KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA

# FINAL

**KNKT.15.08.20.04**

## Aircraft Accident Investigation Report

**PT. Cardig - Air**

**Boeing 737-300 F; Reg. PK-BBY**

**Wamena Airport**

**Republic of Indonesia**

**28 August 2015**

**2016**

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

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

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# TABLE OF CONTENTS

# TABLE OF FIGURES

# ABBREVIATIONS AND DEFINITIONS

| | | |
|---|---|---|
| AFE | : | Above Field Elevation |
| AFM | : | Airplane Flight Manual |
| AGL | : | Above Ground Level |
| AMM | : | Aircraft Maintenance Manual |
| AOC | : | Air Operator Certificate |
| ATPL | : | Air Transport Pilot License |
| ATS | : | Air Traffic Service |
| BMKG | : | *Badan Meterologi Klimatologi dan Geofisika* (Metrological Climatology and Geophysical Agency) |
| °C | : | Degrees Celsius |
| C of A | : | Certificate of Airworthiness |
| C of R | : | Certificate of Registration |
| CAMP | : | Continuous Airworthiness Maintenance Program |
| CASR | : | Civil Aviation Safety Regulation |
| CPL | : | Commercial Pilot License |
| Cu | : | Cumulus |
| CPL | : | Commercial Pilot License |
| CVR | : | Cockpit Voice Recorder |
| DGCA | : | Directorate General of Civil Aviation |
| EGPWS | : | Enhance Ground Proximity Warning System |
| FCOM | : | Flight Crew Operating Manual |
| FCTM | : | Flight Crew Training Manual |
| FDR | : | Flight Data Recorder |
| fpm | : | feet per minute |
| G | : | Gravitation |
| ILS | : | Instrument Landing System |
| IMC | : | Instrument Meteorological Condition |
| kg | : | Kilogram(s) |
| km | : | Kilometer(s) |
| KNKT | : | *Komite Nasional Keselamatan Transportasi* |
| MAC | : | Mean Aerodynamic Chord |
| mbs | : | Millibars |
| mHz | : | Mega Hertz |
| MLG | : | Main Landing Gear |
| MPD | : | Maintenance Planning Data |
| NDB | : | Non Directional Beacon |
| NLG | : | Nose Landing Gear |
| nm | : | Nautical Mile |
| PAPI | : | Precision Approach Path Indicator |
| 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 |
| SCT | : | Scatter |
| SIC | : | Second in Command |
| SMS | : | Safety Management System |
| TBA | : | To be Advise |
| TT/TD | : | Ambient Temperature/Dew Point |
| UTC | : | Universal Time Coordinate |
| VASI | : | Visual Approach Slope Indicator |
| VMC | : | Visual Meteorological Condition |
| VNAV | : | Vertical Navigation |

# INTRODUCTION

## SYNOPSIS

On 28 August 2015 a Boeing 737-300 Freighter, registered PK-BBY was being operated by PT. Cardig Air on a scheduled cargo flight from Sentani Airport (WAJJ) Jayapura to Wamena Airport (WAVV) Papua, Indonesia.

At 1234 LT (0334 UTC), the aircraft departed to Wamena and on board the aircraft were two pilots, and 14,610 kg of cargo. The Pilot in Command (PIC) acted as Pilot Flying (PF) while the Second in Command (SIC) who was under line training acted as Pilot Monitoring (PM). There was no reported or recorded aircraft system abnormality during the flight until the time of occurrence.

When the aircraft approaching PASS VALLEY, the Wamena Tower controller provided information that the runway in use was runway 15 and the wind was 150°/18 knots, QNH was 1,003 mbs and temperature was 23 °C.

At 0646 UTC, the aircraft was on final runway 15 and Wamena Tower controller issued landing clearance with additional information of wind 150°/15 knots and QNH 1,003 mbs.

At 0647 UTC, the aircraft touched down about 35 meter before the beginning runway 15 with vertical acceleration of 3.68 G. The left main landing gear collapsed and the left engine contacted to the runway surface. The aircraft stopped at about 1,500 meters from runway threshold.

No one was injured on this occurrence.

The analysis on this Final Report discussed the relevant issues resulting in the under-shooting and the landing gear damage involving a Boeing 737-300 aircraft. The investigation determined the contributing factor was the large thrust reduction during the windshear resulted in rapid descend and the aircraft touched down with 3.683 G then collapsed the landing gear that had strength degradation.

At the time of issuing this report, the Komite Nasional Keselamatan Transportasi had been informed of safety actions resulting from the PT. Cardig Air. While the KNKT acknowledges the safety actions taken by the Merpati Pilot School, there still remain safety issues that need to be considered.

As a result of this investigation, the KNKT issued safety recommendations to address safety issues identified in this report to the PT. Cardig Air, AirNav Indonesia, Wamena Airport and Directorate General of Civil Aviation.

# 1 FACTUAL INFORMATION

## 1.1 History of the Flight

On 28 August 2015 a Boeing 737-300 Freighter, registered PK-BBY was being operated by PT. Cardig Air on a scheduled cargo flight from Sentani Airport (WAJJ) Jayapura to Wamena Airport[1] (WAVV) Papua, Indonesia.

At 1234 LT (0334 UTC[2]), the aircraft departed to Wamena and on board the aircraft were two pilots, and 14,610 kg of cargo. The Pilot in Command (PIC) acted as Pilot Flying (PF) while the Second in Command (SIC) who was under line training acted as Pilot Monitoring (PM). There was no reported or recorded aircraft system abnormality during the flight until the time of occurrence.

At 0637 UTC, when the aircraft approaching PASS VALLEY, the Wamena Tower controller provided information that the runway in use was runway 15 and the wind was 150°/18 knots, QNH was 1,003 mbs and temperature was 23 °C.

At 0639 UTC, the pilot reported position over PASS VALLEY, descended passing FL135. The Wamena Tower controller instructed the pilot to report position over JIWIKA.

At 0645 UTC, the pilot reported position over JIWIKA and continued to final runway 15.

At 0646 UTC, the pilot reported position on final runway 15 and Wamena Tower controller provided landing clearance with additional information of wind 150°/15 knots and QNH 1,003 mbs.

At 0647 UTC, the aircraft touched down about 35 meter before the beginning runway 15 with vertical acceleration of 3.68 G. The left main landing gear collapsed and the left engine contacted to the runway surface. The aircraft stopped at about 1,500 meters from runway threshold.

No one was injured on this occurrence.

1 Wamena Airport (WAJW) Papua, Indonesia will be named Wamena for the purpose of this report.

2 The 24-hours clock in Universal Time Coordinated (UTC) is used in this report to describe the local time as specific events occured. Local time is UTC+9 hours.

**Figure 1: The aircraft last position**

## 1.2 Injuries to Persons

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

## 1.3 Damage to Aircraft

The aircraft substantially damaged, with the following condition:

The trunnion link of the left Main Landing Gear (MLG) assembly broken with the detail:

- the left MLG collapsed;
- the left landing gear access panel lower fairing damaged;
- the shock strut of the right MLG leaked and deflated.

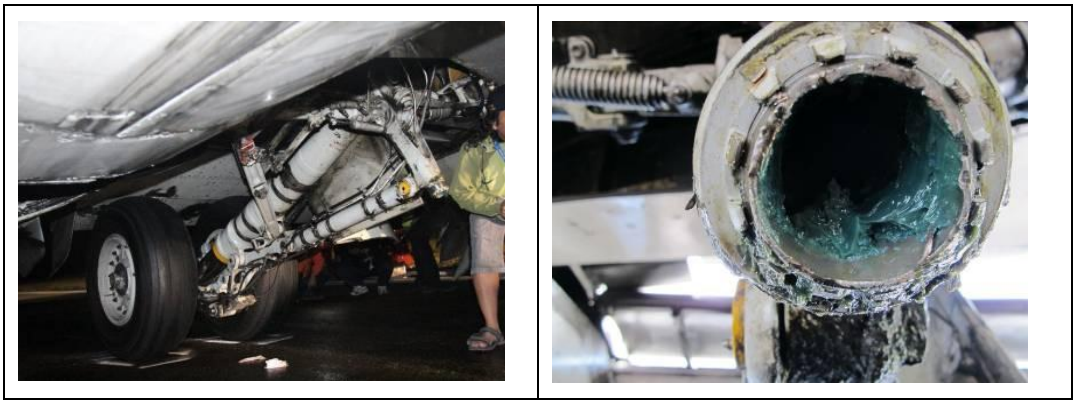


**Figure 2: The collapse left MLG and broken trunion link**

**Figure 3: The left engine condition**

The detail damages on the left Engine are as follow:

- Lower Fan cowling inner and outer damage;
- Lower Gearbox Casing scratch;
- Lower C-Duck thrust reverser inner damage;
- Lower C-Duct thrust reverser outer damage.

The detail damages on the left wing are as follow:

- Lower inboard trailing edge, aft and mid flap dent;
- Upper outboard flap track fairing dent;
- Inboard flap track fairing dent;
- Flap transmission assembly (ball screw) number 2 broken.

## 1.4 Other damage

There was no other damage reported.

## 1.5 Personnel information

### 1.5.1 Pilot in Command

| | | |
|---|---|---|
| Gender | : | Male |
| Age | : | 48 years old |
| Nationality | : | Indonesian |
| Marital status | : | Married |
| Date of joining company | : | 15 September 2008 |
| License | : | ATPL |
| Date of issue | : | 17 October 2002 |
| Aircraft type rating | : | B737 CL |
| Instrument rating | : | 31 October 2014 |
| Medical certificate | : | First Class |
| Last of medical | : | 01 April 2015 |
| Validity | : | 31 October 2015 |

| | | |
|---|---|---|
| Medical limitation | : | Holder shall wear lenses that correct for distant vision and possess glasses that correct for near vision |
| Last line check | : | 13 November 2014 |
| Last proficiency check | : | 20 April 2015 |
| Last windshear recurrent training | : | 2 April 2015 |
| **Flying experience** | | |
| Total hours | : | 13,880.8 hours |
| Total on type | : | 4,877.2 hours |
| Last 90 days | : | 73.6 hours |
| Last 60 days | : | 57.1 hours |
| Last 24 hours | : | 5.1 hours |
| This flight | : | 30 minutes |

### 1.5.2 Second in Command

| | | |
|---|---|---|
| Gender | : | Male |
| Age | : | 35 years old |
| Nationality | : | Korean |
| Marital status | : | Single |
| Date of joining company | : | 15 January 2015 |
| License | : | CPL |
| Date of issue | : | 18 December 2012 |
| Aircraft type rating | : | B 737CL |
| Instrument rating | : | 30 June 2016 |
| Medical certificate | : | First Class |
| Last of medical | : | 15 May 2015 |
| Validity | : | 15 November 2015 |
| Medical limitation | : | Holder shall wear lenses that correct for distant vision and possess glasses that correct for near vision |
| Last proficiency check | : | 24 June 2015 |
| Last windshear recurrent training | : | 20 April 2015 |
| **Flying experience** | | |
| Total hours | : | 608.9 hours |
| Total on type | : | 342.7 hours |
| Last 90 days | : | 77.2 hours |

| | | |
|---|---|---|
| Last 60 days | : | 77.2 hours |
| Last 24 hours | : | 5.1 hours |
| This flight | : | 30 minutes |

## 1.6 Aircraft Information

### 1.6.1 General

| | | |
|---|---|---|
| Registration Mark | : | PK-BBY |
| Manufacturer | : | Boeing Company |
| Country of Manufacturer | : | United States of America |
| Type/ Model | : | 737-300F |
| Serial Number | : | 23535 |
| Year of manufacture | : | 1986 |
| Certificate of Airworthiness | | |
| Issued | : | 15 May 2015 |
| Validity | : | 14 May 2016 |
| Category | : | Transport |
| Limitations | : | None |
| Certificate of Registration | | |
| Number | : | 3070 |
| Issued | : | 14 April 2015 |
| Validity | : | 13 April 2016 |
| Time Since New | : | 54,254 hours |
| Cycles Since New | : | 38,422 hours |
| Last Major Check | : | C01 Check |
| Last Minor Check | : | A03 Check |

### 1.6.2 Engines

| | | |
|---|---|---|
| Manufacturer | : | CFM |
| Type/Model | : | CFM56-3B2 |
| Serial Number-1 engine | : | 721550 |
| ▪ Time Since New | : | 60,055 hours 46 minutes |
| ▪ Cycles Since New | : | 42,997 Cycles |
| Serial Number-2 engine | : | 860256 |
| ▪ Time Since New | : | 17,765 hours 46 minutes |
| ▪ Cycles Since New | : | 12,369 cycles |

### 1.6.3 Flap Load Limiter System

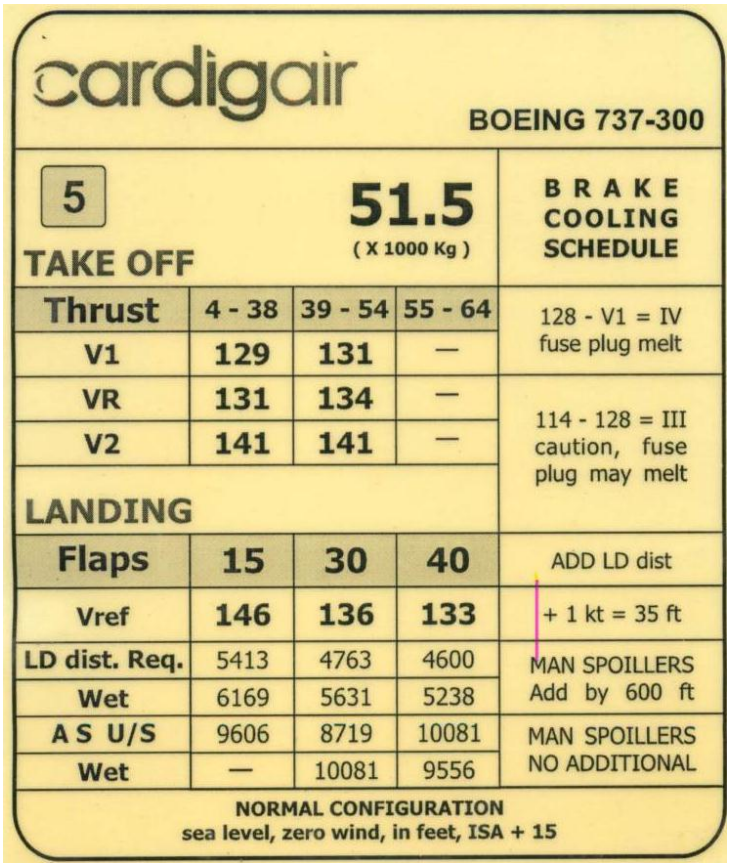
The Boeing 737 Flight Crew Operations Manual chapter Flight Controls -System Description D6-27370-301-PNM stated that the flap load limiter provides trailing edge (TE) flap load relief function which protects the flaps from excessive air loads. This function is operative at the flaps 40 position only.

The FLAP lever does not move, but the flap position indicator displays flap retraction and re–extension and on some airplanes FLAP LOAD RELIEF light illuminates. When the flaps are set at 40 the TE flaps:

- retract to 30 if airspeed exceeds 158 knots for the 737-300.
- re-extend when airspeed is reduced 153 knots for the 737-300.

### 1.6.4 Weight and Balance

The weight and balance document showed the aircraft Zero Fuel Weight was 45,810 kg, Takeoff Weight was 52,810 kg and the Landing weight was 51,110 kg. The Mean Aerodynamic Chord (MAC) for takeoff and landing was 15.5%. The aircraft was operated within the weight and balance envelope.



cardigair — BOEING 737-300

5 TAKE OFF — 51.5 ( X 1000 Kg ) — BRAKE COOLING SCHEDULE

| Thrust | 4 - 38 | 39 - 54 | 55 - 64 | 128 - V1 = IV fuse plug melt |
|---|---|---|---|---|
| V1 | 129 | 131 | — | |
| VR | 131 | 134 | — | 114 - 128 = III caution, fuse plug may melt |
| V2 | 141 | 141 | — | |

LANDING

| Flaps | 15 | 30 | 40 | ADD LD dist |
|---|---|---|---|---|
| Vref | 146 | 136 | 133 | + 1 kt = 35 ft |
| LD dist. Req. | 5413 | 4763 | 4600 | MAN SPOILLERS Add by 600 ft |
| Wet | 6169 | 5631 | 5238 | |
| A S U/S | 9606 | 8719 | 10081 | MAN SPOILLERS NO ADDITIONAL |
| Wet | — | 10081 | 9556 | |

NORMAL CONFIGURATION
sea level, zero wind, in feet, ISA + 15

## 1.7 Meteorological Information

The weather data for Wamena Airport issued by the Badan Meteorologi Klimatologi dan Geofisika **(**BMKG/ Meteorology Climatology and Geophysics Agency), and the weather observation performed 10 minutes prior to the issuance. The weather reports on 28August 2015, between 0600 to 0700 UTC were as follows:

| | 0600 UTC | 0700 UTC |
|---|---|---|
| Wind | 150°/14-19 knots | 150°/15-23 knots |
| Visibility | 10 km | 10 km |
| Weather | NIL | NIL |
| Cloud | SCT[3] Cu 480 m | SCT Cu 480 m |
| TT/TD | 24 /15°C | 23 /14°C |
| QNH (mbs) | 1,003 | 1,004 |
| QFE (mbs) | 834 | 833 |

## 1.8 Aids to Navigation

Wamena Airport equipped with a Non-Directional Beacon (NDB) identify as ZW on frequency 222 mHz. There was no instrument approach procedure published for this airport.

The Wamena Airport equipped with a Visual Approach Slope Indicator (VASI). After the runway extension this VASI was not operated.

## 1.9 Communications

All communications between Air Traffic Services (ATS) and the crew were recorded by ground based automatic voice recording equipment and Cockpit Voice Recorder (CVR) for the duration of the flight. The quality of the recorded transmissions was good.

## 1.10 Aerodrome Information

| | | |
|---|---|---|
| Airport Name | : | Wamena Airport |
| Airport Identification | : | WAVV/WMX |
| Airport Operator | : | DGCA |
| Coordinate | : | 04°31’53”S 136°33’18”E |
| Elevation | : | 5,084 feet |
| Runway Direction | : | 15 – 33 |
| Runway Length | : | 2,175 meters |
| Runway Width | : | 30 meters |
| Surface | : | Asphalt |

3 Cloud amount is assessed in total which is the estimated total apparent area of the sky covered with cloud. The international unit for reporting cloud amount for Scatter (SCT) is when the clouds cover more than half (3/8 up to 4/8) area of the sky.

The Wamena airport was operated by *Unit Pelaksana Teknis* (unit under the DGCA responsible to manage government-owned airport) of Directorate General of Civil Aviation (DGCA), at the time of occurrence the Aerodrome Operation Manual was still on process after last renewal audit by the Airport Directorate of DGCA.

The daily traffic movement was approximately 120 to 150 with various aircraft from general aviation up to Boeing 737-300.

The Visual Approach Slope Indicator (VASI) of runway 15 was not operated after the runway extension.

The investigation found several touchdown marks on the pavement before the runway 15.

The surface of runway 15 found excessive rubber deposit at about 600 meters started from the runway threshold. The investigation did not found specific aerodrome maintenance program and the inspection system applicable to the runway and other facilities of Wamena airport.

**Figure 4: Rubber deposit on runway 15**

**Figure 5: Touchdown marks found on the pavement before the runway 15**

## 1.11 Flight Recorders

### 1.11.1 Flight Data Recorder

The aircraft was equipped with an Allied Signal Flight Data Recorder (FDR) with part number 980-4700-042 and serial number 2466. The recorder was transported to KNKT recorder facility for data downloading process. The FDR recorded 467 parameters which was containing 170 flights including the occurrence flight.

The FDR system of this aircraft was capable to record the vertical acceleration eight samples per second.

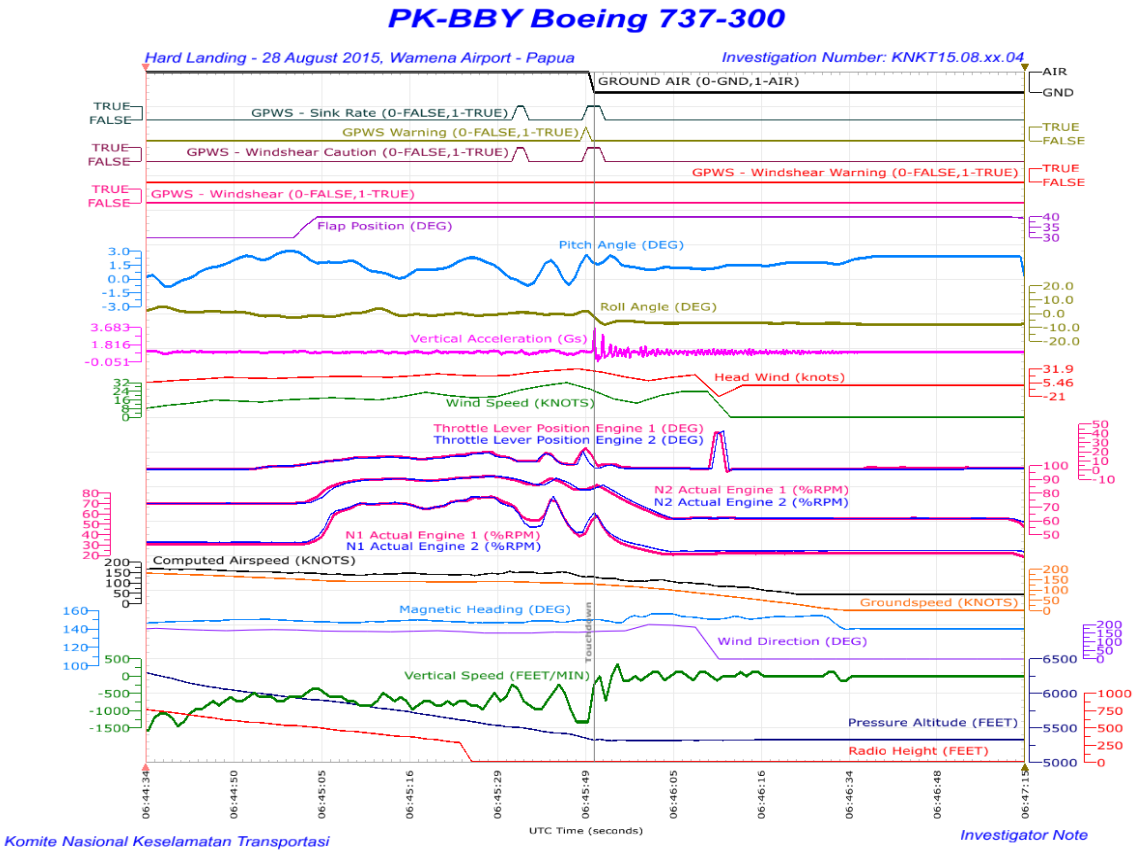



**Figure 6: The significant FDR parameters**

The FDR data contained of 107 flight hours consisted of 170 flight sectors. The following table was the summary of the vertical acceleration (G) recorded on the FDR during landing in Jayapura and Wamena.

| | Landing Airport | |
|---|---|---|
| | WAJJ | WAVV |
| Minimum | 1.0 | 1.4 |
| Maximum | 1.8 | 3.5 |
| Average | 1.4 | 1.8 |
| <1.5 | 51 | 1 |
| 1.5<x<2 | 20 | 65 |
| 2<x<2.5 | 0 | 4 |
| 2.5<x<3 | 0 | 0 |
| >3 | 0 | 1 |

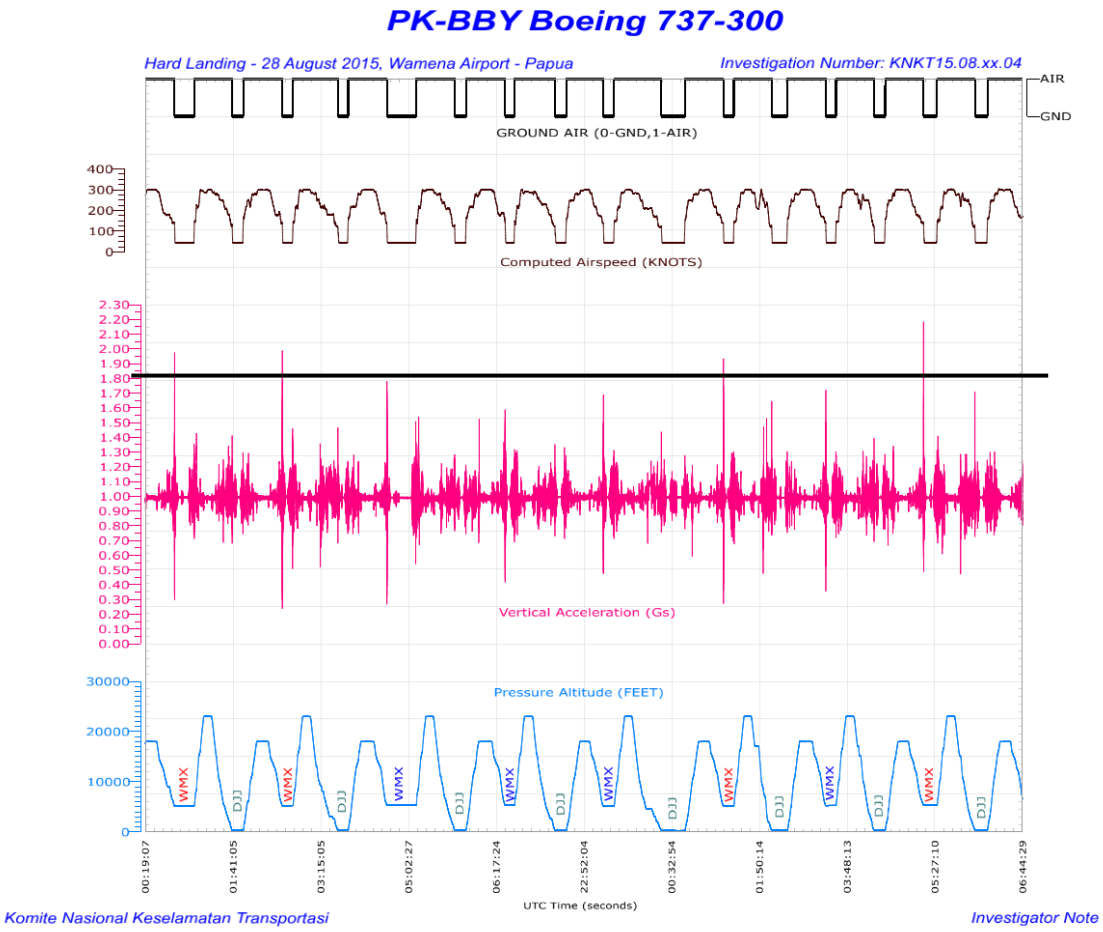



**Figure 7: The FDR data of last 6 hours 25 minutes**

The last 6 hours 25 minutes of FDR recorded 16 flight sectors including four events of the vertical acceleration exceeded 1.8 G during landing at Wamena.

### 1.11.2 Cockpit Voice Recorder

The aircraft was fitted with L3 Communication Cockpit Voice Recorder with part number 2100-1020-00and serial number 0333000320801. The recorder was transported to KNKT recorder facility for data downloading process. The CVR recorded 2 hours and 4 minutes of good quality recording data.

### 1.11.3 Significant Information from Flight Recorders

| Time (UTC) | Vertical Speed (ft/min) | Pressure Altitude (ft) | CAS (kts) | Heading (deg) | Flap (deg) | Ground/ Air | N1 Engine 1 (%RPM) | N1 Engine 2 (%RPM) | Pitch Angle (deg) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 06:41:30 | -1,080 | 11,972 | 183 | 235.5 | - | AIR | 30.6 | 32.6 | 4.32 | Landing Gear extended |
| 06:41:39 | -1,200 | 11,820 | 179 | 235.2 | 4.9 | AIR | 30.7 | 32.6 | 3.4 | Flap 15 selected |
| 06:41:49 | -1,080 | 11,616 | 174 | 235.5 | 14.9 | AIR | 30.6 | 32.5 | 3.36 | - |
| 06:42:24 | -1,920 | 10,568 | 174 | 225.7 | - | AIR | 30.4 | 32.5 | 1.04 | Reported over JIWIKA 10,000 feet |
| 06:42:36 | -1,920 | 10,188 | 176 | 218.0 | - | AIR | 30.4 | 32.6 | 0.7 | Flap 30 selected |
| 06:42:43 | -1,440 | 9,988 | 173 | 219 | 29.9 | AIR | 30.4 | 32.5 | -1.15 | - |
| 06:43:39 | -2,280 | 8,120 | 166 | 208 | 29.9 | AIR | 30.3 | 32.5 | -3.05 | Flap 40 selected |
| 06:43:43 | -2,400 | 7,968 | 168 | 206 | 29.9 | AIR | 30.4 | 32.5 | -2.83 | - |
| 06:43:44 | -2,400 | 7,924 | 168 | 206 | - | AIR | 30.3 | 32.6 | -2.93 | - |
| 06:44:39 | -1,080 | 6,236 | 168 | 147 | 29.9 | AIR | 30.4 | 32.6 | -0.8 | EGPWS altitude call “ONE THOUSAND” heard |
| 06:45:03 | -480 | 5,920 | 149 | 148 | 35.5 | AIR | 31.0 | 33.0 | 2.46 | - |
| 06:45:05 | -360 | 5,908 | 147 | 147 | 39.9 | AIR | 34.4 | 39.5 | 1.72 | - |
| 06:45:07 | -600 | 5,892 | 142 | 147 | 39.9 | AIR | 47.1 | 59.3 | 1.84 | - |
| 06:45:09 | -600 | 5,872 | 143 | 147 | 39.9 | AIR | 62.0 | 64.3 | 1.78 | - |
| 06:45:11 | -720 | 5,848 | 140 | 147 | 39.9 | AIR | 65.6 | 68.3 | 2.01 | - |
| 06:45:13 | -840 | 5,820 | 137 | 147 | 39.9 | AIR | 69.9 | 69.8 | 1.29 | - |
| 06:45:15 | -720 | 5,792 | 143 | 148 | 39.9 | AIR | 69.1 | 69.9 | 0.8 | - |
| 06:45:17 | -600 | 5,776 | 144 | 148 | 39.9 | AIR | 70.3 | 70.1 | 0.55 | - |
| 06:45:19 | -600 | 5,752 | 145 | 149 | 39.9 | AIR | 70.3 | 70.0 | 0.06 | - |
| 06:45:21 | -960 | 5,728 | 148 | 149 | 39.9 | AIR | 69.0 | 68.1 | 0.59 | - |
| 06:45:23 | -720 | 5,700 | 144 | 149 | 39.9 | AIR | 65.5 | 65.0 | 1.04 | - |
| 06:45:25 | -840 | 5,676 | 141 | 148 | 39.9 | AIR | 66.0 | 66.7 | 1.04 | - |
| 06:45:27 | -720 | 5,648 | 141 | 148 | 39.9 | AIR | 67.9 | 69.9 | 1.19 | - |
| 06:45:29 | -720 | 5,620 | 138 | 147 | 39.9 | AIR | 72.5 | 72.8 | 1.84 | - |
| 06:45:31 | -840 | 5,596 | 142 | 147 | 39.9 | AIR | 73.0 | 76.6 | 2.3 | - |
| 06:45:33 | -960 | 5,568 | 140 | 146 | 39.9 | AIR | 75.4 | 75.8 | 2.09 | - |
| 06:45:35 | -480 | 5,544 | 147 | 147 | 39.9 | AIR | 76.4 | 75.8 | 1.58 | - |
| 06:45:37 | -600 | 5,520 | 147 | 147 | 39.9 | AIR | 71.7 | 68.4 | 0.59 | EGPWS “CAUTION WINDSHEAR” heard |
| 06:45:39 | -360 | 5,512 | 150 | 147 | 39.9 | AIR | 66.6 | 61.1 | -0.08 | - |
| 06:45:41 | -840 | 5,488 | 151 | 148 | 39.9 | AIR | 54.8 | 47.5 | -0.72 | - |
| 06:45:43 | -960 | 5,456 | 145 | 149 | 39.9 | AIR | 53.4 | 48.7 | 0.61 | - |
| 06:45:44 | -720 | 5,444 | 147 | 149 | - | AIR | 58.6 | 65.4 | 1.72 | EGPWS altitude call “ONE HUNDRED” heard |
| 06:45:45 | -480 | 5,432 | 148 | 148 | 39.9 | AIR | 73.5 | 77.3 | 2.03 | - |
| 06:45:46 | -240 | 5,428 | 151 | 147 | 39.9 | AIR | 72 | 65.5 | 1.29 | - |
| 06:45:47 | -480 | 5,424 | 154 | 147 | 39.9 | AIR | 59.9 | 54.0 | 0 | - |

| Time (UTC) | Vertical Speed (ft/min) | Pressure Altitude (ft) | CAS (kts) | Heading (deg) | Flap (deg) | Ground/ Air | N1 Engine 1 (%RPM) | N1 Engine 2 (%RPM) | Pitch Angle (deg) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 06:45:48 | -960 | 5,412 | 150 | 148 | - | AIR | 49.7 | 46.8 | -0.64 | EGPWS altitude call “FIFTY” heard |
| 06:45:49 | -1,320 | 5,392 | 142 | 149 | 39.9 | AIR | 42.5 | 41.9 | 0.12 | EGPWS altitude call “FOURTY” heard |
| 06:45:50 | -1,320 | 5,368 | 133 | 150 | - | AIR | 38.4 | 42.3 | 1.62 | EGPWS warning “SINK RATE” heard |
| 06:45:51 | -1,320 | 5,348 | 129 | 149 | 39.9 | AIR | 41.3 | 54.0 | 2.64 | - |
| 06:45:52 | -240 | 5,324 | 131 | 150 | - | GND | 53.1 | 61.3 | 1.8 | Touchdown |

The significant information from the table above was as follows:

- 06:42:24 UTC, the pilot reported over JIWIKA on altitude 10,000 feet and the FDR recorded the altitude was on 10,568 feet. The engines were on idle.
- Between 06:42:24 until 06:43:44 UTC, the average rate of descend was approximately 2,000 feet per minute.
- 06:43:39 UTC, the flap selector was set to 40 position when the aircraft on altitude of 8,120 feet, and moved to 39.9° when the aircraft on altitude of 5,908 feet one minute 25 seconds later.
- 06:45:37 UTC, the EGPWS “CAUTION WINDSHEAR” active on altitude of 5,520 feet.
- 06:45:43 UTC, the engine power increased when the aircraft altitude was on 5,920 feet prior the EGPWS altitude call “ONE HUNDRED” heard.
- Started from 06:45:45 UTC, the FDR recorded the CAS increased from 148 knots to 154 knots followed by N1 decreased gradually from 73% to 38%. Three seconds before touched down, the rate of descend was constant on value 1,320 feet per minute followed by EGPWS warning “SINK RATE”.
- 06:45:52 UTC, the aircraft touched down on altitude 5,324 feet with recorded vertical acceleration up to 3.683 G.

## 1.12 Wreckage and Impact Information

The investigation found touchdown mark before the beginning of the pavement at about 35 meter from threshold runway 15.

**Figure 8: Touchdown mark on the surface before the runway pavement**

There was a combination of metal and rubber scratch mark started from the threshold until position of aircraft stopped at approximately 1,500 meters from beginning runway 15.

**Figure 9: Metal scratch mark started from the runway threshold until aircraft final position**

## 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 pre or post-impact fire.

## 1.15 Survival Aspects

The flight crew safely evacuated from the aircraft.

## 1.16 Tests and Research

No test and research conducted for this investigation.

## 1.17 Organizational and Management Information

| | | |
|---|---|---|
| Aircraft Owner | : | Celestial Trading 51 Limited |
| Address | : | Aviation House Shannon County Clare, Ireland |
| Aircraft Operator | : | PT. Cardig Air |
| Address | : | Alia Building 4$^{th}$ floor, Jl. M.I Ridwan Rais No. 10-18 Jakarta |

PT. Cardig Air held valid Air Operator Certificate (AOC) number 121-013. The operator operated three Boeing 737-300F aircraft and served cargo operation on route Jayapura to Wamena ten times daily.

The operator has not established a system to utilize flight recorder data to monitor flight crew and aircraft performance.

### 1.17.1 Continuous Airworthiness Maintenance Program

The Continuous Airworthiness Maintenance Program (CAMP) of the operator had been reviewed referring to Boeing 737-300/400/500 Maintenance Planning Data (MPD) D6-38278 revision March 2015 by the Directorate General of Civil Aviation (DGCA) and approved on 1 June 2015.

Refer to Component Maintenance Information (Chapter 05-01) both main landing gears maintenance interval was every 21,000 cycles or 10 years, whichever occurs first.

### 1.17.2 Boeing 737-300/400/500 Aircraft Maintenance Manual

**Chapter 05-51-51 page 201**

*Hard Landing or High Drag/Side Load Landing, or Off Runway Excursion Maintenance Practices (Conditional Inspection)*

*B. Hard Landing*

*(1) The hard landing conditional inspection is for hard landings at any landing weight.*

*(2) If the pilot determines the airplane had a hard landing, a structural inspection is necessary.*

*(a) If all three of the following conditions are met, then the inspection of the nose landing gear is not required:*

1) *The flight crew reported that the landing was not a hard nose gear landing, or did not include a hard nose gear touchdown after derotation.*
2) *The landing was not a three-point landing.*
3) *The landing was not a nose gear first landing.*

*NOTE: ALL nose gear inspections are waived under these conditions, not just the NLG axle level check that requires jacking.*

*(b) If a structural examination/inspection is necessary, do the procedure "Phase I Inspection" in this section.*

*(c) For landings at or below maximum design landing weight on airplanes with flight data recording systems capable of at least eight (8) samples per second, the following can be used:*

*An indication of a hard landing on the main landing gear is a peak recorded vertical acceleration that exceeds 2.1 G (incremental 1.1 G). This vertical accelerometer data must be measured by the flight data recorder accelerometer at a data sampling rate of at least eight (8) samples per second.*

*This G-level threshold is valid for a conventional landing impact with no more than 2 degrees of airplane roll, main landing gear touchdown first and normal rotation onto the nose gear. For a hard landing that is a hard nose landing or is accompanied by more than two degrees of roll at the time of main landing gear impact, the recorded peak acceleration can be significantly less than 2.1 G, but a hard landing inspection may still be necessary.*

*(d) For landing at or below maximum design landing weight on airplanes with recording systems capable of at least sixteen (16) samples per second, the following can be used: An indication of a hard landing on the main landing gear is a peak recorded vertical acceleration that exceeds 2.2 G (incremental 1.2 G). This vertical accelerometer data must be measured by the flight data recorder accelerometer at a data sampling rate of at least sixteen (16) samples per second.*

### 1.17.3 Boeing 737-300 Flight Crew Operations Manual

***Windshear (page SP.16.20)***

*Windshear is a change of wind speed and/or direction over a short distance along the flight path. Indications of windshear are listed in the Windshear non-normal maneuver in this manual.*

***Precautions***

*If windshear is suspected, be especially alert to any of the danger signals and be prepared for the possibility of an inadvertent encounter. The following precautionary actions are recommended if windshear is suspected:*

***Approach and Landing***

- *Use flaps 30 for landing*
- *Establish a stabilized approach no lower than 1000 feet above the airport to improve windshear recognition capability*

- *Use the most suitable runway that avoids the areas of suspected windshear and is compatible with crosswind or tailwind limitations. Use ILS G/S, VNAV path or VASI/PAPI indications to detect flight path deviations and help with timely detection of windshear*
- *If the autothrottle is disengaged, or is planned to be disengaged prior to landing, add an appropriate airspeed correction (correction applied in the same manner as gust), up to a maximum of 20 knots*
- *Avoid large thrust reductions or trim changes in response to sudden airspeed increases as these may be followed by airspeed decreases*
- *Crosscheck flight director commands using vertical flight path instruments*
- *Crew coordination and awareness are very important, particularly at night or in marginal weather conditions. Closely monitor the vertical flight path instruments such as vertical speed, altimeters, and glideslope displacement. The pilot monitoring should call out any deviations from normal. Use of the autopilot and autothrottle for the approach may provide more monitoring and recognition time.*

***Recommended Elements of a Stabilized Approach (page 5.4)***

*The following recommendations are consistent with criteria developed by the Flight Safety Foundation.*

*All approaches should be stabilized by 1,000 feet AFE in instrument meteorological conditions (IMC) and by 500 feet AFE in visual meteorological conditions (VMC). An approach is considered stabilized when all of the following criteria are met:*

- *the airplane is on the correct flight path*
- *only small changes in heading and pitch are required to maintain the correct flight path*
- *the airplane should be at approach speed. Deviations of +10 knots to – 5 knots are acceptable if the airspeed is trending toward approach speed*
- *the airplane is in the correct landing configuration*
- *sink rate is no greater than 1,000 fpm; if an approach requires a sink rate greater than 1,000 fpm, a special briefing should be conducted*
- *thrust setting is appropriate for the airplane configuration*
- *all briefings and checklists have been conducted.*

*Specific types of approaches are stabilized if they also fulfill the following:*

- *ILS approaches should be flown within one dot of the glide slope and localizer, or within the expanded localizer scale (as installed)*
- *during a circling approach, wings should be level on final when the airplane reaches 300 feet AFE.*

*Unique approach procedures or abnormal conditions requiring a deviation from the above elements of a stabilized approach require a special briefing.*

*Note: An approach that becomes unstabilized below 1,000 feet AFE in IMC or below 500 feet AFE in VMC requires an immediate go-around.*

### 1.17.4 Boeing 737 CL Flight Crew Training Manual

***Landing (page 1.10)***

*If the autothrottle is disconnected, or is planned to be disconnected prior to landing, the recommended method for approach speed correction is to add one half of the reported steady headwind component plus the full gust increment above the steady wind to the reference speed. The minimum command speed setting is VREF + 5 knots. One half of the reported steady headwind component can be estimated by using 50% for a direct headwind, 35% for a 45° crosswind, zero for a direct crosswind and interpolation in between.*

***Visual Traffic Pattern (page 5.49)***

***Visual Approach - General***

*The recommended landing approach path is approximately 2 1/2° to 3°. Once the final approach is established, the airplane configuration remains fixed and only small adjustments to the glide path, approach speed, and trim are necessary. This results in the same approach profile under all conditions.*

***Thrust***

*Engine thrust and elevators are the primary means to control attitude and rate of descent. Adjust thrust slowly using small increments. Sudden large thrust changes make airplane control more difficult and are indicative of an unstable approach.*

*No large changes should be necessary except when performing a go-around. Large thrust changes are not required when extending landing gear or flaps on downwind and base leg. A thrust increase may be required when stabilizing on speed on final approach.*

***Final Approach***

*Roll out of the turn to final on the extended runway centerline and maintain the appropriate approach speed. An altitude of approximately 300 feet AFE for each NM from the runway provides a normal approach profile. Attempt to keep thrust changes small to avoid large trim changes. With the airplane in trim and at approach airspeed, pitch attitude should be approximately the normal approach body attitude. At speeds above approach speed, pitch attitude is less. At speeds below approach speed, pitch attitude is higher. Slower speed reduces aft body clearance at touchdown. Stabilize the airplane on the selected approach airspeed with an approximate rate of descent between 700 and 900 feet per minute on the desired glide path, in trim. Stabilize on the profile by 500 feet above touchdown.*

*Note: Descent rates greater than 1,000 fpm should be avoided.*

***Chapter 6: Landing (page 6.8)***

***Flare and Touchdown***

***Airspeed Control***

*During an autoland, the autothrottle retards the thrust so as to reach idle at touchdown. The 5 knot additive is bled off during the flare.*

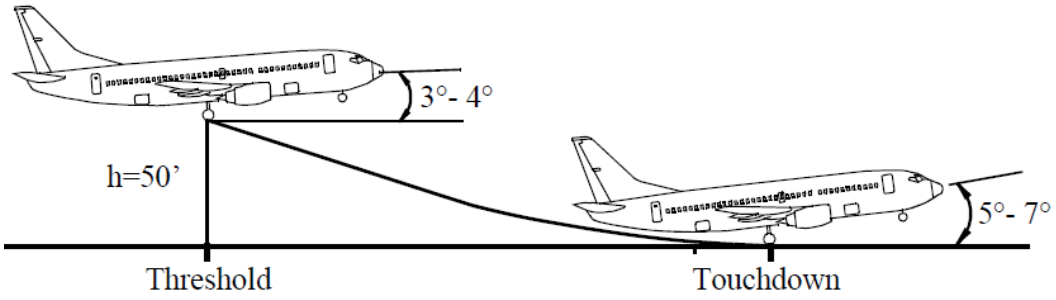
*If the autothrottle is disengaged, or is planned to be disengaged prior to landing, maintain VREF plus the wind additive until beginning the flare. The steady headwind correction is bled off during the flare, however the gust correction is maintained to touchdown. Plan to touchdown at VREF plus the gust correction.*

*With proper airspeed control and thrust management, touchdown should occur at no less than VREF - 5 knots.*

***Landing Flare Profile***

*The following diagrams use these conditions:*

- *3° approach glide path*
- *flare distance is approximately 1,000 to 2,000 feet beyond the threshold*
- *typical landing flare times range from 4 to 8 seconds and are a function of approach speed*
- *airplane body attitudes are based upon typical landing weights, flaps 30, VREF 30 + 5 (approach) and VREF 30 + 0 (touchdown), and should be reduced by 1° for each 5 knots above this speed.*




### 1.17.5 Civil Aviation Safety Regulation Part 25: Airworthiness Standards: Transport Category Airplanes

*EMERGENCY LANDING CONDITIONS*

*25.561 General*

*(a) The airplane, although it may be damaged in emergency landing conditions on land or water, must be designed as prescribed in this section to protect each occupant under those conditions.*

*(b) The structure must be designed to give each occupant every reasonable chance of escaping serious injury in a minor crash landing when−*

*(1) Proper use is made of seats, belts, and all other safety design provisions;*

*(2) The wheels are retracted (where applicable); and*

*(3) The occupant experiences the following ultimate inertia forces acting separately relative to the surrounding structure:*

*(i) Upward, 3.0 G*

*(ii) Forward, 9.0 G*

*(iii) Sideward, 3.0 G on the airframe; and 4.0 G on the seats and their attachments.*

*(iv) Downward, 6.0 G*

*(v) Rearward, 1.5 G*

### 1.17.6 Civil Aviation Safety Regulation Part 121

*121.65 Safety Management System (SMS)*

*(c) An air carrier operating an aircraft of a maximum certificated take-off mass in excess of 27.000 kg shall establish and maintain a flight data analysis program as part of its safety management system.*

## 1.18 Additional Information

**Honeywell EGPWS Pilot Guide**

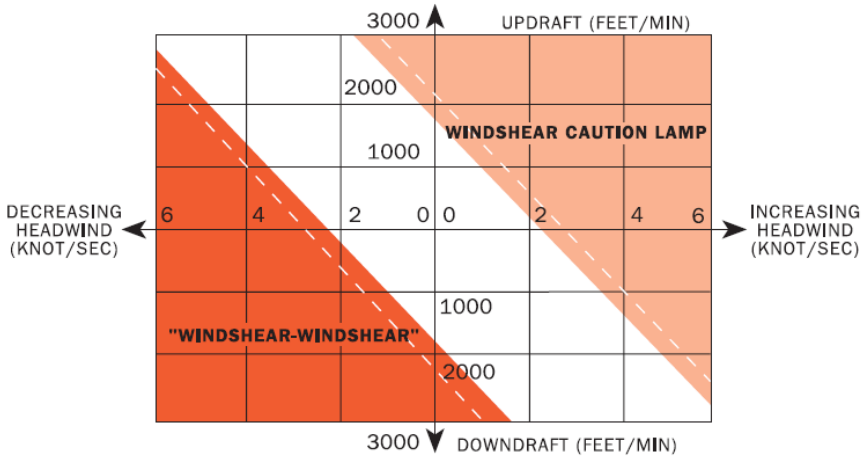
***MODE 7 WINDSHEAR***

*Mode 7 is designed to provide alerts if the aircraft encounters windshear. Two alerting envelopes provide either a Windshear Caution alert or a Windshear Warning alert each with distinctive aural and visual indications to the flight crew.*

*EGPWS windshear is provided for certain (not all) aircraft types and is a function of certain additionally required input signals and enabled internal detection algorithms. These are established during the initial installation and addressed in the appropriate Airplane Flight Manual (AFM) or EGPWS Airplane Flight Manual Supplement (AFMS).*

*Windshear Caution alerts are given if an increasing headwind (or decreasing tailwind) and/or a severe updraft exceed a defined threshold. These are characteristic of conditions preceding an encounter with a microburst.*

*A Windshear Caution (if enabled) results in illumination of amber Windshear Caution lights and may (if separately enabled) also be accompanied by the aural message "CAUTION, WINDSHEAR". The lights remain on for as long as the aircraft is exposed to conditions in excess of the caution alert threshold. The Windshear Caution envelope is illustrated in the figure below.*




***Windshear Caution***

*This alert generally occurs due to increasing performance windshear conditions (i.e., increasing headwind, decreasing tailwind, and/or updraft). This alert is generally considered advisory in that the crew response is to be alert to the possibility of subsequent significant airspeed loss and down draft conditions. Coupled with other weather factors, the Windshear Caution should be considered in determining the advisability of performing a go-around.*

*Wind and gust allowances should be added to the approach speed, increasing thrust if necessary. It may be necessary to disengage autopilot or auto-throttle. Avoid getting low on the approach glidepath or reducing the throttles to idle.*

## 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 the under-shooting and the landing gear damage involving a Boeing 737-300 aircraft. Therefore the analysis will focus on the following issues:

- Windshear precaution;
- Repetitive high vertical acceleration.

## 2.1 Windshear Precaution

Refer to FCTM on chapter Visual Traffic Pattern stated that:

*The recommended landing approach path is approximately 2 1/2° to 3°. Once the final approach is established, the airplane configuration remains fixed and only small adjustments to the glide path, approach speed, and trim are necessary. This results in the same approach profile under all conditions.*

*Stabilize the airplane on the selected approach airspeed with an approximate rate of descent between 700 and 900 feet per minute on the desired glide path, in trim. Stabilize on the profile by 500 feet above touchdown.*

The recommended landing approach with 2 1/2° to 3° will result to the rate of descend between 700 and 900 feet per minute. The FDR recorded the approach below 5,700 feet pressure altitude (500 feet AGL) was performed with rate of descend varies between 700 to 900 feet/minute. This indicated that the approach was on the correct glide path.

The BMKG weather report was wind 150°/14-19 knots, visibility 10 km, cloud scattered cumulus and present weather nil. The Wamena Tower controller reported to the pilot that the wind was 150°/15 knots. The information of gust wind, which indicated the possibility of windshear, was not reported to the pilot.

The CVR recorded that during final approach at approximately 5,500 feet pressure altitude (300 feet AGL), the EGPWS caution "CAUTION WINDSHEAR" active. The FDR recorded that the head wind changed from 19 knots to 25 knots. This head wind changed met the criteria of the EGPWS mode 7 to trigger the caution. This was an indication that the windshear was exist.

The Boeing FCOM stated:

- *If the autothrottle is disengaged, or is planned to be disengaged prior to landing, add an appropriate airspeed correction (correction applied in the same manner as gust), up to a maximum of 20 knots*
- *Avoid large thrust reductions or trim changes in response to sudden airspeed increases as these may be followed by airspeed decreases*

The Boeing FCTM stated the recommended method for approach speed correction is to add one half of the reported steady headwind component plus the full gust increment above the steady wind to the reference speed. While the Boeing FCOM stated that for the windshear precaution, the maximum approach speed correction is 20 knots.

Refer to the CVR data, the reported head wind 15 knots and the approach speed correction should be 8 knots.

The VRef of this flight for the particular configuration and aircraft weight was 133 knots. The recommended approach speed was VRef + 5 or 138. The approach speed correction for head wind precaution was additional 8 knots, hence the approach speed should be 146. FDR recorded that approach speed was average at 150 knots.

The CVR did not record any pilot conversation related to the wind correction of windshear precaution following "CAUTION WINDSHEAR" activation.

The Boeing FCOM for the windshear precaution on approach and landing recommend: a*void large thrust reductions or trim changes in response to sudden airspeed increases as these may be followed by airspeed decreases*. The FDR recorded 6 seconds prior to touchdown, the N1 decreased from 71% to 41% followed by decreasing of airspeed from 151 knots to 129 knots. The vertical speed indicated rapid descend up to 1,320 feet/ minute.

The absence of speed correction following the information of headwind of 15 knots and pilot crew briefing after activation of EGPWS caution windshear indicated that the pilot did not aware of the existing windshear, that might be contributed by the absence of gust wind information.

The large thrust reduction was not in accordance with the FCOM for windshear precaution and resulted in rapid descend.

## 2.2 Repetitive High Vertical Acceleration

The CASR part 25.561 (b) required the design of landing gear capable to support downward force minimum of 6 G. The downward force recorded in the FDR as vertical acceleration. The FDR recorded the vertical acceleration during touchdown was 3.683 G. This impact caused the left main landing gear collapsed.

The FDR data contained 170 landings in 107 flight hours on the flight sector between Jayapura and Wamena. The average vertical acceleration during landing in Jayapura recorded approximately 1.5 G, while in Wamena the average was approximately 1.7 G. The FDR also recorded three events of the vertical acceleration exceeded 2.1 G during landing at Wamena including the accident flight.

According to the AMM chapter 05-51-51, hard landing inspection should be performed following a landing with vertical acceleration exceed 2.1 G for aircraft equipped with FDR, which capable to record eight samples per second of vertical acceleration data including this aircraft. The value of vertical acceleration was not detected as the operator has not established a system to utilize flight recorder data to monitor aircraft performance.

Based on the FDR data, the aircraft had received vertical acceleration of more than 1.5 G at the last 170 landings including two landings exceeded 2.1 G. The accumulation of such value of vertical acceleration might lead to landing gear strength degradation.

The accident flight collapsed the landing gear, the FDR recorded the vertical acceleration was 3.683 G which was within the landing gear design limit. This indicated the degradation of landing gear strength.

# 3 CONCLUSION

## 3.1 Findings[4]

According to factual information during the investigation, the Komite Nasional Keselamatan Transportasi determines the findings of the investigation are listed as follows:

1. The pilots held valid licenses and medical certificates.
2. The aircraft had a valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R), and was operated within the weight and balance envelope.
3. There were no reports of aircraft system abnormalities during the flight.
4. After passed JIWIKA on altitude 10,000 feet, the FDR recorded the engines were on idle, the average rate of descend was approximately 2,000 feet per minute.
5. At altitude approximately 8,000 feet, the flap selected to 40 position and moved to 39.9° one minute 25 seconds later.
6. The BMKG weather report was wind 150°/14-19 knots and the Wamena Tower controller reported to the pilot that the wind was 150°/15 knots. The information of gust wind, which indicated the possibility of windshear, was not reported to the pilot.
7. The EGPWS "CAUTION WINDSHEAR" active on altitude of 5,520 feet.
8. 06:45:43 UTC, the engine power increased when the aircraft altitude was on 5,920 feet prior the EGPWS altitude call "ONE HUNDRED" heard.
9. Started from 06:45:45 UTC, the FDR recorded the CAS increased from 148 knots to 154 knots followed by N1 decreased gradually from 73% to 38%. Three seconds before touched down, the rate of descend was constant on value 1,320 feet per minute followed by EGPWS warning "SINK RATE".
10. The aircraft touched down at about 35 meters before the beginning runway 15 with the vertical acceleration recorded of 3.68 G.
11. The trunnion link of the left Main Landing Gear (MLG) assembly was found broken and the left main landing gear collapsed.
12. The FDR data contained of 107 flight hours consisted of 170 flight sectors which recorded five times of the vertical acceleration more than 2 G during landing at Wamena. The accumulation of such value of vertical acceleration might lead to landing gear strength degradation.
13. The Visual Approach Slope Indicator (VASI) of runway 15 was not operated after the runway extension.
14. The investigation found several touchdown marks on the pavement before the runway 15.

4 Findings are statements of all significant conditions, events or circumstances in the accident sequence. The findings are significant steps in the accident sequence, but they are not always causal, or indicate deficiencies. Some findings point out the conditions that pre-existed the accident sequence, but they are usually essential to the understanding of the occurrence, usually in chronological order.

15. Excessive rubber deposit was found on the surface of runway 15 at about 600 meter started from the runway threshold.
16. The absence of speed correction following the information of headwind of 15 knots and pilot crew briefing after activation of EGPWS caution windshear indicated that the pilot did not aware of the existing windshear, that might be contributed by the absence of gust wind information.
17. The large thrust reduction was not in accordance with the FCOM for windshear precaution and resulted in rapid descend.
18. The accident flight collapsed the landing gear, the FDR recorded the vertical acceleration was 3.683 G which was within the landing gear design limit. This indicated the degradation of landing gear strength.

## 3.2 Contributing Factor[5]

The large thrust reduction during the windshear resulted in rapid descend and the aircraft touched down with 3.683 G then collapsed the landing gear that had strength degradation.

5 "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 report, the Komite Nasional Keselamatan Transportasi (KNKT) has been informed safety actions taken by the aircraft operator following this accident.

The operator performed internal investigation and found several landings with excessive vertical acceleration on another aircraft on the same flight sector.

Based on the result of internal investigation, the operator issued internal recommendation on 16 September 2015 as follow:

- To review the Approach Landing Accident Reduction/Controlled Flight into Terrain training effectiveness and emphasize the implementation for Papua operation.
- Published notice to pilot to encourage pilot to go around when un-stabilized approach occurs on short final.
- To review the Standard Operation Procedure related to Jayapura – Wamena operation.

The aircraft operator had conducted corrective actions following the KNKT recommendations described in the preliminary report as follows:

- Established flight data analysis/flight operation quality assurance system in cooperation with a flight data analysis provider.
- Conducted immediate hard landing phase I inspection on another aircraft which experienced hard landing and schedule the inspection for the other aircraft.

The aircraft operator had conducted several corrective actions following the KNKT recommendations described in the draft final report as follows:

- On 3 April 2016, conducted windshear training briefing for pilots. The detail of briefing material can be found in appendices of this report;
- On 30 April 2016, initiated windshear training for pilots in the simulator. The detail of the windshear training syllabus can be found in appendices of this report.

# 5 SAFETY RECOMMENDATIONS

Komite Nasional Keselamatan Transportasi (KNKT) considered the safety actions taken by the aircraft operator were relevant to improve safety. In addition, KNKT issued safety recommendations to address safety issues identified in this report.

The DGCA is responsible to ensure the implementation of the safety recommendations addressed to the operators.

## 5.1 PT. Cardig Air

- **04.O-2016-45.1**

  To improve the windshear training to ensure appropriate pilot respond.

## 5.2 AirNav Indonesia

- **04.A-2016-46.1**

  To improve the knowledge of air traffic controller related to the windshear to be able to provide useful information for flight operation.

## 5.3 Wamena Airport

- **04.B-2016-47.1**

  To develop an aerodrome maintenance programme.

- **04.B-2016-48.1**

  To review and improve the runway inspection system.

- **04.B-2016-49.1**

  To install VASI on the runway 15.

## 5.4 Directorate General of Civil Aviation

- **04.R-2016.50.1**

  To ensure the establishment and maintenance of flight data analysis program as part of aircraft operator safety management system as stated in Civil Aviation Safety Regulation part 121.65 (c).

# 6 APPENDICES

## 6.1 Safety Reminder PT. Cardig Air

cardigair

**SAFETY REMINDER**

| | | |
|---|---|---|
| No | : | 026/SQS/SR/2015 |
| Date | : | 16 September 2015 |
| To | : | ALL CARDIG PILOTS |
| Subject | : | **APPROACH & LANDING PRECAUTION** |

*Latar Belakang :*

*Pada tanggal 28 Augustus 2015, PK-BBY dengan no. penerbangan 8F199 mengalami "hard landing" pada saat mendarat di runway 15 bandara Wamena sehingga L/H MLG collapsed dan pesawat menutup (blocked) runway Wamena. Tidak ada korban luka dan korban jiwa.*

Dari hasil investigasi internal atas kejadian tersebut diatas, kami juga melakukan download FDR pesawat PK-BBC untuk mendapatkan data performance operation khususnya penerbangan DJJ-WMX sebagai langkah awal pemantauan Operation Performance monitoring sebelum melakukan Flight Data Analysis secara terus menerus dengan vendor yang akan dilakukan kerjasamanya dalam waktu dekat.

Adapun hasil analisys data pada FDR PK-BBC menunjukan kemiripan operation performance dengan PK-BBY hingga terjadinya incident, khususnya pada phase approach dan landing di Wamena, dengan hasil sebagai berikut :

1. Beberapa kali terdapat landing dengan vertical acceleration lebih besar dari 1.8G bahkan sampai 2.1G
2. Masih terdapat kriteria stabilized approach yang belum terpenuhi pada saat approach/ landing di RWY 15 Wamena

Dari temuan tersebut dengan ini kami menerbitkan Safety Notice/Reminder kepada Direktorat Operasi, intinya untuk melakukan perbaikan pada proses :

1. Melakukan review terhadap pilot proficiency check / flight technique khususnya untuk approach landing di Wamena yang tidak dilengkapi dengan VASI agar stabilized approach terpenuhi sampai dengan landing.
2. Menerbitkan instruksi kepada Pilot agar apabila pada short final, approach menjadi unstabilized maka tanpa keraguan melakukan Go Around.
3. Melakukan kajian/review terhadap SOP yang diterapkan untuk operasi penerbangan DJJ-WMX.

Demikian disampaikan. Terima kasih atas perhatian dan kerjasamanya.

PT. Cardig Air
Quality, Security, Health Safety & Environment

## 6.2 List of Windshear Training Briefing Material



# WINDSHEAR TRAINING BRIEFING MATERIAL
# APRIL 2016

1. B 737-CL FLIGHT CREW TRAINING MANUAL
   MANEUVERS – 7.38 **WINDSHEAR**

2. B 737-CL FLIGHT CREW OPERATING MANUAL
   SUPPLEMENTARY PROCEDURES-ADVERSE WEATHER- SP 16.25 **WINDSHEAR**

3. B 737-CL FLIGHT CREW OPERATING MANUAL
   MANEUVERS – NON NORMAL MANEUVERS – MAN.1.9 **WINDSHEAR**

4. B 737-CL FLIGHT CREW TRAINING MANUAL
   APPROACH AND MISSED APPROACH
   5.4 **STABILIZED APPROACH RECOMMENDATIONS**

5. B 737-CL FLIGHT CREW TRAINING MANUAL
   GENERAL INFORMATION – 1.11 **LANDING**

6. B 737-CL FLIGHT CREW TRAINING MANUAL
   APPROACH AND MISSED APPROACH – 5.52 **VISUAL APPROACH**

7. B 737-CL FLIGHT CREW TRAINING MANUAL
   LANDING – 6.8 **FLARE AND TOUCHDOWN - AIRSPEED CONTROL**

8. HONEYWELL EGPWS PILOT GUIDE – **MODE 7 WINDSHEAR**

9. FLIGHT SAFETY FOUNDATION – **ALAR BRIEFING NOTE – 5.4 WINDSHEAR**

## 6.3 Windshear Training Syllabus

cardigair

# WINDSHEAR TRAINING SYLLABUS

## GITC-B737 CLASSIC SIMULATOR

## 30 APRIL 2016

## 1. INTRODUCTION

The PPC profiles are formatted to a Normal Line Operation environment with the inclusion of Non-Normal situation and identified recurrent training items. The Engine Failure After Takeoff, Approach, Missed Approach and Landing check items remain unchanged.

## 2. TRAINING OBJECTIVES

The PPC is developed to enable Cardig Air Pilots to renew the validity of their License, Aircraft Type Rating and Instrument Rating in accordance to the applicable regulations.

All candidates are expected to demonstrate a satisfactory level of knowledge and skill in the performance of all maneuvers and procedures through out the simulator training program.

All candidates should aim for precision and smoothness during all training maneuvers. As a guide, strive to work keeping the following considerations in mind : SAFETY, COMFORT and ECONOMICAL OPERATIONS.

## 3. BRIEFING AND DISCUSSION

All candidates must be prepare for the discussion session associates with the identified Discussion Items. Candidates are expected to familiarize themselves with the information included the program, as well as to take initiative in conducting additional research on the topic concerned.

## 4. TIME SCHEDULE

One hour prior to the simulator session of which 45 minutes are allocated for discussion on items in the syllabus, 15 minutes are allocated for question and answer. After simulator session allocated one hour for de-briefing, discussion and result.

## 5. REQUIREMENTS

For the purpose of this training, the candidate required to present a Valid Medical Certificate and License.

During the LOFT and PPC the candidate shall operate all maneuvers from the respective seat he/she is designated to operate from.

The LOFT and PPC session are encourage CRM and evaluate crew understanding of system and malfunction.

The Pilot Flying (PF) is expected to be in complete command of the flight, without prompting or suggestion from the Pilot Monitoring (PM). The PF is also expected to :

- Adhere to all ATC instructions and procedures although they may differ from the flight path planned, briefed or expected.
- Ensure proper Radio-Navigational Aids setup and identification. For this purpose the PF may delegate to the PM for identification of aids.
- Callout for all Checklist at the appropriate time.

The PM duties shall be evaluated, especially cross-monitoring in a multi-crew environment. The PM also required to execute all task delegated by the PF, including tuning and identification of Navigation Aids and make all required standard callouts deviation callouts e.g. "speed, altitude, bank angle", etc.

De-briefing will be conducted after the simulator session to review the maneuvers and performance in relation to the requirement standards with tolerance :

- Heading : ± 5°
- Altitude : ± 100 feet, but don't descend below MDA
- Airspeed : ± 10 kts
- Instr. Approach : ± ½ deflections

## 7. ASSESMENT

**S** (Satisfactory), if :

- Contains minor errors only.
- Airspeed and altitude control are acceptable for prevailing conditions; and
- Airplane handling and knowledge are acceptable and safe considering the experience of the candidate.

**SB** (Satisfactory with Briefing), when :

- Airplane handling and knowledge are safe but a lower standard than would be expected and any deficiency can be corrected during debriefing.
- The candidate had a brief excursion from published tolerances but initiated corrective action.
- A sequence deviates from standard procedures or practices which the candidate acknowledged without prompting, that does not create a more hazardous condition and from which the candidate can recover unassisted; or
- The candidate experienced some difficultly or required slight prompting from the other crew member to satisfactorily accomplish a task.

**U** (Unsatisfactory), if :

- It endangers the airplane, passengers or crew.
- It result in a crash.
- Multiple errors are made in the completion of any one exercise.
- It violates an ATC clearance or altitude.
- The aim of the exercise is complete but there is a major deviation from standard procedures or practices or the safety of the airplane was jeopardized.
- The candidate required continual prompting or help from the other crew member to complete a task.
- It exceeds airplane limitations; or
- The candidate demonstrated unsatisfactory knowledge of airplane systems, equipment, or procedures.

## 8. ADDITIONAL TRAINING

The Class room WINDSHEAR Training is mandatory given to all Pilots periodically and it is also required to be practiced and evaluated in the Simulator. The Windshear Training is included in the DAY-1 LOFT of this Simulator program, all candidates are expected to demonstrate and reach a satisfactory level of knowledge and performance related to the WINDSHEAR as per briefed.

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