PF) and the Pilot in Command (PIC) acted as Pilot Monitoring (PM) and the third pilot who occupied the cockpit observer seat was also a pilot under line training.

At 0952 UTC, the aircraft touched down and bounced three times with left wing up and rolled to the right about 2°. The aircraft travelled out of the runway for about 180 meters and stopped at approximate 15 meters on the right side of the runway 13.

After the aircraft stop, the pilot called several “mayday” to the Lombok Tower controller and requested for assistance. The pilot then shut off the engines by activation the engine fire handle. The flight attendant contacted the pilot and asked for passenger evacuation, the PIC instructed to evacuate the passenger via left door.

The Lombok Tower controller pressed the crash bell and the Airport Rescue and Fire Fighting (ARFF) team arrived few minutes later and assisted the passenger evacuation. No one injure on this occurrence.

The investigation concluded that the contributing factorsto this serious incidents are:

1. Two transfer of control at critical altitude without clear statement might have made that pilots not aware who has the full control of the flight and jeopardize the flight when the pilot receive the control not fully aware to the condition of the flight.
2. The handling of the aircraft after bounce was contrary to the wind condition, and the application of the right rudder and cross wind condition might have made the aircraft turned to the right.

Prior to issue this draft final report, the Komite Nasional Keselamatan Transportasi (KNKT) has received a Notice to Flight Crew regarding to safety actions taken by the operator following this serious incident.

Following the investigation of this serious incident, Komite Nasional Keselamatan Transportasi (KNKT) issued several safety recommendations addressed to PT. Garuda Indonesia, Lombok International Airport, and Directorate General of Civil Aviation.

1 FACTUAL INFORMATION

1.1 History of the Flight

An ATR 72-600, registration PK–GAG, on 3 February 2015, was being operated by PT. Garuda Indonesia as a passenger schedule flight with flight number GA7040 from Ngurah Ray International Airport of Bali to Lombok International Airport of West Nusa Tenggara[1].

Figure 1: Archive photo of aircraft involved

The aircraft departed from Ngurah Ray Airport at 09:10 UTC[2]. On board in this flight were 34 persons cosisting of three pilots, two Flights Attendants and 29 pasengers.

The Pilot in Command (PIC) acted as Pilot Monitoring (PM) and the Second in Command (SIC) who was under line training acted as Pilot Flying (PF) and the third pilot who occupied the cockpit observer seat was also a pilot under line training.

There were no aircraft technical system abnormality or problem reported or recorded prior to the departure until the time of occurrence.

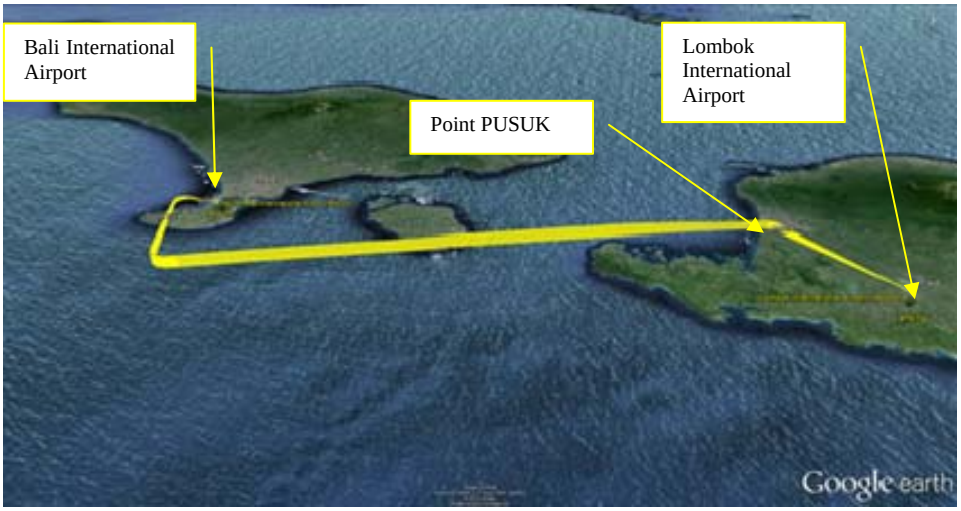
The weather at Lombok Airport the wind velocity was reported from 220/08 knots and temperature was 30°C.

During the interview the pilots stated that the aircraft cruised at 7000 feet and the approach and landing crew briefing was conducted prior to the aircraft descend. Thecrosswind landing was stressed by the PIC during this briefing.

At 0941 UTC, the pilot contacted Lombok Tower at position on 15 NM from PUSUK which it was the Initial Approach Fix (IAF) of the Instrument Landing System (ILS) runway 13 and located at 16 NM from LMB VOR.

1 Lombok international Airport of West Nusa Tenggara will be named as Lombok for the purpose of this report.

2 The 24-hour clock used in this report to describe the time of day as specific events occurred is in Coordinated Universal Time (UTC). Local time for Lombok isWaktu Indonesia Tengah (WITA) is UTC + 8 hours.



Picture courstessy of Google Earth

Figure 2: **The route flown from Bali to Lombok as recorded on the FDR**

At 0948 UTC, the pilot reported that theaircaft was on final runway 13 and the Lombok Tower controller informed that the surface wind was 210/12 knots and visibility was 10 Km, then providedlanding clearance. The pilot also stated that during the approach, the PIC assisted the SIC to align with the runway two timesat approximately at 800 ft and 500 ft. Furthermore, at below 500 ft the PIC took over the control andinstructed to the SIC to follow in controlling the aircraft.

At 0952 UTC, the aircraft touchdown at approximate 700 metresfrom the beginning runway 13, bounced two times.The third touchdown, the FDR recordedthe left wing up and slightly rolled to the right about 2°.The pilot also explained that during the landing the throttles were difficult to be selected to the ground idle. Later on the pilot successfully selected the ground idle when the aircraft veered to the right of the runway. The aircraft travelled on the shoulder for about 180 meters and stopped at approximate 33 meters from the pavement on the right side of the runway 13.

After the aircraft stop, the pilot called several “MAYDAY” addressed to Lombok Tower controller and also requested for assistance. The pilot evaluated and performed procedures then shut down the engines by activation the engine fire handles.

The flight attendant contacted the pilot and asked for passenger evacuation, the PIC instructed to evacuate the passenger via left door.

After received information from the pilot, the Lombok Tower controller pressed the crash bell to alert the Airport Rescue and Fire Fighting (ARFF). The ARFF team arrived few minutes later and assisted the passenger evacuation.

No one injured on this occurrence.

1.2 Injuries to Persons

Injuries	Flight crew	Passengers	Total in Aircraft	Others
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/None	5	9	34	-
TOTAL	5	9	34	-

1.3 Damage to Aircraft

The aircraft had major damage, with the following damages condition;

- The nose landing gear collapsed rearward,
- The lower front of fuselage dent,
- Right propeller blade and the tips bent.

Figure 3: The final position of the aircraft with the nose and main landing gears trapped on the soft soil

Figure 4:The damage on the propeller and the nose wheel

1.4 Other Damage

There was no other damage reported.

1.5 Personnel Information

1.5.1 Pilot in Command

Gender	:	Male
Age	:	44 Years
Nationality	:	Indonesia
Marital status	:	Married
Date of joining company	:	1 November 2013
License	:	Airline Transport Pilot License (ATPL)
Date of issue	:	16 November 2011
Validity	:	31 May 2015
Aircraft type rating	:	ATR 72
Instrument rating	:	31 October 2015
Medical certificate	:	First Class
Last of medical	:	6 January 2015
Validity	:	July 2015
Medical limitation	:	No Limitation
Last line check	:	13 February 2014
Last proficiency check	:	21 October 2014

Flying experience

Total hours	:	4,600 hours
Last 90 days	:	192 hours 37 minutes
Last 60 days	:	103 hours 36 minutes
Last 24 hours	:	1 hour
This flight	:	1 hour

The PIC was a qualified Training Captain who was authorized to conduct line training for candidate first officer or captain. The PIC has successfully trained 8 candidates of first officer and captain.

1.5.2 Second in Command

Gender	:	Male
Age	:	41 Years
Nationality	:	Indonesia
Marital status	:	Married
Date of joining company	:	1 May 2014
License	:	Commercial Pilot License (CPL)
Date of issue	:	15 May 2012
Aircraft type rating	:	ATR72-600
Instrument rating	:	30 September 2015
Medical certificate	:	First Class
Last of medical	:	22 December 2014
Validity	:	22 June 2015
Medical limitation	:	No limitation
Last proficiency check	:	26 September 2014
Flying experience		
Total hours	:	1,300 hrs
Total on type	:	120 hrs 47 minutes
Last 90 days	:	117 hours 8 minutes
Last 60 days	:	28 hours 07 minutes
Last 24 hours	:	1 hour
This flight	:	1 hour

1.5.3 Third Pilot

Gender	:	Male
Age	:	37 Years
Nationality	:	Indonesia
Marital status	:	Married
Date of joining company	:	1 March 2014
License	:	Airline Transport Pilot License (ATPL)
Date of issue	:	12 March 2010
Aircraft type rating	:	ATR 72-600
Instrument rating	:	30 September 2015
Medical certificate	:	First Class
Last of medical	:	13 January 2015

Validity	:	July 2015
Medical limitation	:	No limitation
Last proficiency check	:	5 September 2014

Flying experience

Total hours	:	5,594 hours 9 minutes
Total on type	:	108 hours 19 minutes
Last 90 days	:	106 hours 01 minutes
Last 60 days	:	72 hours 26 minutes
Last 24 hours	:	1 hour
This flight	:	1 hour

The SIC and third pilot were candidates first officer under training to become a qualified first officer. The SIC and the third pilot has been conducted flight schedule for total of approximately 120 hours. Among these 120 hours, the SIC has performed approximately 70 hours active on seat while the third crew has performed 50 hours.

1.6 Aircraft Information

1.6.1 General

Registration Mark	:	**PK-GAG**
Manufacturer	:	Avions De Transport Regional G.I.E
Country of Manufacturer	:	France
Type/ Model	:	ATR72-212A “600 Version”
Serial Number	:	1157
Year of manufacture	:	2014
Certificate of Airworthiness		
Issued	:	10 July 2014
Validity	:	9 July 2015
Category	:	Transport
Limitations	:	None
Certificate of Registration		
Number	:	3500
Issued	:	10 July 2014
Validity	:	9 July 2015
Time Since New	:	1249 hours (3 February 2015)
Cycles Since New	:	1260 cycles (3 February 2015)
Last Minor Check	:	A Check performed at 21 December 2014

1.6.2 Engines

Manufacturer	:	Pratt & Whitney Canada incorporated, Canada
Type/Model	:	PW 127M
Serial Number-1 engine	:	ED-0888
▪ Type/Model	:	PW 127M
▪ Installed	:	29 June 2014
▪ Time Since New	:	1249 hours (3 February 2015)
▪ Cycles Since New	:	1260 cycles (3 February 2015)
Serial Number-2 engine	:	ED-0854
▪ Type/Model	:	PW 127M
▪ Installed	:	29 June 2014
▪ Time Since New	:	1249 hours (3 February 2015)
▪ Cycles Since New	:	1260 cycles (3 February 2015)

1.6.3 Propellers

Manufacturer	:	Hamilton Sundstrand, USA
Type/Model	:	PROP 568F
Serial Number-1 engine	:	FR20140410
▪ Installed	:	29 June 2014
▪ Time Since New	:	1,249 hours (3 February 2015)
▪ Cycles Since New	:	1,260 cycles (3 February 2015)
Serial Number-2 engine	:	FR20140123
▪ Type/Model	:	PROP 568F
▪ Installed	:	29 June 2014
▪ Time Since New	:	1,249 hours (3 Feb 2015)
▪ Cycles Since New	:	1,260 Cycle (3 Feb 2015)

1.7 Meteorological Information

The weather data was provided by the *Badan Meteorologi Klimatologi dan Geofisika* **(**BMKG – Meteorology, Climatology and Geophysics Agency of Indonesia). The weather information provides periodically. The weather observation performs ten minutes prior to the issuance.

Weather Report for Lombok Airport, issued 03 February 2015, between 0900 - 1100 UTC were as follows:

	0900 UTC	1000 UTC	1100 UTC
Wind	230/08 knots	220/07 knot	220/07 knot
Visibility	10 km	10 km	9 km
Weather	NIL	NIL	NIL
Cloud	Scattered	Scattered	Scattered cumulus
TT/TD (Temperature/ dew point - °C)	30 / 23	30 / 23	29 / 23
QNH (mbs)	1010.85	1011	1011
QFE (mbs)	999.50	999.51	1000.51
Remark	No significant	No significant	No significant

The Automatic Terminal Information Services (ATIS) broadcasted on 1054 UTC conained information:

Wind	220/03 knot
Visibility	8 km
Weather	NIL
Cloud	Scattered 1600
TT/TD (°C)	27 / 23
QNH (mbs)	1011
Remark	No significant

1.8 Aids to Navigation

Ground-based navigation aids/onboard navigation aids/aerodrome visual ground aids were serviceable and operated normally. The navigation equipments considered not factor in this occurrence.

1.9 Communications

All communications between Air Traffic Services (ATS) and the crew were recorded by ground based automatic voice recording equipment and the Cockpit Voice Recorder (CVR) for the duration of the flight. The quality of the recorded transmissions was good. The communication equipment and their serviceability were not a factor in this occurrence.

1.10 Aerodrome Information

Airport Name	:	Lombok International Airport
Airport Identification	:	LOP / WADL
Airport Operator	:	PT. Angkasa Pura I
Airport Certificate	:	041/SBU-DBU/IX/2011
Coordinate	:	08° 45' 26.36" S;116° 16' 36.03" E
Elevation	:	36,64 feet
Runway Direction	:	13-31
Runway Length	:	2750 m
Runway Width	:	45 m
Surface	:	Asphalt

Observation on the area of the runway found at the right runway edge pavement surface crack about 20 cm width, 50 cm depth and about 100 meters length, the operator repaired by filling the broken area with the concrete.

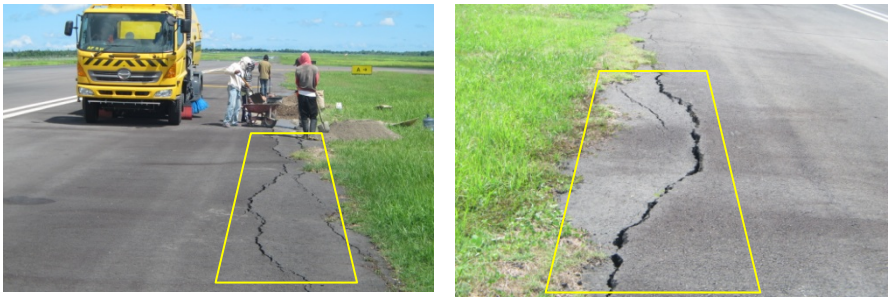


Figure 5: Crack on the runway edge pavement

1.11 Flight Recorders

The aircraft was equipped with a Solid State Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR). The FDR and CVR were transported to the KNKT recorder laboratory for data retrieval and arrived on 05 February 2015 in good condition.

1.11.1 Flight Data Recorder

Manufacturer	:	L3 Aviation
Part Number	:	2100-4045-00
Serial Number	:	000949680

Squence of the significant events from 50 feet until the third touchdown recorded by the FDR.

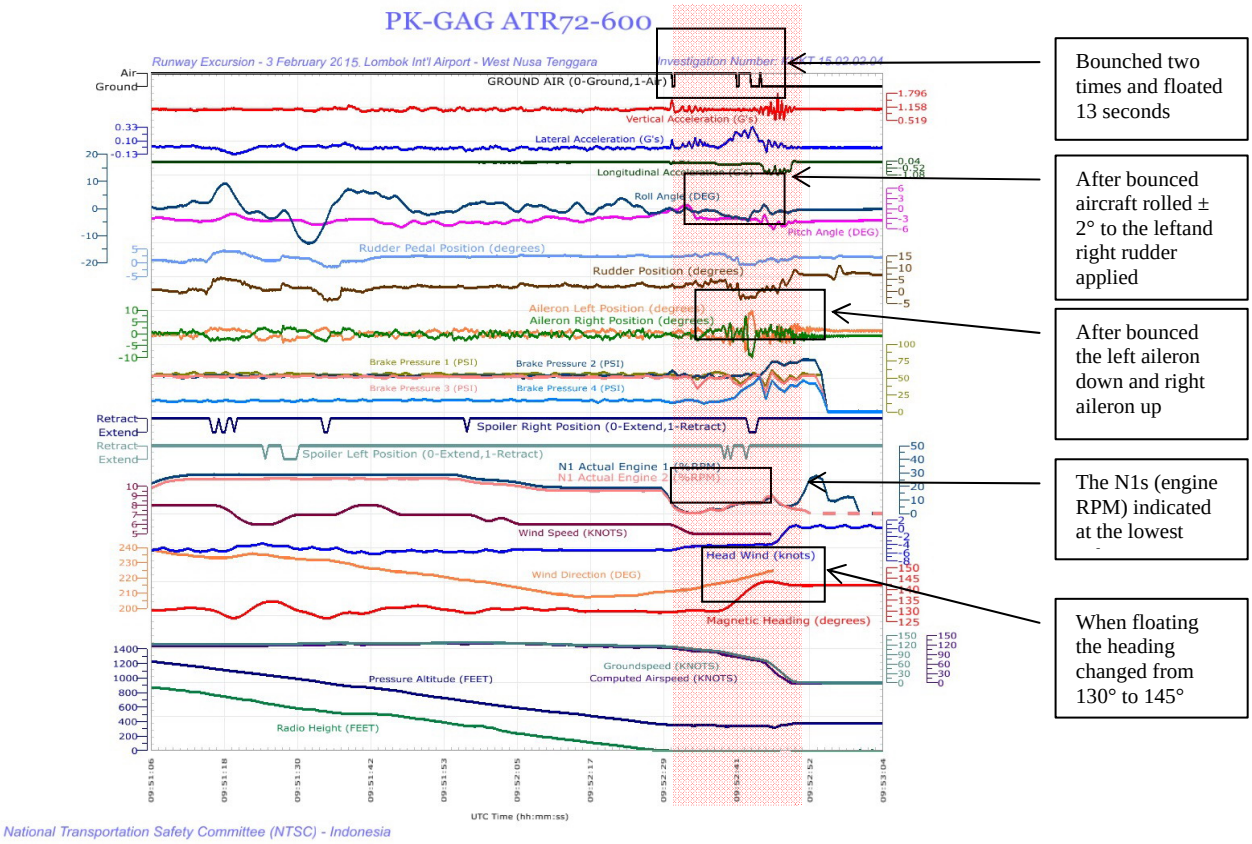


Figure 6: The graph of several parameters of the DFDR started from 1200 feet on final until the aircraft stop

The FDR data showed:

- The aircraft bounced two times. The interval between the first and second touchdown was 10 seconds and the third touchdown was 3 seconds later.
- After bounce, aircraft rolled to the left at approximately 2°, right rudder applied and left aileron up. The aircraft heading changed to the right from 130°.
- The aircraft firmly on the ground at speed approximately 80 knots and at approximately 3 seconds after reached heading 145° the FDR recorded the peak of the lateral acceleration, which indicate aircraft initially left the runway pavement.
- The plot of the FDR superimposed to Google Earth indicated that the first touchdown was at 700 meters from the beginning runway 13.

Picture courstessy of Google Earth

Figure 7: The aircraft flight path based on data recorded on the DFDR superimposed to Google Earth

1.11.2 Cockpit Voice Recorder

The details of the CVR were:

Manufacturer : L3 Aviation

Part Number : 2100-1020-02

Serial Number : 000931323

The CVR data has been downloaded and contained 124 minutes of good quality voice recording.The recorder contained the occurrence flight.

Significant excerpt of the CVR data are as follows:

Time (UTC)	Recorded voice	Source
09.50:22	"ONE THOUSAND"	EGPWS
09.50:26	The PIC informed the wind condition showed on the Navigation Display (ND) was from 267° and 6 knots.	
09.50:43	AUTOPILOT DISENGAGED	
09.50:47	The PIC reminded the SIC to be aware of the speed that was tends to decrease.	
09.51:11	The PIC reminded the crosswind from the right.	
09.51:17	The PIC reminded the SIC related to the localizer.	
09.51:19	The PIC took over the control and asked the SIC to follow the control.	
09.51:43	The PIC showed the correct position of the approach related to the correct localizer position.	
09.52:10	TWO HUNDRED	EGPWS

09.52:19	The PIC told the SIC to trim the aircraft and questioning why the SIC kept the high descend rate when the aircraft was below the correct glide path.	
09.52:20	ONE HUNDRED	EGPWS
09.52:32	Aircraft first touched down	
09.52:42	The SIC expressed his concern to the PIC by calling the PIC three times	
09.52:47	*Sounds similar to impact.*	
09.52:58	The SIC contacted the Lombok Tower controller informed that they have an emergency condition thatthe aircraft has stopped on the right shoulder and requested for assistance.	

1.12 Wreckage and Impact Information

The aircraft was landed for Lombok International Airport in runway 13, after touchdown the aircraft veered to the right and stop about 390 metres from the last touchdown position and 33 metres from the runway edge (position of the nose wheel). The aircraft trapped on the soft soil.

The nose landing gear collapsed rearward and damaging the front lower fuselage, the nose landing gear side broken.

Figure 8: The nose landing gear collapsed rearward and damaging the front lower fuselage

Figure 9: The last aircraft position

1.13 Medical and Pathological Information

There was no medical examination conducted for all crew

1.14 Fire

There was no evidence of fire prior and post impact.

1.15 Survival Aspects

After the aircraft stopped, the flight crew contacted the Lombok Tower controller informed that the aircraft stop out of the runway and request for assistant.

The controller pressed the crash bell to the Airport Rescue and Fire Fighting (ARFF). The ARFF deployed to the location.

The Flight Attendant (FA) noticed that the aircraft stopped in abnormally and checked the outside condition. The FA saw that the aircraft has stopped on the grass. After waited for more than one minute, the FA contacted the PIC and asked for passenger evacuation. The PIC commanded to evacuate the passenger via left passenger entrance door.

While opened the passenger entrance door, the FA noticed that the ARFF has arrived on the site. All passengers were evacuated. No one injured in this serious incident.

1.16 Tests and Research

There was no test and research conducted at this stage of the investigation. Any test and research will be included in the final report.

1.17 Organizational and Management Information

Aircraft Owner	:	PT. Garuda Indonesia
Aircraft Operator	:	PT. Garuda Indonesia
Address	:	Jl. Kebon Sirih No. 44
		Jakarta 10110 Indonesia
AOC Number	:	AOC 121/001

1.17.1 Basic Operation Manual (BOM)

The Basic Operation Manual (BOM) on Chapter 4.1- 4.1.1 describes the General Cockpit Procedure and on 01 Crew Resource Management stated that:

Pilots occupying First Officer position is responsible of informing Captain immediately and at anytime should he believe the aircraft is being handled improperly or placed in jeopardy. When the situation becomes critical and Captain did not response appropriately the First Officer shall take over control. To intervene under such critical situation can be very difficult for junior pilot crew members, particularly if they are still in their new-hire, probation period unless they use a proper strategy at proper progression level.

When the Captain decides to take over the Co-pilot on control by saying "My control" he is normally acknowledged by everyone. Unfortunately the situation is reversed when the co-Pilot has to take over control from a conscious but dysfunctional Captain.

To enable subordinate flight crewmembers to intervene effectively, a structured intervention models using a precise language shall be used to successfully cope with the extremely rare but potentially lethal performance break down of the Captain.

The following are the recommended procedural steps and progressions of inquires which considered being effective to be used by all subordinates;

- *Step 1. Probing for better understanding;*
  Ie. Statement
  "Captain, I need to understand why we are flying like this"
- *Step 2. Alerting Captain of the anomalies;*
  Ie. Statement
  "Captain, It appears to me that we are on a course that is drastically reducing our safety margins and is contrary to both your briefing and to company's SOP
- *Step 3. Challenging suitability of present strategy;*
  I.e. statement;
  "Captain, you are placing the passengers and aircraft in irreversible and immediate danger. You must immediately choose a course of action that will reduce our unacceptability high risk levels."
- *Step 4. Emergency warning of critical and immediate dangers.*
  I.e. statement;
  "Captain, if you don't immediately increase our safety margins, it is my duty and responsibility to immediately take over control of the airplane

These four steps define ordered progressions of inquiries designed to reduce risks at each level of the intervention sequence.

The "P.A.C.E." skills will enable subordinate flight crew members to effectively intervene when a Captain is not performing up to reasonable performance standards.

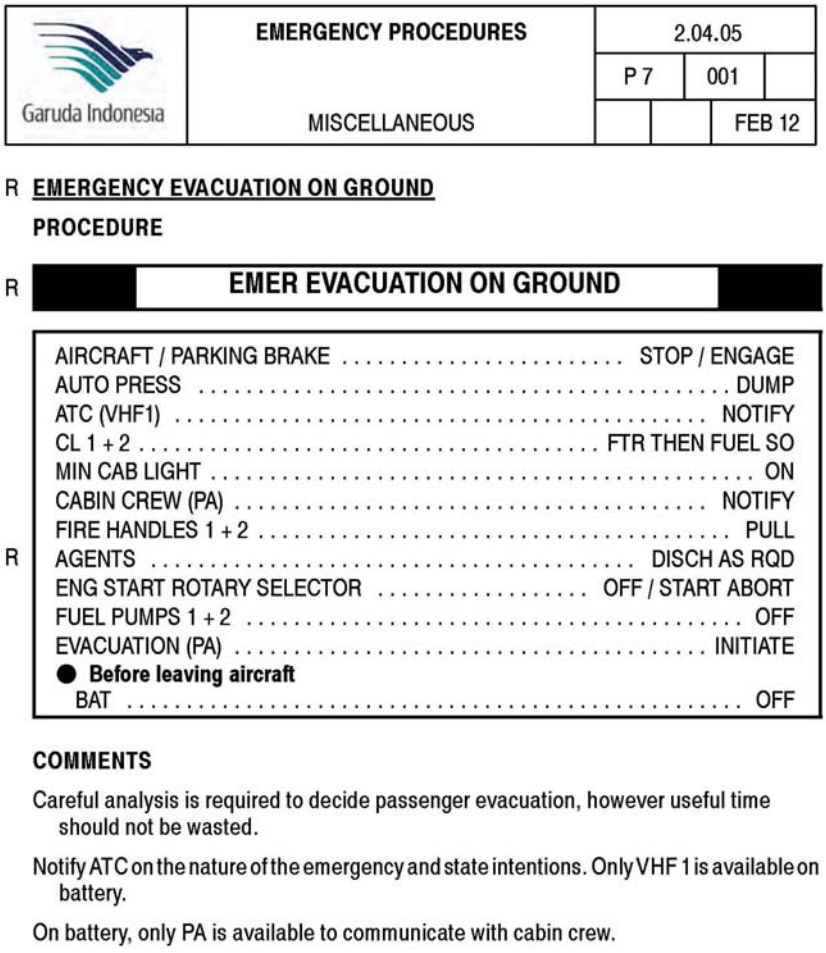
The "P.A.C.E." inquiry procedural steps will ensure that intervention by Co-Pilots will always increase themargins of safety.

The "P.A.C.E." progression tools are carefully designed to never make a bad situation worse.

When unsafe situation suddenly appear in a critical situation where the safety limit will be breached (i.e.Unstabilized approach below 500 ft), the most effective intervention is by directly using the higheststep.

1.17.2 Flight Crew Operation Manual (FCOM)

The Flight Crew Operation Manual on Chapter 2.04.05 describes the Emergency On Ground Procedure.



Garuda Indonesia	EMERGENCY PROCEDURES	2.04.05		
		P 7	001	
	MISCELLANEOUS			FEB 12

R **EMERGENCY EVACUATION ON GROUND**

PROCEDURE

R **EMER EVACUATION ON GROUND**

AIRCRAFT / PARKING BRAKE	STOP / ENGAGE
AUTO PRESS	DUMP
ATC (VHF1)	NOTIFY
CL 1 + 2	FTR THEN FUEL SO
MIN CAB LIGHT	ON
CABIN CREW (PA)	NOTIFY
FIRE HANDLES 1 + 2	PULL
R AGENTS	DISCH AS RQD
ENG START ROTARY SELECTOR	OFF / START ABORT
FUEL PUMPS 1 + 2	OFF
EVACUATION (PA)	INITIATE
● **Before leaving aircraft**	
BAT	OFF

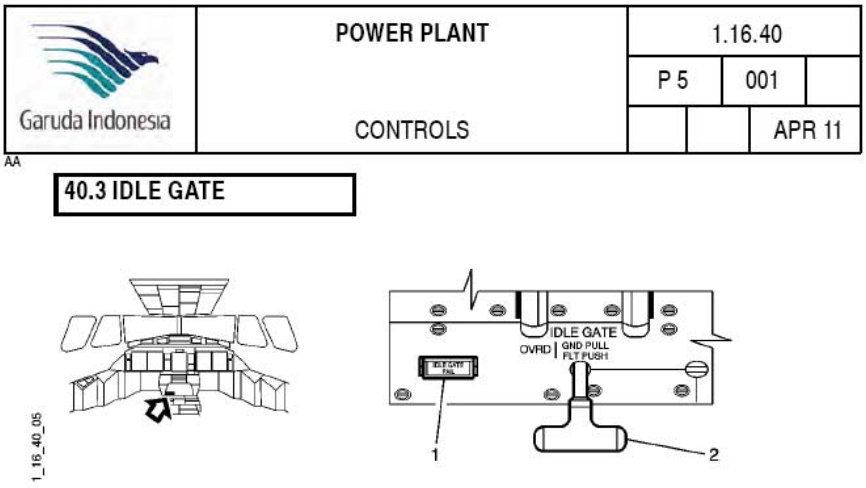
COMMENTS

Careful analysis is required to decide passenger evacuation, however useful time should not be wasted.

Notify ATC on the nature of the emergency and state intentions. Only VHF 1 is available on battery.

On battery, only PA is available to communicate with cabin crew.

The Flight Crew Operation Manual on Chapter 1.16.40 describes the power plant control subject idle gate.



At take off, as soon as both landing gear absorbers are released, a gate prevents PL angle reduction below FI.
At landing, as soon as one landing gear absorber is compressed, this gate is automatically retracted and the PL may travel down to GI and reverse (below GI).

(1) IDLE GATE FAIL light
Illuminates amber and the FWS is activated when the gate does not engage automatically in flight or does not retract automatically at landing.

(2) IDLE GATE lever
Enables manual override in case of failure of the automatic logic.
In flight : push
On graound : pull. An amber band appears.

1.18 Additional Information

1.18.1 ICAO Annex 14

ICAO Annex 14 edition 3rd 1999: Aerodrome Standards - Aerodrome design and Operation

CHAPTER 1. GENERAL

1.1 Definitions

When the following terms are used in this Standard they have the followingmeanings:
Runway strip. A defined area including the runway and stopway, if provided, intended:
a) to reduce the risk of damage to aircraft running off a runway; and
b) to protect aircraft flying over it during take-off or landing operations.

Strength of runway strips

3.3.16 That portion of a strip of an instrument runway within a distance of at least:-75 m where the code number is 3 or 4; from the centre line of the runway and its extended

centre line shall be so prepared or constructed as to minimize hazards arising from differences in load bearing capacity to eroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

*Note.**C** Guidance on preparation of runway strips is given in the ICAO Aerodrome Design Manual, Part 1.*

Chapter 3 Physical Characteristics

3.2 Runway shoulders

General

Note.— Guidance on characteristics and treatment ofrunway shoulders is given in Attachment A, Section 8, and inthe Aerodrome Design Manual, Part 1.

Width of runway shoulders

3.2.3 Recommendation.— The runway shoulders shouldextend symmetrically on each side of the runway so that theoverall width of the runway and its shoulders is not less than 75 m where the code letter is F.

Strength of runway shoulders

3.2.5 Recommendation.— A runway shoulder should beprepared or constructed so as to be capable, in the event of anaeroplane running off the runway, of supporting the aeroplanewithout inducing structural damage to the aeroplane and ofsupporting ground vehicles which may operate on theshoulder.

Note.— Guidance on strength of runway shoulders is givenin the Aerodrome Design Manual, Part 1.

Width of runway strips

3.3.3 A strip including a precision approach runway shall,wherever practicable, extend laterally to a distance of at least:

— 150 m where the code number is 3 or 4; and

— 75 m where the code number is 1 or 2;

on each side of the centre line of the runway and its extendedcentre line throughout the length of the strip.

3.3.4 Recommendation.— A strip including a nonprecision Approach runway should extend laterally to a distance of at least:

— 150 m where the code number is 3 or 4; and

— 75 m where the code number is 1 or 2;

on each side of the centre line of the runway and its extendedcentre line throughout the length of the strip.

Strength of runway strips

3.3.16 Recommendation.— That portion of a strip of aninstrument runway within a distance of at least:

— 75 m where the code number is 3 or 4; and

— 40 m where the code number is 1 or 2;

from the centre line of the runway and its extended centre lineshould be so prepared or constructed as to minimize hazardsarising from differences in load bearing capacity to aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

Note.— Guidance on preparation of runway strips is givenin the Aerodrome Design Manual, Part 1.

3.3.17 Recommendation.— That portion of a stripcontaining a non-instrument runway within a distance of at least:

— 75 m where the code number is 3 or 4;

— 40 m where the code number is 2; and

— 30 m where the code number is 1;

from the centre line of the runway and its extended centre line should be so prepared or constructed as to minimize hazards arising from differences in load bearing capacity to aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

ICAO Annex 14 standards for maintaining the runway strip

Annex 14, 3.4.8 Recommendation.—That portion of a strip of an instrument runway within a distance of at least: — 75 m where the code number is 3 or 4; from the centre line of the runway and its extended centre line should provide a graded area for aeroplanes which the runway is intended to serve in the event of an aeroplane running off the runway.

ICAO Annex 14 recommends that runway strips be graded to minimize hazards to aeroplanes that run off the runway.

1.18.2 Manual of Standard (MOS) CASR 139

Refer to PERATURAN DIREKTUR JENDERAL PERHUBUNGAN UDARA NOMOR: KP 29 TAHUN 2014(Director General of Civil Aviation Decree number KP 29 of 2014) Manual of Standard CASR 139.

Definisi: Runway strip

Suatu daerah tertentu termasuk landas pacu (runway), dan stopway jika tersedia, yang ditujukan untuk:

a) Mengurangi risiko kerusakan pada pesawat udara yang melaju keluar landas pacu; dan

b) Melindungi pesawat udara yang terbang diatasnya pada saat melakukan lepas landas atau pendaratan.

6.3. Runway strip

Runway dan *stopways* yang berhubungan dengan *runwaystrip* harus terletak di tengah di dalam *runwaystrip*.

6.3.1. Komposisi r*unway strip*

Runway strip, sebagai tambahan *runway* dan *stopway*, harus terdiri dari:

6.3.1.1. Area di sekitar *runway* atau *stopway* – jika runway adalah runway non-instrumen; atau

6.3.1.2. *Graded area* di sekitar *runway* dan *stopway* dan sebuah daerah, yang dikenal dengan "daerah fly-over", di sisi luar daerah graded area – jika *runway* adalah runway instrumen. Secara teknis, 'daerah fly-over' adalah komponen dari keseluruhan lebar *runway strip* yang merupakan daerah *ungraded*.

6.3. Runway Strips

Runway and any associated stopways are to be centrally located within a runway strip.

6.3.1 Composition of Runway Strip

Runway Strip is an additional strip of runway and stopway that should consist of :

6.3.1.1. Area surounding the runway or stopway – if the runway is a non–instrument; or

6.3.1.2. The graded area of the runway strip is widened by the addition of obstacle free area so neither idistermed fly-over area in the case of instrument runways. Technically the fly-over area are the width of the un-graded runway strip.

6.3.2. Panjang Runway Strip

Graded area dari sebuah *runway strip* harus diperpanjang sampai jauh keluar ujung *runway*, atau *stopway* lain yang berkaitan, paling sedikit:

a. 30 m-jika *Code Number runway* adalah 1 dan merupakan runway non instrumen; atau

b. 60 m – dalam kasus lain.

6.3.2. Runwaystrip length

Graded area of a runway strip shall extended beyond the end of the runway or stopway with the minimum of:

a. for a distance of 30 m for code 1 runways; or

b. and 60m for code 2, 3 and 4 runways.

6.3.3. Lebar Runway strip

6.3.3.1. *Graded area* dari sebuah *runway* tidak boleh kurang dari nilai yang tercantum dalam Tabel 6.3-1 di bawah ini:

6.3.3. Runway strip width

6.3.3.1 Graded area of the runway should not less than the width of which is shown in table 6.3.1 below:

Table 6.3.1

Kode Referensi Aerodrome *Aerodrome reference code*	Lebar runway strip *Width of runway strips*
1 a b	60 m
2 c	80 m
3 (jika lebar runway 30 m)	90 m
3,4 (jika lebar runway 45 m atau lebih)	150 m

[a] *Runwaystrip might be reduced to 30m depending on the small aircraft operation limitation. See chapter 13 of the MOS 139*

[b] *Runways used for night operation required runway strip width minimum of 80m.*

[c] *Runways used for day light operation by aircraft with maximum take-off weight not exceeding 5,700 kg, should have runway strip with minimum 60m width.*

6.3.3.2. Dalam kasus runway non-presisi (non-precision approach runway), lebar dari runway strip, termasuk daerah fly-over, tidak boleh kurang dari nilai yang tercantum pada Tabel 6.3-2:

6.3.3.2. The wide of runway strip for Non-Precision Approach runways included the fly – over area, it should not less than listed in the table 6.3-2:

Table 6.3.2

Kode Referensi Aerodrome *Aerodrome reference code*	Lebar runway strip *Width of runway strips*
1 atau 2	90 m
3 (jika lebar runway 30 m)	150 m [a]
3,4 (jika lebar runway 45 m atau lebih)	300 m [b]

[a] *Where it is not practicable to provide the full 150 m width of runway strip, a minimum of 90 m wide graded only strip may be provided where the runway is used by up to and including code 3C aircraft, subject to landing minima adjustments.*

[b] *Where it is not practicable to provide the full runwaystrip width, a minimum 150m wide graded only strip may be provided, subject to landing minima adjustments.*

6.3.3.3. Dalam kasus *runway* presisi (*precision approach runway)*, lebar dari runway strip, termasuk daerah fly- over, tidak boleh kurang dari nilai yang tercantum pada Tabel 6.3-3.

6.3.3.3. Runway strip width for precision approach runways, the width of the runway strip, including fly-over area, shall not be less than listed on the table 6.3.3.

Table 6.3.3

Kode Referensi Aerodrome *Aerodrome Refference Code*	Lebar keseluruhan runway *Runway strip wide*
1 atau *(or)* 2	150 m
3 atau *(or)* 4	300 m

Note :

For precision approach runways code 3 and 4, it is recommended that an additional width of graded runwaystrip be provided. In this case, the graded width extends to a distance of 150 m from the runway centreline, except that the width is gradually reduced (over a distance of 150m) to 75 m from the runway centre line at both ends of the strip, for a length of 150m from the runway ends, as shown in the Figure 6.3-2 below:

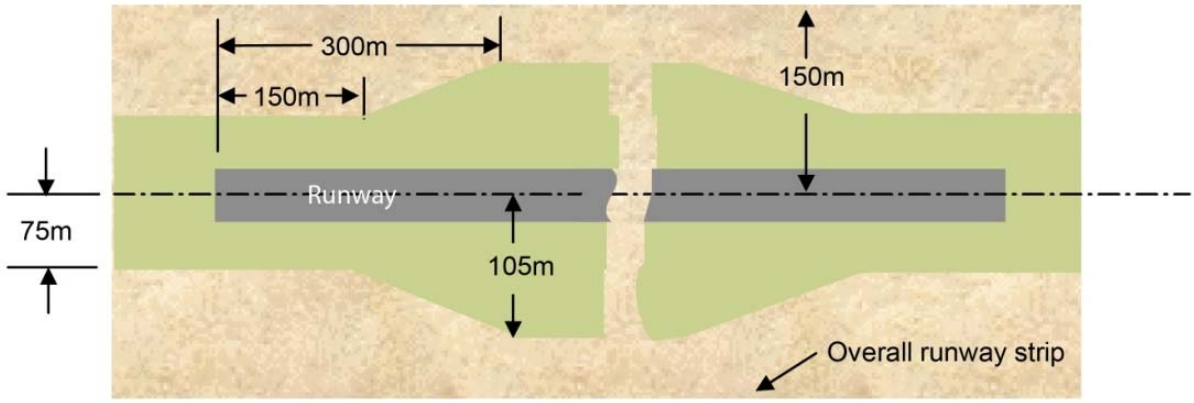


Figure 6.3.2: Runway strip Precision approach runway

6.3.4. Kekuatan dan Grading runway strip

6.3.4.1. Bagian dari *graded area* disediakan untuk mengurangi *hazard* pada pesawat udara yang bergerak di *runway*, maka bagian itu harus diberi perlakuan sedemikian rupa agar mampu untuk mencegah rusaknya *nose landing gear* pesawat udara. Permukaan itu juga harus dipersiapkansedemikian rupa agar mampu menyediakan daya pengereman bagi sebuah pesawat udara dan di bawah permukaan mampu memiliki daya dukung yang cukup untuk menghindari kerusakan terjadi pada pesawat udara.Untuk memenuhi kebutuhan yang beragam, pedoman berikut ini diperuntukan guna mempersiapkan *runway strip*. Produsen pesawat udara mempertimbangkan kedalamanan maksimum sebesar 15 cm ketika *nose landing gear* terperosok tanpa harus rusak.

6.3.4. Strength and Grading of runway strips

6.3.4.1.Part of graded area is provided to reduce hazard to an aircraft movement on the runway, therefore this part shall be treated as to capable to prevent damage to the nose landing gear of an aircraft. The surface shall also be prepared to provide deceleration force to an aircraft and under the surface shall have adequate strength to prevent damage to an aircraft. To accomodate various conditions, the following guidance is provided in preparing runway strip. Aircraft manufacturer considers the maximum of 15 cm for a nose landing gear sink without damage.

1.19 Useful or Effective Investigation Techniques

The investigation wasconducted in accordance with the KNKT approved policies and procedures, and in accordance with the standards and recommended practices of Annex 13 to the Chicago Convention.

2 ANALISYS

The analysis of this draft report will discuss the relevant issues contibuted to the occurrence and issue associated with runway strip surface condition which contributed to the damage to the aircraft. The topics discuss on the analysis are as follows :

1. Crew coordination
2. Flight technique
3. Runway strip condition

2.1 Crew Coordination

The Basic Operation Manual (BOM) Chapter 4.1 - 4.1.1 describes the General Cockpit Procedure and specifically on Crew Resource Management stated that the Captain (PIC) may decides to take over the Co-pilot on control by saying “My control”. The BOM also added that for condition where co-pilot wants to take control from the PICcan be very difficult for junior pilot crew members, particularly if they are still in their new-hire.

During the final approach, the PIC assisted the control to correct the flight track to align with the runway course for two times and when below 500 ft the PIC took over the control. After the correct flight path has been achieved, the PIC questioning the SIC handling of keeping the high descend rate when the aircraft was below the correct glide path. At this time it indicated that the SIC was controlling the aircraft, however, the CVR did not record communication between the pilot related to transfer of control form the PIC to the SIC.

The transfer of control without clear statement might have made that the SIC not aware that he has the full control of the flight. This condition might have made no one was fully responsible to control the flight. Also, as pilot under training might be very difficult to verify to the PIC.

The change over control from the SIC to the PIC occurred at below 500 feet, thereafter the CVR recorded conversation that SIC had the control of the aircraft. It can be concluded that transfer of control occurred two times on short final which was critical phase of a fligt. Transfer of control at critical phase might jeopardize a flight, especially when the pilot received the control is not fully aware to the flight condition.

2.2 Flight technique

The aircraft touched down and bounced two times and the firsttouchdown was at approximate 700 m from the beginning runway 13 with left wing up and rolled to the left about 2°.

The pilot stated that the throttles were difficult to be selected to the ground idle, but later on the throttles successfully selected to ground idle after the aircraft veered to the right of the runway. The aircraft travelled out of the runway for about 180 meters and stopped at approximate 33 meters on the right side of the runway 13.

Refers to Flight Crew Operation Manual (FCOM) on Chapter 1.16.40 the aircraft was equipped with idle gate which prevent the power lever movement to Ground Idle in flight. The idle gate will allow the Power Lever move beyond Ground Idle (GI) after the aircraft landed.

The FDR data revealed that from the first touch down until the third touchdown when the aircraft firmly on the ground showed that the aircraft floated for 13 seconds. At these phase there was no comperessiontothe landing gear absorbers, as consequences the gate would detect as the aircraft in flight and prevented the Power Lever movement to Ground Idle and reverse (below GI).

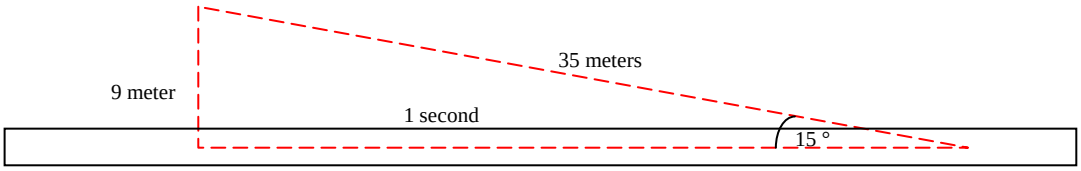
The CVR recorded that the PM informed the wind condition displayed on the Navigation Display was 267° at 6 knots, which means slightly tail wind and cross wind from the right of the aircraft. The PIC also stressed the cross wind condition during approach.

The FDR recorded that after bounce, the aircraft rolled to the left at approximately 2°, right rudder applied and left aileron up. The aircraft heading changed to the right from 130°. After the second bounce, the aircraft has firmed on the ground, the aircraft heading was 145°.

The handling of the aircraft after bounce was contrary to the wind condition, which it should be left rudder applied and right aileron up. The application of the right rudder and right cross wind condition might have made the aircraft turned to the right.

The FDR recorded at 3 seconds after reached heading 145°, the peak of the lateral acceleration, which indicate aircraft initially left the runway pavement.The calculation on the heading changed for 15°, can be as follows:

- The ground speed recorded was about 80 knots or 35 m/s.
- With the 15° angle deviation the aircraft would have deviated from the center line of the runway with rate of 9 m/s.



At the ground speed about 80 knots (35 m/s), the 15° angle deviationfor 3 seconds would havemade the aircraft devaiated from the centerline of the runway for 27 meters. On runway with 60 meters wide, the distance from the centerline to the runway edge pavement approximately 30 meters and the deviation would have made the aircraft run off the runway pavement.

2.3 Runway Strips

The Manual of Standard (MOS) CASR 139 on requires the runway strip shall be so prepared or constructed as to prevent the damage of the aircraft nose landing gear. According to this MOS, the aircraft was stopped on runway strip.

In this occurrence the main and nose landing gear traped on the runway strip and the nose landing gear collapsed rearward and damaging the front lower fuselage. This indicated that the strength of the runway strip did not meet the requirement as stated in the MOS 139.

3 CONCLUSION

3.1 Findings

The Komite Nasional Keselamatan Transportasi findings on the accident flight are as follows:

1. All crew have valid licenses with current type rating and valid medical certificates.
2. The aircraft was airworthy prior to the occurrence.
3. The Second in Command (SIC) was a pilot under line training, acted as pilot flying (PF) while the Pilot in Command (PIC) acted as Pilot Monitoring. The third pilot was another pilot under training occupied cockpit observer seat.
4. The flight approach and landed runway 13 and the wind reported 210/12 knots and the wind condition displayed on the Navigation Displayed during approach was 267/6 knots.
5. At below 500 ft the PIC took over the control while giving several instructions to the SIC to follow on the controlling and landing the aircraft.
6. After correcting the flight path, the CVR indicated that the SIC was controlling the aircraft, however, the CVR did not record communication between the pilot related to transfer of control form the PIC to the SIC.
7. The aircraft bounced on the first touchdown. After bounce, aircraft rolled to the left at approximately 2°, right rudder applied and left aileron up. The aircraft heading changed to the right from 130°. After the second bounce, the aircraft has firmed on the ground, the aircraft heading was 140° and continued to 145°.
8. The pilot stated that the throttles were difficult to be selected to the ground idle, but later on the throttles successfully selected to ground idle after the aircraft veered to the right of the runway.
9. The aircraft travelled on the shoulder for about 180 meters and stopped at approximate 33 meters from the pavement on the right side of the runway 13.
10. The main nose landing gear traped on the runway strip and the nose landing gear collapsed rearward, damaging the front lower fuselage, and the nose landing gear side stay broken.
11. After the aircraft stop, the pilot called several “mayday” to the Lombok Tower controller and requested for assistance.
12. The flight attendant contacted the pilot and asked for passenger evacuation, the PIC instructed to evacuate the passenger via left door. The Flight Crew Operation Manual (FCOM) Chapter 2.04.05 describes the standard On Ground Procedure, it stated that the evacuation initiated by the pilots.
13. The pilot shut off the engines by activation the engine fire handle.
14. This indicated that the strength of the runway strip did not meet the requirement as stated in the MOS 139.

3.2 Contributing Factors[3]

1. Two transfer of control at critical altitude without clear statement might have made that pilots not aware who has the full control of the flight and jeopardize the flight when the pilot receive the control not fully aware to the condition of the flight.
2. The handling of the aircraft after bounce was contrary to the wind condition, and the application of the right rudder and cross wind condition might have made the aircraft turned to the right.

3 Contributing Factors is defined as events that might cause the occurrence. In the case that the event did not occur then the accident might not happen or result in a less severe occurrence.

4 SAFETY ACTION

At the time of issuing this preliminary report, the Komite Nasional Keselamatan Transportasi (KNKT) has received a Notice to Flight Crew regarding to safety actions taken by PT. Garuda Indonesia following this serious incident.

The Notice to Flight Crew Number 004/15 Subject: Safety Alertness Regarding Critical Phase of flight. Issued on 09 February 2015 by VP Operation.

The detail of the operation safety action was on the appendices of this report.

5 SAFETY RECOMMENDATIONS

As a result of this investigation, the *Komite Nasional Keselamatan Transportasi* (KNKT) issued safety recommendations to address safety issues identified in this report.

This safety recommendations addressed to;

5.1 PT Garuda Indonesia

a) The handling of the aircraft was contrary to the wind condition. The KNKT recommends that the operator shall emphasized the crosswind handling.

b) In the preliminary report of this investigation, KNKT issued recommendation related to standard call out on final. In addition, investigation identified two change over control of the flight at critical phase of flight without clear statements.This condition may also extend to the other instructors within the company. Therefore, KNKT recommends to review the policy of change over control at critical altitude.

5.2 Lombok International Airport, PT. AngkasaPura 1.

Refer to analysis chapter 2.3 of this report, the KNKT recommends that the airport operator should improve the surfaces runway strip conditionto comply with existing regulation.

5.3 Directorate General Civil Aviation (DGCA)

Refer to analysis chapter 2.1, 2.2 and 2.3 of this report, the KNKT recommends that DGCA should oversight the implementation of recommendation addressed to the air operator, to ensure the effectiveness ofthe operators safety improvement and to facilitate the recommendation addressed to airport operator.

6 APPENDICES

Garuda Indonesia

FLIGHT OPERATION

Notice To : **Flight Crew**
Nr : **004/15**
Subject : **Safety Alertness Regarding Critical Phase of Flight**

Date : 09 February 2015

Dear Pilots,

Related to our ATR 72-600 serious incident at Lombok Praya International Airport recently, we instruct to all flight crews to follow the SOP consistently on all of phase of flight to prevent incident, serious incident and/ or accident.

There for to anticipate unstabilized approach which is lead to unsafe landing or violate landing criteria, we urge to all flight crews to :

1. Strictly to follow Stabilized Approach criteria as stated on BOM 4.4.4-07 and as stated on FCOM/AOM related on type of aircraft . If Stabilized Approach Criteria does not meet (1000ft AFE for IMC and 500 ft AFE for VMC), make GO AROUND.The landing with unstabilized approach is prohibited.
2. Keep and maintain Situational Awareness in all phase of flight, especially on Critical Phase of Flight (Take Off, Approach and Landing).
3. The PiC shall responsible for the manipulation of the flight control on the right moment in all phase of flight **especially during critical phase** to prevent the incident, serious incident and/ or accident as state on BOM 1.1.4.13(b). The How To manipulate flight control is depend on the flight technique of each type aircraft.
4. Use the optimum recomended procedural steps and progressions of inquiries :
   - **P**robing
   - **A**lerting
   - **C**hallenging
   - **E**mergency Warning

   (As state on BOM 4.1.1.01 Crew Resource Management)

   When unsafe situatuion suddenly appear in critical situation where the safety limit will be reached, the most effective intervention is by directly using the highest step.
5. The PiC, in an in-flight emergency requiring immediate action, may deviate from any rule to the extent reqiured to meet that emergency for the safety of the flight (BOM 2.1.2.03).
6. The PiC is responsible for the operation, safety and security of the aircraft (BOM 1.1.4.13)

Thank you for your attention and cooperation. Have a Safe Flight.

PT GARUDA INDONESIA (PERSERO) Tbk.
VP FLIGHT OPERATION

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