KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA

FINAL

KNKT.11.12.32.04

Aircraft Serious Incident Investigation Report

PT. Merpati Nusantara Airline

Boeing 737-500; PK-MDT

Sultan Hasanuddin International Airport

Republic of Indonesia

26 December 2011

2016

This final investigation report was produced by the Komite Nasional Keselamatan Transportasi (KNKT), Transportation Building 3rd Floor, Jalan Medan Merdeka Timur 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, the Indonesian Aviation Act (UU No. 1/2009) and Government Regulation (PP No. 62/2013).

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When the KNKT makes recommendations as a result of its investigations or research, safety is its primary consideration.

However, the KNKT fully recognizes that the implementation of recommendations arising from its investigations will in some cases incur a cost to the industry.

Readers should note that the information in KNKT reports and recommendations is provided to promote aviation safety. In no case is it intended to imply blame or liability.

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GLOSSARY OF ABBREVIATIONS

AD	:	Airworthiness Directive
AFM	:	Airplane Flight Manual
AGL	:	Above Ground Level
ALAR	:	Approach-and-landing Accident Reduction
AMSL	:	Above Mean Sea Level
AOC	:	Air Operator Certificate
ATC	:	Air Traffic Control
ATPL	:	Air Transport Pilot License
ATS	:	Air Traffic Service
ATSB	:	Australian Transport Safety Bureau
Avsec	:	Aviation Security
BMG	:	Badan Meterologi dan Geofisika
BOM	:	Basic Operation Manual
°C	:	Degrees Celsius
CAMP	:	Continuous Airworthiness Maintenance Program
CASO	:	Civil Aviation Safety Officer
CASR	:	Civil Aviation Safety Regulation
CPL	:	Commercial Pilot License
COM	:	Company Operation Manual
CRM	:	Cockpit Recourses Management
CSN	:	Cycles Since New
CVR	:	Cockpit Voice Recorder
DFDAU	:	Digital Flight Data Acquisition Unit
DGCA	:	Directorate General of Civil Aviation
DME	:	Distance Measuring Equipment
EEPROM	:	Electrically Erasable Programmable Read Only Memory
EFIS	:	Electronic Flight Instrument System
EGT	:	Exhaust Gas Temperature
EIS	:	Engine Indicating System
FL	:	Flight Level
F/O	:	First officer or Copilot
FDR	:	Flight Data Recorder
FOQA	:	Flight Operation Quality Assurance
GPWS	:	Ground Proximity Warning System
hPa	:	Hectopascals
ICAO	:	International Civil Aviation Organization
IFR	:	Instrument Flight Rules

IIC	:	Investigator in Charge
ILS	:	Instrument Landing System
Kg	:	Kilogram(s)
Km	:	Kilometer(s)
Kt	:	Knots (NM/hour)
Mm	:	Millimeter(s)
MTOW	:	Maximum Take-off Weight
NM	:	Nautical mile(s)
KNKT / NTSC	:	Komite Nasional Keselamatan Transportasi / National Transportation Safety Committee
PIC	:	Pilot in Command
QFE	:	Height above aerodrome elevation (or runway threshold elevation) based on local station pressure
QNH	:	Altitude above mean sea level based on local station pressure
RESA	:	Runway End Safety Area
RPM	:	Revolution Per Minute
SCT	:	Scattered
S/N	:	Serial Number
SSCVR	:	Solid State Cockpit Voice Recorder
SSFDR	:	Solid State Flight Data Recorder
TS/RA	:	Thunderstorm and rain
TAF	:	Terminal Aerodrome Forecast
TSN	:	Time Since New
TT/TD	:	Ambient Temperature/Dew Point
TTIS	:	Total Time in Service
UTC	:	Coordinated Universal Time
VFR	:	Visual Flight Rules
VMC	:	Visual Meteorological Conditions

INTRODUCTION

SYNOPSIS

On 26 December 2011, a Boeing 737-500 aircraft, registered PK-MDT, was being operated by PT. Merpati Nusantara Airline on a schedule passenger flight MZ 755 from Sam Ratulangi Airport (WAMM) Manado to Sultan Hasanuddin Airport (WAAA), Makassar.

There were 64 persons on board; two pilots, four cabin crews and 58 passengers consist of 49 adults, 6 children and 3 infants.

The aircraft was on radar vector for ILS approach on runway 13, and the pilot had instructed to fly the aircraft direct to MKS for ILS runway 03. The weather condition during approach was raining with thunderstorm.

At 10.34 UTC the pilot reported to the controller that the aircraft established localizer runway 13, on position 10 miles from touchdown runway 13. The pilot requested runway 13 for landing and it was approved by the Hasanuddin Tower (Aerodrome Control Tower) Controller.

At 10.38 UTC the aircraft landed on runway 13. After touchdown the aircraft veered to the right side of the runway, hit the taxi sign board and rolled on the shoulder for about 375 meters then returned to the runway.

The pilot continued taxi and proceeded to parking stand number 7. The passengers disembarked normally at the parking stand and no one injured.

At the time of issuing this safety recommendation, the operator had been stopped the operation since January 2014. The recommendation is addressed to the DGCA to take the benefits from the investigation and this might be used as a lesson learned for the other operators, therefore the KNKT recommends that;

The operator should review the un-stabilised approach procedure and to include the un-stabilised when crossing the runway threshold and directional control after touchdown.

The references for the lesson learned;

- FCTM page 5.5 describes a criteria of when aircraft cross the runway
- Go-Around after Touchdown FCTM page 5.58
- Directional problem during the landing roll FTCM page 6.31.

1 FACTUAL INFORMATION

1.1 History of the flight

On 26 December 2011, a Boeing 737-500 aircraft, registered PK-MDT, was being operated by PT. Merpati Nusantara Airline on a schedule passenger flight MZ 755 from Sam Ratulangi Airport (WAMM), Manado to Sultan Hasanuddin Airport (WAAA), Makassar.

There were 64 persons on board the flight, consisted of two pilots, four flight attendants and 58 passengers consisted of 49 adults, 6 children and 3 infants.

The aircraft departed from Sam Ratulangi Airport, Manado at 1710 LT (0910 UTC) with the Second in Command (SIC), as part of the line training, was acting as the Pilot Flying (PF) and the Pilot in Command (PIC) was acting as Pilot Monitoring (PM).

There were no technical and or system abnormalities reported or recorded during the flight.

At 1009 UTC, the crew contacted Ujung Pandang Director controller (Makassar Approach Controller) as the aircraft entered the Makassar control airspace. The controller identified the position of the aircraft on the radar screen, which was approaching point KANIP then vectored to fly direct to MKS VOR (Very High Frequency Omni Range) for Instrument Landing Position (ILS) approach to runway 03.

At 1021 UTC, the controller informed the pilot about the current wind direction from 140° between 6 and 10 knots and requested the crew to nominate the runway that they wished to use. The crew assessed conditions and requested runway 13 for landing which was approved by the controller.

At 1033 UTC, when the aircraft was 10 miles from touchdown on runway 13, the crew was advised to contact Hassanudin Tower. The Hassanudin Tower controller issued a landing clearance and advised the crew that the runway was wet.

At 1034 UTC, the crew noticed that the aircraft established on the localizer of runway 13 and continued the ILS approach.

At 1036 UTC, when the aircraft was approximately at 550 feet radio altitude, the PF felt uncomfortable with the rain conditions and suggested to go around. The PIC advised that the runway was in sight and suggested to continue the approach and took over control of the flight from the SIC.

At 1038 UTC, the aircraft landed and veered to the right off the runway, hit a taxi sign board and rolled on the shoulder for about 375 meters, then returned to the runway.

The tower controller instructed the crew to continue to taxi and proceed to the apron. No one injured in this serious incident.

1.2 Personal Information

The pilot in command 42-year old, Airline Transport Pilot License (ATPL) holder, joined the company on 10 January 1989, and held a first class medical certificate that valid until 03 April 2012.

The PIC had accumulated 1,339 hours and 27 minute total flying time and total time on type of 440 hours including 134 hours 38 minutes in the last 90 days.

The second in command (SIC) was 23-year old, Commercial Pilot License (CPL) holder, who joined the company on 27 September 2010 and held a first class medical certificate that valid until 15 April 2012.

The SIC was in the line training program to become qualified First Officer and had accumulated 188 hours 15 minute total flying time on type including 116 hours 48 minutes in the last 90 days.

The SIC later reported that in previous approaches, conditions like those in this occurrence had not been encountered.

1.3 Aircraft Information

The aircraft was a Boeing 737-500, serial number 26704 with a total flight time of 43,210 hours 49 minutes.

The engines installed on the aircraft were manufactured by CFM International, type/model CFM56-3C1. The left engine with serial number 856670 had a total of 41,427 hours and the right engine with serial number 857654 had a total of 41,644 hours.

The aircraft was being operated within the approved weight and balance envelope.

1.4 Weather Information

The meteorology report (METAR) on 26 December 2011 for Sultan Hasanuddin Airport, at 10:30 UTC indicated a wind of 130° at 4 knots, a visibility of 2,000 meters and rain with thunderstorm activity. At 11:00 UTC indicated a wind of 080° at 04 knots, and a visibility of 3,000 meters also with rain and thunderstorm activity.

1.5 Damage to aircraft

An inspection following the occurrence found the right engine cowl had been damaged.

Figure 1: Damaged to the right engine cowl

1.6 Other damage

Two right runway lights and one of the taxiway alpha signboards was broken due to impact with nose gear and right engine.

Figure 2: The broken runway lights, taxiway alpha signboard and wheels mark

1.7 Aerodrome Information

Sultan Hasanuddin International Airport is located at South Sulawesi at an elevation of 47 feet above sea level and operated by PT. Angkasa Pura I. The airport had two runways with directions of 03/21 and 13/31. The runway 13/31 surface was asphalt and a length of 2,500 meters and width of 45 meters. The runway 13 ILS approach procedures, as published in the Aeronautical Information Publication (AIP), specified a Minimum Descend Altitude (MDA) of 344 feet and a minimum visibility of 1,200 meters.

At that time of the occurrence, there were no NOTAMs issued for the runway and facilities.

1.8 Flight Recorders

The aircraft was equipped with a Solid State Flight Data Recorder (SSFDR) and a Solid State Cockpit Voice Recorder (SSCVR). The recorders were downloaded at the KNKT facility for further analysis.

Flight Data Recorder (SSFDR)

Manufacturer	:	Honeywell
Serial Number	:	6670
Part Number	:	980-4700-042

The graph of the FDR showed the flight parameters from approximately 1,500 feet until the aircraft completed the landing roll. The circles on the following graph show the significant events.

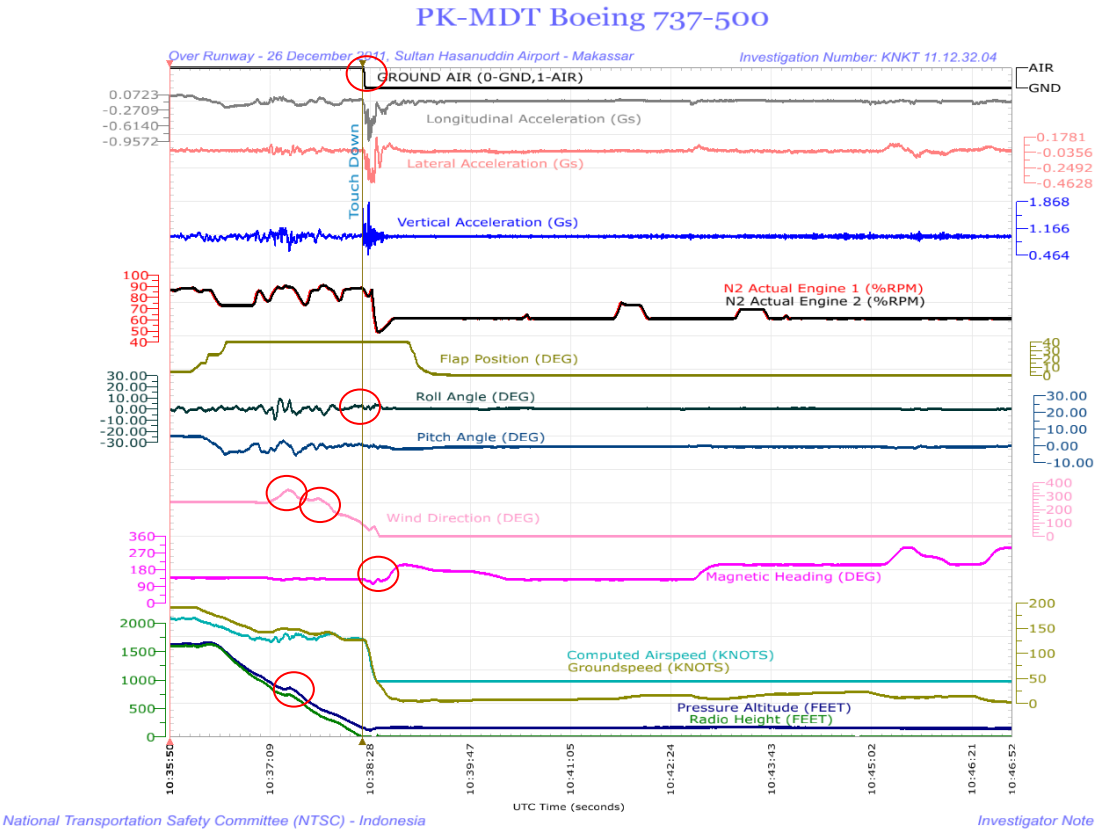


Figure 3: FDR from approximately 1,500 feet

UTC Time (seconds)	Pressure Altitude (FEET)	Radio Height (FEET)	N2 Actual Engine 1 (%RPM)	Magnetic Heading (DEG)	Roll Angle (DEG)	GROUND AIR (0-GND,1-AIR)	Computed Airspeed (KNOTS)	Wind Direction (DEG)	Groundspeed (KNOTS)	Head Wind (knots)	Wind Speed (KNOTS)	AT Engaged (0-NOT ENG,1-ENGAGE)	AP Engaged (0-NOT ENG,1-ENGAGE)	TR Left Deployed Engine 1 (0-NOT DEPLOY,1-DEPLOY)	TR Left Deployed Engine 2 (0-NOT DEPLOY,1-DEPLOY)	N1 Actual Engine 1 (%RPM)	N1 Actual Engine 2 (%RPM)	Brake Pressure Left (PSI)	Brake Pressure Right (PSI)
10:37:39	628	512	76,2438	131,133	2,11	AIR	129	272,812	141	-5,4919		ENGAGE	ENGAGE	NOT DEPL	NOT DEPL	33,75	33,75	110	
	612			131,484	2,11	AIR	129		140			ENGAGE	ENGAGE	NOT DEPL	NOT DEPL	38,5	39,875		55
	600	479	85,5695	131,836	0	AIR	129		139		9	ENGAGE	ENGAGE	NOT DEPL	NOT DEPL	49	52,125	110	
	588			131,836	-1,05	AIR	128		139			ENGAGE	ENGAGE	NOT DEPL	NOT DEPL	56,25	54		55
10:37:43	572	450	86,3256	131,484	-1,05	AIR	128	269,297	139	-6,6685		ENGAGE	ENGAGE	NOT DEPL	NOT DEPL	56,25	54,625	110	
	560			130,781	-0,35	AIR	131		138			ENGAGE	ENGAGE	NOT DEPL	NOT DEPL	55,5	56,25		55
	548	426	86,7037	130,078	1,76	AIR	129		138		8	ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	55,875	56,5	110	
	536			129,375	2,46	AIR	126		138			ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	55,75	55,625		55
10:37:47	520	398	86,8297	129,375	0,35	AIR	130	285,469	138	-7,3136		ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	55,875	57,5	110	
	504			130,078	-0,35	AIR	132		139			ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	67,375	65,625		55
	492	366	90,4844	130,781	0,35	AIR	133		139		6	ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	69	68,875	110	
	480			131,484	-2,46	AIR	133		140			ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	71,125	71		55
10:37:51	472	347	90,9885	131,836	-4,57	AIR	134	259,453	141	-3,6623		ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	71,125	70,125	110	
	464			131,484	-5,27	AIR	135		141			ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	71	70,375		55
	456	330	90,7364	130,43	-3,87	AIR	136		142		7	ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	70,375	66,875	110	
	448			129,727	-3,16	AIR	137		142			ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	64	60,125		55
10:37:55	440	308	88,09	129,375	-1,05	AIR	139	236,25	142	-2,0319		ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	60,625	58	110	
	428			128,672	0,35	AIR	138		142			ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	57,875	54,875		55
	420	296	87,2078	128,32	2,81	AIR	139		141		5	ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	57,25	55,25	110	
	416			127,969	3,16	AIR	141		140			ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	57,25	54,625		55
10:37:59	408	281	85,5695	128,32	3,16	AIR	140	186,328	139	2,64902		ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	53,75	48,875	110	
	400			128,672	2,81	AIR	138		138			ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	45,125	43		55
	388	265	81,2847	129,023	0,7	AIR	138		137		4	ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	40	39	110	
	384			129,375	0,35	AIR	136		135			ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	36,125	36,5		55
10:38:03	372	247	77,126	129,375	-0,7	AIR	134	162,422	133	3,3529		ENGAGE	NOT ENG	NOT DEPL	NOT DEPL	33,5	34,375	110	
	360			129,375	-0,35	AIR	132		132			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	33,625	32,875		55
	348	223	78,5122	129,023	0	AIR	131		130		5	NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	34,5	35,25	110	
	340			128,672	-0,7	AIR	128		129			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	40,25	39,5		55
10:38:07	328	195	86,5777	129,023	-0,7	AIR	129	159,609	128	4,30433		NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	53,25	50,875	110	
	316			129,023	0,7	AIR	128		127			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	59,875	55,375		55
	304	160	87,3338	128,672	0	AIR	128		127		4	NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	60,125	55,25	110	
	288			128,32	0	AIR	127		127			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	59,375	55,25		55
10:38:11	280	134	87,4598	127,969	0,35	AIR	128	146,25	127	3,79811		NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	59,25	56,75	110	
	268			127,969	0,7	AIR	128		127			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	61,875	58,875		55
	256	109	88,09	128,32	1,41	AIR	129		127		3	NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	61,875	58,875	110	
	248			128,32	1,41	AIR	130		127			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	61,625	58,625		55
10:38:15	236	84	88,09	129,023	2,46	AIR	129	127,969	127	2,99949		NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	61,5	58,5	110	
	224			129,375	3,16	AIR	130		127			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	61,5	58,625		55
	216	53	88,09	129,375	2,81	AIR	131		127		5	NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	61,625	58,875	110	
	204			129,375	2,46	AIR	130		127			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	62,25	59,375		55
10:38:19	192	30	88,468	129,375	2,11	AIR	130	111,094	127	4,74764		NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	62,375	59,5	110	
	180			129,023	2,46	AIR	129		127			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	62,375	59,625		55
	168	12	88,594	129,023	2,81	AIR	129		127		6	NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	62,5	59,5	110	
	156			129,375	3,87	AIR	129		127			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	62,375	59,375		55
10:38:23	156	0	87,2078	128,32	1,05	AIR	128	79,4531	127	3,94684		NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	59,5	53,25	110	
	152			126,914	0,35	GND	126		126			NOT ENG	NOT ENG	DEPLOY	NOT DEPL	49,25	45,875		55
	128	-2	81,7	121,289	0	GND	120		124		12	NOT ENG	NOT ENG	DEPLOY	DEPLOY	41,25	40,375	385	
	132			119,531	1,76	GND	111		115			NOT ENG	NOT ENG	DEPLOY	DEPLOY	37,375	37,875		440
10:38:27	124	2	81,1587	118,477	2,46	GND	105	46,4062	110	3,6942		NOT ENG	NOT ENG	DEPLOY	DEPLOY	38,5	44,625	550	
	120			116,367	-0,35	GND	92		100			NOT ENG	NOT ENG	DEPLOY	DEPLOY	50,25	62,625		385
	124	-4	87,3338	110,742	0,7	GND	76		87		21	NOT ENG	NOT ENG	DEPLOY	DEPLOY	69,875	77,625	440	
	140			105,469	2,46	GND	67		73			NOT ENG	NOT ENG	DEPLOY	DEPLOY	41,25	69,125		385
10:38:31	148	2526	63,1374	105,82	1,05	GND	58	73,8281	64	17,8105		NOT ENG	NOT ENG	DEPLOY	DEPLOY	25,5	58,625	385	
	152			113,203	4,92	GND	51		53			NOT ENG	NOT ENG	DEPLOY	DEPLOY	18,375	48,875		495
	156	34	49,779	124,453	3,16	GND	45		46		41	NOT ENG	NOT ENG	DEPLOY	DEPLOY	15,75	44,125	605	
	156			129,727	3,16	GND	45		41			NOT ENG	NOT ENG	DEPLOY	DEPLOY	15,25	41,25		660
10:38:35	160	0	48,8969	126,211	3,52	GND	45	0	40	-24,2211		NOT ENG	NOT ENG	DEPLOY	DEPLOY	15,5	38,25	1045	
	160			118,125	3,52	GND	45		37			NOT ENG	NOT ENG	DEPLOY	DEPLOY	15,875	36,875		1100
	164	-3	50,7872	116,719	2,11	GND	45		34		0	NOT ENG	NOT ENG	DEPLOY	DEPLOY	16,375	42,875	1100	
	164			121,289	0,35	GND	45		30			NOT ENG	NOT ENG	DEPLOY	DEPLOY	16,875	50,5		605
10:38:39	164	-3	52,8036	124,805	0,35	GND	45	0	27	0		NOT ENG	NOT ENG	DEPLOY	DEPLOY	17,375	52,5	990	
	164			126,562	0,35	GND	45		22			NOT ENG	NOT ENG	DEPLOY	DEPLOY	17,875	53,25		1100
	164	-3	54,946	128,32	0,7	GND	45		19		0	NOT ENG	NOT ENG	DEPLOY	DEPLOY	18,375	54	660	
	164			135	0,7	GND	45		15			NOT ENG	NOT ENG	DEPLOY	DEPLOY	19	54,5		165
10:38:43	164	-3	57,5924	143,789	0,35	GND	45	0	13	0		NOT ENG	NOT ENG	DEPLOY	DEPLOY	19,875	54,625	330	
	168			156,445	0,35	GND	45		11			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	20,625	50,125		220
	168	-3	60,3649	165,234	0,35	GND	45		10		0	NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,5	43,25	440	
	168			174,023	0,7	GND	45		9			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	22,25	39,75		220
10:38:47	168	-3	61,3731	181,758	1,05	GND	45	0	9	0		NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,875	36,125	220	
	168			188,438	0,7	GND	45		9			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,5	34,25		275
	168	-3	61,3731	193,359	0,35	GND	45		9		0	NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,625	32,75	440	
	168			198,984	0,35	GND	45		8			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,625	31,625		385
10:38:51	168	-3	61,2471	202,5	0	GND	45	0	7	0		NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,625	30,875	550	
	168			204,609	0,35	GND	45		6			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,625	29,875		275
	168	-3	61,2471	205,312	0,35	GND	45		6		0	NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,625	28,875	495	
	168			206,016	0	GND	45		5			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,625	27,75		110
10:38:55	168	-3	61,2471	206,719	0	GND	45	0	5	0		NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,75	26,75	275	
	168			207,07	0	GND	45		6			NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,75	25,625		330
	168	-3	61,2471	206,367	0	GND	45		5		0	NOT ENG	NOT ENG	NOT DEPL	NOT DEPL	21,625	24,5	330	

Figure 4: Significant data recorded from approximately 500 feet

Significant parameters shown from when the aircraft was at approximately a radio altitude of 500 feet are as follows:

- At 10:37:37 UTC, radio altitude 552 feet the flight parameter recorded

on the FDR, an aircraft heading of 130°, a Pitch angle of -1.05°, an airspeed of 133 knots, a westerly wind direction, a tailwind of 6 knots, and auto pilot (A/P) and auto throttle (A/T) were engaged.

- At 10:37:49 UTC, the A/P was disengaged. Radio altitude of 366 feet, airspeed 133 knots, heading 130°, pitch angle 1°, westerly wind of 6 knots (5 knot tailwind).
- At 10:37:57 UTC, at 300 feet radio altitude, the wind component changed from a tailwind to a headwind at an approximate wind speed of 5 knots.
- At 10:38:04 UTC, the A/T was disengaged. Radio altitude of 233 feet, airspeed 133 knots, heading 132°, pitch angle 0°, southerly wind of 3 knots (5 knot headwind).
- At an approximate radio altitude of 20 feet, the aircraft heading gradually changed from 129° to 126° at touchdown and continued to decrease to 106° during the landing roll for period of 8 seconds.
- At touchdown the left thrust reverser deployed a second before the right thrust reverser.
- Three seconds later the N-1[1] of the right engine indicated a greater value than that of the left engine. The maximum differential value recorded was up to 35% for 16 seconds later.
- Braking application after touchdown indicated asymmetric application and more left brake pressure than right brake pressure for12 seconds.

Cockpit Voice Recorder

Manufacturer	:	Honeywell
Serial Number	:	120-09555
Part Number	:	980-6022-001

The solid-state Cockpit Voice Recorder (CVR) was recovered and transported to KNKT recorder facility in Jakarta. The CVR contained the last 30 minutes of communication and the recorded data was of good quality.

The significant events recorded from the last four minutes prior to landing were as follows:

Note:
TWR refers to Hasanuddin Tower Controller
P2 refers to Second in Command
P1 refers to Pilot in Command
EXT refers to external sounds recorded

1 N1 the indicator of the rotation speed of low pressure compressor of a turbine engine.

Time UTC	From	To	Description
10:34:39	TWR	Pilot	The Makassar Approach controller instructed the pilot to contact Hasanuddin Tower controller.
10:34:54	TWR	Pilot	Hasanuddin Tower controller issued landing clearance with additional information of the wind 290/07 knots, QNH 1009 mbs and runway was wet
10:35:59	P2	P1	Requested to select the landing gear down and continued with flap selection.
10:36:36	P2	P1	Requested the landing check list
10:37:04	P1	P2	Suggested to continue using the auto pilot
10:37:37	P2	P1	Suggested go around
10:37:37	P1	P2	Instructed to continue landing approach and advised that the runway was in sight
10:37:41	P1	P2	Took over the control from P2 and continued landing approach
10:38:21	GPWS		Aural 10 followed by P2 advising P1 to fly left
10:38:24	EXT		A sound of the aircraft touchdown on the runway
10:38:34	EXT		Prolonged sound of aircraft rolling on rough surface.

1.9 Organisational and Management Information

Aircraft Owner : PT. Plan Business Leasing

Address : 56 / 63 Line Wall Road, Gibraltar

Aircraft Operator : PT. Merpati Nusantara Airlines

Address : Jalan Angkasa Blok B 15, Kavling 2-3
Kemayoran Jakarta 17210
Republic of Indonesia

Operator Certificate Number : AOC 121/002

Aircraft Operator manual

The explanations of Flight Crew Training Manual (FCTM) below are extracts of the FCTM related to stabilized approaches, directional problem during the landing roll and crew resource management.

Stabilized Approach

FCTM page 5.5 described the criteria when the aircraft crosses the runway threshold on landing, as follows:

As the airplane crosses the runway threshold it should be:

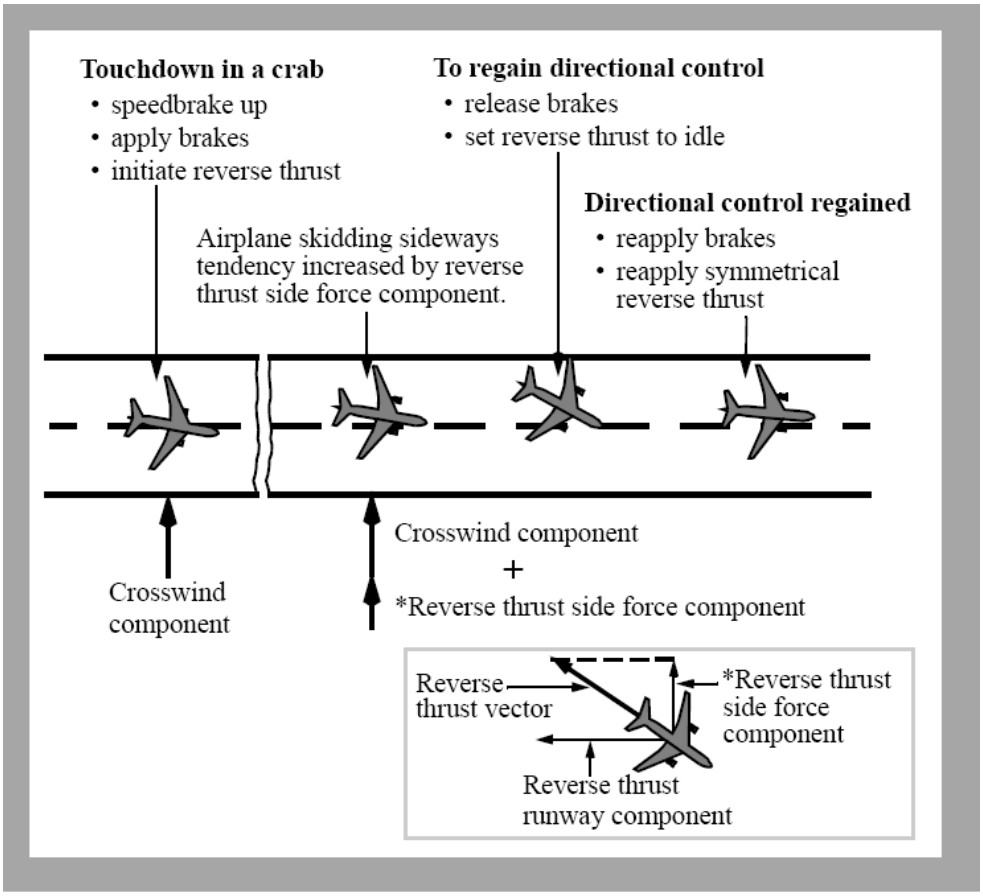
- *stabilized on approach airspeed to within + 10 knots until arresting descent rate at flare.*
- *on a stabilized flight path using normal maneuvering.*
- *positioned to make a normal landing in the touchdown zone (the first 3,000 feet or first third of the runway, whichever is less).*

Initiate a go-around if the above criteria cannot be maintained.

Directional Problem during the Landing Roll

The procedure to regain directional control is described in the FCTM page 6.31.

Reverse Thrust and Crosswind (All Engines)



This figure shows a directional control problem during a landing rollout on a slippery runway with a crosswind. As the airplane starts to weathervane into the wind, the reverse thrust side force component adds to the crosswind component and drifts the airplane to the downwind side of the runway. Also, high braking forces reduce the capability of the tires to corner.

To correct back to the centerline, release the brakes and reduce reverse thrust to reverse idle. Releasing the brakes increases the tire-cornering capability and contributes to maintaining or regaining directional control. Setting reverse idle reduces the reverse thrust side force component without the requirement to go

through a full reverser actuation cycle. Use rudder pedal steering and differential braking as required, to prevent over correcting past the runway centerline. When directional control is regained and the airplane is correcting toward the runway centerline, apply maximum braking and symmetrical reverse thrust to stop the airplane.

***Note**: Use of this technique increases the required landing distance.*

2 ANALYSIS

The FDR data showed that during the approach from 550 feet, the aircraft was on the ILS approach profile. A few seconds after touchdown it showed that the aircraft veered to the right of the runway 13 and returned to the runway a few seconds later.

The investigation examined the FDR data recorded from radio altitude 550 feet through the landing roll up to point where the aircraft speed reduced to 60 knots. Additionally, the investigation examined the decision to continue the approach and land the aircraft and the directional control after touched down.

2.1 The Decision to Continue the Approach and Land the Aircraft

At 10.36 UTC, the aircraft was approximate at Radio Altitude 550 feet, the SIC as PF felt uncomfortable with the rain conditions (check the transcript whether the visibility also become consideration) and suggested going-around. The PIC, as PM, advised that the runway was in sight and decided to continue the landing approach and took over control of the aircraft.

At the time when the SIC suggested to go around, the FDR showed that the aircraft was on the correct flight path for the ILS approach. At an altitude between 300 – 200 feet above the ground, the auto pilot and throttle were disengaged and the PIC flew the aircraft manually. The heading, speed and roll were mostly within the normal range for an approach.

At aircraft altitude approximately 10 feet, the SIC advised the PIC to fly left. The PIC responded as indicated by the aircraft heading changing from 129° to 126° at touchdown and continuing left to 106° for 8 seconds during the landing roll.

The FCTM chapter on stabilized approaches stated that the aircraft should be on a stabilized flight path using normal maneuvering and in position to make a normal landing in the touchdown zone when crossing the runway threshold. If the criteria cannot be maintained a go-around should be initiated.

The Decision Altitude (DA) for the runway 13 ILS approach was 344 feet with a minimum visibility of 1,200 meters. At the time the SIC suggested going around, the aircraft was in the proper configuration and well above the published DA and visibility was greater than the minimum. In this situation, the procedure permitted a pilot to continue the approach until the DA or, if when the runway was in sight, but the aircraft was in an un-stabilized approach condition or other conditions which endangered the safety of the flight, the pilot should initiate a go-around. The decision rested with the PF and overriding decision made by the PIC.

The relative low experience of the SIC, under line training, and never having previously experienced rain condition on an approach suggested a go-around. Under these circumstances the SIC’s discomfort was understandable and the suggestion to go-around was reasonable.

The PIC’s decision to take over the control as PF was appropriate. Consequently, the directional control of the aircraft was the responsibility of the PIC as PF. The SIC advised the PF to fly left when crossing the runway threshold in order to regain runway centerline.

2.2 Directional Control after Touch Down

The FCTM on Reverse Thrust Operation, described that after touchdown, rapidly select the thrust reversers. The PM should monitor the engine parameters and their limitations and inform the PF of any deviations.

The FDR data recorded that at touchdown the left thrust reverser deployed a second before the right thrust reverser, momentarily resulting in asymmetric reverse thrust. Three seconds later the N1 of the right engine was greater than that of the left engine, with a momentary differential value recorded up to 35%.

The increasing of the N1 after the thrust reverser deployed would increase the drag and asymmetric reverse thrust would also create asymmetric drag. The N1 of the right engine was greater than the left engine which mean that the drag induced by the right engine was greater than the left engine. This condition led to the aircraft veered to the right.

During the landing roll, the CVR did not record any communication from the PM to the PF about the engines parameters. The SIC might not have fully adapted to the role of PM following the handover of control to the PIC. This led to the continued asymmetry of the reverse thrust, and worsening the situation.

Moreover, the FDR also showed asymmetric brake pressure application 12 seconds after touchdown, in which the average left brake pressure was 200 psi greater. The FCTM stated that the reverse thrust side force component drifts the airplane to the downwind side of the runway and high braking forces reduce the capability of the tires to corner in order to regain the aircraft direction.

The brake and reverse thrust applications were not in accordance with the FCTM procedure for regaining the directional control and consequently led to the aircraft diverging from the runway during the landing roll.

3 CONCLUSIONS

3.1 Findings

1. The aircraft was airworthy prior to departure and was within the weight and balance envelope.
2. The pilots were appropriately licensed and held valid medical certificates.
3. The Second in Command (SIC) acted as the Pilot Flying (PF) and the Pilot in Command (PIC) acted as the Pilot Monitoring (PM).
4. There were no technical and or system abnormalities reported or recorded during the flight.
5. The controller informed the pilot about the current wind direction from 140° between 6 and 10 knots, and the crew having assessed conditions requested runway 13 for landing.
6. When the aircraft was approximate at Radio Altitude of 550 feet, the SIC as a PF suggested going around but the PIC as a PM advised that the runway was in sight and to continue the landing approach, and took over control. At 300 feet, the wind component changed from a tailwind to a headwind at an approximate speed of 5 kts.
7. At approximate 20 feet the heading gradually changed from 129° to 126° at touchdown and at approximate 10 feet the SIC advised the PF to fly left.
8. After touchdown the aircraft heading on 106° during roll for 8 seconds.
9. The left thrust reverser deployed a second before the right thrust reverser and the average value of the right engine N-1 was greater than the left engine, with the maximum differential value of up to 35%. The asymmetric thrust led to the aircraft veered to the right.
10. The PM did not advise the differential N-1 during reverse thrust application.
11. The asymmetric brake pressure application 12 seconds after touchdown, in which the average left brake pressure was 200 psi greater.
12. The action of the PIC to correct the directional control was not according with the published procedures.

3.2 Contributing Factors

- The reverse thrust was applied asymmetrically and no advice of the differential N1 during reverse thrust application provided
- The braking and reverse thrust application to correct the directional control was not in accordance with the published procedures.

4 SAFETY ACTIONS

After this serious incident, the aircraft operator published Aviation Safety Notice number DS/1/2012/N-003 to the flight crew related to precaution of wet landing on Sultan Hasanuddin Airport runway 13–31.

5 SAFETY RECOMMENDATIONS

At the time of issuing this safety recommendation, the operator had ceased operations from January 2014. As such this recommendation is addressed to the DGCA to take the benefits from the analysis and this might be used as a lesson learned for the other operators. The KNKT recommends that;

- **04.R-2016-1.1**

  The operator should review the un-stabilized approach procedure and emphasize the corrective directional control action during the landing roll.

  The references for the lesson learned:

- FCTM page 5.5 that described criteria for when an aircraft crosses the runway threshold on landing.
- FCTM page 6.31 that described directional problems during the landing roll.

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