FINAL
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KOMITE NASIONAL KESELAMATAN TRANSPORTASI

Aircraft Accident Investigation Report

PT. Deraya
BAe ATP Freighter; PK -DGI
Wamena Airport, Wamena, Papua
Republic of Indonesia
31 May 2013

KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA
2016

This final report was produced by the Komite Nasional Keselamatan Transportasi (KNKT), 3rd Floor Transportation Building, 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).

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ABBREVIATIONSAND DEFINITIONS

AGL	:	Above Ground Level
ALAR	:	Approach and landing accident reduction
ATC	:	Air Traffic Controller
ATPL	:	Air Transport Pilot License
ATS	:	Air Traffic Service
BAe ATP	:	British Aerospace ATP
BMKG	:	Badan Meterologi Klimatologi dan Geofisika (Metrological Climatology and Geophysical Agency)
°C	:	Degrees Celsius
CFIT	:	Control Flight Into Terrain
COM	:	Company Operating manual
CRM	:	Crew Resources Management
CVR	:	Cockpit Voice Recorder
DFDR	:	Digital Flight Data Recorder
DGCA	:	Directorate General Civil Aviation
EGPWS	:	Enhanced Ground Proximity Warning Systems
FL	:	Flight Level
ICAO	:	International Civil Aviation Organization
IIC	:	Investigator In Charge
ILS	:	Instrument Landing System
IMC	:	Instrument Meteorological Condition
Km	:	Kilometer (s)
mbs	:	Millibars
KNKT/ NTSC	:	Komite Nasional KeselamatanTransportasi/ National Transportation Safety Committee
PF	:	Pilot Flying
PIC	:	Pilot in Command
PM	:	Pilot Monitoring
QFE	:	Height above mean sea level based on field elevation
QNH	:	Height above mean sea level based on local station pressure

S/N	:	Serial Number
SIC	:	Second in Command
UK	:	United Kingdom
UTC	:	Universal Time Coordinate
VOR	:	VHF Omni-directional Range
VMC	:	Visual Meteorological Condition

INTRODUCTION

SYNOPSIS

On 31 May 2013 aircraft BAe ATP freighter registered PK-DGI operated by PT. Deraya as scheduled cargo / freight flight from Sentani Airport (WAJJ) to Wamena Airport (WAJW), Papua. On board in this flight were the Pilot in Command (PIC) acted as Pilot Flying (PF) and the Second in Command (SIC) acted as Pilot Monitoring (PM).

The first pilot contact with Wamena Tower controller was at 2201 UTC, the aircraft position was approaching Pass Valley point, the controller informed the pilot toexpect runway 15 to be used and the weather condition was wind calm, visibility 4 Km and QNH 1008 mbs.

At 2207 UTC, the pilot reported the position was on final runway 15. The controller requested the information of the flight condition and the pilot reported that the runway has not insight.

At 2209 UTC, the pilot reported that the runway was insight and the controller provided the clearance to land and 25 seconds later the aircraft touched down on the centerline.

During the landing roll at the aircraft veered to the left of the centerline, the pilot recovered by applying the right rudder and asymmetric reverses thrust but the aircraft continued veer to the left and stopped at about 10 meters on the left shoulder of the runway 15.

The nose landing gear detached and found on the shoulder at about 250 meter from the aircraft final position. The main landing gears broken and all the propellers bent.

No one injured in this accident.

The investigation concluded that the contributing factors of this serious incident were as follow;

- The flight did not meet the criteria according to the recommended elements of stabilized approach which required go around.
- The aircraft touched down with 2° misalignment with the runway direction then the aircraft veered off to the left.
- The recovery action was not in accordance to the correct technique according to the ALAR Tool Kit.

At the time of issuing this draft final investigation report, the Komite Nasional Keselamatan Transportasi (KNKT) has not been informed of safety actions resulting from this occurrence.

Includes in this report, the KNKT issued several safety recommendations to address the safety issues identified in this final report to PT. Deraya and The Directorate General of Civil Aviation(DGCA).

1 FACTUAL INFORMATION

1.1 History of the Flight

On 31 May 2013 aircraft BAe ATP freighter registered PK-DGI operated by PT. Deraya as scheduled cargo/ freight flight from Sentani Airport (WAJJ) to Wamena Airport (WAJW), Papua. On board in this flight were the Pilot in Command (PIC) acted as Pilot Flying (PF) and the Second in Command (SIC) acted as Pilot Monitoring (PM).

At 2127 UTC (0627 LT) the aircraft departed from Sentani Airport. The aircraft cruised at 12,000 feet (FL 120)and estimated time of arrival Wamena Airport was 2207 UTC (0707 LT).

The first pilot contact with Wamena Tower controller was at 2201 UTC, the aircraft position was approaching Pass Valley point, the controller informed that runway 15 expect to be used and the weather condition was wind calm, visibility 4 Km, low cloud at final area and QNH 1008 mbs. There was no specific of approach and landing briefing by pilot flying to the pilot non flying considering to such weather condition.

At 2207 UTC, the pilot reported the position was on final runway 15. The controller requested the information of the flight condition and the pilot reported that the runway has not insight.

At 2209 UTC, the pilot reported that the runway was insight and the controller provided the clearance to land and 25 seconds later the aircraft touched down on the centerline.

Figure 1: When the aircraft on short final

During the landing roll at about 750 meters from the beginning of runway 15 the aircraft veered to the left of the runway shoulder, the pilot recovered by applying the right rudder and asymmetry reverses thrust but the aircraft continued veer to the left and stopped at about 10 meters on the left shoulder of the runway 15.

On the landing roll, the FDR recorded that the left engine torque greater then right engine torque.

The pilot shutdown both engines normally and evacuated the aircraft safely.

The nose landing gear detached and found on the shoulder at about 250 meter from the aircraft final position. The main landing gears broken and all the propellers bent.

No injured in this occurrence.

1.2 Injuries to Persons

Injuries	Flight crew	Passengers	Total in Aircraft	Others
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/None	2	-	2	-
TOTAL	2	-	2	-

1.3 Damage to Aircraft

The damage of the aircraft were the nose and main landing gear broken, all the propeller blades bend.

Figure 2: The aircraft final position and the nose landing gear detached

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	:	39 Years
Nationality	:	Indonesian
Marital status	:	Married

Date of joining company	:	2009
License	:	Air Transport Pilot License (ATPL)
Date of issue	:	15 April 2011
Validity	:	21 June 2013
Aircraft type rating	:	CASA212-100/200, BAe ATP
Instrument rating	:	31 December 2013
Medical certificate	:	First Class
Last of medical	:	21 December 2012
Validity	:	21 June 2013
Medical limitation	:	None
Last line check	:	02 December 2012
Last proficiency check	:	02 December 2012 (on aircraft)

Flying experience

Total hours	:	3,108 hours
Total on type	:	1,366 Hours
Last 90 days	:	208 Hours 80 Minutes
Last 60 days	:	112 hours 90 minutes
This flight	:	80 Minutes

Observation on the flight training record showed that the training and proficiency checks result were standards. The exercise consists of abnormal and emergency procedures application.

1.5.2 Second in Command

Gender	:	Male
Age	:	49 years old
Nationality	:	Indonesian
Marital status	:	Married
Date of joining company	:	2012
License	:	Air Transport Pilot License (ATPL)
Date of issue	:	23 December 2011
Validity	:	31 January 2014
Aircraft type rating	:	CASA 212/ MA60/BAe ATP
Instrument rating	:	29 January 2013
Medical certificate	:	First Class
Last of medical	:	06 February 2013

Validity	:	06 July 2013
Medical limitation	:	The holder shall possess corrective glass
Last line check	:	12 June 2012
Last proficiency check	:	31 January 2013

Flying experience

Total hours	:	5,648 Hours
Total on type	:	689 hours
Last 90 days	:	218 hours
Last 60 days	:	111 hours
Last 24 hours	:	05 hours 20 minutes
This flight	:	80 minutes

Observation on the flight training record showed that the training and proficiency checks result were standards. The exercise consists of abnormal and emergency procedures application.

1.6 Aircraft Information

1.6.1 General

Registration Mark	:	**PK-DGI**
Manufacturer	:	British Aerospace
Country of Manufacturer	:	United Kingdom
Type/ Model	:	BAe ATP/ Freighter
Serial Number	:	2027
Year of manufacture	:	1990
Certificate of Airworthiness		
Issued	:	13 October 2012
Validity	:	13 October 2013
Category	:	Transport
Limitations	:	None
Certificate of Registration		
Number	:	2650
Issued	:	13 October 2012
Validity	:	12 October 2013
Time Since New	:	15,755 hours
Cycles Since New	:	25,431 cycles

Last Major Check	:	15 July 2008
Last Minor Check	:	05 May 2013

1.6.2 Engines

Manufacturer	:	Pratt & Whitney Canada
Type/Model	:	PW126
Serial Number-1 engine	:	124451
▪ Time Since New	:	15,384. 65 hours
▪ Cycles Since New	:	21,578 cycles
Serial Number-2 engine	:	124304
▪ Time Since New	:	10,083.25 hours
▪ Cycles Since New	:	16,825 cycles

1.6.3 Propellers

Manufacturer	:	Hamilton Standard, USA
Type/Model	:	6-5500F
Serial Number-1 propeller	:	4A424866 (BD 92)
▪ Time Since New	:	13,518.33 hours
Serial Number-2 propeller	:	4A424892 (BD 143)
▪ Time Since New	:	15,736. 53 hours

1.7 Meteorological Information

Weather report of Wamena Airport, issued 30 May 2013, at 2200 UTC as follows:

Wind	:	Calm
Horizontal Visibility	:	5- 7 Km
Present Weather	:	Cloudy
Temperature	:	16.5˚C
Dewpoint	:	15.9 ºC
QNH	:	1008.3 mbs
QFE	:	836.2 mbs

1.8 Aids to Navigation

The Wamena Airport was equipped with NDB (Non-Directional Beacon) and there was no instrument procedure provided.

1.9 Communications

The communications between Wamena Tower controller and the pilot was normal and considered not related to the occurrence.

1.10 Aerodrome Information

Airport Name	:	Wamena Airport
Airport Identification	:	WAJW / WMX
Coordinate	:	04 31 53 S 136 33 18 E
Elevation	:	5,084 feet
Airport Operator	:	Directorate General of Civil Aviation (DGCA)
Runway Direction	:	15 – 33
Runway Length	:	1,650 meters
Runway Width	:	30 meters
Surface	:	Asphalt

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 North Gap, with the route from airways W67, 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 to Wamena Airport.

Most of the incoming and outgoing flights are in VFR while the weather phenomena there will be lot of cumulus cloud formation nearby the top of the mountainous area. The aerodrome controller provided only by Wamena Tower Controller to serve more than 150 flights movement per day consist of several aircraft types of single engine aircraft up to Boeing 737 classic.

The figure below shows Wamena Airport and the operator VFR route guidance shows the area surrounds by mountainous and the gaps that usually used for the incoming and outgoing flights of Wamena Airport.

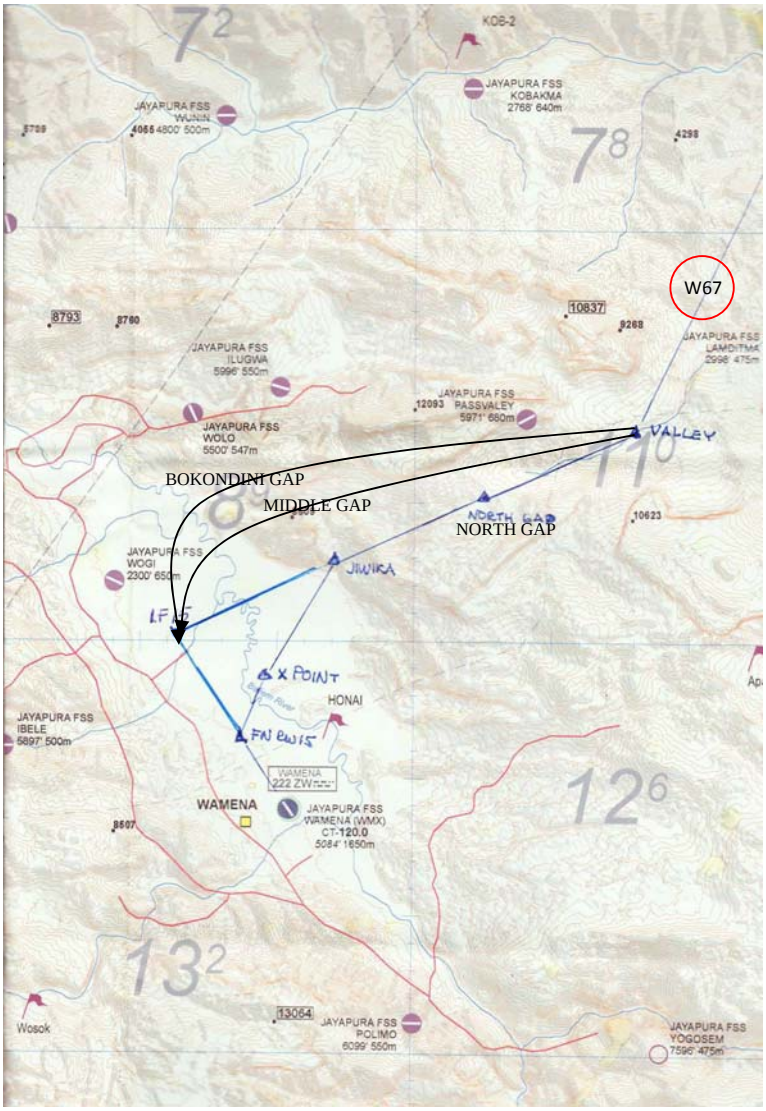

Figure 3: The illustration of gaps and routes of Incoming and outgoing flights

1.11 Flight Recorders

The aircraft was equipped with Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR). Both recorders were recovered after the accident and transported to KNKT facility for data retrieval.

1.11.1 Flight Data Recorder

Manufacturer	:	Plessey, UK
Type/Model	:	PV 15846
Part Number	:	650/I/14040/205
Serial Number	:	10004

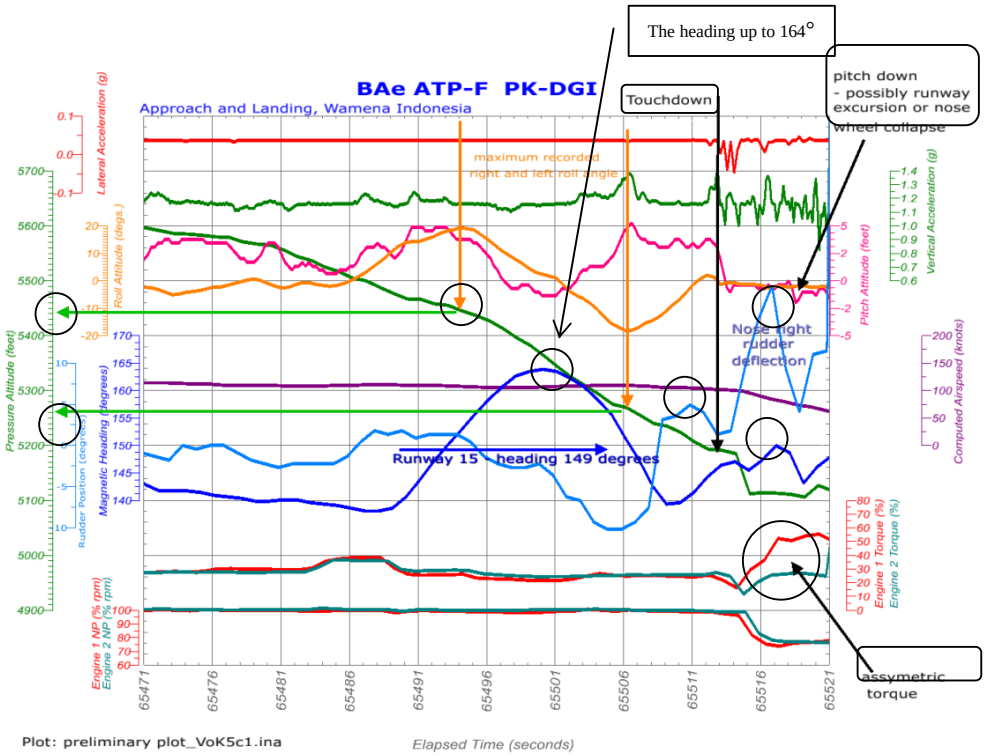

Figure 4: The FDR graph data for several significant parameters

The significant events recorded by the DFDR (the airport elevation is 5084 feet)

- When at approximate 5,450 feet (± 400 feet AGL) and 5,260 feet (± 200 feet AGL) the pitch varied from1° down to 5° up and the aircraft rolled to the right up to 20° and at aircraft heading 164° the aircraft rolled to the left up to 20°.
- The aircraft speed relatively constant from 105 kts until touchdown.
- The aircraft touchdown with roll angle approximately 2° to the left and heading of 147 while the runway heading was 149°.
- After touchdown the NP indicated drop from 100% to approximately 70% and maintained.
- The engine torques was asymmetric; it shows that the left engine torque was approximate 55% while the right engine torque was approximate 25%.

1.11.2 Cockpit Voice Recorder

Manufacturer	:	Fairchild, USA
Type/Model	:	A100
Part Number	:	93A100-83
Serial Number	:	50796

The CVR contents of 2 hours and 4 minutes of in good quality recording data. Significant excerpt from the CVR for the last minutes started when the pilot reported position Jiwika until the end of recording are as follow:

Note: times are CVR time and not local time or UTC.

CVR TIME (min: sec)	FROM	TO	DESCRIPTION
26:21	PK-DGI	WMX TWR	The pilot reported the position just passed point 'Jiwika' and instructed by Wamena Tower controller to report when position on final.
28:22	P1	P2	The PIC clarified to the SIC whether the runway has been insight and was replied that the runway has not been insight.
28:56	WMX TWR	PK-DGI	Wamena Tower controller confirmed to the pilots whether they have the runway in sight and the pilot replied that they have not seen the runway.
29.26	EGPWS		"MINIMUM MINIMUM"
29.33	EGPWS		"TOO LOW TERRAIN"
29.47	EGPWS		"TOO LOW TERRAIN"
29.52	EGPWS		FIVE HUNDRED
29.59	EGPWS		"TOO LOW TERRAIN"
30.13	EGPWS		"TOO LOW TERRAIN"
30.17	PK-DGI	WMX TWR	The pilot reported that they have seen the runway.
30.21	EGPWS		"TOO LOW TERRAIN"
30.22	WMX TWR	PK-DGI	Wamena Tower controller issued clearance to land
30.26	PK-DGI	WMX TWR	The pilot acknowledge the clearance to land
30.27	EGPWS		"TOO LOW TERRAIN"
30.30	EGPWS		"SINK RATE"
30.31	EGPWS		"TOO LOW TERRAIN"
30.33	EGPWS		"SINK RATE"
30.36	EGPWS		"TOO LOW TERRAIN"
30.38	EGPWS		"TOO LOW TERRAIN"
30.42			The aircraft Touchdown
31.05			End of Recording

1.12 Wreckage and Impact Information

Observation on the runway found several marks since first aircraft touchdown, initial

left main wheel out of the runway pavement until the last position of the aircraft.

- The touchdown marks indicated that the aircraft movement misalign with the runway centerline
- The initial left main wheel out of the runway pavement found at 750 meters from the beginning runway 15.
- The aircraft travelled on the left runway shoulder parallel with the runway 15.
- The nose landing gear was detached and the aircraft last position was 1,073 meters from the beginning and 10 meters left side of runway 15.

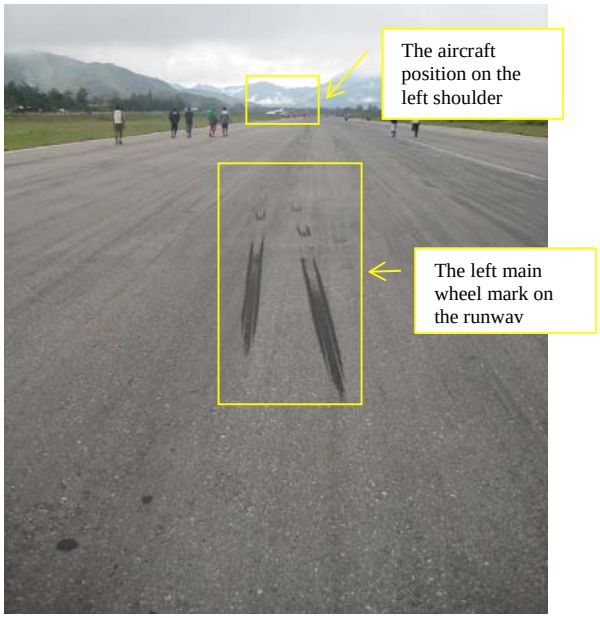

Figure 5: The mark of first touchdown found on the runway

Figure 6: **The mark of left main wheel off the runway**

Figure 7: **The mark of both main wheels off the runway**

Figure 8: **The aircraft final position and the nose wheel detached**

1.13 Medical and Pathological Information

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

1.14 Fire

There was no evidence of fire in-flight or after the aircraft impacted terrain.

1.15 Survival Aspects

The crew evacuated the aircraft normally after shutdown the engines.

1.16 Tests and Research

Not applicable

1.17 Organizational and Management Information

This section describes the organization and operator manuals relates to ALAR & CFIT training given to the pilots. Observation showed that the Company Operation Manual 2013 has been revised on 2015, which the latest revision includes the elements of un-stabilize approach.

1.17.1 PT Deraya

Aircraft Owner	:	PTB (Emerald) Pty. Ltd.
Address	:	22 Orient Avenue Pinkenah Halim Brisbane Airport, Queensland, Australia
Aircraft Operator	:	PT. Deraya
Address	:	Terminal Building first floor no 150 HT, Halim Perdanakusuma Airport, Jakarta 13610, Indonesia
Operator Certificate Number	:	135-013

1.17.2 Company Operations Manual (COM) PT. Deraya

2.10 TRAINING ALAR AND CFIT TRAINING

For all cockpit crew member conducting operation under DGCA Regulation. The ALAR and CFIT training as required by the training Element of the company"s flight safety program. The training is designed to reduce the approach and landing accident and ensure the flight crew adhere to SOP, good CRM practices, emphasize on the operation differences in briefings and conducting the flight and maintain professional attitude toward flying.

ALAR & CFIT training is a measure that will improve safety for aircraft from commencement of approach through circling, landing or missed approach.

The training program shall include:

a ALAR objectives

b Equipment for aircraft and traffic control

c Flight Operation and training.

d *Pilot guide to preventing CFIT.*

On March 2015 the 2.10 TRAINING ALAR AND CFIT TRAINING was revised to include the RECOMMENDED ELEMENT OF STABILIZED APPROACH which described;

All flights must be stabilized by 1000 feet above airport elevation in instrument meteorological conditions (IMC) and by 500 ft above airport elevation in visual meteorological conditions (VMC). An approach is stabilize when all of the following criteria are met:

1. *The Aircraft is on the correct Flight path*
2. *Only small changes in heading/pitch are required to maintain the correct flight path*
3. *The aircraft speed is not more than Vref + 20 kts indicated airspeed and not less than Vref.*
4. *The aircraft is in the correct landing configuration*
5. *Sink rate is no greater than 1000 ft per minute, if an approach requires a sink rate greater than 1000 feet per minute , a special briefing should be conducted*

6. *Power setting is appropriate for the aircraft configuration and is not below the minimum power for approach as defined by the aircraft operation manual*
7. *All briefing and checklist have been conducted*
8. *Specific types approaches are stabilize if they also fulfil the following instrument landing system (ILS) approaches must be flown within one dot of the glide slope and localizer; a category II or category III ILS approach must flown within the expended localizer band; during a circling approach, wings should be level on final when the aircraft reaches 300 ft above airport elevation ; and*
9. *Unique approach procedure or abnormal conditions requiring a deviation from the above elements of stabilized approach require a special briefing.*

An approach that become un-stabilized bellow 1000 ft above airport elevation in IMC or below 500 ft above airport elevation in VMC requires an immediate GO AROUND.

1.17.3 4.10 Flight Deck Procedure

4.10.6 APPROACH AND LANDING

4.10.6.1. Crew Coordination During Holding, Approach and Landing par 5:

Referring to COM paragraph 3.1.1 and AOM section 'Flight Techniques' the crew briefing should be completed well in advance of terminal area penetration, preferably before starting descent, but anyhow before handling the "Before Landing Initial - checklist", and shall be updated if changing circumstances require so.

If weather conditions are such that diversion becomes a real possibility, the time of diversion as well as the selection of, and routing to, the alternate shall be discussed.

As of general crew briefing prior to approach and landing contains:

- Weather evaluation at the airport,
- Defining the top of descend, the minimum safe altitude and type of approach as well as the minima of the runway use,
- Remaining the standard call out on each point specified in the approach charts,
- Review the procedures, configuration of go around and the flight path.

1.18 Additional Information

1.18.1 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 Section91.157 of the CASRs are not applicable (See Part 91, Appendix D, Section 3 of the CASRs). The basic VFR weather minimums of Section 91.155 of the CASRs apply at those locations.

91.157 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).

1.18.2 Crew Resource Management (CRM)

The Good CRM pattern is techniques that help build habit pattern on the flight deck are discussed, situational awareness and communication are stressed.

The Situational Awareness or the ability to accurately perceive what is going on in the flight deck and outside the airplane, requires ongoing monitoring, questioning, crosschecking, communication, and refinement of perception.

1.18.3 Landing on Slippery Runway (Flight Safety Foundation ALAR Tool Kit)

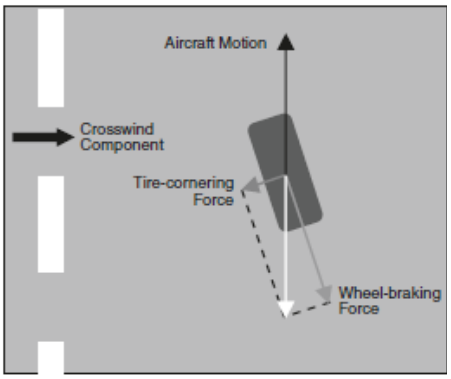

Figure 9: Tire-cornering and wheel-braking Force (source FSF ALAR Task Force)

Effect of Touchdown on Alignment

When touching down with some crab angle on a dry runway the aircraft tends to realign itself with the direction of travel down the runway.

When touching down with some crab angle on a contaminated runway, the aircraft tends to continue traveling with a crab angle along the runway centerline.

Effect of Wind on the Fuselage and Control Surfaces

As the aircraft touches down, the side force created by the crosswind striking the

fuselage and control surfaces tends to make the aircraft skid sideways off the centerline (Figure 6, page 195).

Thrust Reverser Effect

When selecting reverse thrust with some crab angle, the reverse thrust results in two force components (Figure 6):

- *A stopping force aligned with the aircraft's direction of travel (runway centerline); and,*
- *A side force, perpendicular to the runway centerline, which further increases the aircraft's tendency to skid sideways.*

The thrust-reverser effect decreases with decreasing airspeed. Rudder authority also decreases with decreasing airspeed and is reduced further by airflow disturbances created by the thrust reversers. Reduced rudder authority can cause directional control problems.

Effect of Braking

In a strong crosswind, cross-control usually is maintained after touchdown to prevent the into-wind wing from lifting and to counteract the weather-vane effect (i.e., the aircraft's tendency to turn into the wind). (Some flight crew training manuals say that the pilot should continue to "fly the aircraft" during the landing roll.)

However, into-wind aileron decreases the lift on the into-wind wing, thus resulting in an increased load on the into-wind landing gear.

Because braking force increases as higher loads are applied on the wheels and tires, the braking force increases on the into-wind landing gear, creating an additional tendency to turn into the wind (Figure 7, page 195).

When runway contamination is not evenly distributed, the antiskid system may release only the brakes on one side.

Maintaining Directional Control

The higher the wheel-braking force, the lower the tire cornering force. Therefore, if the aircraft tends to skid sideways, releasing the brakes (i.e., by taking over from the auto brakes) will increase the tire-cornering force and help maintain directional control.

Selecting reverse idle thrust will cancel the side-force component caused by the reverse thrust, will increase rudder authority and will further assist in returning to the runway centerline.

After the runway centerline and directional control have been regained:

- *Pedal braking can be applied (auto-brakes were previously disarmed) in a symmetrical or asymmetrical manner, as required; and,*
- *Reverse thrust can be reselected.*

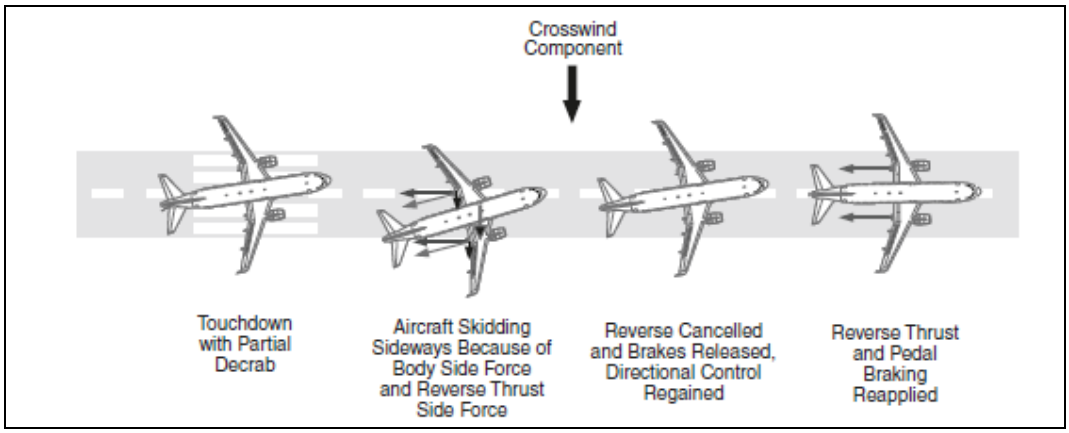

Figure 10: Recovery From a Skid Caused by Crosswind and Reverse Thrust Side Forces (source: FSF ALAR Task Force)

Factors Involved in Crosswind Incidents and Accidents

The following factors often are involved in crosswind-landing incidents and accidents:

- *Reluctance to recognize changes in landing data overtime (e.g., wind shift, wind velocity/gust increase);*
- *Failure to seek additional evidence to confirm initial information and initial options (i.e., reluctance to change plans);*
- *Reluctance to divert to an airport with more favorable wind conditions;*
- *Insufficient time to observe, evaluate and control aircraft attitude and flight path in a highly dynamic situation; and/or,*
- *Pitch effect on aircraft with under wing-mounted engines caused by the power changes required in gusty conditions.*

Summary

To increase safety during a crosswind landing, flight crews should:

- *Understand all applicable operating factors ,recommended maximum values and limitations;*
- *Use flying techniques and skills designed for crosswind landings;*

1.19 Useful or Effective Investigation Techniques

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

2 ANALYSIS

The analysis part of this Final Report will discuss the relevant issues resulting in this runway excursion occurrence involving a BAe ATP aircraft on 31 May 2013 at Wamena Airport on runway 15.

The investigation determined that there was no issue related to the aircraft and its systems, however several interest issues associated with procedural (Human Factors) during the pilots conducting the approach are the focus of this investigation, therefore there are two areas to be analyzed and as follows:

- Decision for landing;
- Directional control;
- Crew coordination.

2.1 Decision for Landing

When on final approach position, the pilot reported that the runway was not insight. The CVR data revealed that the pilot reported runway insight 25 seconds after EGPWS call FIVE HUNDRED. The aircraft landed 25 seconds after the pilots have seen the runway.

The Indonesia CASR Part 91.157 stated that a landing shall not be made for as flight under VFR when ground visibility less than 4.8 km or 3 statues miles.

The FDR recorded that the aircraft approach speed was constant at approximately 105 knots or 0.03 miles/ second. The aircraft landed 25 seconds after the pilot report runway insight or approximately at position of 0.8 miles from the runway.

The CVR also revealed that 25 seconds after EGPWS called “FIVE HUNDRED” the pilot reported the runway insight and landed 25 seconds later. The pilot able to see runway at approximately 250 feet AGL with assumption of constant rate of descend.

This can be concluded that the visibility at the time of the accident was less than 3 statues miles or 4.8 km. The approach should not be continued on this visibility condition for a flight under VFR.

The COM determine the stabilize approach criteria which require to all flight operates under VFR flight shall stabilized at 500 feet.

The FDR recorded that when aircraft at 5450 feet (± 400 feet AGL) and 5260 (± 200 feet AGL) until the aircraft touched down showed that the pitch varied from 1° down to 5° up and the aircraft rolled to the left and right up to 20°and the heading changed from 140° up to 164°.This might be a pilot action to align with the runway.

These indicated that on short final the aircraft was on heading 140° and was on the right side of the correct flight path. The pilot then roll to the left up to 20° to align with the runway up to 164°, then rolled to the right to final path runway 15. This correction was conducted at altitude between 400 to 200 feet AGL. This indicated that stabilized approach criteria as required in the COM did not achieved at 500 feet.

After received clearance to land, the EGPWS recorded an aural warning of SINK RATE, this indicated that the rate of descend was greater than 1500. This was contrary to the requirements of the stabilize approach. The COM stated that go around shall be initiated.

2.2 Directional Control

During the landing roll at about 750 meters from the beginning of runway 15 the aircraft veered to the left.

The FDR revealed that the aircraft touchdown with roll angle approximately 2° to the left and heading of 147 while the runway heading was 149°, this was confirmed by the evidence of touch down mark found on the runway.

The FDR also recorded that after touchdown the NP drop from 100% to approximately 70% and maintained and the engine torques were asymmetric with the left engine torque greater than the right engine torque. Decreasing of NP value to 70% indicated that the propeller entered the Beta Mode[1] and the increased of the torque indicated that the propellers were reversed. The asymmetric value indicated that the reverse on the left side was greater than the right side.

The ALAR Tool kit published by Flight Safety Foundation (FSF) on the section Effect of Touchdown on Alignment stated that: when touching down with some crab angle on a dry runway, the aircraft tends to realign itself with the direction of travel down the runway. This means that after PK-DGI landed with 2° to the left misalignment to the runway, the aircraft would realign itself with the direction of travel down the runway which was 2° differences with the runway heading.

After touchdown the pilot applied asymmetric reverse with left engine propellers had greater value attempt to regain the aircraft direction align with the runway.

The ALAR Tool kit published by Flight Safety Foundation (FSF) on the section Thrust Reverser Effect stated that:

When selecting reverse thrust with some crab angle, the reverse thrust results in two force components:

- *A stopping force aligned with the aircraft's direction of travel (runway centerline); and,*
- *A side force, perpendicular to the runway centerline, which further increases the aircraft's tendency to skid sideways.*

The thrust-reverser effect decreases with decreasing airspeed. Rudder authority also decreases with decreasing airspeed and is reduced further by airflow disturbances created by the thrust reversers. Reduced rudder authority can cause directional control problems.

The ALAR Tool kit published by Flight Safety Foundation (FSF) also recommends that to recover such condition and realign to the runway centerline, the brake and thrust reverse shall be released or reduced.

2.3 Crew Coordination

The Good CRM pattern is techniques that help build habit pattern on the flight deck

1 Beta Mode is a range of operations whereby the pilot can select infinite propeller blade angle within predetermine range to enhance ground handling of the aircraft.

are discussed, situational awareness and communication are stressed.

The Situational Awareness or the ability to accurately perceive what is going on in the flight deck and outside the airplane, requires ongoing monitoring, questioning, crosschecking, communication, and refinement of perception.

Refers to the CVR and FDR data, there was no communication between the pilots related to the coordination other than the PIC confirming the SIC whether the runway has been insight.

At 500 feet the runway has not been insight, however there was no communication between pilots to determine the approach would be continued or aborted. The PIC did not communicated the decision and the SIC did not questioning the PIC intention.

The CVR recorded 8 EGPWS aural warnings, however these warnings were disregarded.

Without having good communication between pilots, a good situational awareness unable to be developed.

3 CONCLUSIONS

This part should list the findings and the causes established in the investigation. The conclusions are drawn from the analysis. However, it is essential to maintain the same degree of certainty in a conclusion as was established in the analysis. For example, if the discussion in the analysis indicates that an event or circumstance was likely, then the finding should contain the same qualifier (likely).

3.1 Findings

According to factual information during the investigation, the National Transportation Safety Committee founded any initial findings as follows:

1. All crew have valid licenses with current type rating and valid medical certificates.
2. The proficiency check results of both pilots were standards.
3. The aircraft was airworthy prior to the occurrence.
4. The aircraft operated within the correct weight and balance envelope.
5. The Pilot in Command (PIC) acted as pilot flying (PF) while the Second in Command (SIC) acted as Pilot Monitoring (PM).
6. At 2127 UTC the aircraft departed from Sentani Airport use runway 12 and cruised at FL 120 (12,000 feet).
7. The controller provided weather condition of: wind calm, visibility 4 Km and QNH 1008 mbs.
8. At 2207 UTC pilot reports on final runway 15 and runway has not been insight.
9. The aircraft speed relatively constant from 105 knots until touchdown.
10. 25 seconds after EGPWS altitude call FIVE HUNDRED, the pilot reported the runway insight.
11. The FDR recorded that when aircraft at 5450 feet (± 400 feet AGL) and 5260 (± 200 feet AGL) until the aircraft touched down showed that the pitch varied from 1° down to 5° up and the aircraft rolled to the left and right up to 20°and the heading changed from 140° up to 164°.
12. The aircraft touchdown with roll angle approximately 2° to the left and heading of 147 while the runway heading was 149°.
13. After touchdown the NP indicated drop from 100% to approximately 70% and maintained and the engine torques were asymmetric with the left engine torque greater than the right engine torque.
14. The visibility at the time of the accident was less than 3 statues miles or 4.8 km.
15. Since on final the aircraft was not according to the recommended elements of stabilized approach when at and below 500 feet, while the pilot continued the landing.
16. Stabilized approach criteria as required in the COM did not achieved below 500 feet as required by the COM and go around shall be initiated.

17. Communication between pilots was minimum and a good situational awareness unable to be developed.
18. Most of the incoming and outgoing flights are in VFR.
19. The aerodrome controller provided only by Wamena Tower Controller to serve more than 150 flights movement per day consist of several aircraft types of single engine aircraft up to Boeing 737 classic.

3.2 Contributing Factors[2]

The flight did not meet the criteria according to the recommended elements of stabilized approach which required go around.

The aircraft touched down with 2° misalignment with the runway direction then the aircraft veered off to the left.

The recovery action was not in accordance to the correct technique according to the ALAR Tool Kit.

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 report, the Komite Nasional Keselamatan Trasportasi (KNKT) has not been informed of any safety actions resulting from this occurrence.

5 SAFETY RECOMMENDATIONS

According to factual information and findings examined, the Komite Nasional Keselamatan Trasportasi (KNKT) publishes safety recommendations to address safety issues identified in this report.

The Directorate General of Civil Aviation is responsible for the implementation of these recommendations addressed to the relevant parties.

5.1 PT. Deraya

The investigation concluded that contributing factors to this occurrence were un-stabilized approach and recovery technique. Therefore KNKT recommends to the operator:

- **04.0-2016-2.1**

  To ensure that pilots have adequate knowledge and skill to understand and correct implementation of the Company Operation Manual (COM) Chapter 2.10.1 Recommended Element of Stabilized Approach.

- **04.0-2016-3.1**

  To review the procedure in crew coordination in respect to the EGPWS aural warning when it activated.

- **04.0-2016-4.1**

  The crew did not communicate accordingly while the aircraft was not in the correct profile for landing. Therefore the NTSC recommends the operator should review the current method of CRM (Crew Resource Management) training and its implementation.