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KOMITE NASIONAL KESELAMATAN TRANSPORTASI

Runway Excursion Investigation Report

PT. Garuda Indonesia
Airbus A330-200; PK-GPN
Soekarno-Hatta International Airport, Tangerang
Republic of Indonesia
13 December 2013

NATIONAL TRANSPORTATION SAFETY COMMITTEE
REPUBLIC OF INDONESIA
2014

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

The report is based upon the investigation carried out by the NTSC 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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ABBREVIATIONS AND DEFINITIONS

AGL	Above Ground Level
AOC	Air Operator Certificate
ATC	Air Traffic Control
ATIS	Aerodrome Terminal Information Services
ATPL	Air Transport Pilot License
ATS	Air Traffic Service
BMKG	*Badan Meterologi Klimatologi dan Geofisika* (Metrological Climatology and Geophysical Agency)
BOM	Basic Operation Manual
°C	Degrees Celsius
CAM	Cockpit Area Microphone
CASR	Civil Aviation Safety Regulation
CB	Cumulonimbus
CPL	Commercial Pilot License
CRM	Crew Resources Management
CSN	Cycles Since New
CVR	Cockpit Voice Recorder
DA	Decision Altitude
DGCA	Directorate General of Civil Aviation
DH	Decision Height
DME	Distance Measuring Equipment
EGPWS	Enhance Ground Proximity Warning System
FAC	Flight Attendant Certificate
FCTM	Flight Crew Training Manual
FCOM	Flight Crew Operation Manual
FDR	Flight Data Recorder
FL	Flight Level
FMGES	Flight Management Guidance and Envelope System
FOQA	Flight Operation Quality Assurance
ft	Feet
FWC	Flight Warning Computer
Hrs	Hours
ICAO	International Civil Aviation Organizationn

IFR	Instrument Flight Rules
IIC	Investigator in Charge
ILS	Instrument Landing System
IMC	Instrument Meteorological Condition
In Hg	Inch Hydrargyrum
Kg	Kilogram(s)
Km	Kilometer(s)
kts	Knots (nm/hours)
mbs	Millibars
MDA	Minimum Descend Altitude
mHz	Mega Hertz
Mm	Millimeter(s)
MTOW	Maximum Take-off Weight
NDB	Non Directional Beacon
Nm	Nautical mile(s)
NOTAM	Notice to Airman
KNKT	Komite Nasional Keselamatan Transportasi
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
PNF	Pilot Non Flying
QFE	Height above airport elevation (or runway threshold elevation) based on local station pressure
QNH	Height above mean sea level based on local station pressure
S/N	Serial Number
TCAS	Traffic Collision Avoidance System
TSN	Time since New
TT/TD	Ambient Temperature/Dew Point
UTC	Universal Time Coordinate
VMC	Visual Meteorological Condition
VOR	Very High Frequency Omnidirectional Range

INTRODUCTION

SYNOPSIS

On 13 December 2013 an Airbus A330, registration PK-GPN operated by PT. Garuda Indonesia was on scheduled passenger flight from Ngurah Rai International Airport (WADD), Bali, to Soekarno-Hatta International Airport (WIII), Tangerang, Indonesia. On board in this flight were two pilots, 11 flight attendants, 185 passengers.

There was no reported or recorded that the aircraft had system abnormality during the flight from take-off until the time of the occurrence.

The weather report for Soekarno-Hatta International Airport was broadcasted at 08.00 UTC and 08.45 UTC was moderate rain, thunder storm, wind direction was north-westerly and no significant weather were reported.

At 124 ft, the autopilot was disengaged and the pilot resumed hand flying. Prior to touchdown after Flight Warning Computer (FWC) callout "*TWENTY*", the SIC called "*fly left*" for two times, and followed by the FWC callout "*RETARD*" for tree times within three seconds.

During the interview, the pilots explained that at about flare out altitude the aircraft entered a heavy rain impacted the left windshield and the PF loss of visual reference. The PF also felt that the aircraft floating. The PNF explained that he was able to see the runway all the time and observed that the aircraft was slightly on the right of the runway and advised the PF to fly left two times.

At 08.00 UTC the aircraft touched down with the right main landing gear were on the right shoulder and travelled for 500 meters and returned to the runway then proceeded to taxiway S5.

The investigation determined that there were no issues with the aircraft system, therefore the analysis part of this final report focused on four safety issues, such as: course deviation prior to touchdown, approach and landing techniques, decision to land and meteorological concerning to the observing and reporting of visibility.

The investigation concluded that the contributing factors to this serious incident were as the following factors:

During the hand flying at approximately 90 feet AGL the aircraft started rolled in average of 2° to the right for approximately 12 seconds resulted to aircraft deviation to the right, whilst the PF loss the visual reference and prolong flare prior to touch down.

- The above condition was an indication for go around which was not executed, this might cause by insufficient pilot intuitive decision to cope such condition.
- The absence of no significant weather report might influence the pilot judgment and expectation of any weather change which may requires pilot decisions especially when occurs at low altitude.

Following this serious incident, the VP Flight Operation of PT. Garuda Indonesia issued safety actions as shown in the appendix 6 of this final report.

As result from the investigation Komite Nasional Keselamatan Transportasi issued several safety recommendations addressed to PT. Garuda Indonesia, Badan Meteorologi Klimatologi dan Geofisika (BMKG), AirNav Indonesia and Directorate General of Civil Aviation.

1 FACTUAL INFORMATION

1.1 History of the Flight

On 13 December 2013 an Airbus 330-200, registration PK-GPN operated by PT. Garuda Indonesia was on scheduled passenger flight. At 06.20 UTC[1] the aircraft departed from Ngurah Rai International Airport (WADD), Bali, to Soekarno-Hatta International Airport (WIII), Tangerang, Indonesia. On board in this flight were two pilots, 11 flight attendants, 185 passengers.

The Pilot in Command (PIC) acted as Pilot Flying (PF) while the Second in Command (SIC) acted as Pilot Non Flying (PNF).

There was no report or record that the aircraft had system abnormality during the flight from take-off until the time of the occurrence.

All equipment, facilities, such as, navigation aids, communication and supporting operational facilities in Soekarno-Hatta Airport operated normally.

The Weather report for Soekarno-Hatta International Airport broadcasted from the Aerodrome Terminal Information Services (ATIS), issued, at 08.00 UTC and 08.45 UTC was moderate rain and thunder storm with the wind direction was north-westerly.

During conducted the ILS approach at 3,000 ft the pilot requested to fly right to avoid the Cumulonimbus (CB) cloud and continued descend then maintain altitude at 2,000 ft and realigned to the ILS runway 25L.

At altitude 184 ft, the wind direction changed from westerly to southerly followed by the increasing of the wind speed from 4 kts to 24 kts when the aircraft touched down.

At 124 ft the autopilot was disengaged and the pilot resumed hand flying.

Prior to touchdown, after the Flight Warning Computer (FWC) callout "*TWENTY*", the SIC called "*fly left*" for two times, and followed by the FWC callout "*RETARD*" for three times, within three seconds.

During the interview, the pilots explained that at about flare out altitude, the aircraft entered a heavy rain an impacted more on the left windshield and made the PF loss of visual reference. The PF also felt that the aircraft floated. The PNF explained that he was able to see the runway all the time and observed that the aircraft was slightly on the right of the runway and advised the PF to fly left two times.

At 08.00 UTC the aircraft touched down with the right main landing gear were on the right runway shoulder, travelled for 500 meters, returned to the runway then proceeded to taxiway S5.

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1 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 Bali is Waktu Indonesia Tengah (WITA) is UTC + 8 hours.

Figure 1: The flight trajectory and touchdown point revealed from the FDR and superimposed to Google Earth.

The pilot stopped the aircraft on taxiway S5 due to a hydraulic problem and unable to taxi. The aircraft towed to parking bay E21.

No one was injured and the passengers disembarked in a normal procedure.

Figure 2: The right main wheel mark on runway shoulder

1.2 Injuries to Persons

Injuries	Flight crew	Passengers	Total in Aircraft	Others
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/None	13	185	198	-
TOTAL	13	185	198	-

1.3 Damage to Aircraft

Observation of the aircraft after the serious incident at the Garuda Maintenance Facility AeroAsia (GMF-AeroAsia) found the hydraulic leak on the right landing gear actuator and one of the tires torn and cut.

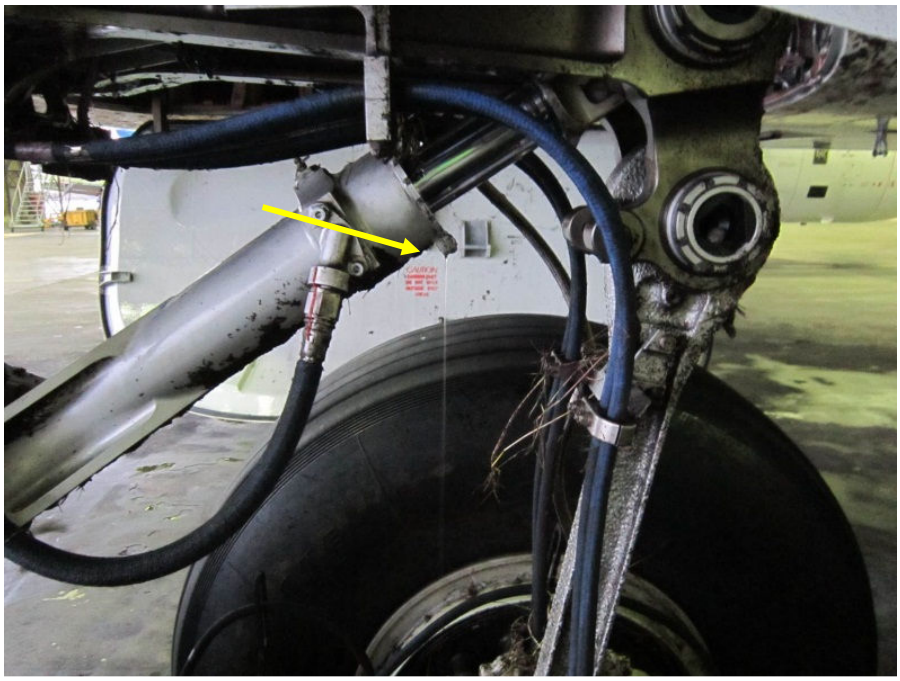

Figure 3: Leak on the right main landing gear actuator (yellow arrow).

Figure 4: One of the tires torn and cut

1.4 Other Damage

There was no other damage to property and/or the environment.

1.5 Personnel Information

1.5.1 Pilot in Command

Gender	:	Male
Age	:	63 years
Nationality	:	Indonesia
Marital status	:	Married
Date of joining company	:	6 February 1975
License	:	ATPL
Date of issue	:	08 June 1978
Aircraft type rating	:	A330
Instrument rating	:	31 October 2014
Medical certificate	:	First Class
Last of medical	:	3 September 2013
Validity	:	3 March 2014

Medical limitation	:	The holder shall wear lenses that correct for distant vision and possess glasses that correct for near vision.
Last line check	:	12 May 2013
Last proficiency check	:	25 October 2013
Flying experience		
Total hours	:	25,594 hours 09 minutes (until November 2013)
Total on type	:	8,596 hours 06 minutes
Last 90 days	:	185 hours 15 minutes
Last 60 days	:	138 hours 01 minutes
Last 24 hours	:	10 hours
This flight	:	1 hours 35 minutes

1.5.2 Second in Command

Gender	:	Male
Age	:	24 years
Nationality	:	Indonesia
Marital status	:	Married
Date of joining company	:	1 May 2009
License	:	CPL
Date of issue	:	28 May 2009
Aircraft type rating	:	A330
Instrument rating	:	30 November 2014
Medical certificate	:	First Class
Last of medical	:	9 October 2013
Validity	:	9 April 2014
Medical limitation	:	No Limitation
Last line check	:	24 February 2013
Last proficiency check	:	28 November 2013
Flying experience		
Total hours	:	2,671 hours 45 minutes (until November 2013)

Total on type	:	851 hours 31 minutes
Last 90 days	:	198 hours 30 minutes
Last 60 days	:	156 hours 1 minute
Last 24 hours	:	10 hours
This flight	:	1 hour 35 minutes

1.6 Aircraft Information

1.6.1 General

Registration Mark	:	**PK-GPN**
Manufacturer	:	Airbus
Country of Manufacturer	:	France
Type/ Model	:	A330-200
Serial Number	:	1261
Year of manufacture	:	2011
Certificate of Airworthiness		
Issued	:	13 November 2013
Validity	:	13 November 2014
Category	:	Transport
Limitations	:	None
Certificate of Registration		
Number	:	2984
Issued	:	14 November 2013
Validity	:	13 November 2014
Time Since New	:	10,447 hours
Cycles Since New	:	2019 cycle
Last Major Check	:	None
Last Minor Check	:	“A” Check , 6- 15 November 2013

1.6.2 Engines

Manufacturer	:	Rolls Royce
Type/Model	:	RR Trent 700
Serial Number-1 engine	:	41959
▪ Time Since New	:	10,447 hours

- Cycles Since New : 2019 Cycle

Serial Number-2 engine : 40960

- Time Since New : 10,447 hours
- Cycles Since New : 2019 Cycle

1.6.3 Weight and Balanced

Maximum allowable take-off weight	233,000 kg
Actual take-off weight	157,084 kg
Maximum allowable landing weight	182,000 kg
Actual landing weight	148,906 kg
Fuel at take off	20,490 kg
Flight planned fuel burn	8,178 kg
Fuel at landing	11,800 kg
Flight planned centre of gravity at time of the take-off was	31

The aircraft was operated within the correct weight and balance envelope.

1.7 Meteorological Information

Weather reports of Soekarno-Hatta International Airport were as follows:

Time	:	08.00 UTC	08.45 UTC
Wind	:	270/ 10 Knots	360 / 07 knots
Weather	:	Moderate Rain	Moderate TS with Rain
Visibility	:	4 Km	6 Km
Cloud	:	CB 2000ft, BKN 2100ft	CB 1900ft, SCT 2000ft
Temperature	:	27°C	26°C
Dewpoint	:	25°C	24°C
Pressure	:	1006 hPa	1006 hPa
Weather	:	no significant	no significant

A picture taken 22 minutes after the serious incidents indicated a heavy rain and low clouds on the area of Soekarno-Hatta Airport.

Figure 5: Picture taken at terminal two, 22 minutes after the serious incident

1.7.1 Meteorology Observation Office

The Badan Meteorologi Klimatologi and Geofisika (BMKG – Indonesian Agency for Meteorology, Climatology, and Geophysics) office at Soekarno-Hatta International Airport responsible to serves the weather information.

The weather observed conducts every 30 minutes or if any significant change of weather condition. The weather information broadcasted through ATIS (Aerodrome Terminal Information Service) on a frequency 126.85 mHz.

1.7.2 Weather Observation Requirement

The following paragraphs detail the International Civil Aviation Organization (ICAO) Annex 3 recommended visibility reporting requirements.

Observing and reporting of visibility

4.6.1 Recommendation- the visibility should be measured or observed by reference to objects or light whose distance from the point of observation is known.

4.6.3 Recommendation- when local routine and special reports are used for departing aircraft, the visibility observations for these reports should be representative of the take-off/climb-out area: when local routine and special reports are used for arriving aircraft, the visibility observations for these reports should be representative of the approach/landing area. Visibility observations made for reports in the METAR/SPECI codes forms should be representative of the aerodrome and its immediate vicinity: in such observations special attention should be given to significant directional variations.

1.8 Aids to Navigation

At the time of this serious incident, all the navigation aids at Soekarno-Hatta Airport operated normally.

1.9 Communications

The quality of communication between pilot and controller was good and performed normally as recorded by Air Traffic Controller (ATC) ground base recorder as well as Cockpit Voice Recorder (CVR).

1.10 Aerodrome Information

Airport Name	:	Soekarno-Hatta International Airport, Tangerang
Airport Identification	:	WIII
Elevation	:	34 feet
Airport Operator	:	PT. Angkasa Pura II (Persero)
Airport Category	:	I
Runway Direction	:	07 L/R – 25 L/R (parallel runway)
Runway Length	:	3,600 meters
Runway Width	:	60 meters
Surface	:	Concrete

1.10.1 The AirNav Indonesia

The AirNav Indonesia provides Air Traffic Services (ATS), Aeronautical Telecommunication Services (ATS/COM), Aeronautical Information Services (AIS) and Aeronautical Meteorological Services (MET) in Indonesia.

The meteorology information obtains from the BMKG or any other sources whenever the information from the BMKG is not available.

1.11 Flight Recorders

1.11.1 Cockpit Voice recorder

The aircraft was equipped with Cockpit Voice Recorder (CVR):

Manufacturer : Honeywell

Type/Model : MFR97896

Part Number : 980-6022-001

Serial Number : 04784

The CVR data was downloaded at NTSC facility. The CVR contain 120 minutes of good quality recording.

The significant excerpts of the CVR data were as follows:

TIME (UTC)	DESCRIPTION
07:43:05	The pilot acknowledge the altimeter setting
07:43:25	The pilots commented about weather condition that blocked the flight path.
07:44:07	The pilots received clearance to descent to 3000 feet
07:44:21	The pilots conducted approach checklist
07:51:29	The aircraft reached altitude of 3000 feet
07:55:09	The aircraft was established on localizer 25 left, and was cleared for approach
07:55:53	The aircraft on landing configuration and landing checklist conducted
07:57:31	The pilot received clearance to land with additional information of wind from 250 and 7 knot and rain over the field
07:59:02	The aircraft passed 500 feet
07:59:10	The aircraft passed 400 feet
07:59:13	FWC callout “HUNDRED ABOVE”
07:59:23	FWC callout “MINIMUM”
07:59:37	Trickle Sound of autopilot disengagement
07:59:42	FWC callout “FORTY”
07:59:44	The PNF called “Fly Left”
07:59:44	FWC callout “THIRTY”
07:59:47	FWC callout “TWENTY”
07:59:47	FWC callout “RETARD” three times
07:59:50	FWC callout “TEN”
07:59:50	The PNF called “Fly Left”
07:59:50	The PF acknowledge by replied “Siaaap” .
07:59:52	The aircraft landed

1.11.2 Flight Data Recorder

The aircraft was equipped with Flight Data Recorder (FDR).

Manufacturer: Honeywell

Type/Model : HFRS-D

Part Number : 980-4750-001

Serial Number : FDR-01389

The FDR data was downloaded at NTSC facility. The significant parameters were marked with circles on figure 6.7 and 8.

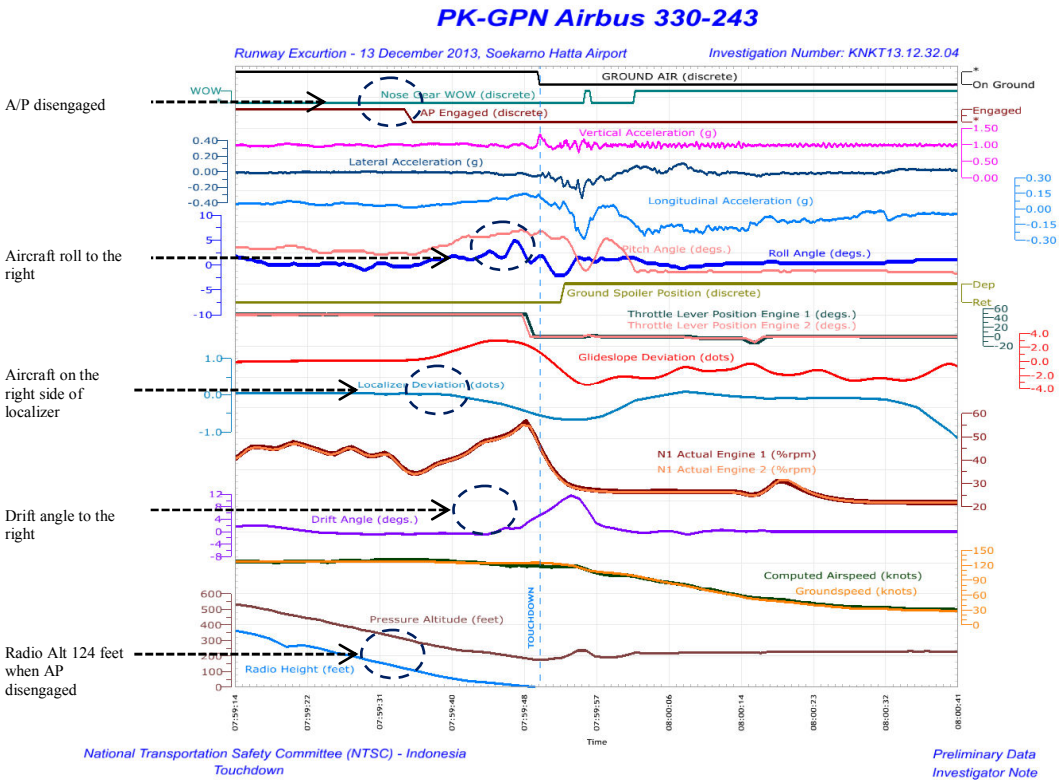

Figure 6: The FDR data on approach from 350 feet of Radio Altimeter

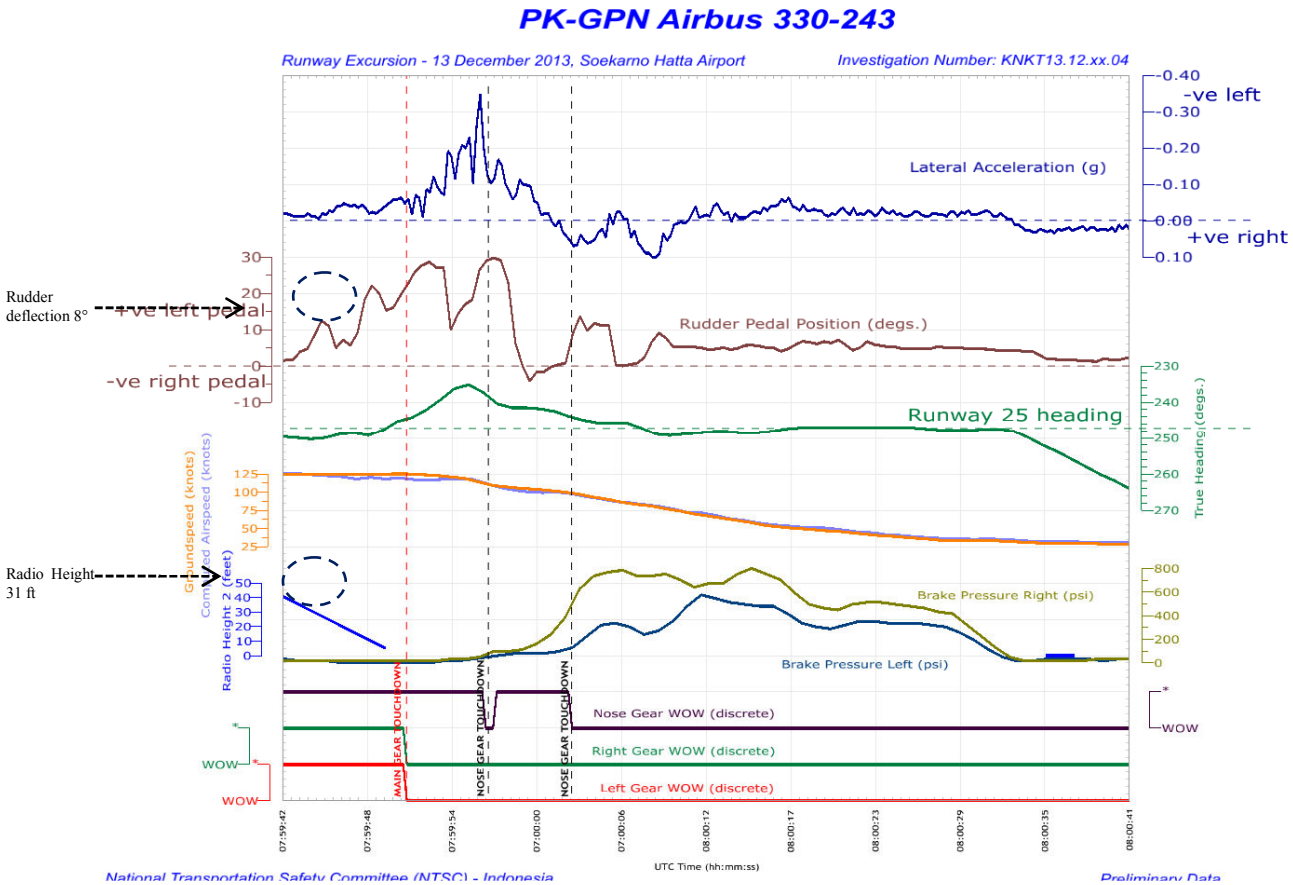

Figure 7: The FDR data of the rudder pedal deflection at 31 feet

UTC Time (hh:mm:ss)	Radio Height (feet)	Computed Airspeed (knots)	Groundspeed (knots)	GROUND AIR (discrete)	True Heading (degs.)	Roll Angle (degs.)	Pitch Angle (degs.)	Glideslope Deviation (dots)	Localizer Deviation (dots)	Drift Angle (degs.)	N1 Actual Engine 1 (%rpm)	N1 Actual Engine 2 (%rpm)	Lateral Acceleration (g)
	201	128	128	*	249	0	3	0.11	0.05	-1	45.4	44.5	-0.004
		128	128	*	249	-1	3			-1	43.6	42.4	0
	172	128	128	*	249	0	2	0.14	0.04	-1	41.8	41.5	0
7:59:32		131	128	*	249	0	2			-1	42	42.4	-0.008
	150	131	128	*	249	0	2	0.11	0.01	-1	43	42.3	-0.008
		131	128	*	249	0	2			-1	41	38.7	-0.008
	124	131	128	*	249	0	2	0.09	0.04	-1	37.1	35.2	-0.012
7:59:36		131	127	*	249	0	2			-1	34.5	33.9	-0.004
	101	131	127	*	249	0	2	0.21	0.01	-1	34.3	34.6	-0.008
		130	127	*	249	1	3			-1	35.7	36.6	-0.008
	75	129	126	*	249	1	4	0.41	0.02	-1	38	38.6	-0.012
7:59:40		129	126	*	249	1	4			-1	39.2	39.4	-0.012
	56	128	125	*	249	2	4	1.23	-0.02	-1	40.3	40.7	-0.008

UTC Time (hh:mm:ss)	Radio Height (feet)	Computed Airspeed (knots)	Groundspeed (knots)	GROUND AIR (discrete)	True Heading (degs.)	Roll Angle (degs.)	Pitch Angle (degs.)	Glideslope Deviation (dots)	Localizer Deviation (dots)	Drift Angle (degs.)	N1 Actual Engine 1 (%rpm)	N1 Actual Engine 2 (%rpm)	Lateral Acceleration (g)
		126	125	*	250	1	5			-1	41.5	42.1	-0.012
	39	126	124	*	250	1	6	2.84	-0.1	-1	43.3	44.4	-0.016
7:59:44		125	124	*	250	2	6			-1	46	47	-0.012
	31	124	124	*	250	3	6	2.32	-0.17	-1	48.2	48.2	-0.004
		122	124	*	249	2	6			0	48.8	48.9	-0.023
	21	121	124	*	249	2	6	3.89	-0.25	1	49.9	50	-0.043
7:59:48		118	124	*	249	5	6			1	51.2	51.9	-0.043
	10	120	124	*	248	3	7	2.68	-0.38	1	53.7	55.1	-0.02
		118	125	*	245	0	7			3	56.7	54.3	-0.051
	1	119	125	*	244	2	6	1.89	-0.52	5	50.9	46.5	-0.047
7:59:52		117	124	OG	242	0	7			6	43.3	39.5	-0.062
	4095	117	123	OG	239	-2	5			8	37.1	34.2	

Figure 8: The FDR tabular data of significant parameters from 201 feet of radio altitude

The significant events retrieved from the FDR as shown in the black boxes are as follow;

1. The FDR data recorded that the aircraft was on the localizer up to the autopilot disengage at 124 feet AGL.
2. The aircraft started roll to the right from 1° up to 5° to the right at altitude approximately 90 feet AGL for 12 seconds and the graph showed that the average roll angle was 2°.
3. The aircraft started deviate 0.01 up to 0.17 dots to the right of the localizer after disengagement of the auto pilot at altitude between 101 and 31 feet and greatest deviation was 0.52 dots at altitude one feet.
4. The left rudder pedal deflection showed average 8° varied from 12° to 5° left.
5. A small of heading changed from 250° at altitude 31 feet to 244° at altitude one feet.
6. At approximately 20 feet, the N1 values increased from approximately 35% to 55%.
7. The wind direction and speed displayed on FMGES at the aircraft altitude 184 feet was 132° at 8 kts and at the altitude of 208 feet was 151° at 24 kts.

1.12 Wreckage and Impact Information

The mark of the right main wheels found on the right runway shoulder about 500 m before re-entered the runway. Refer to the interview, the pilot stated that the initial touched down, the right main wheels were on the right unpaved of the runway 25L.

Figure 9: The mark of initial touch down

1.13 Medical and Pathological Information

No medical or pathological investigations were conducted as a result of this serious incident, nor were they required.

1.14 Fire

There was no evidence of fire.

1.15 Survival Aspects

All occupants disembarked normally. No one injured in this serious incident.

1.16 Tests and Research

There was no test or research conducted following this serious incident

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 Simulation on the A330 simulator

After the serious incident, the investigation and the representatives of the operator had discussed several items to complete the investigation data. During this discussion, the operator described of the simulation that has been performed in the flight simulator to simulate the serious incident.

The simulation was based on the relevant data of the serious incident taken from the FOQA system (Flight Operation Quality Assurance). The simulation was part of the pilot proficiency check and has been performed to all pilots within the operator. The result of the simulation indicated that most of the pilots could not achieve a normal landing on the runway where the similar conditions to the serious incident applied in this simulation, notably the loss of visual reference.

1.17.2 Operator's Basic Operation Manual (BOM)

1.4.2. Crew Resource Management (CRM). (Page 1, Date 30 April 2006)

The Principles, Philosophy, Policies, Procedures and Practices (Behaviours) define the Garuda Indonesia approach to CRM. Principles form the basis for our philosophy; our philosophy shapes our policies; policies guide the development of procedures and practices.

1.4.2.1 Principles

One principle, thoroughly understood, can help solve many problems. Crewmembers should think deeply about this idea, particularly in light of the Garuda Indonesia CRM principles.

(a). Safety is my duty.

(b). No one is perfect, everybody makes mistakes.

(c). CRM is the way to correct mistakes.

(d). Teamwork is the result of cooperation, not competition.

(e). It is what is right, not who is right, that matters.

(f). Do first things first.

(g). Encourage open discussion

(h). Be self-critical and self-correcting.

(i). Good EQ (emotional intelligence) enhances crew performance.

(j). When in doubt, check it out.

(k). Don't rush! Stay cool! Think it out!

(l). Take care of each other.

1.4.2.2 CRM Philosophy

(a). CRM is the effective use of all available resources -- people, equipment, and information -- to achieve the highest possible levels of safety and efficiency.

(b). CRM ability and a facility for teamwork shall be selection criteria for all crewmembers.

(c). CRM is based on the principle of synergy (teamwork) functioning within a cultural environment that supports and encourages human growth and commitment.

(d). CRM involves the continuous improvement of procedures, attitudes, and behaviours, applying human factor concepts to enhance individual and crew performance.

(e). CRM training is focused on specific teamwork, communication, decision-making, and workload management behaviours that have been proven to enhance personal effectiveness and job satisfaction. As a result of CRM training, employees will be better able to function as members of self-criticizing, self-correcting teams.

1.4.2.3 CRM Policy

(a). CRM principles and behaviours must be fully integrated into all aspects of flight operations training.

(b). Periodic CRM assessments and performance feedback will be conducted for all flight crewmembers, flight-attendants, and dispatchers, in order to assure effective teamwork.

(c). Flight schedules for crewmembers will be prepared and administered to assure adequate rest and safe crew pairings (i.e., new captains will not be scheduled with new first officers unless a DGCP/CCP or FIA is part of the crew).

(d). The PIC shall be responsible for establishing an environment of trust and mutual-commitment prior to each flight, encouraging his fellow crewmembers to speak up and to accept mutual responsibility for the safety and well-being of the passengers, cargo, and equipment entrusted to them. "What's right, not who's right" shall be the motto of all members of the Garuda Indonesia operating team.

(e). Each Garuda Indonesia crewmember shall be responsible for notifying the pilot-in command of any condition or circumstance that might endanger the aircraft or impair the performance of any flight crewmember.

(f). CRM skills and performance will be periodically evaluated at all organizational levels to provide regular feedback and ensure continuous improvement.

(g). CRM skills and performance will be a factor in the promotion of all Garuda Indonesia crewmembers.

1.5.1.1 Training Policy (Page 1, Date 18 September 2009)

Crew member / FOO and Operations Personnel shall participate on required training programs to maintain professional experience and acquaintance with recent development.

No crew member/FOO / operations personnel may report for duty if aware of any

lack experience or knowledge.

(a) Approval and Supervision

(1) All Instructors/Examiners/Check Airmen/ Flight Crew members (whether employed or subcontracted)/Training Facility/ Devices/ Equipment/ and Course Material (whether owned or contracted) shall:

(i) Have the required certification(s) and approval or acceptance from DGCA as applicable;

(ii) Meet the required qualification and performance standards of Garuda or DGCA, as applicable;

(iii) Be periodically evaluated to ensure compliance with required qualification and performance standards.

(2) All Instructors/Examiner/Check Airmen/ Crew member / FOO and Operations Personnel shall be trained for their assigned tasks, appropriately by using the approved Ground Training, Flight Training and Examination program.

(3) All Instructors/Examiner/Check Airmen/ Crew member / FOO and Operations Personnel shall be qualified and standardize for their assigned tasks, and are certified by the company or approved by the DGCA.

(4) New policies, rules, instructions and procedures, new aircraft type, system and fleet modifications/upgrade shall be introduced to applicable personnel through:

(i) Operations/Technical or administrative notice;

(ii) Class room session;

(iii) TR/PC or ground recurrent training;

(5) To achieve continuous improvement of ground, simulator and aircraft training and improvement on line operations, the formal feedback mechanism is recognized through:

(i) Regular meeting.

(ii) Feedback during training

(iii)Feedback form

(6) Flight crew is prohibited to operate previous aircraft type once training is completed on new aircraft type without appropriate training and examination.

(7) The scheduling department shall be informed following flight crew qualification change.

(8) The company shall provide sufficient instructors and support personnel to conduct the training and examination program.

4.4 Approach and Landing

4.4.1.Crew Coordination

For operations into lower weather minima the crew coordination and procedures are

based upon the principles of the monitored approach. This means that particular attention is paid to the distribution of cockpit duties/ task sharing.

AOM/FCOM procedures ensure that one pilot continues to monitor his/her instruments down to and below decision height.

On practice approach (Crew Qualification, BOM), or whenever part of an actual approach is flown in VMC, a regular lookout should form part of the scanning cycle.

The Pilot Monitoring, monitors the approach, keep look out, executes the allocated system operation on command of the Pilot Flying and confirms its execution, does the radio communication and checks for visual reference.

The Pilot Monitoring shall be fully familiar with the intentions of the pilot flying, and shall have facts and figures ready when needed. The use of facilities shall be planned beforehand, and on passing one facility, the Pilot Monitoring shall inform the pilot flying and be ready to retune to the next facility immediately.

4.4 Approach and Landing

4.4.4 Final Approach and Landing

07. Approach Stability

All flight must be stabilized by 1000 feet above airport elevation in IMC and by 500 feet above airport elevation in VMC.

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

1. *The aircraft is in the correct flight path.*
2. *Only small changes in heading / pitch are required to maintain the correct path.*
3. *The aircraft speed is not more than Vref + 20 indicated airspeed and not less than Vref.*
4. *The aircraft is in the correct landing configuration.*
5. *Sink rate not more than 1000 fpm; if an approach require sink rate greater than 1000 fpm, special briefing shall be conducted.*
6. *Thrust setting is appropriate for the aircraft configuration and is not below the minimum thrust for approach as defined by the aircraft operating manual.*
7. *All briefing and checklist have been conducted.*
8. *Specific type of approach:*
    - *ILS: within one dot of the glide slope and localizer.*
    - *CAT II or III ILS: within the expanded localizer.*
    - *Circling approach: wings level on final when the aircraft reaches 300 feet above airport elevation.*
9. *Unique approach procedure or abnormal condition requiring a deviation from the above elements of a stabilized approach requires special briefing / training.*

If the aircraft is not stabilized below 1000 feet above airport elevation in IMC and by

500 feet above airport elevation in VMC in accordance with the criteria, the PIC or PF shall go around.

3.2 Weather

3.2.1 Weather Minima

03. Definitions and Regulations

Decision Altitude (DA) or Decision Height (DH)

A specified altitude or height in the 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.

Note 1. — Decision altitude (DA) is referenced to mean sea level and decision height (DH) is referenced to the threshold elevation.

Note 2. — The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path.

In Category III operations with a decision height the required visual reference is that specified for the particular procedure and operation.

Level flight after reaching DH/DA is prohibited. At or before reaching the DH/DA, the decision must be made either continue the approach to land or to go around.

07. Landing Weather Minima

The length of the visual segment must enable pilots to see the visual cues needed to assess the aircraft's position, bank angle and cross track velocity relative to the approach lights or the runway. For roll reference, sights of one or more elements providing horizontal information is required (cross bars,

red side barrettes, and threshold). This ground segment, which contains part of the final approach and/or touchdown area, must be continuously in view to the pilot from the time he reaches the descent limit up to and including touchdown and roll-out. Since for a manual landing, the overriding requirement is for visual cues to be available, sufficient runway surface must be visible to manually control flare and touchdown.

1.17.3 Operator Flight Crew Manual (FCTM):

1.5 TRAINING AND ASSESSMENT

1.5.2 Assessments Standards

05. GENERAL TOLERANCES

- *Height* : *± 200 feet Maximum*
  ± 100 feet NOT more than 15 seconds
- *DH* : *0 / + 50 feet to initiate overshoot*

- *MDA* : *0 / + 50 feet to maintain*
- *Airspeed* : *± 15 kts Maximum*

  ± 10 kts in cruise NOT more than 15 seconds

  ± 5 kts on approach
- *Heading* : *± 10º degrees of assigned or intended heading*
- *Airway Tracking* : *5° of specified track*
- *ILS approach* : *½ scale deflection of "G/S or LOC"*
- *VOR approach* : *½ scale deflection*

** (1 scale = 1 dot = 1 degrees for ILS or 5 degrees for VOR)*

1.17.4 AIRBUS A330 Flight Crew Training Manual (FCTM) Aircraft Leases

*NORMAL OPERATIONS LANDING: FLARE (*NO-170 P 2/10 – 3/10, 31 MAY 2012)

PITCH CONTROL

When reaching 100 ft, auto-trim ceases and the pitch law is modified to be a full authority direct law as described in OPERATIONAL PHILOSOPHY Chapter. Indeed, the normal pitch law, which provides trajectory stability, would not be well adapted to the flare manoeuvre. Consequently, in the flare, as the speed reduces, the pilot will have to move the stick rearwards to maintain a constant path. The flare technique is thus very conventional.

Prior to flare, avoid destabilization of the approach and steepening the slope at low heights in attempts to target a shorter touchdown. If a normal touchdown point cannot be achieved or if destabilization occurs just prior to flare, a go-around (or rejected landing) should be performed. The PNF monitors the rate of descent and should call "SINK RATE" if the vertical speed is excessive prior to the flare.

From stabilized conditions, the flare height is about 40 ft.

LATERAL AND DIRECTIONAL CONTROL

FINAL APPROACH

In crosswind conditions, a crabbed-approach wings-level should be flown with the aircraft (cockpit) positioned on the extended runway centerline until the flare.

FLARE

The objectives of the lateral and directional control of the aircraft during the flare are:

• To land on the centerline, and

• to minimize the lateral loads on the main landing gear.

The recommended de-crab technique is to use all of the following:

• The rudder to align the aircraft with the runway heading during the flare.

• *The roll control, if needed, to maintain the aircraft on the runway centerline. Any tendency to drift downwind should be counteracted by an appropriate lateral (roll) input on the side stick.*

In the case of strong crosswind, in the de-crab phase, the PF should be prepared to add small bank angle into the wind in order to maintain the aircraft on the runway centerline. The aircraft may be landed with a partial de-crab (residual crab angle up to about 5 °) to prevent excessive bank. This technique prevents wingtip (or engine nacelle) strike caused by an excessive bank angle.

Operational Recommendation: : (OP-020 P 2/6, 31 May 2012)

Since the aircraft is stable and auto-trimmed, the PF needs to perform minor corrections on the side stick, if the aircraft deviates from its intended flight path.

The PF should not fight the side stick, or over control it. If the PF senses an over control, the side stick should be released.

NORMAL OPERATION – APPROACH (NO-110 P 8/10, 31 May 2012)

TRAJECTORY STABILIZATION

The first prerequisite for safe final approach and landing is to stabilize the aircraft on the final approach flight path laterally and longitudinally, in landing configuration, at Vapp speed, i.e:

- *Only small corrections are necessary to rectify minor deviations from stabilized conditions.*
- *The thrust is stabilized, usually above idle, to maintain the target approach speed along the desired final approach path.*

Airbus policy requires that stabilized conditions be reached at 1 000 ft above airfield elevation in IMC and 500 ft above airfield elevation in VMC.

If, for any reason, one flight parameter deviates from stabilized conditions, the PNF will make a callout as stated below:

Exceedance and associated PNF callout				
Parameter		Exceedance		Callout
IAS		Speed target +10 kt / -5 kt		"SPEED"
V/S		<-1 000 ft/min(1)		"SINK RATE"
Pitch attitude		+10 °/ 0 °		"PITCH"
Bank angle		7 °		"BANK"
ILS only	Localizer	Excess Deviation	1/4 dot PFD	"LOCALIZER"
	Glide slope		1 dot PFD	"GLIDE SLOPE"
NPA only	Course	Excess deviation: ½ dot on PFD (or 2.5 ° (VOR)/5 ° (ADF))		"COURSE"
	Altitude at check points	Deviation		" xFT HIGH (LOW)"

(1) The V/S callout threshold becomes 1 200 ft/min for A340-500 and A340-600

Following a PNF flight parameter exceedance call out, the suitable PF response will be:

- *Acknowledge the PNF call out, for proper crew coordination purposes*

- *Take immediate corrective action to control the exceeded parameter back into the defined stabilized conditions*
- *Assess whether stabilized conditions will be recovered early enough prior to landing, otherwise initiate a go-around.*

AP DISCONNECTION (NO-110 P 9/10, 31 May 2012)

During the final approach with the AP engaged, the aircraft will be stabilised. Therefore, when disconnecting the AP for a manual landing, the pilot should avoid the temptation to make large inputs on the sidestick.

The pilot should disconnect the autopilot early enough to resume manual control of the aircraft and to evaluate the drift before flare. During crosswind conditions, the pilot should avoid any tendency to drift downwind.

Some common errors include:

• Descending below the final path, and/or

• reducing the drift too early.

NORMAL OPERATIONS LANDING (NO-170 P 9/10 -10/10, 31 May 2012)

DEVIATION FROM NORMAL TECHNIQUES

Deviations from normal landing techniques are the most common causes of tail strikes.

The main reasons for this are due to:

- *Allowing the speed to decrease well below VAPP before flare*

  Flying at too low speed means high angle of attack and high pitch attitude, thus reducing ground clearance. When reaching the flare height, the pilot will have to significantly increase the pitch attitude to reduce the sink rate. This may cause the pitch to go beyond the critical angle.

- *Prolonged hold off for a smooth touch down*

  As the pitch increases, the pilot needs to focus further ahead to assess the aircraft's positioning relation to the ground. The attitude and distance relationship can lead to a pitch attitude increase beyond the critical angle.

- *Too high flare*

  A high flare can result in a combined decrease in airspeed and a long float. Since both lead to an increase in pitch attitude, the result is reduced tail clearance.

- *Too high sink rate, just prior reaching the flare height In case of too high sink rate close to the ground, the pilot may attempt to avoid a firm touch down by commanding a high pitch rate. This action will significantly increase the pitch attitude and, as the resulting lift increase may be insufficient to significantly reduce the sink rate, the high pitch rate may be difficult to control after touch*

down, particularly in case of bounce.

- *Bouncing at touch down*

  In case of bouncing at touch down, the pilot may be tempted to increase the pitch attitude to ensure a smooth second touchdown. If the bounce results from a firm touch down, associated with high pitch rate, it is important to control the pitch so that it does not further increase beyond the critical angle.

APPROACH AND LANDING TECHNIQUES

A stabilized approach is essential for achieving successful landings. It is imperative that the flare height be reached at the appropriate airspeed and flight path angle. The A/THR and FPV are effective aids to the pilot.

VApp should be determined with the wind corrections (provided in FCOM/QRH) by using the FMGS functions. As a reminder, when the aircraft is close to the ground, the wind intensity tends to decrease and the wind direction to turn (direction in degrees decreasing in the northern latitudes). Both effects may reduce the head wind component close to the ground and the wind correction to VApp is there to compensate for this effect.

When the aircraft is close to the ground, high sink rate should be avoided, even in an attempt to maintain a close tracking of the glideslope. Priority should be given to the attitude and sink rate. If a normal touchdown distance is not possible, a go-around should be performed.

If the aircraft has reached the flare height at VApp, with a stabilized flight path angle, the normal SOP landing technique will lead to the right touchdown attitude and airspeed.

During the flare, the pilot should not concentrate on the airspeed, but only on the attitude with external cues.

Specific PNF call outs have been reinforced for excessive pitch attitude at landing.

After touchdown, the pilot must "fly" the nose wheel smoothly, but without delay, on to the runway, and must be ready to counteract any residual pitch up effect of the ground spoilers. However, the main part of the spoiler pitch up effect is compensated by the flight control law itself.

FINAL APPROACH MONITORING (NO-110 P 5/10, 31 May 2012).

The final approach is to be monitored through available data. Those data depends on theapproach type and the result of the navigation accuracy check.

Approach type	***Navigation accuracy check***	***Data to be monitored***
ILS	-	*LOC, GS deviation, DME and/or OM*

Managed NPA	*GPS primary*	*VDEV, XTK and F-PLN*
Managed NPA	*Non GPS PRIMARY*	*VDEV, XTK, Needles, DME and ALT*
Selected NPA	*Accuracy check negative*	*Needles, DME and ALT, Time*

SPEED CONSIDERATION

……..In most cases, the FMGC provides valuable VAPP on MCDU PERF APPR page, once towerwind and FLAP 3 or FLAP FULL landing configuration has been inserted (VAPP = VLS + max of{5 kt, 1/3 tower head wind component on landing RWY in the F-PLN}).

The crew can insert a lower VAPP on the MCDU APPR page, down to VLS, if landing isperformed with A/THR OFF, with no wind, no downburst and no icing.

He can insert a higher VAPP in case of strong suspected downburst, but this increment islimited to 15 kt above VLS.

In case of strong or gusty crosswind greater than 20 kt, VAPP should be at least VLS +5 kt; the5 ktincrement above VLS may be increased up to 15 kt at the flight crew's discretion.

The crew will bear in mind that the wind entered in MCDU PERF APPR page considers thewind direction to be in the same reference as the runway direction e. g. if airport if magneticreferenced, the crew will insert magnetic wind.

USE OF A/THR

The pilot should use the A/THR for approaches as it provides accurate speed control. The pilot will keep the hand on the thrust levers so as to be prepared to react if needed.

During final approach, the managed target speed moves along the speed scale as a function of wind variation. The pilot should ideally check the reasonableness of the target speed by referring to GS on the top left on ND. If the A/THR performance is unsatisfactory, the pilot should disconnect it and control the thrust manually.

If the pilot is going to perform the landing using manual thrust, the A/THR should be disconnected by 1.000 ft on the final approach.

NORMAL OPERATIONS (NO-180 P1/4, 31 May 2012)

GO AROUND

CONSIDERATIONS ABOUT GO-AROUND

Applicable to: ALL

A go-around must be considered if:

- *There is a loss or a doubt about situation awareness*
- *If there is a malfunction which jeopardizes the safe completion of the approach e.g. major navigation problem*

- *ATC changes the final approach clearance resulting in rushed action from the crew or potentially unstable approach*
- *The approach is unstable in speed, altitude, and flight path in such a way that stability will not be obtained by 1 000 ft IMC or 500 ft VMC.*
- *Any GPWS, TCAS or windshears alert occur*
- *Adequate visual cues are not obtained reaching the minima.*

REJECTED LANDING

Applicable to: ALL

A rejected landing is defined as a go-around manoeuvre initiated below the minima.

Once the decision is made to reject the landing, the flight crew must be committed to proceed with the go-around manoeuvre and not be tempted to retard the thrust levers in a late decision to complete the landing.

TOGA thrust must be applied but a delayed flap retraction should be considered. If the aircraft is on the runway when thrust is applied, a CONFIG warning will be generated if the flaps are in CONF full.

The landing gear should be retracted when a positive climb is established with no risk of further touchdown. Climb out as for a standard go-around.

In any case, if reverse thrust has been applied, a full stop landing must be completed.

1.17.5 AIRBUS A 330 Crew Operation Manual (FCOM)

AUTOMATIC CALLOUT (DCS-34-40-10 P 1/2, 07 APRIL 2011)

General

Flight Warning Computer (FWC) generates a synthetic voice for radio height announcement below 2500ft. These announcements come through the cockpit loudspeaker even if the speakers are turned off.

PREDETERMINED CALLOUTS

The altitude callout uses the following predetermined threshold:

height (ft)	call out
2 500	TWO THOUSAND FIVE HUNDRED or TWENTY FIVE HUNDRED
2 000	TWO THOUSAND
1 000	ONE THOUSAND
500	FIVE HUNDRED
400	FOUR HUNDRED
300	THREE HUNDRED
200	TWO HUNDRED
100	ONE HUNDRED
80	EIGHTY
70	SEVENTY
60	SIXTY
50	FIFTY
40	FORTY
30	THIRTY
20	TWENTY
10	TEN
5	FIVE
DH (or MDA/MDH) + 100	HUNDRED ABOVE
DH (or MDA/MDH)	MINIMUM

RETARD MODE (DSC-22_30-90 P 11/18, 30 May 2012)

The RETARD mode is available only during automatic (AP engaged in LAND mode). RETARD mode engages at approximately 40ft RA and remains engaged after touchdown. The A/THR commands IDLE thrust during the flare, and the FMA and engine warning display show "IDLE". If the autopilot is disengaged during the flare before touchdown, the SPEED mode replaces RETARD mode, and the flight crew has to reduce thrust manually.

Note;

In automatic landing, the system generates a "RETARD" callout at 10 ft RA, which prompts the flight crew to move the thrust levers to IDLE in order to confirm thrust reduction. In manual landing conditions, the system generates this callout as a reminder at 20 ft RA.

PROCEDURES SUPPLEMENTARY PROCEDURES (PRO-SUP-27-20 P3/4 -4/4)

FLIGHT CONTROLS (FLYING CONDITIONS) - NORMAL OPERATIONS

LANDING MODE

The system's landing mode gives the aircraft a stabilized flight path and makes a conventional flare and touchdown. It carries out the initial approach as this manual described earlier. At 100 ft, the normal flight law is changed to the flare law which is a full authority pitch direct law compensated for CG and for certain pitching effects so that the pilot has to exert a progressive pull to increase pitch gently in the flare. He should pull the thrust levers back at or above 20 ft, and the landing should occur without a long flare. An audible "RETARD" callout reminds the pilot if he has not pulled back the thrust levers when the aircraft has reached 20 ft.

Crosswind landings are conventional. The preferred technique is to use the rudder to align the aircraft with the runway heading, during the flare, while using lateral control to maintain the aircraft on the runway centerline (Refer to PRO-NOR-SOP 21 LANDING - FLARE). The lateral control mode does not change until the wheels are on the ground, so there is no discontinuity in the control laws. The aircraft tends to roll gently in the conventional sense as drift decreases, and the pilot may have to use some normal cross control to maintain roll attitude.

Even during an approach in considerable turbulence, the control system resists the disturbances quite well without pilot inputs. In fact, the pilot should try to limit his control inputs to those necessary to correct the flight path trajectory and leave the task of countering air disturbances to the flight control system.

Derotation is conventional.

Pitch trim then resets to 4 ° UP after the transition to ground law, which happens 5s after the ground condition is confirmed and if the ground spoilers are retracted.

AIRCRAFT SYSTEMS: AUTO FLIGHT - GENERAL

PILOT INTERFACE - NAVIGATION DISPLAY (DSC-22_10-40-50 P 1/4 30 MAY 2012)

The FMGES (Flight Management Guidance and Envelope System) generates the following information, displayed on the EFIS (Electronic Flight Instruments System) Navigation Displays:

- Aircraft position

- Flight plans (active, secondary, temporary, and dashed)

- Lateral deviation from primary flight plan

- Pseudo waypoints along the flight plan

- Raw data from tuned navaids

- Wind information

- Various options, depending on what the flight crew selects on the EFIS control panel:

• Waypoints, navaids, NDBs, airports, constraints

• Type of approach selected

• Messages.

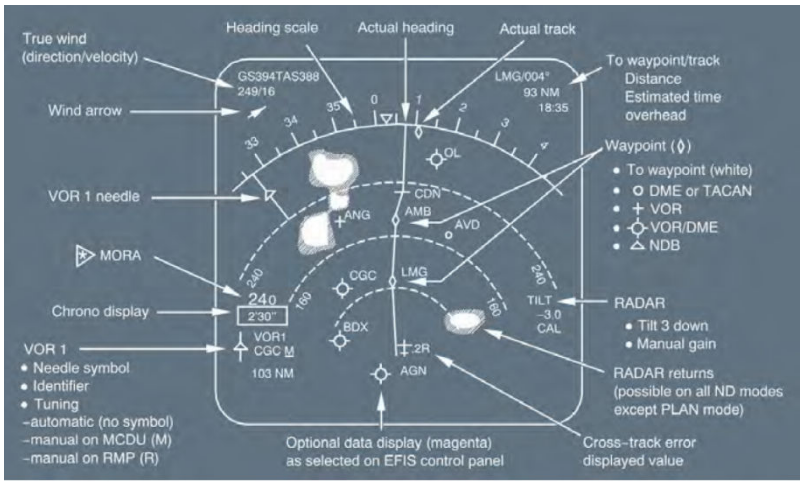

Figure 10: Navigation Display

1.18 Additional Information

Interview note:

During conducted the ILS approach at 3,000 ft the pilot requested to fly right avoid the CB cloud and continued descend to 2,000 ft then returned to intercept the ILS of runway 25L.

Prior to touchdown the pilot explained that at about flare out altitude the aircraft entered a heavy rain which was not expected by the pilots and the PF loss of visual

reference and also felt that the aircraft floating. The PNF explained that he able to see the runway all the time and observed that the aircraft was slightly on the right of the runway, and advised the PF to fly left twice.

1.19 Useful or Effective Investigation Techniques:

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

2 ANALYSIS

The analysis part of this Final Report will discuss the relevant issues resulting in the runway excursion involving an Airbus 330-200 aircraft, PK-GPN during the landing at Soekarno – Hatta International Airport of Tangerang on 13 December 2013.

The investigation determined that there were no issues with the aircraft and all systems were operating normally.

The analysis will therefore focus on the following issues:

- Course deviation prior to touchdown.
- Approach and landing techniques.
- Decision to land.
- Observing and reporting of visibility.

2.1 Course Deviation Prior to Touch Down

The FDR data recorded that the aircraft was on the localizer when the autopilot disengage at radio altitude 124 feet and when approximately 90 feet AGL the aircraft started rolled in average of 2° to the right for approximately 12 seconds. The FDR also recorded that during this period the computed airspeed average was 120 knots.

Based on the formula of Rate One Turn of (1,091 X tangent of the angle of bank) : airspeed (in knots) = (1,091 X 0.0349) : 120 = 0.317 degrees per second or 1 degree per 3 seconds.

With the aircraft speed of 120 knots, the aircraft travelled 60 meters per second. One degree deviation would result the aircraft deviated approximately 3.1 meters per second. The FDR recorded that the aircraft rolled with 2 degrees for approximately 12 seconds and would have resulted the aircraft deviated 37.2 meters.

This calculation was consistent with the localizer deviation as recorded in the FDR and the initial touchdown mark of the right main wheel found on the unpaved area on the right side of the runway 25 L.

The runway at Soekarno-Hatta Airport has 60 meters wide or 30 meters from the runway centre line each side. The deviation of 37 meters have resulted the aircraft deviated 7 meters from the runway edge.

2.2 Approach and Landing Techniques

Refers to FCOM Airbus A330

A stabilized approach is essential for achieving successful landings. It is imperative that the flare height be reached at the appropriate airspeed and flight path angle. The A/THR and FPV are effective aids to the pilot.

When the aircraft is close to the ground, high sink rate should be avoided, even in an attempt to maintain a close tracking of the glideslope. Priority should be given to the attitude and sink rate. If a normal touchdown distance is not possible, a go-around

should be performed.

The significant events excerpt from the FDR and CVR:

- The autopilot disengaged at 124 feet.
- The aircraft started to roll to the right at average of 2° from approximately 90 feet for 12 seconds.
- At 20 ft the PNF called "fly left".
- The aircraft deviated up to 0.52 dots to the right of the localizer.
- Prior to touchdown, the PF loss of visual reference.
- The FDR recorded that prior to touchdown the flight path angle changed from -3° to -1° simultaneously the N1 value increased from approximately 35% to 55 %.
- The CVR recorded three seconds after the first FWC callout "RETARD", the FWC callout "TEN" which indicated that the aircraft altitude was 10 feet above the ground. The FWC callout "RETARD" *callout reminds the pilot if he has not pulled back the thrust levers when the aircraft has reached 20 ft*.
- The flight path angle changed from -3° to -1° and the pitch angle changed from 2° to 7° prior to touchdown.
- The second PNF called "fly left" heard after the third FWC callout "RETARD".

The condition where the PNF called "fly left", roll 2° to the left, localizer deviation indicated that the aircraft deviated from the runway centre line and FWC callout "RETARD" three times. It means that there was no synchronization with runway expected touchdown point. Those particulars conditions could be classified that the flight was un-stabilized approach.

The operator BOM stated that "..... *part of the final approach and/or touchdown area, must be continuously in view to the pilot from the time he reaches the descent limit up to and including touchdown and roll-out*." The PF had lost the visual reference prior to touchdown.

The operator Basic Operation Manual (BOM) stated one of the approach stability criteria is the aircraft is in the correct flight path and only small changes in heading / pitch are required to maintain the correct path. The BOM also stated that "the approach stability criteria is not met, a go around should be made".

The FCOM of the Airbus A330 also stated that: "*Prior to flare, avoid destabilization of the approach and steepening the slope at low heights in attempts to target a shorter touchdown. If a normal touchdown point cannot be achieved or if destabilization occurs just prior to flare, a go-around (or rejected landing) should be performed*."

Prior to touchdown 3 simultaneous events occurred which were the flight path angle changed from -3° to -1°, the pitch angle changed from 2° to 7°, and the N1 value increased from approximately 35% to 55 % followed by FWC callout "RETARD" three times and the FWC callout "TEN".

These particular events resulted the prolong flare and touchdown of the aircraft as the pitch angle increased the auto thrust increased the N1 to maintain the selected speed. Refer to the aircraft RETARD MODE SYSTEM, during the landing with auto pilot disengage, requires the pilot to pull back the thrust levers.

The elapsed time in between the FWC callout "RETARD" and "TEN" indicated that the aircraft floated between 20 – 10 feet as a result of the delay pullback of the thrust levers.

The Airbus A330 FCTM allows that a go-around manoeuvre initiated below the minima or a rejected landing provided the reverse thrust has not been applied.

The condition that at very low altitude the aircraft was in un-stabilized approach, the pilot loss of visual reference, and prolong flare to touchdown met the requirement for a go around and it was possible to be performed provided that the thrust reversers have not been applied.

2.3 Decision to Land

Refer to the analysis described in the chapter 2.2 of this report, concluded that the condition that the aircraft was in un-stabilized approach, the PF loss of visual reference and the PNF calls "fly left" required go around according to the operator BOM and Airbus FCOM.

Go around from any position when the thrust reversers have not been applied is possible to be performed according to the Airbus FCOM.

The pilot decision to continue landing might due to the pilot assumption that he would be able to land the aircraft safely.

The FDR recorded the aircraft heading was relatively constant at 250° until the aircraft at 31 feet. After passed 31 feet, the roll angle recorded between 2° up to 5° to the right until aircraft altitude 1 feet, meanwhile the aircraft heading changed from 250° to 244°. The left rudder pedal order leads the aircraft nose yawing to the left but does not change the track thus the aircraft rolled to the right however, the heading changed to the left.

At this phase of flight, the localizer deviation continued to the right that might due to the centrifugal force. The heading changed possibly was the pilot action to correct the condition.

The simulation performed to all pilots within the operator indicated that most of the pilots could not achieve a normal landing on the runway where the similar conditions to the serious incident were applied in this simulation.

At low altitude prior to touch down and the condition required for go around it is a decision that has to be made by the pilot in very short time or known as intuitive decision. Intuitive decision is almost like a reflex however, it can be enriched by experience or training that will be retained as long term memory. The approach briefing is a method to develop intuitive decision in the short term memory.

In this serious incident, the ongoing condition which could not be expected such as loss of visual reference might has not been discussed in the approach briefing. This might cause by of the information available required to be analysed related to the visibility was different with the actual condition when the aircraft at very low altitude. These

unexpected conditions required pilot intuitive decision that could be retained either by training as a long term memory or approach briefing as a short term memory.

The Airbus FCOM stated that "*If a normal touchdown point cannot be achieved or if destabilization occurs just prior to flare, a go-around (or rejected landing) should be performed*". This statement was related to the condition existed in this particular phase of flight and should have become a part of the long term memory for the pilot to make such decision.

The PF decision to continue landing was most likely an indication that the absence of the spatial information to cope such unexpected condition had taken place either in long term memory as stated in the Airbus FCOM or in the short term memory performed in the approach briefing.

2.4 Observing and reporting of visibility

Refers to International Civil Aviation Organisation (ICAO) Annex 3 recommended visibility reporting requirements.

4.6.3 Recommendation- when local routine and special reports are used for departing aircraft, the visibility observations for these reports should be representative of the take-off/climb-out area: when local routine and special reports are used for arriving aircraft, the visibility observations for these reports should be representative of the approach/landing area. Visibility observations made for reports in the METAR/SPECI codes forms should be representative of the aerodrome and its immediate vicinity: in such observations special attention should be given to significant directional variations.

This Annex recommended that the weather observation should include the area of aerodrome vicinity to enable the observer in predicting the possibility of significant changing that may occurs and reported in METAR/SPECI forms.

The investigation found that;

- The weather reported by the ATIS for Soekarno-Hatta International Airport, issued, at 08.00 UTC and 08.45 reported that, the average visibility was 5 Km, the wind directions between 270°- 360° and the speed between 10 kts to 07 kts. There was no significant condition stated in the remark.
- The wind direction and speed displayed on FMGES at the aircraft altitude 184 feet was 132° at 8 kts and at the altitude of 208 feet was 151° at 24 kts.
- The PF loss of visual reference when the aircraft at about flare out altitude.

The weather reported stated that there was no significant condition stated in the remark. There was no information of the possibility weather change. The fact that the significant weather changed occurred it indicated that the weather observation might not include area of the vicinity of the aerodrome.

The weather report of no significant condition has made the pilot of arriving aircraft did not expect any weather change. The absence of no significant weather report might influence the pilot judgment and expectation of any weather change which may requires pilot decisions especially when occurs at low altitude.

3 CONCLUSIONS

3.1 Findings

1. The aircraft was airworthy prior to this occurrence.
2. All crew have valid licenses and medical certificates.
3. The aircraft was operated under a correct weight and balance envelope.
4. The Pilot in Command (PIC) acted as Pilot Flying (PF) and the Second in Command (SIC) as Pilot Non Flying (PNF).
5. The flight from takeoff until approach was uneventful.
6. ICAO Annex 3 para 3.4.6.3 Recommendation - when local routine and special reports are used for departing aircraft, the visibility observations for these reports should be representative of the take-off/climb-out area: when local routine and special reports are used for arriving aircraft, the visibility observations for these reports should be representative of the approach/landing area.
7. The Automatic Terminal Information Services (ATIS) broadcasted at 08.00 UTC without significant weather and at 08.45 UTC reported thunderstorm and rain.
8. Prior to touchdown the pilot explained that the aircraft entered a heavy rain and the PF loss of visual reference.
9. The PNF explained that he able to see the runway all the time and saw the aircraft was slightly on the right of the runway and advised the PF to fly left two times.
10. When aircraft altitude of 184ft, the wind direction was changing form westerly to southerly.
11. Refers to FCOM Airbus A330, The pilot should disconnect the autopilot early enough to resume manual control of the aircraft and to evaluate the drift before flare.
12. At 90 feet, the FDR recorded the aircraft rolled to the right at average of 2°.
13. Flight path angle changed from -3 to -1, and the pitch angle change from 2° to 7° prior to touchdown.
14. The left rudder pedal deflection showed average 8° varied from 12° to 5° left.
15. After FWC callout “TWENTY”, the SIC called “fly left” two times.
16. Callout FWC “RETARD” activated three times. An callout “RETARD” callout reminds the pilot if he has not pulled back the thrust levers when the aircraft has reached 20 ft.
17. The Airbus FCOM stated ‘If a normal touchdown point cannot be achieved or if destabilization occurs just prior to flare, a go-around (or rejected landing) should be performed’.

18. The aircraft was in un-stabilized approach, the pilot loss of visual reference, and prolong flare to touchdown conditions required for a go around.
19. The Airbus A330 FCTM allows that a go-around maneuver initiated below the minima or a rejected landing is allowed provided the reverse thrust has not been applied.
20. The result of the simulation by the PT Garuda on the A330 simulator indicated that most of the pilots could not achieve a normal landing on the runway where the similar conditions to the serious incident applied in this simulation.
21. The decision to continue landing was most likely an indication that the absence of the spatial information to cope such unexpected condition had taken place either in long term memory.
22. At 08.00 UTC the aircraft touched down and the right main wheels were on the right shoulder, travelled 500 meters on the runway shoulder.
23. Due to hydraulic problem the pilot stopped the aircraft on taxiway S5 then the aircraft was towed to parking bay E21.
24. The weather was reported by ATIS stated that there was no significant condition in the remark.
25. The weather was broadcasted by the ATIS was significantly different with the current condition as recorded by the FDR when the aircraft on final and landing phase.

3.2 Contributing Factors[2]

During the hand flying at approximately 90 feet AGL the aircraft started rolled in average of 2° to the right for approximately 12 seconds resulted to aircraft deviation to the right, whilst the PF loss the visual reference and prolong flare prior to touch down.

- The above condition was an indication for go around which was not executed, this might cause by insufficient pilot intuitive decision to cope such condition.
- The absence of no significant weather report might influence the pilot judgment and expectation of any weather change which may requires pilot decisions especially when occurs at low altitude.

2 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 final investigation report, the National Transportation Safety Committee had been informed of safety actions resulting from this occurrence by PT. Garuda Indonesia.

Following this serious incident, the VP Flight Operation of PT. Garuda Indonesia issued notice to flight crews on 20 December 2013 to all pilot with subject Continuation approach below DA/DH, concerning to the reminder to the company policies and procedures. The detail of this safety notice is attached in the appendix of this report.

5 SAFETY RECOMMENDATIONS

Base on the examination of the factual data, analysis and the relevant findings that contributed to this serious incident, it was identified that after the autopilot disengaged at the aircraft altitude of 124 ft, which most likely contributed to series of events, such as, the aircraft started roll to the right with average 2°, localizer deviation, floating for 3 seconds, resulted to the aircraft was on un-stabilized approach.

The decision to continue landing that might contributed by inadequate required memory to cope unexpected condition when the go around required at low altitude.

The recommendations issued are based on the findings of this investigation. However the operator shall consider that the condition possibly extends to other pilots and related supporting units within the company.

The National Transportation Safety Committee issued several safety recommendations addressed to:

5.1 PT. Garuda Indonesia

a. To evaluate the flight crew ability when changing control the aircraft from automatic flight to hand flying especially when interferes with one or more condition changes such as wind speeds and directions, and visibility at critical flight condition.

b. To reinforce the pilot discipline to the current operator manuals in respect to the procedure contributed to this serious incident as discussed in the chapter 2 analysis of this report.

c. To enrich long term memory in relation to pilot intuitive decision making at critical flight condition.

5.2 Badan Meteorologi Klimatologi dan Geofisika (BMKG) and AirNav Indonesia

The analysis described that the weather reported did not include information of the possibility weather change which might indicate that the weather observation did not accordance to the recommendation in Annex 3 observing and reporting of visibility.

As such the National Transportation Safety Committee recommends:

a. To the BMKG to comply with the recommendation of the ICAO Annex 3.4.6

b. To BMKG and the AirNav to review the internal network to improve the observed weather information aforesaid in point a) to be distributed to the pilot in timely manner.

c. To refers to the past and similar occurrences which have been recommended by KNKT, it is necessary to implement the ICAO Annex 3 3.4.6 recommendation as mandatory.

5.3 Directorate General of Civil Aviation

a. To refer to the past and similar occurrences which have been recommended by the KNKT, it strongly required that the DGCA has to facilitate the recommendation described on the recommendation 5.2.

b. To oversight the correct interpretation and implementation of recommendations in this report, to ensure effectiveness for safety improvement to the operators.

6 APPENDICES

6.1 PT. Garuda Indonesia Notice to Flight Crews

Garuda Indonesia

FLIGHT OPERATIONS

Notice To : **Flight Crews**
Nr : **009/13**
Subject : **Continuation Approach Below DA/DH**

Date : 20 Desember 2013

Para Penerbang Yang Terhormat,

Mengingat telah terjadinya beberapa kejadian accident / incident di dalam penerbangan Domestik beberapa waktu lalu, didapatkan informasi awal atas kejadian- kejadian tersebut dan berdasarkan analisa terkait, diduga kuat terjadi deviasi terhadap elemen-eemen antara lain yang terkait dengan "approach continuation below DH/DA", Loss visual contact after passing DH/DA dan Stabilized Approach Criteria.

Untuk itu, diingatkan kembali mengenai **"Go Around"** minded kepada rekan-rekan sekalian untuk dilaksanakan secara konsisten terutama terkait dengan policy yang ada di BOM :

1. **BOM 3.2.1-7 B s/d E; WEATHER MINIMA**
If at any time after descent below DA (ILS CAT 1) or DH (ILS CAT II or IIA) OR MDA (Non Precision App) the Captain no longer convinced that the safe landing and rollout can be made, **Go Around.**

2. **BOM 4.4.4 -04; CIRCLING APPROACH**
Upon reaching the Missed Approach Point (MAP), adequate outside visual reference must be obtained. If not, or if the PIC is not convinced that uninterrupted adequate outside reference can be maintained, a **Go Around** must be executed.
The circuit part of the circling may be executed at or above the minimum descent altitude, provided:
- The aircraft is clear of clouds and
- Full visual reference can be maintained and
- The duty runway and/or runway lights and/or approach lights and/or other lights, marking or objects identifiable with the runway can be kept in sight.
- Down-wind timing is adjusted to ensure maneuvering within the circling area.

If one of these conditions cannot be fulfilled a **Go Around** must be executed.
Descent below the MDA shall not be commenced until intercepting a visual glide path of 3°.

BOM 4.4.4 -06 500 FEET CALL
If the aircraft is not stabilized at 500 ft **Go Around.**
If disagreement to the objective of 500 feet call (and stabilized approach criteria) exists or when doubt exists to the awareness of or no appropriate response from the PF, the PM shall consider him/her in the subtle incapacitation state (BOM 5.2.1-C). The PM shall take over control and execute **Go Around.**
It is mandatory to execute go around and/or reject the landing at any time when the safety of the flight is jeopardized.

3. **BOM 4.4.4 -07: APPROACH STABILITY**
If the aircraft is not stabilized below 1000 feet above airport elevation in IMC and by 500 feet above airport elevation in VMC in accordance with the criteria, the PIC or PF shall **Go Around**.

4. **BOM 4.4.4 -11;LANDING PERFORMANCE ASSESSMENTS AT TIME OF ARRIVAL**

The decision to land rest basically with the PIC, who shall take into account; If gross deviations occur, the pilot shall not hesitate to execute **Go Around** or **Rejected Landing**.

BOM telah menjamin bahwa pada setiap pelaksanaan Go Around sebagaimana yang tercantum pada BOM 4.4.4-06 bahwa; ***The company will not initiate disciplinary measures for a go around executed under any unsafe or unstabilized approached.***

Demikian disampaikan untuk dilaksanakan, atas perhatiannya kami ucapkan terimakasih.

6.2 Bureau d'Enquètes et d'Analyses (BEA) France and Airbus Comments

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de l'Écologie,
du Développement
durable,
des Transports
et du Logement

BEA
Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile

Toulouse, 16 June 2014

N° 331/BEA/INV

Subject: Comments on Draft Final Report
Yr/ref: KTU-RH/2/13 KNKT 2014
Copy: Airbus

Dear Sir,

Thank you for giving us the opportunity to review and comment the draft final report on the serious incident involving the Airbus A330, registration PK-GPN on 13 december 2013.

The BEA and Airbus technical advisors have reviewed the English version of the draft final report provided on 13h may 2013.

The BEA does not have any comments on this draft final report. You will find attached some comments suggested by Airbus, you may wish to consider.

I remain at your disposal for any further information you may require.

Best regards,

Comments provided by Airbus

The BEA has received the following comments from Airbus, which it transmits to the NTSC for consideration.

Draft Report Paragraph	Proposed amendment	Comments
- *Pages vi, 1, 9, 10, 28, 29, 32*	*Replace EGPWS by FWS*	All the audio synthesis (TEN, TWENTY, THIRTY, FORTY, RETARD, HUNDRED ABOVE, MINIMUM) are generated by the FWS and not by the EGPWS
- *Page 13 §1.17.1 : "The result of the simulation indicated that most of the pilots could not achieve a normal landing on the runway where the similar conditions to the serious incident applied in this simulation" (also repeated p29 §2.3)*	"The result of the simulation indicated that most of the pilots could not achieve a normal landing on the runway where the similar conditions to the serious incident applied in this simulation, notably the loss of visual reference"	Without the loss of visual reference, the wind conditions were such that it should have been possible for pilots to correct the aircraft trajectory prior to touchdown, had they used appropriate LH roll input order.
- Page 28 :" The condition where the PNF called "fly left", roll 2° to the left, localizer deviation indicated that the aircraft deviated from the runway centre line and EGPWS audible "RETARD" three times indicated the aircraft was deviated from the runway touchdown point"	:" The condition where the PNF called "fly left", roll 2° to the left, localizer deviation indicated that the aircraft deviated from the runway centre line"	The "RETARD" callout is generated at 20ft if the throttle levers are not yet on Idle detent. There is no synchronization with runway expected touchdown point.
- Page 29 : "The fact that the EGPWS audible "RETARD" and "TEN" indicated that the aircraft floated between 20 – 10 feet as a result of the delay pullback of the thrust levers"	"The elapsed time in between the FWS "RETARD" callout and "TEN" indicated that the aircraft floated between 20 – 10 feet as a result of the delay pullback of the thrust levers"	The successive triggering of TWENTY – RETARD – TEN is not always synonymous of overflare.
- Page 29 : "The FDR recorded the aircraft heading was relatively constant at 250° until the aircraft at 31 feet. After passed 31 feet, the roll	Add the following additional explanation: " The left rudder pedal order leads the a/c nose yawing to the left but does not change the track thus the	

angle recorded between 2° up to 5° to the right until aircraft altitude 1 feet, meanwhile the aircraft heading changed from 250° to 244°. The aircraft rolled to the right however, the heading changed to the left. At this phase of flight, the localizer deviation continued to the right that might due to the centrifugal force. The heading changed possibly was the pilot action to correct the condition."	divergent trajectory remains divergent : to come back towards the runway centerline, it should have needed additional LH roll order to cancel the a/c banking on the RH side, and bring it back on the runway axis. »	