

FINAL
KNKT.14.10.24.04

KOMITE NASIONAL KESELAMATAN TRANSPORTASI

Aircraft Serious Incident Investigation Report

PT. Cardig Air
Boeing 737-300; PK-BBS
Wamena Airport
Republic of Indonesia
24 October 2014



NATIONAL TRANSPORTATION SAFETY COMMITTEE
REPUBLIC OF INDONESIA
2015



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 KNKT in accordance with Annex 13 to the Convention on International Civil Aviation Organization, the Indonesian Aviation Act (UU No. 1/2009) and Government Regulation (PP No. 62/2013).

The final report consists of factual information collected until the final report published. This report includes analysis and conclusion.

Readers are advised that the KNKT investigates for the sole purpose of enhancing aviation safety. Consequently, the KNKT reports are confined to matters of safety significance and may be misleading if used for any other purpose.

As the KNKT believes that safety information is of greatest value if it is passed on for the use of others, readers are encouraged to copy or reprint for further distribution, acknowledging the KNKT as the source.

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.

TABLE OF CONTENTS

TABLE OF CONTENTS	i
TABLE OF FIGURES	ii
ABBREVIATIONS AND DEFINITIONS	iii
INTRODUCTION	v
1 Factual Information	1
1.1 History of the Flight.....	1
1.2 Organizational and Management Information	8
1.2.1 Flight Crew Operation Manual (FCOM) chapter Performance In flight.....	8
1.2.2 Standard Operating Procedure (SOP).....	9
1.3 Additional Information	11
1.3.1 Certification revision for runway length of Wamena Airport	11
1.3.2 Civil Aviation Safety Regulation (CASR)	11
1.3.3 Runway excursion occurrences at Wamena airport last 2 years.....	12
2 ANALYSIS	13
2.1 Decision to continue approach.....	13
2.2 Landing Distance Calculation.....	14
2.3 Post occurrence pilot decision to taxi the aircraft	15
3 CONCLUSIONS	16
3.1 Findings.....	16
3.2 Contributing Factors	17
4 SAFETY ACTION	18
4.1 PT. Cardig Air.....	18
5 SAFETY RECOMMENDATIONS	19
5.1 PT. Cardig Air.....	19
5.2 Wamena Airport Management.....	19
5.3 Directorate General of Civil Aviation (DGCA).....	19

TABLE OF FIGURES

Figure 1: Aircraft involved	1
Figure 2: The video footage of the aircraft on short final.....	2
Figure 3: The video footage made by a person on ground Wamena of the accident flight from short final until taxi to runway	2
Figure 4: Aircraft trajectory based on FDR data and superimposed to Google earth	3
Figure 5: The wheel marks found on RESA surfaces after the occurrence	3
Figure 6: The damage of left & right engine fan blades.....	4
Figure 7: FDR graph of relevant information from 800 feet AGL.....	5
Figure 8: Table of significant data from approximately 800 feet AGL until the aircraft stop at RESA.....	6

ABBREVIATIONS AND DEFINITIONS

AGL	:	Above ground level
ALAR/CFIT	:	Approach landing reduction/ control flight into terrain
AIP	:	Aeronautical Information Publication
ARFF	:	Airport Rescue and Fire Fighting
ATPL	:	Air Transport Pilot License
BMKG	:	<i>Badan Meterologi Klimatologi dan Geofisika</i> (Metrological Climatology and Geophysical Agency)
°C	:	Degrees Celsius
CASR	:	Civil Aviation Safety Regulation
CPL	:	Commercial Pilot Licence
CVR	:	Cockpit Voice Recorder
DFDR	:	Digital Flight Data Recorder
DGCA	:	Directorate General of Civil Aviation
DJJ	:	Jayapura
GPWS	:	Ground Proximity Warning Systems
FCOM	:	Flight Crew Operation Manuals
FCTM	:	Flight Crew Training Manuals
FOD	:	Foreign object damage
ICAO	:	International Civil Aviation Organization
Kg	:	Kilogram(s)
KNKT	:	Komite Nasional Keselamatan Transportasi
mbs	:	Millibars
ND	:	Navigation Display
Notam	:	Notice to airman
PF	:	Pilot Flying
PIC	:	Pilot in Command
PM	:	Pilot Monitoring
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
RTB	:	Return to Base
S/N	:	Serial Number

SIC : Second in Command
Twr : Tower
UTC : Universal Time Coordinate
VOR : VHF Omni-directional Range
VFR : Visual Flight Rules
WMX : Wamena

INTRODUCTION

SYNOPSIS

On 24 October 2014 a Boeing 737-300 Freighter, registration PK-BBS operated by PT. Cardig Air was on scheduled cargo flight. At 03:34 UTC the aircraft departed from Sentani Airport (WAJJ) Jayapura to Wamena Airport (WAJW) Papua of Indonesia.

On board in this flight were two pilots, and 14844 Kg of cargo. The Pilot in Command (PIC) acted as Pilot Flying (PF) while the Second in Command (SIC) acted as Pilot Monitoring (PM). There was no reported nor recorded that the aircraft had system abnormality during the flight until the time of the occurrence.

At about 15 minutes prior to the occurrence, the weather reported was the wind calm, visibility 10 Km and rain insight in the vicinity of the airport. The runway 15 was in used and according to the Aeronautical Information Publication (AIP) there was no instrument approach procedure and all incoming and departure flights refers to the Visual Flight Rule.

The aircraft was flown in the proper weight and balance margin and in the estimate landing weight of 51.114 kgs, and when approach for landing runway 15 the pilot had selected Flap 40° with Vref 133 Knots and auto-brake 3.

The pilot saw the runway was approximately at 700 ft AGL and Wamena Tower informed the pilot that cleared to land following an advice that there was no rain on the runway.

At 04.06:16 UTC the aircraft touched down and full reversed thrust was applied. During landing roll the pilot did not feel any deceleration and then the pilot applying the manual brake and keeping full reverse thrust. The aircraft stopped at the Runway End Safety Area (RESA).

The aircraft was taxied from the RESA to the apron by the pilot, and the inspections found that number 3 and 4 tires spotted, both engines fan blades and the left side of aircraft horizontal stabilizer damaged.

The investigation concluded that the contributing factors of this occurrence was that the approach was conducted when the weather was below minima for VFR and required for return to Jayapura according to the company SOP and resulted the aircraft touchdown at approximately 719 meters beyond the touchdown zone.

At the time of issuing this final report the Komite Nasional Keselamatan Transportasi (KNKT) had received safety actions taken by PT. Cardig Air following this serious incident. The safety actions consider relevant and KNKT does not issue safety recommendation to PT. Cardig Air.

On this final report the Komite Nasional Keselamatan Transportasi (KNKT) issued several safety recommendations addressed to Wamena Airport management and Directorate General of Civil Aviation (DGCA).

1 FACTUAL INFORMATION

1.1 History of the Flight

On 24 October 2014 a Boeing 737-300 Freighter, registration PK-BBS operated by PT. Cardig Air was on scheduled cargo flight from Sentani Airport (WAJJ) Jayapura, to Wamena Airport (WAJW), Papua, Indonesia with flight number 8F197. The aircraft departed at 03:34 UTC and on board in this flight were two pilots and 14844 Kgs of cargo. This flight was the 2nd scheduled flight of the day for the aircraft and the crew with same route.

The Pilot in Command (PIC) acted as Pilot Flying (PF) while the Second in Command (SIC) acted as Pilot Monitoring (PM). There was no report or record of aircraft system abnormality during the flight. All equipment, facilities, such as, navigation aids, communication and supporting operational facilities in Wamena Airport operated normally.



Figure 1: Aircraft involved

The weather reported by the Wamena Tower controller at 03.10 UTC wind 150/08, visibility 10 Km, Cloud Few 067 CB, temperature 26°C, dew point 16°C, QNH 1005, QFE 833 and rain insight.

Wamena Airport is situated on a valley and surrounded by mountains up to 13,000 feet. There were three ways, which commonly called gap, to enter and exit to the valley. The gaps are Middle Gap, Bokondini Gap and North Gap. The nearest gap for a flight from Sentani is via North Gap, with the route from point MALEO on airways W 67, to point PASS VALLEY which located on the centre of the gap, proceed to point JIWIKA which located at end of the gap and proceed Wamena Airport.

The flight was in accordance with Operational Flight Plan, which was via airway W67 to North Gap then to Wamena Airport. There was no instrument approach procedure published for Wamena Airport, therefore all incomings and departures flight refers to the Visual Flight Rule (VFR).

The aircraft was in the proper weight and balance margin with estimate landing weight of 51114 kgs and landing configuration of flap 40°, the landing speed (Vref) would be 133 Knots and auto-brake 3.

While aircraft descending and approaching the airport, the Wamena Tower controller informed to the pilot that the runway in used was runway 15.

At 04:05:28 UTC the aircraft was on final at approximately 700 feet AGL, the pilot reported to the Wamena Tower controller that the runway was insight and then Wamena Tower issued clearance to land with additional information that there was no rain on the runway.

Investigation received video footage of the aircraft during the approach until taxi to apron. The video was taken by a person from Wamena apron.



Figure 2: The video footage of the aircraft on short final

The video footage shows that the aircraft roll to the right and headed to the person taking the video.



Figure 3: The video footage made by a person on ground Wamena of the accident flight from short final until taxi to runway

At 04:06:17 UTC the aircraft touched down and the pilot applied full reversed thrust. During landing roll the pilot did not feel the deceleration, the pilot then applied

manual brake and keeping full reverse thrust. The aircraft stopped at the Runway End Safety Area (RESA).

After the aircraft stopped the Wamena Tower controller asking whether the pilot able to make a turn and taxi the aircraft to the apron. The pilot responded that he would try. The pilot taxi and turned the aircraft to the right approximate 180° then continued taxi to apron via taxiway D.

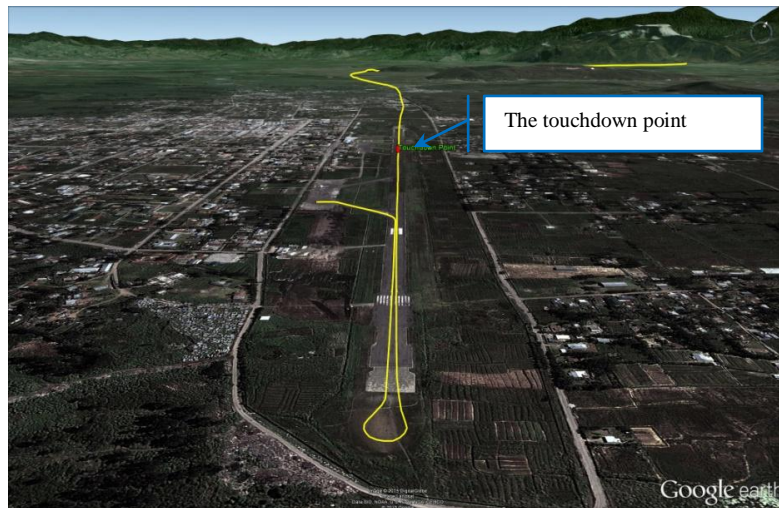


Figure 4: Aircraft trajectory based on FDR data and superimposed to Google earth



Figure 5: The wheel marks found on RESA surfaces after the occurrence

After the aircraft parked on the apron, the aircraft inspections found that number 3 and 4 tires spotted, fan blades of both engines and the left side of aircraft horizontal stabilizer damaged.

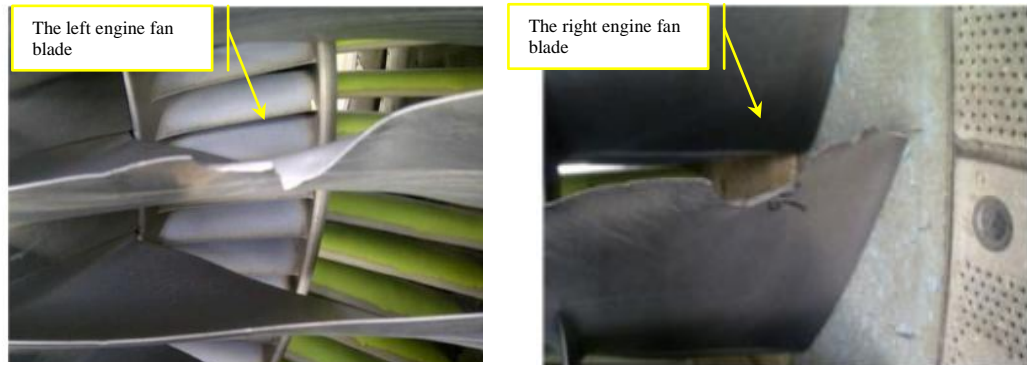


Figure 6: The damage of left & right engine fan blades

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

The PIC was 42 years old, ATPL holder and Indonesia nationality pilot. The pilot has flying experience with total of 10,368 hours, including 5,200 hours on type. During the interview the PIC stated that the stopway and RESA were provided for overrun and it is allowed to taxi the aircraft on these areas.

The SIC was 43 years old CPL holder Indonesia nationality pilot. The pilot has flying experience with total of 6,500 hours, including 4,800 hours on type.

The Boeing 737-300 Freighter aircraft registration PK-BBS with serial number 23258, has total Time Since New (TSN) was 73,077 hours and 55 minutes and total Cycles Since New (CSN) was 49,662 cycles. The engines installed were manufactured by General Electric with Type/Model CFM56-3B2, the serial number of engine 1 was 725177 and the engine 2 was 7257454.

The Flight Data Recorders (FDR) and Cockpit Voice Recorder (CVR) were downloaded at KNKT facility. The recorders data were found good and contain the information of the occurrence flight.

The graph of the aircraft landing profile from 800 feet AGL to a point the aircraft taxied and parked at apron was used for analysis of this occurrence.

The graph and table shows the significant flight events until stopped at RESA area of runway 15.

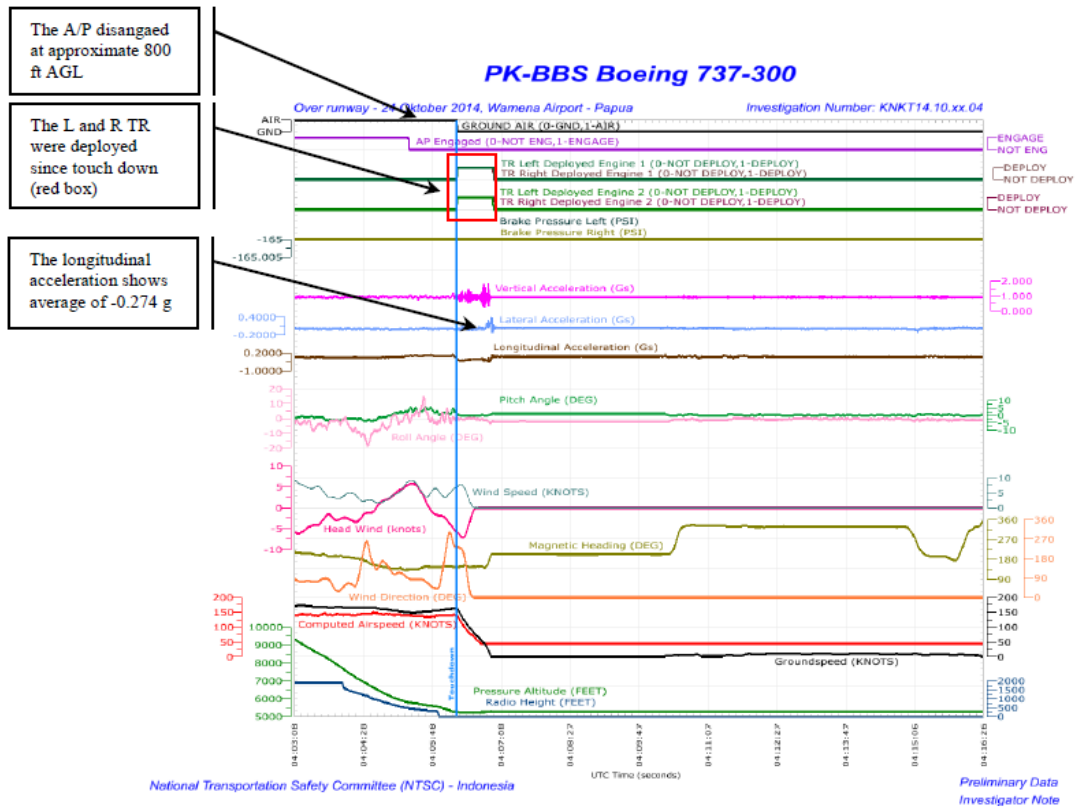


Figure 7: FDR graph of relevant information from 800 feet AGL

UTC Time (seconds)	Pressure Altitude	Radio Height	Comp Airspeed	Groundspeed (kts)	GROUND AIR	Vert Acc	Brake Press L (PSI)	Brake Press R (PSI)	AP ENGAGED	Roll Angle (DEG)	TR DEPLOYED	Mag Head	Long Acc	Head Wind	Wind Direction
4:05:23	5780		139	149	AIR	1,0	-165	NOT		-2	NOT	134,3	0,0	5,8	84,5
4:05:24	5772	446	138	149	AIR	1,0	-165	NOT		0	NOT	133,9	0,0	5,8	84,1
4:05:37	5680		136		AIR	0,9	-165	NOT		11	NOT	143,8	0,0	3,0	80,9
4:05:38	5672	363	138		AIR	1,0	-165	NOT		14	NOT	145,9	0,0	2,6	78,9
4:05:39	5664		135		AIR	1,0	-165	NOT		14	NOT	147,7	0,0	2,2	76,5
	5632		134	152	AIR	0,9	-165	NOT		3	NOT	147,7	0,0	0,5	62,9
4:05:44	5624	335	134	152	AIR	0,9	-165	NOT		0	NOT	147,3	0,0	0,1	59,1
	5620		134	153	AIR	0,9	-165	NOT		-2	NOT	147,3	0,0	-0,3	55,5
	5612	324	135	153	AIR	1,0	-165	NOT		-3	NOT	147,0	0,1	-0,6	52,1
	5608		136	154	AIR	1,0	-165	NOT		-1	NOT	146,3	0,1	-0,9	49,1
4:05:53	5568		140	156	AIR	0,9	-165	NOT		-4	NOT	144,8	0,0	-1,7	40,0
16:06:02	5400		139		AIR	1,0	-165	NOT		6	NOT	148,0	0,0	-3,0	255,5
4:06:12	5284	20	140	162	AIR	1,1	-165	NOT		1	NOT	147,3	0,1	-4,9	251,1
	5272		142	163	AIR	1,1	-165	NOT		1	NOT	147,0	0,1	-5,1	241,6
	5276	20	141	164	AIR	0,9	-165	NOT		-1	NOT	146,3	0,0	-5,3	236,8
	5268		141	163	AIR	1,0	-165	NOT		0	NOT	146,3	-0,1	-5,5	235,1
4:06:16	5272	20	139	162	AIR	0,9	-165	NOT		-2	NOT	145,9	-0,1	-5,7	234,5
	5268		139	161	GND	0,9	-165	NOT		-1	DEP	146,3	-0,2	-5,9	233,7
	5256	20	136		GND	0,9	-165	NOT		1	DEP	147,0	-0,3	-6,1	232,4
	5244		131	154	GND	0,7	-165	NOT		0	DEP	147,3	-0,3	-6,3	231,0
4:06:20	5236	20	126		GND	0,9	-165	NOT		-1	DEP	147,7	-0,3	-6,6	229,6
	5232		121	144	GND	0,8	-165	NOT		0	DEP	147,7	-0,3	-6,8	228,3
	5232	20	116	139	GND	1,1	-165	NOT		0	DEP	148,4	-0,3	-7,0	225,4
	5232		112		GND	0,6	-165	NOT		-1	DEP	149,4	-0,3	-7,1	219,0
4:06:24	5236	20	107	130	GND	1,2	-165	NOT		-1	DEP	150,5	-0,3	-7,1	207,3
	5236		103		GND	1,1	-165	NOT		-1	DEP	151,9	-0,4	-6,9	189,0
	5236	20	100		GND	0,8	-165	NOT		-1	DEP	151,9	-0,3	-6,5	165,4
	5240		95		GND	0,7	-165	NOT		0	DEP	150,8	-0,2	-6,0	138,4
4:06:28	5240	20	92		GND	1,0	-165	NOT		0	DEP	149,4	-0,3	-5,4	110,1
	5244		88		GND	0,8	-165	NOT		0	DEP	148,0	-0,3	-4,8	82,3
	5248	20	86		GND	1,1	-165	NOT		0	DEP	147,3	-0,2	-4,2	56,7
	5248		82		GND	1,1	-165	NOT		0	DEP	146,6	-0,3	-3,5	34,8
4:06:32	5248	20	79		GND	0,7	-165	NOT		0	DEP	146,3	-0,2	-2,8	18,1
	5248		76		GND	1,0	-165	NOT		0	DEP	146,6	-0,3	-2,1	7,6
	5248	20	75		GND	0,7	-165	NOT		0	DEP	147,3	-0,2	-1,5	2,3
	5248		73		GND	1,1	-165	NOT		0	DEP	147,7	-0,2	-0,9	0,3
4:06:36	5248	20	70		GND	0,8	-165	NOT		0	DEP	147,3	-0,2		
	5248		66		GND	1,0	-165	NOT		0	DEP	147,3	-0,2		
	5252	20	63		GND	0,9	-165	NOT		0	DEP	147,3	-0,2		
	5252		61	74,5	GND	0,9	-165	NOT		-1	DEP	147,0	-0,2		
4:06:40	5252	20	57		GND	1,1	-165	NOT		-1	DEP	148,0	-0,2		
	5252		55	68,5	GND	0,9	-165	NOT		0	DEP	148,4	-0,2		
	5252	20	51	65,5	GND	1,1	-165	NOT		-1	DEP	147,3	-0,2		
	5252		49		GND	1,0	-165	NOT		-1	DEP	148,0	-0,2		
4:06:44	5252	20	47	59,5	GND	0,7	-165	NOT		-1	DEP	150,1	-0,2		
	5256		45	56,5	GND	0,6	-165	NOT		-1	DEP	150,5	-0,2		
	5256	20	45		GND	0,8	-165	NOT		0	DEP	149,1	-0,2		
	5256		45	51	GND	0,6	-165	NOT		-1	DEP	147,0	-0,4		
4:06:48	5256	20	45		GND	0,8	-165	NOT		-1	DEP	143,8	-0,2		
	5256		45	43,5	GND	1,3	-165	NOT		-1	DEP	143,4	-0,4		
	5264	20	45		GND	0,6	-165	NOT		-1	DEP	147,0	-0,2		
	5264		45	35	GND	0,8	-165	NOT		-1	DEP	149,8	-0,3		
4:06:52	5264	20	45		GND	1,1	-165	NOT		-1	DEP	154,7	-0,4		
	5256		45	24,5	GND	0,5	-165	NOT		-2	DEP	163,8	-0,3		
	5272	20	45	19	GND	0,7	-165	NOT		-2	DEP	174,7	-0,4		
	5284		45		GND	1,1	-165	NOT		-3	DEP	184,9	-0,4		
4:06:56	5300	20	45		GND	1,0	-165	NOT		-3	DEP	195,1	-0,3		
	5292		45	1	GND	0,9	-165	NOT		-3	DEP	204,3	-0,3		

At about 700 ft aircraft was at normal speed & configuration

The aircraft rolled 11° left then 14° right

At approximate 550 ft the aircraft speed down to below min speed

The wind direction changed from north easterly to short westerly, wing calm

Aircraft touched down at Vref + 4 kts and the reversers deployed and brakes activated along the runway.

Thrust Reversers deployed on landing roll

Total time since touched down is 40 Seconds

Figure 8: Table of significant data from approximately 800 feet AGL until the aircraft stop at RESA

The pilot and tower controller communication recorded by the Cockpit Voice Recorder (CVR) for the last approximately 26 minutes.

UTC	From	To	RECORDED
3:55:05.638	P1	Twr	The pilot informing Wamena Tower that the flight still maintaining FL 180 and will leave North Gap at FL 140 and arrival Wamena at 0405.
3:58:06.279	P1	Twr	P1 call to Wamena tower
3:58:10.357	Twr	P1	Go ahead
3:58:13.590	P1	Twr	Report position at Five miles to pass Valley FL 155 and estimate arrival Wamena at 0405 UTC
3:58:20.922	Twr	P1	Wamena tower acknowledge Cardig 197 position at 5 miles Pass Valley passing FL 155 arrival 0405 UTC and inform runway in use 15, QNH 1006 ,temperature 16° and must be report over Jiwika
3:58:34.246	P1	Twr	P1 acknowledge for report over Jiwika
3:58:39.086	Twr	P1	Wamena Tower informed rain over the field, on short final heavy rain
3:58:46.623	P1	Twr	P1 Acknowledge
3:58:50.824	Twr	P1	Tower informed that any traffic behind Cardig 187 arrival will be 0411 UTC
3:58:56.323	Twr	P1	P1 acknowledge about the traffic
4:02:21.893	P1	Twr	P1 report leaving Jiwika 10000 feet
4:02:26.362	Twr	P1	Tower acknowledge and instructed report Jiwika
4:02:29.348	P1	Twr	P1 acknowledge and will report on Final 15
4:02:31.902	P1	Twr	P1 asked about rain on short final
4:02:35.568	Twr	P1	Answer that on final still rain but runway was clear
4:02:41.046	P1	Twr	P1 acknowledge
4:04:40.944	P1	Twr	P1 report position on final 15
4:04:43.622	Twr	P1	Tower asked confirm runway insight
4:04:46.320	P1	Twr	runway not yet insight
4:04:48.049	Twr	P1	Tower acknowledge and instructed report when runway insight
4:04:50.150	P1	twr	Report runway insight
4:05:00.200	GPWS		One Thousand warning
4:05:21.000			Sound similar to auto pilot disengage
4:05:28.826	P1	Twr	P1 report runway insight
4:05:30.720	Twr	P1	Tower informed runway in use 15, QNH 1006 and clear to land
4:05:31.874	GPWS		Five Hundred
4:05:35.395	P1	Twr	P1 Answer Clear to land
4:06:05.607	P2	P1	Inform crosswind three knots
4:06:06.678	P1	P2	Acknowledge
4:06:07.625	GPWS		One Hundred
4:06:10.467	GPWS		Fifty
4:06:11.456	GPWS		Forty
4:06:12.156	GPWS		Thirty
4:06:12.856	GPWS		Twenty
4:06:13.597	GPWS		Ten
4:06:17.161			Touchdown
4:06:29.949	P2		P2 call out Auto-brake disarm
4:07:01.087	P2	P1	Aircraft stopped
4:07:19.313	P1	Twr	Report about the cardig 197 overrun
4:07:21.609	Twr	P1	Asked can make 180 turn
4:07:23.813	P1	Twr	Tried make 180 turn
4:08:33.174	P1	Twr	P1 request the personal for check the aircraft
4:10:35.358	P1	Twr	P1 report possible taxi to the runway proceed to apron
4:10:36.913	Twr	P1	Tower given clearance to apron via taxiway delta
4:21:58.042			end of recording

1.2 Organizational and Management Information

The Operator held Air Operator Certification No. AOC/ 121-013, and the head office were at Alia Building 4th Floor, Ridwan Rais street No. 10-18, Jakarta 10110, Indonesia.

The operator publish Standard Operating Procedures (SOP) of Boeing B 737-Series is a brief standard procedure of the operator's flight crew's operation design as a supplement to the Boeing 737-Series FCOM / FCTM and used as approved manual.

The objective of the manual is to concur upon a safe and efficient operation, uniformity built to maintain airmen's self-discipline therefore this SOP is an obligatory.

1.2.1 Flight Crew Operation Manual (FCOM) chapter Performance In flight

The chapter Performance In Flight (PI) is used to calculate the normal and non normal landing distance with certain aircraft configuration and environment conditions. The table on page PI.12.3 below shows the normal configuration Landing Distance Flap 40° and dry runway with certain reported braking actions.

737-300/CFM56-3_22K
FAA

Performance Inflight
Advisory Information

737 Flight Crew Operations Manual

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

Dry Runway

BRAKING CONFIGURATION	LANDING DISTANCE AND ADJUSTMENTS (FT)											
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ PER 10 KTS		SLOPE ADJ PER 1%		TEMP ADJ PER 10°C		VREF ADJ	REVERSE THRUST ADJ	
	48000 KG LANDING WEIGHT	PER 5000 KG ABOVE/BELOW 48000 KG	PER 1000 FT ABOVE/SEA LEVEL	HEAD WIND	TAIL WIND	DOWN HILL	UP HILL	ABV ISA	BLW ISA	PER 10 KTS ABOVE VREF40	ONE REV	NO REV
MAX MANUAL	2520	290/-160	50	-90	320	30	-30	50	-50	200	30	120
MAX AUTO	3200	260/-220	70	-120	410	0	0	70	-70	320	0	10
AUTOBRAKE 3	4430	400/-370	110	-200	680	20	-40	110	-110	450	40	60
AUTOBRAKE 2	5250	520/-480	150	-260	890	90	-110	140	-140	420	200	200
AUTOBRAKE 1	5650	600/-540	170	-300	1040	170	-170	150	-150	420	560	890

The Dry Runway landing distance for landing weight 51144 = 3590 feet

Good Reported Braking Action

MAX MANUAL	3440	290/-250	80	-160	550	80	-70	80	-80	280	150	560
MAX AUTO	3650	310/-280	90	-160	570	60	-50	80	-80	320	170	620
AUTOBRAKE 3	4440	400/-370	110	-200	690	30	-40	110	-110	450	40	200
AUTOBRAKE 2	5250	520/-480	150	-260	890	90	-110	140	-140	420	200	200
AUTOBRAKE 1	5650	600/-540	170	-300	1040	170	-170	150	-150	420	560	890

The Dry Runway landing distance for landing weight 51144 = 5472 feet

Medium Reported Braking Action

MAX MANUAL	4500	430/-380	120	-240	890	180	-150	110	-110	340	410	1770
MAX AUTO	4520	440/-390	120	-240	890	160	-120	110	-110	400	410	1750
AUTOBRAKE 3	4820	460/-410	130	-250	930	130	-110	120	-120	450	320	1730
AUTOBRAKE 2	5580	530/-500	150	-280	1010	160	-160	140	-140	420	270	1180
AUTOBRAKE 1	5680	600/-550	170	-300	1080	210	-180	150	-150	420	580	1440

The Medium reported Braking Action landing distance = 1832meter

Poor Reported Braking Action

MAX MANUAL	5620	580/-510	170	-350	1360	400	-270	140	-140	390	810	4890
MAX AUTO	5620	580/-510	170	-350	1360	400	-260	140	-140	410	800	4910
AUTOBRAKE 3	5660	590/-520	170	-350	1370	390	-260	140	-140	420	840	4950
AUTOBRAKE 2	5930	610/-560	170	-360	1400	380	-270	150	-150	420	670	4630
AUTOBRAKE 1	6100	650/-590	190	-370	1430	410	-300	160	-160	420	820	4610

Reference distance is for sea level, standard day, no wind or slope, VREF40 approach speed and two engine detent reverse thrust.

Max manual braking data valid for auto speedbrakes. Autobrake data valid for both auto and manual speedbrakes.

For max manual braking and manual speedbrakes, increase reference landing distance by 250 ft.

Actual (unfactored) distances are shown.

Includes distance from 50 ft above threshold (1000 ft of air distance).

Boeing Proprietary. Copyright © Boeing. May be subject to export restrictions under E.A.R. See title page for details.

June 18, 2010

D6-27370-4Y0K-GUI

PI.12.3

Refer to the table above the calculations of landing distance with aircraft landing weight of 51,144 kg for 3 different conditions:

1. dry (Good reported braking action) runway with Flaps 40°, reverse, auto brake
2. dry (Good reported braking action) runway with Flaps 40°, reverse, manual maximum brake
3. Medium Reported Braking Action (assuming wet runway), are as follows:

Adjustment of	Medium braking A/B 3	Good Braking A/B 3	Dry Runway, Max Manual Braking
Landing weight 48,000 kg	4820	4440	2520
Landing weight adjustment (3,144 kg above 48,000 kg)	289	251	520
Elevation 5000 ft	650	550	250
Wind (calm)	0	0	0
Temperature above ISA (26° C)	252	231	110
Vref (134 kts)	0	0	0
No reverse	0	0	0
Total	6011 ft /1832 meter	5472 ft /1668 m	3590 ft/1120m

1.2.2 Standard Operating Procedure (SOP)

The company Standard Operating Procedure stated that as part of the approach briefing, the pilot will refer to the auto brake selection for the certain runway length and conditions. The table on chapter 5.4.2.1 of the SOP shows several auto brake selection, runway condition and reference landing distances.


According to the interview with Management Personnel the SOP values is based on normal environment and at sea level.

Auto Brake Selection	Runway Condition	Landing Distance Available
1	DRY	More than 6000 feet
2	DRY	Less than 6000 feet
2	WET	More than 6000 feet
3	WET or SLIPPERY	Less than 6000 feet

Auto brake selection depicted above is minimum values, based on normal aircraft environment condition.

When environment condition are adverse, e.g. strong crosswind reduced visibility and or wet runway surface, and or directional asymmetry is anticipated during landing roll e.g. one engine inoperative landing, unserviceable or asymmetrical thrust reverser, it is recommended that the next higher auto brake selection to be use.

Standard Operating Procedure B737 – Series for Jayapura to Wamena.



STANDARD OPERATING PROCEDURE B 737 – SERIES

SPECIAL PROCEDURE DJJ - WMX
CHAPTER : SP

9. Flight Level :

Minimum cruising altitude is	FL.180
Transition Altitude	11.000 feet
Transition Level	FL 130

10. Alternate :

EnRoute Alternate
 Sentani Airport as First Alternate (RTB)
 Biak Airport as Second Alternate (if DJJ closed or WX below minima)

Note :
 Depend on situation and condition and Subject Captain Discretion.
 In case diverting to Biak , inform (asap) PT. CARDIG AIR for all arrangement in Biak.

Destination Alternate :
 Sentani Airport as First Alternate
 Biak Airport as Second Alternate

Note : Depend on situation and condition and Subject Captain Discretion
 In case diverting to Biak , inform (asap) operation PT. CARDIG AIR for all arrangement in Biak.

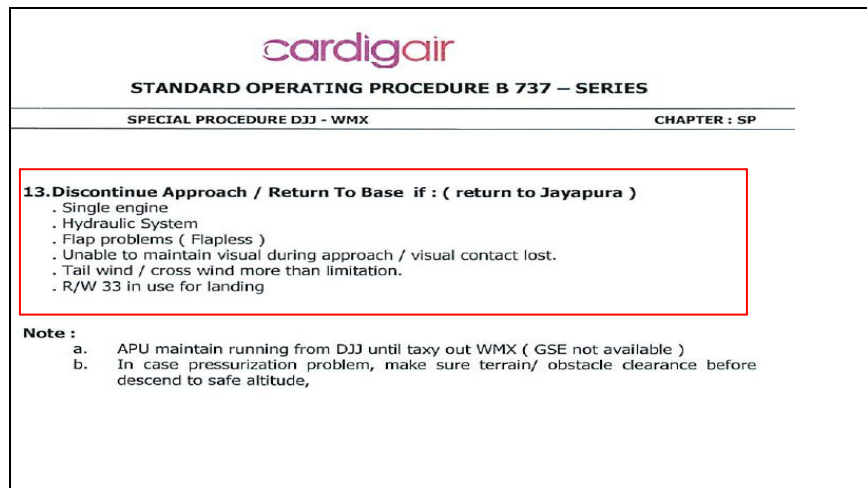
11. Position Report :

- a. The priority is to report to ATC as required by ATC.
- b. Maintain DJJ APP as long as possible for traffic info.
- c. Wamena Tower (121.00) , for positioning and Traffic monitor

12. Descent Approach WMX (RW 15 only) :

- a. Constraint alt and speed ON FMC as follow :
 - MALIO : 250 / 145
 - PSLEY : 210 / 125
 - JWKA : 180 / 105
 - XPOIN : 150 / 8500
- b. Should be VISUAL APPROACH,
 - Decision to discontinue Approach to be make as soon as visual flight condition can't be maintain
 - Closely , monitor out going and incoming traffic
- c. PASS VALEY start selecting flaps to flap 5
- d. JIWIKA, L/G Down and continue selecting flap for landing
- e. XPOIN, completed landing configuration (flap 40) and intercept final leg RW 15.
- f. On final leg, correct flight path and speed (avoid flat / low angle approach (N1 higher than usual due to high elevation
- g. Go around procedure :
 At 400' RA, HDG SEL, immediate turn to the **Right hdg 330**, bank limit 25 proceed to XPOINT (max distance is 2.5 NM abeam RW), maintain speed V2+15 and flap 5

Issued :
Revision : 0
Date : 14 May 2012
Page: 2 of 7



The red box shows the criteria which the pilots are requires for return to base (RTB) if one or more of the criteria are met.

1.3 Additional Information

1.3.1 Certification revision for runway length of Wamena Airport

Observation on the published runway length as of Aeronautical Information Publication (AIP) by the DGCA issued on November 2010 found that the runway length was 1755 m. The actual information of runway length observed by the KNKT after the occurrence as well as the information from the pilot during the interview, found that the runway length has been extended to 2050 meters since 2014. There was no Notice to Airman (NOTAM) published.

Concerning to these differences, the Wamena Airport management (Unit Penyelenggara Bandar Udara Kelas 1 Wamena) submitted the letter number UM/002/406/V/UPBU.WMN/2015 on 11 May 2015 proposing for revision of airport certification includes the additional runway length.

1.3.2 Civil Aviation Safety Regulation (CASR)

121.649 Takeoff and Landing Weather Minimums: VFR: Domestic Air Carriers

- a) Except as provided in Paragraph (b) of this section, regardless of any clearance from ATC, no pilot may takeoff or land an airplane under VFR for day operations when the reported ceiling or visibility is less than 1,000-foot ceiling and one-mile visibility.
- b) Where a local surface restriction to visibility exists (e.g., smoke, dust, blowing snow or sand) the visibility for day operations may be reduced to one-half (½) mile, if all turns after takeoff and prior to landing, and all flight beyond one mile from the airport boundary can be accomplished above or outside the area of local surface visibility restriction.
- c) The weather minimums in this section do not apply to the VFR operation of fixed wing aircraft at any of the locations where the special weather minimums of Section 91.157 of the CASRs are not applicable. The basic VFR weather minimums of Section 91.155 of the CASRs apply at those locations.

91.155 Basic VFR Weather Minimums

- (d) No person may take off or land an aircraft, or enter the traffic pattern of an airport, under VFR, within the lateral boundaries of the surface areas of Class B, Class C, Class D, or Class E airspace designated for an airport
 - (1) Unless ground visibility at that airport is at least 3 statute miles (4.8 km);
or
 - (2) If ground visibility is not reported at that airport, unless flight visibility during landing or takeoff, or while operating in the traffic pattern is at least 3 statute miles (4.8 km).

139.125 Notice of Changes in Information Published in AIP

1. The operator of registered aerodrome or heliport/ helideck or waterbase shall report any information changes to AIS.
2. Information in sub regulation (1) must be in written to AIS to be published in AIP.
3. The operator of registered aerodrome or heliport/helideck or waterbase shall clarify the published information to report back to AIS for the validity.

1.3.3 Runway excursion occurrences at Wamena airport last 2 years

According to the KNKT database, there were four runway excursions occurred involving two B737-300, and two BAe ATP at Wamena between 2013 and early 2015. Observation on such occurrences data available revealed that the weather was rain and the runway was wet when the aircraft approach and landing. Most of the occurrences were initiated by un-stabilized approach prior to landing.

2 ANALYSIS

The analysis of this report will discuss the relevant issues resulting in the runway excursion at Wamena Airport involving a Boeing 737-300 on 24 October 2014, registered PK-BBS.

The investigation examined focus on the data recorded on the CVR of the last six minutes conversation and FDR data begin at aircraft altitude of 700 feet until stopped at the RESA. Furthermore the other relevant operator's policies information and aircraft landing performance data such as, the Operator's SOP, current of Performance In Flight associated with landing distance calculation of the Boeing 737-300 manuals as well as Aerodrome Information Publication (AIP) data were also examined.

According to the report, the rain was around the final track of runway 15 prior to the aircraft touchdown, the analysis will therefore discuss on the following issues;

1. Decision to continue approach while loss of visual reference.
2. Landing distance calculation.
3. Post occurrence pilot decision to taxi the aircraft

2.1 Decision to continue approach

The policy in the Standard Operating Procedure manual Chapter SP describes the criteria as route guidance for pilot flying on sector Jayapura to Wamena. One of the criteria stated that the pilot should return to Jayapura when loss of visual contact during the approach.

The CVR data recorded that at 3:58:39 UTC the Wamena Tower controller informed that rain over the field with addition that on the short final was heavy rain. The conversation indicated the particular weather condition was also associated with visibility.

The conversation recorded that at 4:02:31 UTC pilot asked to Wamena Tower controller confirming of rain on short final, and was replied that on final was still raining while on runway was clear. Furthermore when the aircraft was about on final, the Wamena Tower controller asked the pilot whether they could see the runway, and the pilot replied that they still could not see the runway.

At 4:05:28 UTC. The pilot informed that the runway was in sight while the aircraft altitude was approximately at 700 ft AGL. The Wamena Tower controller issued landing clearance for runway 15. The aircraft touched down at 04:06:17 UTC.

The triangle formula shows that with 700 ft altitude and the average of 3° glide path will equal to approximately 3.7 km of slant range. This can be concluded that the visibility to enable the pilot see the runway at particular weather condition was approximately 3.7 km. Since there was no instrument approach procedure available for Wamena Airport and all incoming and departure aircraft shall be conducted under VFR. The visibility during the approach was below the VFR weather minima as described in CASR 91.155.

The company SOP describes that while the pilot unable to maintain visual during approach/visual contact loss the pilot should cancel the approach and return to Jayapura.

2.2 Landing Distance Calculation

The FDR data revealed the time from aircraft touchdown and rolling along the runway to the initial heading changed was 34 seconds. Other data were:

- Initial touchdown groundspeed (V_0)= 145 knot = 244.7 ft/s
- Average longitudinal acceleration (a) = - 0.265 g = - 8.54 ft/s

Based on these data the investigation calculated the distance of the ground roll.

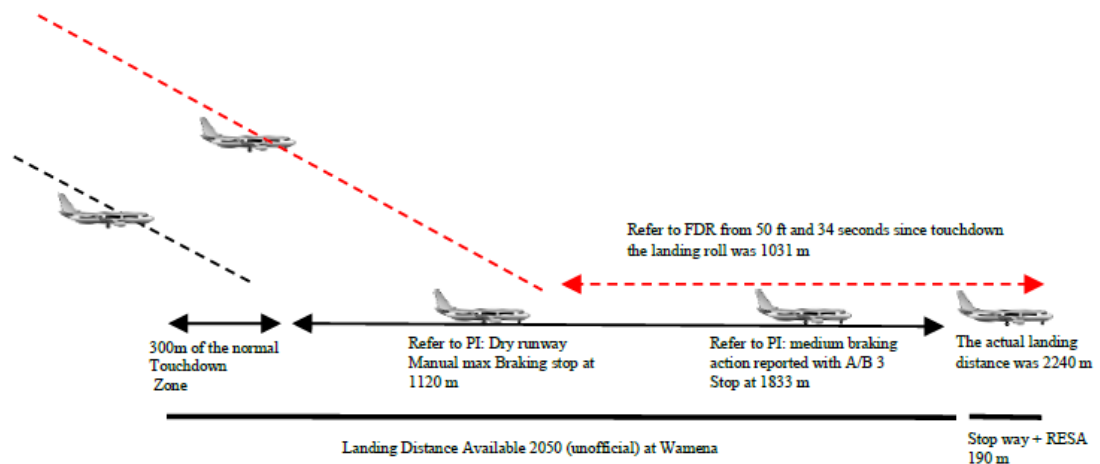
$$S = V_0 \cdot T + \frac{1}{2} a \cdot t^2$$

$$S = (244.7 \times 34) + \frac{1}{2} (-8.54 \times 34^2)$$

$$S = 3383 \text{ feet} = 1031 \text{ meter}$$

Hence, the distance of the ground roll was 1031 meters.

Illustration of the landing distance refers from FDR and Boeing manual on chapter Performance In Flight shows as follow:



Note:

- The right line is illustration of the flight path and the landing distance based on the calculation of FDR data.
- The black line is the illustration of the flight path based on the calculation from Boeing manual, chapter Performance In Flight with the landing weight of 51,144 kg for dry and medium braking action.

According to the calculation the particular condition (configuration flap 40, assumed the braking action was medium, auto brake 3 and normal approach profile), the aircraft would be able to stop at 1833 meter from the touchdown point or within the

available runway length.

The aircraft stopped at RESA after ground rolled of 1031 meters which include the distance on the RESA. The total runway length available was 2050 meter, as such it can be assumed the aircraft touched down around 1019 meters after the threshold runway 15 or approximately 719 meters beyond the normal touchdown zone.

2.3 Post occurrence pilot decision to taxi the aircraft

Runway End Safety Area (RESA) defines as an area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an airplane undershooting or overrunning the runway. The Wamena RESA was unpaved.

During the interview the PIC stated that the stop way and RESA were provided for overrun and it is allowed to taxi the aircraft on these areas.

The CVR recorded that after the aircraft stopped at the RESA, there was conversation between the Wamena Tower controller and the pilots concerning to the possibility pilot able to make 180° turn. The other conversation recorded from the pilot to the Wamena Tower that the pilot requested for person to check the aircraft while the engines were running.

Observation on some figures shows that the Airport Rescue and Fire Fighting and some airport ground staffs were at the stop-way when the aircraft taxiing. The conditions above indicated that the situation nearby the aircraft was unsafe for the persons as well as for the aircraft operation. The pilot decided to turn 180° and taxied the aircraft to the apron.

The post occurrence inspections found that both engines fan blades and the left side of aircraft horizontal stabilizer damaged which was most probably due to the FOD of excavated surface sucked by the engines when the aircraft was taxiing to the apron.

3 CONCLUSIONS

According to factual information and analysis of the investigation, the National Transportation Safety Committee concludes the findings of this investigation are.

3.1 Findings

According to factual information gathered during the investigation, the KNKT founded any findings were listed as follows:

1. The aircraft was airworthy prior to the occurrence and was operated within the weight and balance envelope. There was no report or record that the aircraft had system abnormality during the flight from take-off until the time of the occurrence.
2. All crew has valid licenses and medical certificates.
3. All equipment, facilities, such as, navigation aids, communication and supporting operational facilities in Wamena Airport operated normally.
4. The Wamena Tower Controller informed the pilot that no rain on the runway.
5. The pilot informed that they able to see the runway when aircraft altitude approximately at 700 ft Above Ground Level (AGL).
6. The calculation estimated the visibility during aircraft approach was approximately 3.7 km.
7. Refer to the company SOP, the pilots requires returning to Jayapura (RTB) if unable to maintain visual during approach/visual contact lost.
8. The landing configuration flap 40, Vref 133-138 Knots and auto-brake 3.
9. The total runway length available is 2050 meter (has not been included on the AIP), and the aircraft stopped at RESA with estimated ground roll of 1031 m. The aircraft touched down estimated 791 m beyond the normal touchdown zone.
10. The runway extension has not been published by the DGCA. The Wamena Airport Management has submitted a letter proposed for revision of certification related to runway extension from 1850 to 2175 meter on 11 may 2015.
11. The pilot taxied the aircraft proceeded to apron via taxiway D, and while the aircraft taxiing to the runway the ARFF started to leave the runway.
12. During the interview the PIC stated that the function of Stop way and RESA was usable for overrun and it is allowed to taxi the aircraft on such area.
13. Post flight inspection found main wheel tire number 2 melting/burst, number 3 and 4 were spotted and damage on engines fan blades and left horizontal stabilizer which most likely from the foreign object damage (FOD) of excavated surface sucked by the engines when the aircraft was taxiing.
14. Observation on the occurrences of runway excursion at Wamena Airport between

2013 and early 2015 showed that the weather condition (rain and visibility) and wet runway appeared during the aircraft approach and landing. Most of the occurrences were initiated by un-stabilized approach prior to landing.

3.2 Contributing Factors¹

The approach was conducted when the weather was below minima for VFR and required for return to Jayapura according to the company SOP and resulted the aircraft touchdown at approximately 719 meters beyond the touchdown zone.

¹ “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 draft final investigation report, the National Transportation Safety Committee had been informed of safety actions resulting from this occurrence.

4.1 PT. Cardig Air

As part of the safety action the operator had performed an internal investigation and issued safety recommendations (ref CAD letter# 080/CA-A/CZ/SKEP-TI/X/14 dated 24 October 2014) are as follows:

- To review the SOP for B737-300 special procedures DJJ-WMX particularly in the approach/ landing phase to runway 15 of Wamena airport during rainy weather and/or other hazard occurrence during this phase, so as to empower the pilot to reject the landing/ go around.
- To review the SOP for B737-300 special procedure DJJ-WMX particularly in the use of airport movement area, so as to empower the pilot to stop the aircraft whenever the aircraft is not in the airport movement area.
- To reinforce the pilots in ALAR/CFIT implementation especially pertinent to the flight operation in Papua (DJJ-WMX)
- To empower the flight crew to immediately stop or taking safest action when ambiguity or uncertain condition occurred. To enhance CRM/ADM among the pilots.

..”

5 SAFETY RECOMMENDATIONS

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

5.1 PT. Cardig Air

In respect to the occurrence and for the purpose of safety improvement the PT. Cardig Air has issued safety actions ref CAD letter# 080/CA-A/CZ/SKEP-TI/X/14 dated 24 October 2014, the KNKT has examined and considered that all the content of such particular safety actions were relevant to be implemented, therefore KNKT does not issue safety recommendation to PT. Cardig Air as result of this investigation.

5.2 Wamena Airport Management

Observation on the published runway length as of Aeronautical Information Publication (AIP) by the DGCA issued on November 2010 found that the runway length was 1755 m. The actual information of runway length observed by the KNKT after the occurrence as well as the information from the pilot, known that the runway length was extended to 2050 m. To minimize the operational misinterpretation in respect to the differences of runway length data the KNKT recommends that:

The Wamena airport management includes the DGCA shall review the current system publication of the AIP to comply with the requirement stated in CASR 139.105 point 1.

5.3 Directorate General of Civil Aviation (DGCA)

Concerning to the occurrences data of Wamena Airport between 2013 and early 2015, revealed that the rain and wet runway contributed to the initiation of un-stabilized approach in VFR flight and runway excursions. KNKT recommends that:

1. To review the weather minima of VFR flight special for Wamena Airport for takeoff and landing that may (CASR 91.155 Basic VFR Weather Minimums).
2. To review the possibility to install the aerodrome by additional navigation aid and instrument approach procedure.