KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA

FINAL

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Aircraft Accident Investigation Report

Perkumpulan Penerbangan Alfa Indonesia

DHC – 4 Caribou; PK-SWW

Ilaga Cut, Papua

Republic of Indonesia

31 October 2016

2023

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

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

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Jakarta, 21 November 2023
KOMITE NASIONAL
KESELAMATAN TRANSPORTASI
CHAIRMAN

SOERJANTO TJAHJONO

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ABBREVIATIONS AND DEFINITIONS

AC	:	Advisory Circular
AFIS	:	Aerodrome Flight Information Service
AIS	:	Aeronautical Information Service
ATPL	:	Airline Transport Pilot License
BASARNAS	:	*Badan SAR Nasional* (Indonesia National Search and Rescue Agency)
BMKG	:	*Badan Meteorologi Klimatologi dan Geofisika* (Bureau of Meteorology, Climatology and Geophysics)
CAA	:	Civil Aviation Authority
CAM	:	Cockpit Area Microphone
CASR	:	Indonesia Civil Aviation Safety Regulation
CPL	:	Commercial Pilot License
CVR	:	Cockpit Voice Recorder
DEM	:	Digital Elevation Models
DGCA	:	Directorate General of Civil Aviation
DH	:	Decision Height
DSM	:	Digital Surface Models
DTM	:	Digital Terrain Models
DVI	:	Disaster Victim Identification
ELT	:	Emergency Locator Transmitter
FAA	:	Federal Aviation Administration
FISO	:	Flight Information Services Officer
GA-EGPWS	:	General Aviation Enhance Ground Proximity Warning System
GPS	:	Global Positioning System
HF	:	High Frequency
ICAO	:	International Civil Aviation Organization
inHg	:	Inch of Hydrargyrum (Mercury)
KNKT	:	*Komite Nasional Keselamatan Transportasi*
km	:	Kilo meters
LT	:	Local Time
LNAV	:	Lateral Navigation
LPV	:	Localizer Performance with Vertical guidance
m	:	meter(s)
mb	:	millibar(s)
MEL	:	Minimum Equipment List
MMEL	:	The Master Minimum Equipment List
MHz	:	Mega Hertz

MSL	:	Mean Sea Level
NDB	:	Non-Directional Beacon
NM or Nm	:	Nautical Mile
PIC	:	Pilot in Command
PWS	:	Predictive Windshear System
RWS	:	Reactive Windshear System
SAR	:	Search And Rescue
SBAS	:	Satellite Based Augmentation System
SIC	:	Second in Command
STC	:	Supplement Type Certificate
TAWS	:	Terrain Avoidance & Warning Systems
TSN	:	Time Since New
TSO	:	Technical Standard Order
VHF	:	Very High Frequency
VNAV	:	Vertical Navigation
VOR	:	Very High Frequency Omni Range
WGS	:	World Geodetic System
UTC	:	Universal Time Coordinate

SYNOPSIS

A DHC-4A Caribou Turbo aircraft, registered PK-SWW, was being operated by Perkumpulan Penerbangan Alfa Indonesia, on 31 October 2016, conducted a cargo flight from Moses Kilangin Airport Timika, with intended destination to Kaminggaru Aerodrome, Ilaga Papua. The accident flight was the second of three scheduled flights of Timika – Ilaga and return for the day. On board on this flight was 4 persons consisted of two pilots, one company engineer and one flight operation officer. The aircraft carried cargo with the total load of 6,900 lbs.

At 2257 UTC (0757 LT), the aircraft departed from Timika with intended cruising altitude of 12,500 feet.

At 2323 UTC, the pilot made first contact with Ilaga Flight Information Services Officer (FISO) and reported that the aircraft position was at Ilaga Cut and informed the estimate time of arrival Ilaga would be on 2327 UTC. Ilaga FISO advised to continue descend to circuit altitude and to report when the aircraft position on downwind.

At 2330 UTC, the Ilaga FISO contacted the pilot of PK-SWW without replied. The Ilaga FISO asked another pilot of an aircraft in the vicinity to contact the pilot of PK-SWW aircraft without any replied.

on 1 November 2016, the search and rescue team found the aircraft wreckage on a ridge of mountain near Jila Pass at coordinate 4°5’55.10” S; 137°38’47.60” E, at elevation approximately of 13,000 feet. The accident site was about 7.5 Nm on bearing 170° from Ilaga. All occupants were fatally injured and the aircraft destroyed by impact force.

The investigation determined the contributing factor was very likely that the pilot did not aware to the surrounding terrain condition as the aircraft was flying into the cloud and the Terrain Awareness Warning System (TAWS) did not function normally resulted in the aircraft impacted to the terrain.

As the result of the investigation safety actions have been taken by related parties. KNKT issued safety recommendations to address safety issues identified in this investigation Indonesia DGCA, Pen Turbo Aviation Inc., USA, and the aircraft operator.

1 FACTUAL INFORMATION

1.1 History of the Flight

A DHC-4A Caribou Turbo aircraft, registered PK-SWW, was operated by Perkumpulan Penerbangan Alfa Indonesia. On 31 October 2016, the aircraft was being conducted a cargo flight from Moses Kilangin Airport Timika[1], with intended destination of Kaminggaru Aerodrome, Ilaga[2] Papua. The accident flight was the second of three scheduled flights of Timika to Ilaga and return for the day. On board on this flight was 4 persons consisted of two pilots, one company engineer and one flight operation officer. The aircraft carried cargo with the total load of 6,900 lbs.

At 2257 UTC[3] (0757 LT), on day light condition, the aircraft departed Timika with intended cruising altitude of 12,500 feet.

At 2323 UTC, the pilot made first contact with Ilaga Flight Information Services Officer (FISO) and reported that the aircraft position was at Ilaga Cut and informed the estimate time of arrival Ilaga would be on 2327 UTC. Ilaga FISO advised to continue descend to circuit altitude and to report when the aircraft position on downwind.

At 2330 UTC, the Ilaga FISO contacted the pilot of PK-SWW without replied. The Ilaga FISO asked another pilot of an aircraft in the vicinity to contact the pilot of PK-SWW and did not get any reply.

At 0020 UTC, Sentani Aeronautical Information Service (AIS) officer declared the flight status as ALERFA[4].

At 0022 UTC, Timika Tower controller received information from a pilot of another aircraft, that an Emergency Locator Transmitter (ELT) signal was detected approximately 40 – 45 Nm on radial 060° from TMK VOR (Very High Frequency Omni Range) or around coordinate 4° 7’ 46” S; 137° 38’ 11” E. This coordinate position was located between Ilaga Cut and Jila Pass.

1 Moses Kilangin Airport Timika Papua will be named as Timika for the purpose of this report.

2 Ilaga Kaminggaru Aerodrome Papua will be named as Ilaga for the purpose of this report.

3 The 24-hour clock used in this report to describe the time of day as specific events occurred is in Universal Coordinated Time (UTC). Local time for Timika is Eastern Indonesia Standard Time /*Waktu Indonesia Timur* (WIT) or UTC + 9.

4 According to ICOA Annex 11, the ALERFA refer to an emergency phase of aircraft operation which become an alert phase when:

1) following the uncertainty phase, subsequent attempts to establish communication with the aircraft or inquiries to other relevant sources have failed to reveal any news of the aircraft, or when
2) an aircraft has been cleared to land and fails to land within five minutes of the estimated time of landing and communication has not been re-established with the aircraft, or when
3) information has been received which indicates that the operating efficiency of the aircraft has been impaired, but not to the extent that a forced landing is likely, except when evidence exists that would allay apprehension as to the safety of the aircraft and its occupants, or when
4) an aircraft is known or believed to be the subject of unlawful interference.

At 0053 UTC, Sentani AIS officer declared the occurrence as DETRESFA[5].

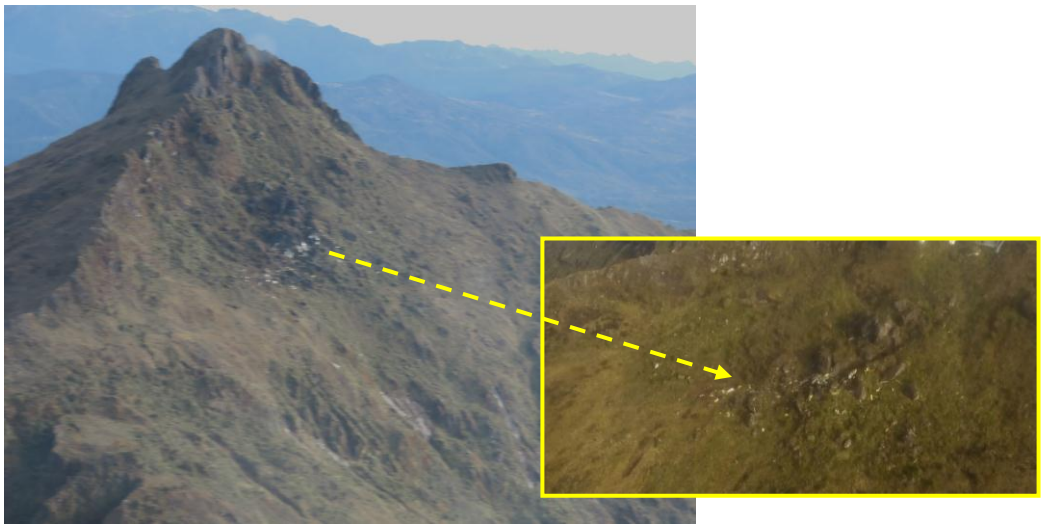


Figure 1: The location of the aircraft wreckage

On 1 November 2016, the aircraft wreckage was found on a ridge of mountain near Jila Pass on coordinate 4°5'55.10" S; 137°38'47.60" E, at the elevation approximately of 13,000 feet. The accident site was about 7.5 Nm on bearing 170° from Ilaga.

All occupants were fatally injured and the aircraft destroyed by impact force.

1.2 Injuries to Persons

Injuries	Flight crew	Passengers	Total in Aircraft	Others
Fatal	2	2	4	-
Serious	-	-	-	-
Minor/None	-	-	-	-
TOTAL	2	2	4	-

All occupants were Indonesian.

1.3 Damage to Aircraft

The aircraft destroyed by impact force.

5 According to ICOA Annex 11, the DETRESFA refer to an emergency phase of aircraft operation which become an distress phase when:

1) following the alert phase, further unsuccessful attempts to establish communication with the aircraft and more widespread unsuccessful inquiries point to the probability that the aircraft is in distress, or when
2) the fuel on board is considered to be exhausted, or to be insufficient to enable the aircraft to reach safety, or when
3) information is received which indicates that the operating efficiency of the aircraft has been impaired to the extent that a forced landing is likely, or when
4) information is received or it is reasonably certain that the aircraft is about to make or has made a forced landing, except when there is reasonable certainty that the aircraft and its occupants are not threatened by grave and imminent danger and do not require immediate assistance.

1.4 Other Damage

There was no other damage to property.

1.5 Personnel Information

1.5.1 Pilot in Command

Gender	:	Male
Age	:	54 years
Nationality	:	Indonesia
Marital status	:	Married
Date of joining company	:	September 2016
License	:	ATPL
Date of issue	:	9 September 2009
Aircraft type rating	:	DHC-4A
Instrument rating validity	:	31 October 2017
Medical certificate	:	First Class
Last of medical	:	15 August 2016
Validity	:	15 February 2017
Medical limitation	:	Holder shall wear lenses that correct for distant vision and possess glasses that correct for near vision
Last line check	:	5 October 2016
Last proficiency check	:	5 October 2016
Flying experience		
Total hours	:	9,336 hours 18 minutes
Total on type	:	38 hours 21 minutes
Last 90 days	:	194 hours 40 minutes
Last 60 days	:	144 hours 19 minutes
Last 24 hours	:	None
This flight	:	Approximately 30 minutes

1.5.2 Second in Command

Gender	:	Male
Age	:	39 years
Nationality	:	Indonesia
Marital status	:	Married

Date of joining company	:	September 2016
License	:	CPL
Date of issue	:	19 August 2010
Aircraft type rating	:	DHC-4A
Instrument rating validity	:	30 September 2017
Medical certificate	:	First Class
Last of medical	:	27 June 2016
Validity	:	27 December 2016
Medical limitation	:	None
Last line check	:	15 September 2016
Last proficiency check	:	15 September 2016
Flying experience		
Total hours	:	3,636 hours 44 minutes
Total on type	:	17 hours 59 minutes
Last 90 days	:	61 hours 17 minutes
Last 60 days	:	17 hours 59 minutes
Last 24 hours	:	None
This flight	:	Approximately 30 minutes

1.6 Aircraft Information

1.6.1 General

Registration Mark	:	PK-SWW
Manufacturer	:	Viking Air Limited (De Havilland)
Country of Manufacturer	:	Canada
Type/Model	:	DHC-4 Caribou Turbo
Serial Number	:	303
Year of Manufacture	:	1960
Certificate of Airworthiness		
Issued	:	25 August 2016
Validity	:	24 August 2017
Category	:	Transport (cargo version)
Limitations	:	None
Certificate of Registration		
Number	:	3847
Issued	:	25 August 2016

Validity	:	24 August 2019
Time Since New	:	2,748.1 hours
Cycles Since New	:	5,953 cycles
Last Major Check	:	1,200-hour inspection performed on 15 September 2014 (TSN 2627.6 hours)

The aircraft had been operated 121 hours since last major inspection and the investigation did not find the maintenance document (the maintenance and/or flight log) as the documents were onboard the aircraft and could not be found after the occurrence.

According to the Aircraft Technical Record, the aircraft was manufactured by de Havilland Canada of Downsview Ontario on 12 July 1971 and delivered to Kenya Air Force. The aircraft retired from Kenya Airforce in 1985 with total hours of 2561.8 hours and ferried to Malta for storage. The aircraft was re-registered N300NC on 6 October 1994 and issued a standard United States (US) civil airworthiness on 25 November 1994. The aircraft was ferried to Cape May, New Jersey, USA and arrived on 8 August 1995 with the total time of 2627.6 hours. The aircraft registration was changed to N303PT on 20 October 2011 and the work began to modify the aircraft to a Turbo Caribou. The modification based on the Transport Canada (TC) Supplement Type Certificate (STC) SA99-217 and SA01-153, and the Federal Aviation Administration (FAA) STC ST01294NY and ST01471NY performed by Pen Turbo Aviation Inc. of Cape May, New Jersey, USA.

The modification was to install the Pratt and Whitney PT6A-67T engines, including the modification of the aircraft instruments and avionics. The modification was also to install the General Aviation Enhance Ground Proximity Warning System (GA-EGPWS) model KGP-860 manufactured by Honeywell and the Cockpit Voice Recorder (CVR) model CVR-120A manufactured by Universal. The investigation utilized the document DHC-4A Caribou Turbo serial number 303 TC4M-1 as the reference to system description.

The aircraft was delivered to Indonesia by the registration PK-SWW on 25 August 2016 operated by Perkumpulan Penerbangan Alfa Indonesia.

The cockpit layout before modification was as follow:

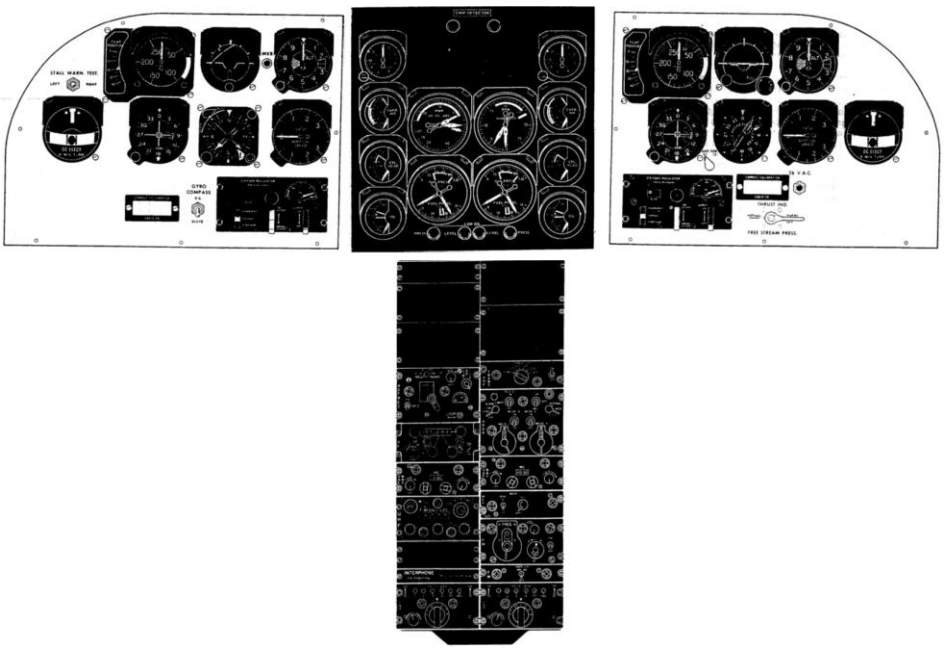


Figure 2: The cockpit layout before modification

The layout of the cockpit display after modification refer to the TC4M-1 document chapter 34-25-00 page 12 is shown in the figure below.

Figure 3: The cockpit layout after modification

1.6.2 Engines

Manufacturer	:	Pratt & Whitney
Type/Model	:	PT6A-67T
Serial Number-1 engine	:	PCE-PY0091
▪ Time Since New	:	114.43 hours
▪ Cycles Since New	:	80 cycles
Serial Number-2 engine	:	PCE-PY0090
▪ Time Since New	:	114.43 hours
▪ Cycles Since New	:	80 cycles

1.6.3 Propellers

Manufacturer	:	Hartzell Propeller Inc.
Type/Model	:	HC-B5MA-3M
Serial Number-1 propeller	:	HBA1921
Serial Number-2 propeller	:	HBA1902

1.6.4 Weight and Balance

Maximum allowable take-off weight	:	27,500 lbs
Take-off weight	:	26,862 lbs
Maximum allowable landing weight	:	27,500 lbs
Estimated landing weight	:	26,267 lbs
Fuel at take off	:	2,500 lbs
Flight planned fuel burn	:	595 lbs
Estimated fuel at landing	:	1,905 lbs
Take off Centre of Gravity	:	36 % MAC

The weight and balance showed that the aircraft weight was operated within the aircraft weight operating envelope.

1.6.5 Enhance Ground Proximity Warning System

Refer to the Aircraft Maintenance Supplement TC4M-1, the aircraft equipped with the General Aviation Enhance Ground Proximity Warning System (GA-EGPWS) model KGP-860 manufactured by Honeywell. The KGP-860 satisfies the Terrain Avoidance & Warning Systems (TAWS) Class B installation as defined in FAA TSO C151b. The KGP-860 was integrated into the Garmin GTN750.

The GTN750 is a radio and avionic integration to a single multifunction display unit. The GTN 750 have its own GPS/SBAS navigator and flight planning functions and is TSO C146c certified for primary domestic, oceanic, and remote navigation including en-route, terminal, non-precision approaches, and approaches with vertical guidance, such as Localizer Performance with Vertical guidance (LPV) and LNAV/VNAV.

With an update Jeppesen database installed in the system, the GTN750 can also provide the data of airports, VORs, NDBs, intersections, Flight Service Stations, approaches procedures, departure procedures, Standard Terminal Arrival Routes (STAR) and Special Use Airspace information.

In general, the GTN750 multifunction display provides to the pilot the information of navigation, traffic, weather, and terrain on a large color moving map display.

The terrain information in the GTN750 multifunction display can be accessed on the TAWS page (Terrain page), which will show the terrain, obstacle, and terrain height compares to the aircraft current altitude. Specifically, the terrain will be displayed in red color if the terrain is 100 feet below or above the aircraft altitude.

After electrical power available on the aircraft initially, the GTN750 will perform system check including the TAWS system self-test. After the system check completed and if the TAWS is serviceable, the GTN750 will announce an aural message "TAWS system test OK". If the TAWS system is unserviceable, the aural message will be "TAWS System Failure".

The layout of the cockpit display regarding the TAWS and the GTN750 multifunction display is shown in the figure 3. The typical terrain display as depicted from the GTN750 Pilot Guide is shown in the figure below.

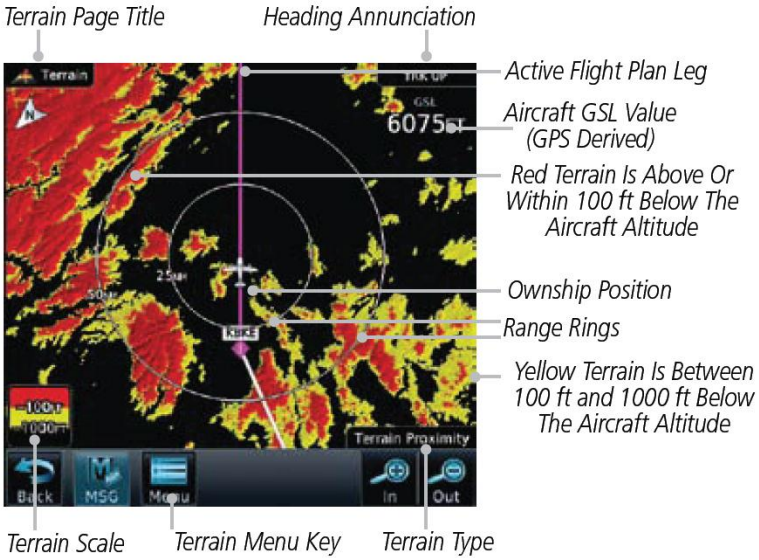


Figure 4: The Terrain Display in GTN750 Multifunction Display

As part of the TAWS installation, the MD41-1208 annunciator light and control of terrain was installed on the pedestal (see figure 3 for the location in the cockpit).

Figure 5: The MD41-1208 annunciator light and terrain control

The interpretation of the annunciator light illumination and control as stated in the MD41-1208 manual is as follow:

TERR/NA (amber color) : Terrain information is not available.

TERR (amber color) : Terrain is very near or above the aircraft altitude.

TERR (red color) : Terrain is well above the aircraft altitude.

TERR/INHB (white color) : TAWS/EGPWS system in standby mode.

TEST (white color) : The TAWS/EGPWS system in test mode.

If the aircraft flight path approaches to terrain or obstacle within approximately 60 seconds (1 minute) ahead of the aircraft, the voice alert "Caution Terrain, Caution Terrain" or "Caution Obstacle, Caution Obstacle" respectively will be activated. In conjunction to the voice alert, the "threat area" will be shown as bright and solid yellow of on the GTN750 multifunction display. Should the aircraft flight path continue toward the threat area, the alert message will be repeated approximately every 7 seconds.

If the aircraft flight path approaches to within approximately 30 seconds of a threat area, the voice message "Terrain Ahead" (or "Obstacle Ahead") or optionally "Terrain - Terrain, Pull Up" (or "Obstacle - Obstacle, Pull Up") will be activated continuously.

The threat area will be shown in a bright and solid red color on the Terrain page.

In addition, the TAWS annunciator panel on the pedestal will provide the corresponding annunciation light.

When the terrain proximity was imminent and the TAWS (Terrain) page is not displayed or when "TERR INHB" button was selected, a pop-up alert of terrain information will appear on the on the page being viewed on GTN750 multifunction display and the TAWS annunciator light will illuminate.

The pop-up alert of terrain information which appears on the page being viewed on the GTN750 multifunction display is shown in the figure below.

Figure 6: The pop-up alert in the GTN750 multifunction display

To acknowledge the pop-up terrain alert on the GTN750 multifunction display, the pilots can access or touch the "Go to Terrain" key on the GTN750 multifunction display which will convert the display to the Terrain page. The pilot may select the "Close" key which will remove the pop-up alert and return to the page being viewed. If the pilot takes no action, the pop-up will stop when the alert is no longer active.

The test result after the installation of the GTN750 system was not found in the maintenance documents. In addition, the investigation did not find line operation test related to the TAWS system.

1.6.6 Terrain Data Coverage

Refer to the ICAO Doc 9881 Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information, the terrain is defined as "*the surface of the Earth containing naturally occurring features such as mountains, hills, ridges, valleys, bodies of water, permanent ice and snow, excluding obstacles*".

Whenever a flight is conducted in the area proximity to a terrain, the TAWS or EGPWS will provide the pilot an early warning if the flight path is predicted will be collided with the terrain. The terrain information is represented in the terrain database which usually stored in a memory card that required to be inserted into the TAWS or EGPWS unit. The TAWS or EGPWS uses the terrain information in order to mathematically compute the conflicting terrain and the predicted flight path.

A terrain database is a digital representation of the vertical extent (elevation) of the terrain at number of discrete points.

Terrain database also referred to as digital elevation models (DEMs), digital terrain models (DTMs), and digital surface models (DSMs).

Terrain may be depicted on a grid of elevations at regular intervals.

The result of a gird of elevation in a DEM is represented in figure below.

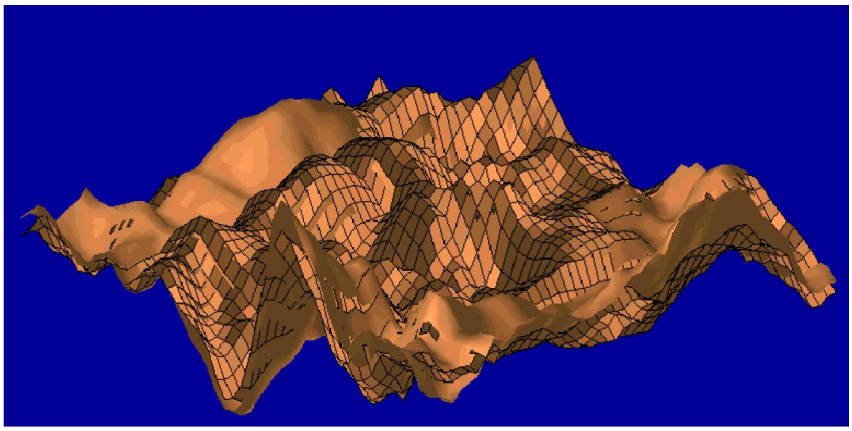


Figure 7: Terrain as depicted in Digital Elevation Models (DEMs)

The terrain data in the grid sets and cells referenced to the geographic (latitude/longitude) coordinate system of the World Geodetic System 1984 (WGS-84). Elements of the grid sets include the highest terrain altitude (above MSL) in each cell respective area. Grid sets vary in resolution depending on geographic location.

The accuracy of the TAWS or EGPWS to predict the terrain depends on the grid resolution. The grid resolution is represented in arc second. The higher arc second (low resolution) is less accurate and sometime generates a nuisance to the pilot who flies in the known and visible terrain.

The grid resolution is described in the Technical Standard Order (TSO) number TSO-C151c Terrain Awareness and Warning System (TAWS) as shown below.

6.3 Resolution. *Terrain and airport information must be accurate and of acceptable resolution in order for the system to perform its intended function. Terrain data should be gridded at 30 arc seconds with 100-foot resolution within 30 NM of all airports with runway lengths of 3500 feet or greater, and whenever necessary (particularly in mountainous environments), 15 arc seconds with 100-foot resolution (or even 6 arc seconds) within 6 NM of the closest runway. It is acceptable to have terrain data gridded in larger segments over oceanic and remote areas around the world.*

Note: Class B equipment may require information relative to airports with runways less than 3500 feet whether public or private. Small airplane owners and operators, as well as small non-scheduled part 135 operators, will likely be the largest market for Class B equipment and they frequently use airports of less than 3500 feet. Those TAWS manufacturers who desire to sell to this market must be willing to customize their terrain databases to include selected airports used by their customers.

The representation of the 30 arc second (low resolution) and 15 arc second (high resolution) is shown in the figure below.

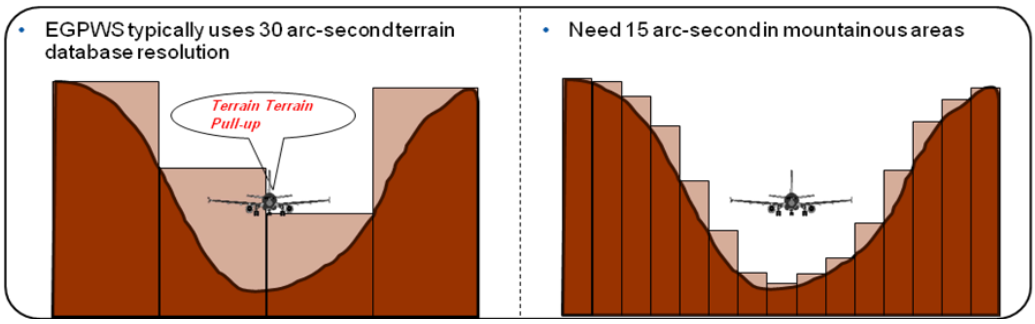


Figure 8: The 30 arc second and 15 arc second resolution comparison

In figure 8 shows that when an aircraft flies in the mountainous area where the terrain database resolution is 30 arcs second, the TAWS or EGPWS will issue a caution or warning even though the distance margin to the terrain is sufficient and safe to conduct the flight. This unnecessary caution or warning may generate nuisance that may annoy the pilot during the flight. According to the statement of several pilots flying in Papua area, to avoid this condition, sometime pilot elected to inhibit or pull the TAWS circuit breaker to silent the nuisance.

Since the aircraft was destroyed in this occurrence, the investigation could not define the TAWS switches position including whether the TAWS circuit breaker was pulled or inhibited during the flight.

1.7 Meteorological Information

The satellite image issued by Meteorological Climatological and Geophysics Agency of Indonesia (*Badan Meteorologi Klimatologi dan Geofisika – BMKG*) showed that the weather information at Ilaga area on 30 October 2016 on 2200 – 2300 UTC were as follows:

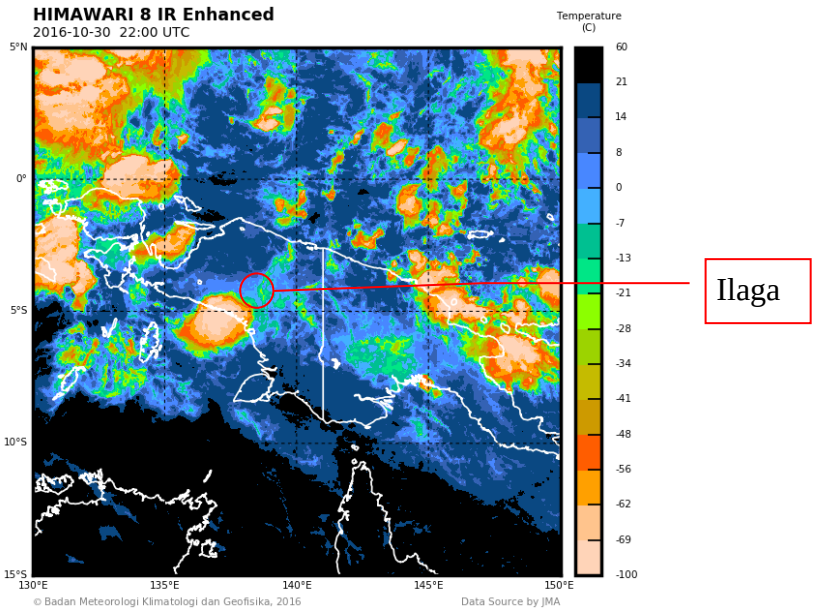


Figure 9: Satellite weather image 31 October 2016 at 2200 UTC

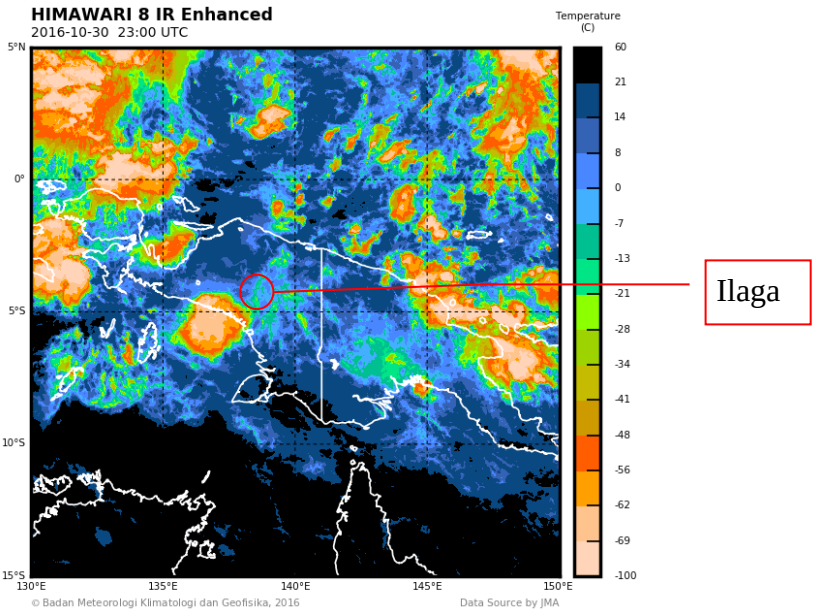


Figure 10: Satellite image 31 October 2016 at 2300 UTC

The satellite image showed the low clouds covered the Ilaga area during the accident flight, identified by blue and green color in the figure 9 and 10.

Ilaga weather information issued 31 October 2016 as follow:

	2300 UTC	0000 UTC	0100 UTC
Wind	Calm	Calm	Calm
Visibility (km)	3	3	8

	2300 UTC	0000 UTC	0100 UTC
Weather	Slight rain	Slight rain	Nil
Cloud[6]	BKN 1000	BKN 1000	SCT 1300
Temperature / Dew point (°C)	23/23	24/24	25/24
QNH[7] (mb/in Hg)	1012/29.89	1012/29.91	1011/29.87
QFE[8] (mb/in Hg)	1007/29.75	1008/29.77	1006/29.73

1.8 Aids to Navigation

There was no ground navigation aid available at Ilaga.

1.9 Communications

The aircraft was equipped with High Frequency (HF) and Very High Frequency (VHF) radio communication system. The communication between the pilot and the Ilaga FISO officer was reported normal.

There was no ground base recorder available for aeronautical communication in Ilaga Aerodrome Flight Information services (AFIS) station.

The communication between the pilot and the Timika Tower controller was recorded on the ground base recorder available for aeronautical communication in Timika.

The communication between the pilot and the Timika Tower controller will be discussed in the chapter 1.11 Flight Recorder.

1.10 Aerodrome Information

Airport Name	:	Ilaga – Kaminggaru
Airport Identification	:	ILA/WABL
Airport Operator	:	DGCA
Airport Certificate	:	-
Coordinate	:	04°03’00.00” S; 137°40’00.02” E
Elevation	:	7,975 feet (2316 m) above mean sea level
Runway Direction	:	07 – 25
Runway Length	:	600 m
Runway Width	:	18 m
Surface	:	Asphalt

6 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 Scattered (SCT) is when the clouds cover 3/8 to 4/8 portion of the sky and Broken (BKN) is when the clouds cover more than half (5/8 up to 7/8) portion of the sky.

7 QNH is the Q code indicating the atmospheric pressure adjusted to mean sea level.

8 QFE is the Q code indicating atmospheric pressure at the current ground level.

1.11 Flight Recorders

The flight recorder installed on the aircraft was Cockpit Voice Recorder (CVR). The Flight Data Recorder was not installed since it was not required by the Indonesia Civil Aviation Safety Regulation (CASR).

The installed CVR identification is as follow:

Manufacturer : Universal

Type/Model : CVR-120A

Part Number : 1606-00-00

Serial Number : 1233

The CVR information contains 4 channels consisted of SIC, PIC, Cockpit Area Microphone (CAM) and spare channel.

The CVR was recovered from the accident site on 6 November 2016 by KNKT team and transported to KNKT recorder facility for data download process. The CVR has been successfully downloaded and successfully retrieved 120 minutes of audio recording data including the accident flight.

The PIC and SIC channel recorded the PIC or SIC voice respectively. The voice recorded on the CAM channel was covered by the engine noise therefore any sound in the cockpit including any aural warning could not be heard. The filtering to the audio was performed however no sound other than engine noise was recovered.

The radio communication transmitted by another radio station or any aircraft aural warning was not recorded. The investigation reviewed the wiring diagram of the CVR and audio system in the DHC-4A Caribou Turbo serial number 303 TC4M-1 document (see the CVR and audio system wiring diagram in the appendix). It revealed as follow:

1. The cockpit area microphone wiring interconnection to the CVR CAM channel line was normally connected. The cockpit area microphone unit was located on the central lower panel in between avionics master switch and TAWS annunciator remote warning switch (see figure 3, the cockpit layout after modification).
2. The investigation revealed that in the modification of the CVR wiring system of the aircraft, by hooked the microphones lines of the SIC, PIC, and spare line directly to the channel 1 (SIC), 2 (PIC) and 3 (spare) of CVR audio line respectively. As the result, the incoming audio communication and other audio which generated by the aircraft system were not accommodated into the CVR.
3. Normally, in an aircraft which equipped with the CVR, depend on the relevant aircraft manufacture documentation, the audio coming from the pilot microphones, all incoming audio communication and any systemic aural warning coming from the aircraft system will be mixed in separate audio mixer to ensure all audio (not only the microphone lines) are recorded in respective input channel of the CVR.

   For example, in some Boeing 737-200 or Boeing 737 classic, the output of the audio selector panel is hooked to the CVR input line where the other Boeing 737 classic uses the Remote Electronic Unit (REU) as an input to the CVR.

The DHC-6 Twin Otter uses the Baker Audio Mixer M-1090 as an audio mixer as an input to the CVR input line. This configuration is to ensure that any audio captured by the pilot microphone, any incoming audio communication and any aircraft alert or warning will be recorded in respective channel of the CVR.

1.11.1 The CVR Information of the First Flight

The CVR data download successfully retrieved voice data with duration of 2 hours including the accident and the previous flight (first flight of the day).

The investigation noticed when the aircraft was on ground with the electrical system activated and the engines were not operated, the sounds in the cockpit were clearly heard from the CAM channel of the CVR. When the engines were operating, all the audios in the CAM channel were covered by the engines noise.

Because the radio communication transmitted by another radio station was not recorded in the CVR, to complete the conversation in the excerpt transcript between the pilot and the Timika Tower controller, the investigation combined the CVR and audio recorded from the Timika Tower controller.

Reviewing the CVR and audio recorded from the Timika Tower controller of the first flight, revealed the information as follows:

1. The Timika Tower controller informed that the departure time was 2058 UTC and instructed after departure runway 12 to intercept radial 060, and the SIC acknowledged it.
2. At 21:00:12 UTC, the SIC reported to Timika Tower controller that the aircraft reached 5 Nm and established radial 060 from Timika VOR. About 30 seconds later the PIC stated that the weather was raining.
3. At 21:03:33 UTC, the SIC reported to Timika Tower controller that the aircraft reached 10 Nm while climbing passed 5,000 feet and maintaining the radial 060 from Timika VOR.
4. At 21:15:36 UTC, the SIC reported to Timika Tower controller that the aircraft reached the altitude of 12,000 feet and heading to Ilaga Cut.
5. At 21:24:20 UTC, the SIC broadcasted the message informing that the aircraft was descending to 11,500 feet with the position of 4 Nm from Ilaga. About 1 minute later the PIC stated that the sun was visible.
6. At 21:35:58 UTC, the SIC reported to Ilaga FISO that the aircraft flew over Ilaga at an altitude of 10,000 feet. The PIC stated to prepare to join left downwind for landing Ilaga.
7. At 21:36:50 UTC, the SIC reported to Ilaga FISO that the aircraft altitude was 8,500 feet and preparing for approach.
8. At 21:39:49 UTC, the SIC reported to Ilaga FISO that the aircraft was on final approach runway 25.
9. At 21:41:34 UTC the aircraft landed at Ilaga.

The return flight from Ilaga to Timika was uneventful.

1.11.2 The CVR Information of the Second Flight

The CVR audio observation to the intonation of PIC and SIC found that during the second flight, the pilots did not declare any distress situation or discuss any aircraft system failure. The excerpt of the CVR and combined with audio recorded from the Timika Tower controller of the second flight are shown below.

Time (UTC)	Events
22:51:36	The SIC made an initial contact to Timika Tower controller. Note: The engine had not been started and the CAM clearly recorded the SIC voice and ground handling process in finishing the cargo loading.
22:51:57	The CAM channel recorded the sound similar to the engines noise prevailed indicated that the engines start has been completed. Note: 1. After the engine start completed, all voices recorded in the CAM channel could not be heard except the engine noise. 2. After the engine start, the voices of Timika Tower controller in this transcript were retrieved from the tower audio recorded of the Timika Tower.
22:52:02	The PIC advised the SIC to request to Timika Tower controller for taxi clearance
22:52:03	The SIC requested to Timika Tower controller for taxi clearance
22:52:06	The Timika Tower controller issued a taxi clearance to runway 12 via taxiway Bravo and was acknowledged by the SIC.
22:52:21	The PIC advised the SIC to conduct ‘before taxi checklist’
22:52:38	Before taxi checklist completed.
22:52:39	The PIC requested to the SIC to conduct ‘before take-off checklist’.
22:52:40	PIC and SIC conducted the ‘before take-off checklist’
22:52:54	The Timika Tower controller instructed the pilot to hold on short runway 12, and was acknowledged by the SIC. Afterward the ‘before take-off checklist’ continued.
22:53:00	The before take-off checklist was completed and the SIC requested to conduct the take-off briefing which was agreed by the PIC. The PIC stated the standard take-off briefing and then continued with the discussion of the route while the SIC did the setting into the GPS.

Time (UTC)	Events
22:53:19	The PIC discussed with the SIC regarding the flight track.
22:55:10	The Timika Tower controller issued clearance for the pilot to line up runway 12, after traffic has passed and acknowledged by the SIC.
22:56:18	The SIC reported to the Timika Tower controller that the aircraft was lining up on runway 12.
22:56:20	The Timika Tower controller issued the take-off clearance and instructed the pilot to turn left and to capture the radial 065 to Ilaga. The SIC acknowledged the instruction.
22:57:00	The SIC stated "V1 and rotate"
22:57:02	The PIC command to gear up.
22:57:25	The SIC called the aircraft altitude of 400 feet and the PIC command to flap up.
22:57:27	The PIC stated to set the engine power to climb power.
22:57:57	The Timika Tower controller provided the pilot of take-off time and advised the pilot to report when established radial 065 at 10 Nm from Timika VOR. The SIC acknowledged the Timika Tower controller instruction.
22:58:32	Both pilots conducted the 'after take-off checklist'.
22:59:58	The SIC reported to the Timika Tower controller that the aircraft had established radial 065 at 5 Nm from Timika VOR, and climbing passed altitude 2,000 feet. The Timika Tower controller acknowledged and instructed the pilot to report at 10 Nm from Timika on radial 065. The SIC acknowledged the instruction.
23:00:22	The SIC contacted the company operation and reported the departure time was at 2257 UTC and estimate arrival Ilaga at 2327 UTC, and the cargo carried as reported in the cargo manifest.
23:01:04	The PIC instructed the SIC to contact Biak Flight Information Services (FIS) via High Frequency (HF) radio to report the departure time, destination and estimate time of arrival. The PIC stated that the procedure is not mandatory, therefore both pilots agreed to delay the communication with Biak FIS.
23:01:20	The PIC and SIC discussed related to the flight procedure in Timika and Ilaga.

Time (UTC)	Events
23:02:56	The SIC reported to Timika Tower controller that the aircraft had passed 10 Nm from Timika VOR and was passing altitude 4,500 feet. The Timika Tower controller acknowledged the report.
23:03:26	The SIC contacted Biak FIS and reported that the aircraft departed from Timika at 2257 UTC to Ilaga with estimated time arrival of 2327 UTC. The aircraft altitude was 13,000 feet, and position at approximately 11 Nm on radial 060 from Timika VOR. The Biak FIS communication audio was not recorded.
23:04:38	Sound like the PIC contacted to another station, reporting that the altitude was 6,000 feet at 14 Nm from Timika VOR.
23:05:05	The SIC broadcasted message in the VHF frequency 126.20 MHz reported that PK-SWW was from Timika to Ilaga on radial 060 at 14 Nm from Timika VOR, heading to Jila pass and estimate arrival to Ilaga was 2327 UTC.
23:06:16	The PIC briefed the SIC that he would take the route via Jila which on radial of 070 of Timika VOR.
23:10:07	The PIC responded another station and reported that PK-SWW was at altitude 9,500 feet and position at 24 Nm from Timika VOR at radial 065.
23:11:10	The PIC took over the control of the aircraft from SIC and SIC acknowledged the take over control. Note: The CVR did not record the statement of take over control from PIC and SIC.
23:11:24	The PIC commented that he would like to enroute via Jila and stated that the Jila Pass was not visible.
23:11:36	The PIC and SIC discussed about the aircraft performance related to the speed and the aircraft weight.
23:12:47	The PIC commented that the aircraft altitude was 12,500 feet.
23:13:18	The PIC and SIC discussing about the weather over Timika. The PIC said about his experience when his flight encountered bad weather over the Pangkalan Bun and utilizing of the weather radar.
23:13:34	The SIC interrupted that the aircraft reached the cruising altitude of 12,500 feet, and the discussion about the weather continued.

Time (UTC)	Events
23:15:36	The SIC broadcasted message via VHF frequency 122.0 MHz mentioning that the aircraft had reached 12,500 feet at approximately 11 Nm from Jila and the arrival time to Ilaga was 2327 UTC.
23:15:43	The PIC said that they would take route via Ilaga Cut and acknowledge by the SIC. The PIC and SIC discussed about the waypoint and utilizing the GPS regarding the Ilaga and Jila pass.
23:16:18	The PIC requested the SIC to contact Biak FIS and the SIC conducting the communication to Biak FIS used HF radio.
23:16:57	The SIC suggested to the PIC to climb to altitude of 13,000 feet. The PIC did not response but instead of responding the SIC question, the PIC called to the other aircraft and mentioning that the aircraft altitude was 13,000 feet.
23:17:17	The PIC communicated with the other station mentioning that the aircraft altitude was 13,000 feet and 7 Nm from Ilaga Cut. The PIC also mentioning that another aircraft (PK-BVM) was behind him.
23:17:35	The PIC stating that the aircraft was cruising.
23:17:51	The SIC broadcasted the message that the aircraft was maintaining 13,000 feet, heading to Ilaga Cut and the aircraft position was about 6 Nm from Ilaga Cut with estimated time arrival 2327 UTC.
23:18:02	The PIC briefed that if the aircraft too high for approach, he intended to fly over the Ilaga and then join left downwind. The SIC acknowledged the brief.
23:18:18	The PIC communicated with a pilot of another aircraft asking the destination of the other aircraft. The PIC also commented to the other aircraft pilot that PK-SWW “was diving”. This term commonly used to describe that the aircraft is flying in the cloud.
23:19:37	The SIC said that the aircraft reached the Ilaga Cut and acknowledge by the PIC.
23:20:11	The PIC said to the SIC ’just leave it ZERO FIVE FOUR for a while’.
23:20:39	The PIC asking for approach checklist and the SIC conducted the ‘approach checklist’.
23:21:35	The SIC broadcasted the message on VHF radio frequency 122.0 MHz, stated “ok, one two two, second traffic Siera Whiskey Whiskey ready for descent four eight miles from Jila Pass”.

Time (UTC)	Events
23:21:50	The SIC communicated with a pilot of another aircraft and waving for happy landing.
23:22:43	The SIC replied to Ilaga FISO and informed that the aircraft was descending passing altitude 12,500 feet and position at 7 Nm from Ilaga with the estimate arrival was 2327 UTC.
23:22:52	The PIC exclaiming something (unintelligible).
23:22:54	Sound similar of impact and end of CVR recording

1.12 Wreckage and Impact Information

The aircraft wreckage found at the ridge of a mountain on coordinate 4° 5’ 55.10” S 137°38’ 47.60” E at elevation approximately 13,000 feet. The wreckage spread approximately 100 m long on direction of about 080°.

The figure below was the aerial view of the crash site.

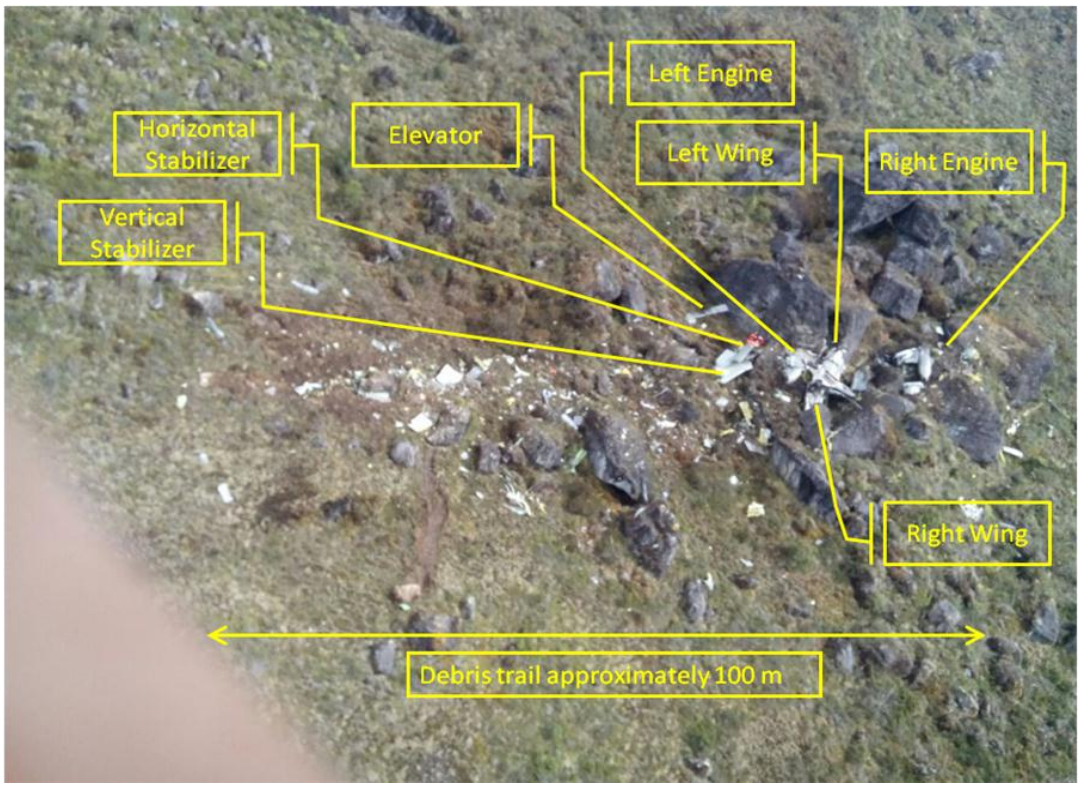


Figure 11: The wreckage distribution

All aircraft major parts were found in the one area. The details of identified major components are as follow:

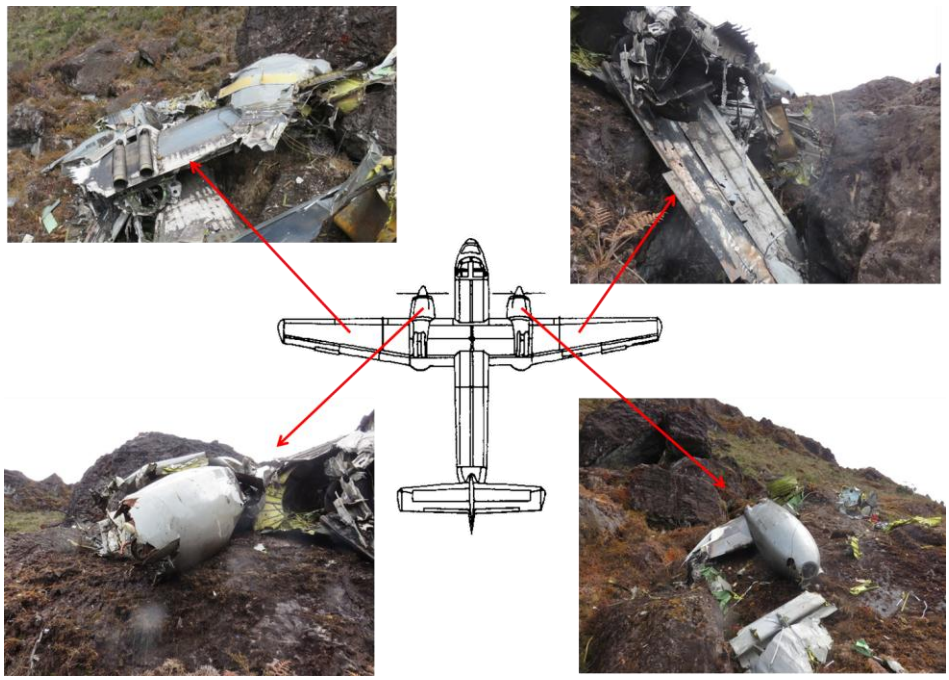


Figure 12: Wings and engines wreckage

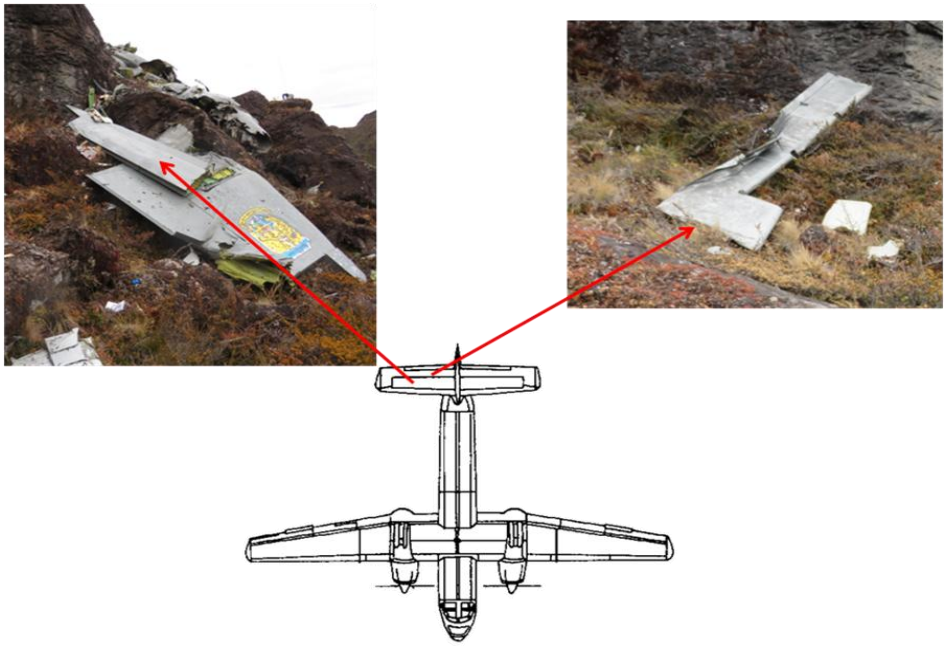


Figure 13: Horizontal stabilizer and elevator wreckages

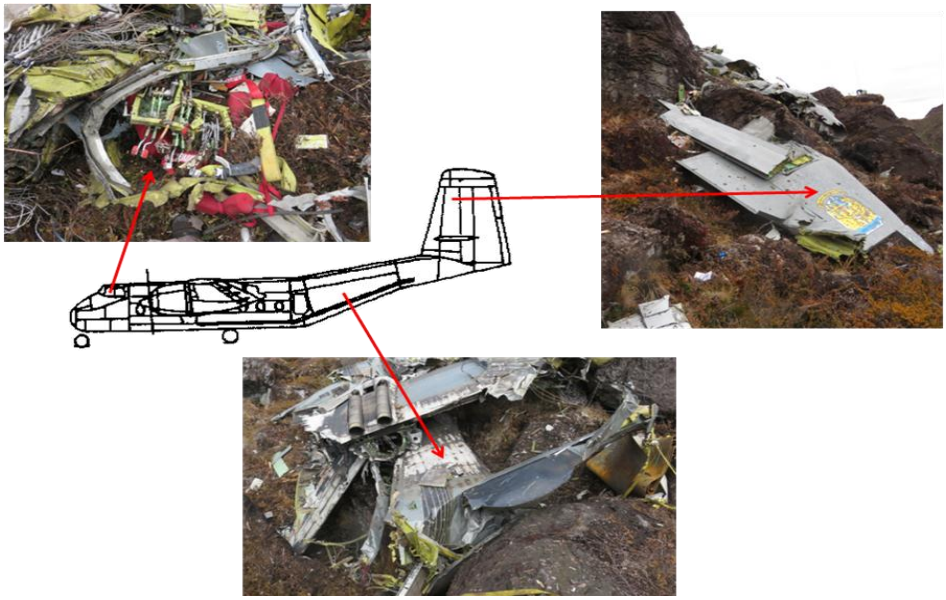


Figure 14: Cockpit, vertical stabilizer, and part of empennage wreckage.

1.13 Medical and Pathological Information

No medical or pathological investigations were conducted as a result of this occurrence.

1.14 Fire

There was a sign of post impact fire on the engines area.

1.15 Survival Aspects

On 31 October 2016 at 0020 UTC, the Sentani Aeronautical Information Service (AIS) declared as ALERFA after received information from Ilaga FISO that PK-SWW aircraft had not landed and the communication with the pilot unable to establish. The Ilaga flight information service was under AirNav Sentani Branch office.

The ALERFA message was conveyed to The Indonesian Search and Rescue Agency (Badan SAR Nasional – BASARNAS) office in Timika.

At 0022 UTC, Timika Tower controller received information from a pilot, that Emergency Locator Transmitter (ELT) signal was detected at approximately 40 – 45 Nm with radial 060° from Timika VOR or at around coordinate 4° 7’ 46” S; 137° 38’ 11” E. This coordinate was situated between Ilaga Cut and Jila Pass or about 9 Nm south of Ilaga.

At 0053 UTC, the aircraft emergency status was declared as DETRESFA and search and rescue (SAR) team was assembled led by BASARNAS and assisted by Indonesia Air Force based in Timika.

At 0440 UTC, the SAR team departed to the nearest reported ELT signal area using MI171 helicopter. The mission was to identify the aircraft position and to place the search and rescue team at Jila village which was the nearest village from the predicted crash site.

The accident site could not be identified as the predicted area was covered by low cloud. The helicopter continued to Jila village and dropped the team, fuel and logistic.

On 1 November 2016, a search operation was conducted using a DHC 6 Twin Otter aircraft which departed Timika at 2100 UTC and KNKT investigator was onboard on this flight. At 2133 UTC, the aircraft wreckage was found at the ridge of mountain between Ilaga Cut and Jila Pass, about 7.5 Nm on bearing 170° from Ilaga, at coordinate 4°5'55.10" S; 137°38'47.60" E, at elevation of approximately 13,000 feet. The aircraft destroyed by impact force. The rescue team was deployed to the crash site used a Bell 212 helicopter, departed Timika at 2300 UTC, to evacuate the occupants. After the rescue team arrived at the accident site, it was confirmed that all occupants were fatally injured. At 0330 UTC, the helicopter returned to Timika with deceased bodies which then transferred to Disaster Victim Identification (DVI) in Jakarta for identification.

On 5 November 2016, the DVI declared that the deceased bodies transferred to Jakarta were consisted three bodies from the total of four. After received the information, the SAR team was reassembled to rescue the remaining occupant and to recover the aircraft CVR.

On 6 November 2016 at 2100 UTC, the SAR team and KNKT investigator, departed to the crash site using helicopter Kamov 32.

At 0035 UTC, the remaining occupant was discovered and subsequently the CVR.

At 0200 UTC, the remaining occupant was evacuated to Timika using Kamov 32 however the helicopter could not land due to strong wind, therefore the remaining occupant was slung by the cargo net while the team stayed near the accident site waited for pickup when weather permitted.

After evacuating the body of remaining occupant to Timika the helicopter Kamov 32 could not reach the crash site due to weather. The team and the CVR stayed overnight, near the accident site.

On 7 November 2016 at 0200 UTC, the team and the CVR picked up by the helicopter Kamov 32 to Timika. The CVR subsequently transported to KNKT recorder facility in Jakarta.

1.16 Tests and Research

1.16.1 Estimated Flight Track and the Flight Plan

The investigation estimated the flight track based on the CVR data, pilot communication, the DHC-4A Caribou flight performance and the Google Earth.

Several points used in this estimation are as follow:

1. The point Ilaga Cut is a point at coordinate of 4°11'23.81" S; 137°31'48.25" E with the elevation about 9,000 feet.
2. The point Jila is the Jila aerodrome at coordinate of 4°14'49.01" S; 137°35'43.18" E with the elevation about 4,100 feet.
3. The point Jila Pass is a point at coordinate 4°4'56.57" S; 137°40'8.03" E with the elevation of 11,000 feet.

Based on the CVR, the first flight was following the radial 060 from Timika VOR.

At 21:15:36 UTC, the aircraft maintained the altitude of 12,000 feet and flew toward Ilaga Cut in which the aircraft was slightly deviated to the right about 3° and 9 minutes later the SIC stated that the aircraft was about 4 Nm from Ilaga. The aircraft was landed safely at Ilaga. The estimated flight track of the first flight is shown in the blue line in the figure 15 below.

The flight plan of the second flight (see the flight plan in the Appendices) stated that the flight would take the route from Timika to Ilaga by following the radial 070, via Jila, Jila Pass and direct to Ilaga.

Based on the CVR communication and the DHC-4A Caribou flight performance, the investigation re-created the estimated track and superimposed to the Google Earth. The flight plan was illustrated in the green line and the estimated flight track of the second flight (the accident flight) is shown in the white line.

The estimated flight track of the flight plan (green line), the first flight (blue line) and the second flight (white line) are as follow.

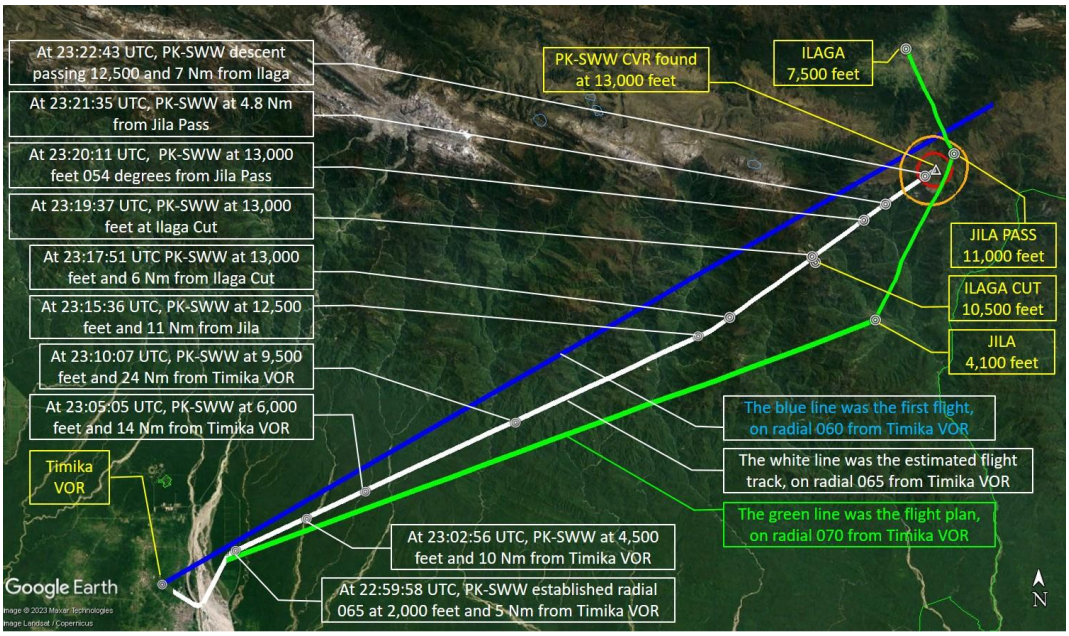


Figure 15: The estimated flight track of the aircraft

Refer to the CVR information the data utilized are as follows:

1. At 22:56:20 UTC, the Timika Tower controller issued the take-off clearance and instructed the pilot to turn left and to capture the radial 065 to Ilaga.
2. At 22:57:00 UTC, the SIC stated the "V1 and Rotate", indicated that the pilot initiated to airborne and at 22:57:25 UTC, the SIC stated that the aircraft altitude was 400 feet.
3. At 22:59:58 UTC the aircraft reached 5 Nm from Timika VOR with aircraft altitude of 2,000 feet or about 2 minutes 58 seconds since the aircraft airborne. The most plausible track from the take off until the aircraft reached 5 Nm from Timika VOR with aircraft altitude of 2,000 feet, was that the pilot maintained the runway heading until the aircraft altitude about 400 feet, then made the left turn to capture the radial 065, while setting the engine to climb power.

4. At 23:02:56 UTC, or approximately 3 minutes after the point of 5 Nm from Timika VOR, the aircraft reached the point of 10 Nm from Timika VOR at altitude 4,500 feet. Using the equation of S = V × t (Distance = Velocity × time), at this time the aircraft speed was approximately of:

   V= S ÷ t

   V= (10 – 5) ÷ (3 ÷ 60)

   V=100 knots.

   The vertical speed was approximately (4,500 feet – 2,000 feet) ÷ 3 minutes = 833.3 feet/minute.

   Therefore, at 23:02:56 UTC, the aircraft speed at this segment was approximately of 100 knots with the vertical speed between 800 and 900 feet per minute.

5. At 23:05:05, the SIC broadcasted message and informed that the aircraft position was 14 Nm from Timika VOR, at altitude of 6,000 feet.

   The message was made approximately 2 minutes after the aircraft reached the point of 10 Nm from Timika VOR. Therefore, using the same equation of V = S ÷ t, at this point the aircraft speed was approximately of 120 Knots. The vertical speed was approximately of (6,000 feet – 4,500 feet) ÷ 2 minutes = 750 feet per minute.

6. At 23:10:07 UTC, the PIC responded radio communication of another station and informed that the aircraft reached 24 Nm from Timika VOR, at altitude of 9,500 feet. Based on the equation, at this segment, the aircraft speed was still approximately of 120 Knot and the vertical speed was approximately of 700 feet per minute.

7. At 23:15:36 UTC, the SIC broadcasted message via VHF radio frequency 122.0 MHz, informed that the aircraft reached 12,500 feet at approximately 11 Nm from Jila.

8. At 23:17:51 UTC, the SIC broadcasted a message informed that the aircraft maintained at altitude of 13,000 feet, heading to Ilaga Cut and the distance to Ilaga Cut was about 6 Nm.

9. At 23:19:37 UTC, the SIC stated that the aircraft reached the Ilaga Cut and acknowledge by the PIC.

10. At 23:20:11 UTC, the PIC said to the SIC “just leave it Zero Five Four”.

    The identification of three-digit numbers starting with ‘ZERO’, normally refer to the aircraft direction or bearing or radial. Assuming that the ‘ZERO FIVE FOUR’ was a bearing, the plotting the direction of 054 in the Google Earth from the current aircraft position, found the direction toward Jila Pass. Therefore, it can be assumed that at this point, the pilot was slightly deviated from the radial 065 (refer from Timika VOR) and flew on bearing 054 to Jila Pass (see figure 16). Using the equation of S = V × t and the assumption of the aircraft speed was 120 Knots, the aircraft reached approximately 4.67 Nm from the position at 23:17:51 UTC.

11. At 23:21:35 UTC, the SIC broadcasted message stated “122, second traffic SWW ready for descend 48 miles from Jila Pass”.

The “122” was the VHF radio frequency for the broadcast messages of 122.0 MHz and the “SWW” was the aircraft registration. The message informed that the aircraft was ready for descend.

The statement of “48 miles” was a pilot statement about a distance. The probable interpretation of the “48 miles” was of 4.8 Nm distance from Jila Pass (see figure 16 below).

Plotting the 4.8 Nm to Jila Pass in direction of 054 in the Google Earth shows the distance about 3.2 Nm to the impact point. The time spent of the point “4.8 Nm from Jila Pass” (at 22:21:35 UTC) to the impact point (at 23:22:54 UTC), was 1 minute and 19 seconds. Assuming the aircraft speed of 120 knots, the aircraft would travel about 2.63 Nm which is close to the plotted distance about 3.2 Nm in the Google Earth.

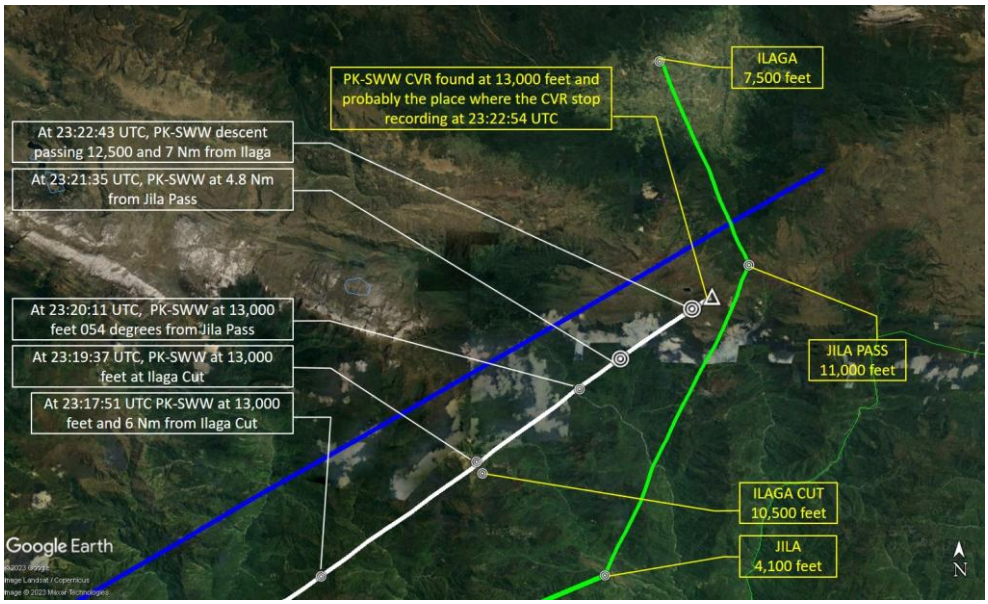


Figure 16: The plot of 4.8 Nm from Jila Pass

12. At 23:22:43 UTC, the SIC reported to the Ilaga FISO stated that the aircraft was descending passed altitude of 12,500 feet and position at 7 Nm from Ilaga Airport.

    This was the last point where the pilot broadcasting the aircraft position before impacting at coordinate of 4°5’55.10” S; 137°38’47.60” E, with elevation approximately of 13,000 feet.

1.16.2 Estimating the TAWS Caution and Warning Range

The aircraft was equipped with the TAWS model KGP-860 manufactured by Honeywell and displayed to the flight crew in the GTN750 multifunction display in the cockpit.

The system will trigger a caution when the aircraft is within 60 seconds to the threat area and changed to a warning when reached 30 seconds to the threat area.

The CVR did not record the aural caution or warning of the TAWS that might be caused by the recording system issue. Investigation considered necessary to determine the point of the activation of the caution and warning.

Assuming the aircraft speed was 120 knots, therefore the 60 seconds TAWS caution area is S = V × t or 120 knots × (60 ÷ 3600) = 2 Nm. Hence, the 30 seconds TAWS warning area is 1 Nm.

The estimated TAWS caution and warning areas are as follow:

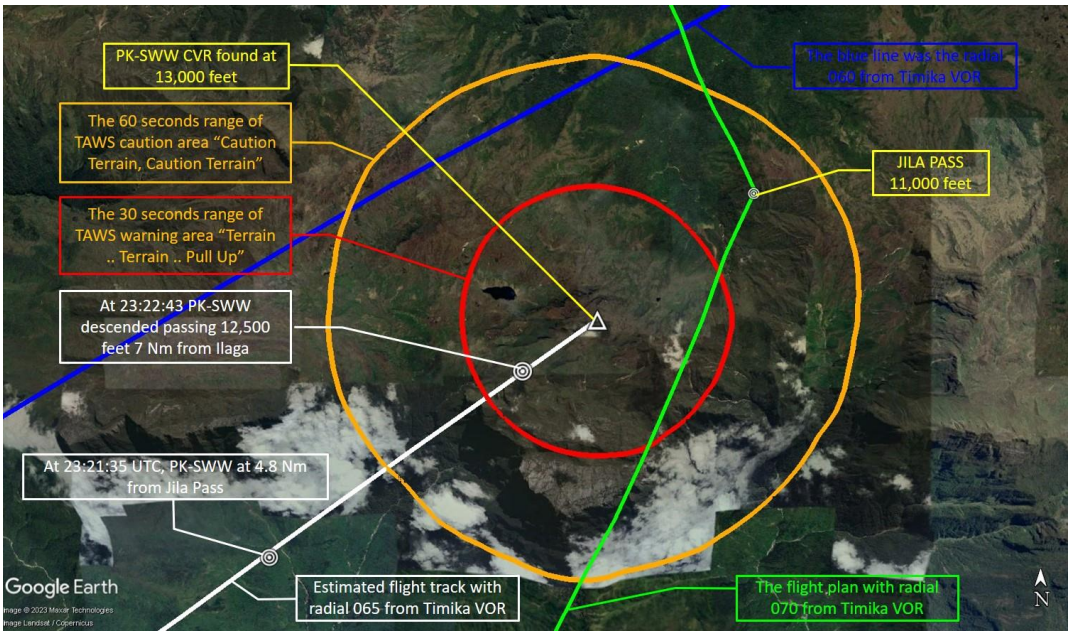


Figure 17: The estimated TAWS caution (amber line) and warning (red line) areas

At 23:22:43 UTC, the SIC reported to the Ilaga FISO informed that the aircraft was on descend passing 12,500 feet and 7 Nm from Ilaga Airport and at 23:22:54 UTC, the aircraft was impacted to the ridge of the mountain. The 60 seconds TAWS caution should have been active at 23:21:54 UTC, and the 30 seconds TAWS warning should have been active at 23:22:24 UTC.

Refer to the point when the SIC informed ready to descend from altitude 13,000 feet at 23:21:35 UTC and the point when the SIC reported passing altitude 12,500 feet at 23:22:43 UTC, it can be assumed that the rate of descend was about 500 feet per minute.

Assumed that the TAWS caution activated at 23:21:54 UTC, it means that the caution active 19 seconds after the report ready for descend. Assuming the aircraft speed was 120 knots, the aircraft would travel about (19 ÷ 3,600) × 120 knots = 0.63 Nm.

It can be concluded that if the TAWS was functioning properly, 19 seconds or 0.63 Nm after the SIC broadcasted the message that the aircraft was ready for descend, the TAWS caution should have been active and because the pilot did not react to the caution, 30 seconds later the TAWS warning of "Terrain Terrain, Pull Up" should have been active.

The estimated aircraft vertical profile compare with the terrain elevation is shown in the figure below.

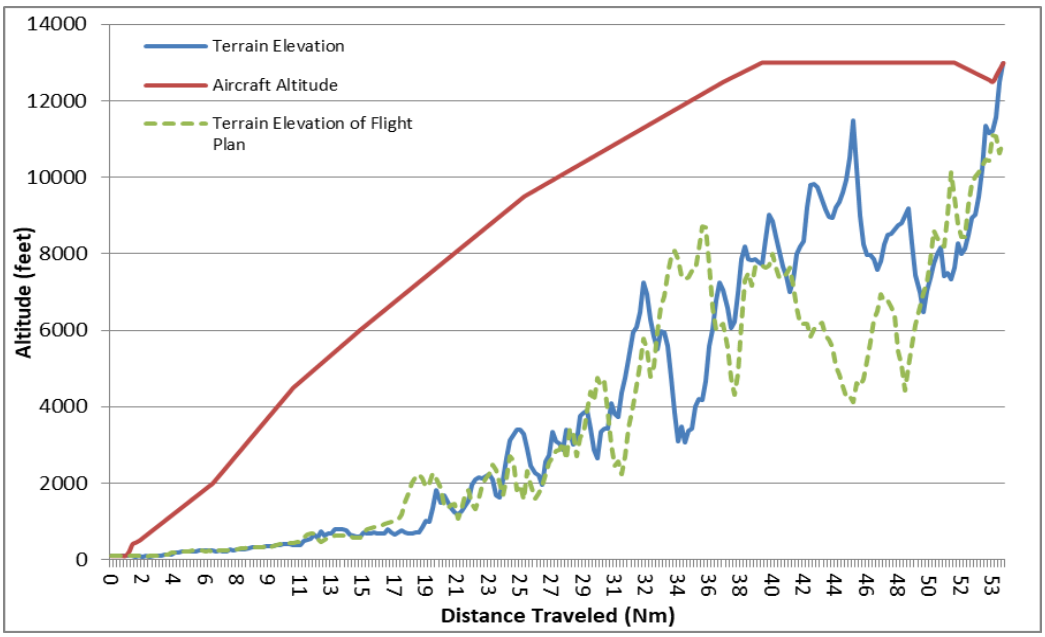


Figure 18: The estimated aircraft vertical profile (red line) compares to the terrain elevation (blue line)

1.17 Organizational and Management Information

1.17.1 Perkumpulan Penerbangan Alfa Indonesia

1.17.1.1 Operator Information

Aircraft owner	:	District Puncak (Pemerintah Kabupaten Puncak) Desa Kimak, Distrik Ilaga Kabupaten Puncak Papua – Indonesia
Aircraft operator	:	Perkumpulan Penerbangan Alfa Indonesia Bulding B.20 A-B/SM Halim Perdanakusumah International Airport Jakarta Timur 13610 Indonesia
Air operator certificate	:	OC/91-016

The DHC-4 Caribou Turbo was the only aircraft of this type, operated by the operator.

1.17.1.2 Master Minimum Equipment List (MMEL)

The investigation did not find the Minimum Equipment List (MEL) issued by the operator. The Master Minimum Equipment List (MMEL) issued by the manufacture regarding the ground proximity warning is as follow:

System and Sequence Item Number	*Number Installed*	*Number Required for Dispatch*	*Remark or Exception*
34 Navigation *14. Ground Proximity Warning System*			

(GPWS) *1) Modes 1 – 4*	*A*	-	*0*	*(O) May be inoperative provided:* *a) Alternate procedure are established and used, and* *b) Repairs are made within two flight days*
2) Test Modes	*A*	-	*0*	*May be inoperative provided:* *a) GPWS is considered inoperative, and* *b) Repairs are made within two flight days*

At the time of the occurrence, the operator stated that there was no deferred item regarding the TAWS system. The investigator did not find the document of hold item or deferred item of the aircraft.

1.17.1.3 Flight Plan

The flight plan was filed to conduct the flight in Visual Flight Rules (VFR). Refer to the flight plan of the second flight, after the aircraft took off from Timika, the pilot should follow the departure procedure to intercept radial 070 of Timika VOR to waypoint JILA (4° 15’ 00” S; 137° 38’ 00” E). Thereafter the pilot should direct to waypoint JILA PZ (Jila Pass) at coordinate 4° 5’ 00” S; 137° 40’ 00” E.

Before landing to the Ilaga, the pilot should fly over Ilaga airport then follows the Ilaga FISO advisory to landing.

The detail flight plan is available in the appendices.

1.17.2 Civil Aviation Safety Regulation (CASR) Indonesia

CASR 91.155 Basic VFR Weather Minimums

(a) Except as provided in Paragraph (b) of this section and Section 91.157, no person may operate an aircraft under VFR when the flight visibility is less, or at a distance from clouds that is less, than that prescribed for the corresponding altitude and class of airspace in the following table:

Airspace	Flight Visibility	Distance from Clouds
Class A	Not applicable	Not applicable
Class B	8 km above 10.000 feet 5 km below 10.000 feet	Clear of clouds
Class C	8 km above 10.000 feet 5 km below 10.000 feet	1,000 feet above 1,000 feet above 1,500 meters horizontal
Class D	8 km above 10.000 feet 5 km below 10.000 feet	1,000 feet above 1,000 feet above 1,500 meters horizontal
Class E	8 km above 10.000 feet 5 km below 10.000 feet	1,000 feet above 1,000 feet above 1,500 meters horizontal
Class F	8 km above 10.000 feet 5 km below 10.000 feet. The higher of: 3000 feet AMSL 5 km, or 1000 feet AGL in sight	1,000 feet above 1,000 feet above 1,500 meters horizontal Clear of clouds
Class G	8 km above 10.000 feet 5 km below 10.000 feet. The higher of: 3000 feet AMSL 5 km, or 1000 feet AGL in sight	1,000 feet above 1,000 feet above 1,500 meters horizontal Clear of clouds

CASR 91.229 Terrain awareness and warning system

(a) Airplanes manufactured before March 29, 2002. No person may operate a turbine-powered R.O.I.-registered airplane of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers, unless that airplane is equipped with an approved terrain awareness and warning system that as a minimum meets the requirements for Class B equipment in FAA Technical Standard Order (TSO)-C151 or equivalent.

(b) Airplanes manufactured after March 29, 2002. No person may operate a turbine-powered R.O.I.-registered airplane of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers, unless that airplane is equipped with an approved terrain awareness and warning system that as a minimum meets the requirements for Class A equipment in FAA Technical Standard Order (TSO)-C151 or equivalent.

(c) Airplane Flight Manual. The Airplane Flight Manual shall contain appropriate procedures for—

(1) The use of the terrain awareness and warning system; and

(2) Proper flight crew reaction in response to the terrain awareness and warning system audio and visual warnings.

1.17.3 Federal Aviation Administration (FAA) Advisory Circular (AC) 25-23 Airworthiness Criteria for the Installation Approval of a Terrain Awareness and Warning System (TAWS)

15. ALERT PRIORITIZATION.

a. Installations of TAWS on aircraft also equipped with a Reactive Windshear System (RWS), Predictive Windshear System (PWS), and Traffic Alert and Collision Avoidance System (TCAS) should include an alert prioritization scheme such that:

(1) Only one alert is given at any one time, and

(2) Alerts for situations requiring immediate action by the flight crew have priority in situations where conditions for multiple alerts may occur.

NOTE: In older aircraft, the system architecture may preclude the prioritization of alerts for multiple alerting systems. If such is the case, a prioritization scheme is not required. However, if simultaneous alerts can be given, then the aural words must be understandable and the associated visual alerts must not be confusing to the flightcrew.

b. Implementing this prioritization scheme within the TAWS equipment is acceptable. Table 2, below, displays an example of the recommended alert prioritization:

TABLE 2.

Recommended Alert Prioritization between the TAWS and Other Systems Installed

Priority		Description
Highest	1	Reactive Windshear Warning
Class A/B	2	Sink Rate Pull-Up Warning *(Excessive Rates of Descent)*
Class A	3	Terrain Closure Pull-Up Warning *(Excessive Closure Rates)*
Class A/B	4	Terrain Awareness Pull-Up Warning *(FLTA)*
	5	Predictive Windshear Warning
	6	Minimums *(Voice Callouts)*
Class A/B	7	Terrain Awareness Caution *(FLTA)*
Class A	8	Too Low Terrain *(Flight Into Terrain When Not in Landing Configuration)*
Class A/B	9	PDA *("Too Low Terrain")* Caution
Class A/B	10	Altitude Callouts *(Voice callouts)*
Class A	11	Too Low Gear *(Flight Into Terrain When Not in Landing Configuration)*
Class A	12	Too Low Flaps *(Flight Into Terrain When Not in Landing Configuration)*
Class A/B	13	Sink Rate *(Excessive Rates of Descent)*
Class A/B	14	Don't Sink *(Negative Climb Rate or Altitude Loss After Take-off)*
Class A	15	Glideslope *(Excessive Downward Deviation From an ILS Glideslope)*
	16	PWS Caution
	17	Approaching Minimums *(Voice Callouts)*
	18	Bank Angle *(Voice Callouts)*
	19	Reactive Windshear Caution
	20	TCAS RA *("Climb," "Descend," etc.)*
Lowest	21	TCAS TA *("Traffic, Traffic")*

1.18 Additional Information

There was no other information that was relevant to the circumstances leading up to the occurrence.

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 investigation did not reveal any information related to the aircraft serviceability and no pilot discussion of any abnormality in aircraft system during the flight.

The analysis will discuss related to the pilot awareness to the terrain and the CVR modification

2.1 Pilot Awareness to the Terrain

During the first flight from Timika to Ilaga, the aircraft flew on radial 060 from Timika VOR via the Jila Pass. When the aircraft established on radial 060, the PIC stated that the weather was raining. On the route the SIC stated that the aircraft headed to Ilaga Cut which mean the aircraft flight track was slightly deviate to the right from the radial 060 (see figure 15). This deviation might be considering the weather condition at Ilaga Cut, as the flight via Ilaga Cut has shorter distance. When the aircraft was about 4 Nm from Ilaga while descending the PIC stated that the sun was visible mean that the weather in Ilaga was good. The aircraft arrived and landed safely at Ilaga.

In the second flight, after the aircraft departure the Timika Tower controller instructed the pilot to fly on radial 065 which was different with the first flight. Radial 065 would make the aircraft flew between Jila and Ilaga Cut. This route selection might be affected by the observation of the weather condition during the first flight.

At 23:06:16 UTC, after about 14 Nm from Timika VOR while the PIC maintained the radial 065, the PIC briefed the SIC the intention to follow the radial 070 (the radial 070 was the filed flight plan) direct to Jila (see figure 15). About 4 minutes later, the PIC responded the other station calling and stated that the aircraft was at 24 Nm with altitude of 9,500 feet at radial 065 from Timika VOR, which mean the PIC intention to fly the radial 070 probably was not executed at that time.

Reviewing the track along the radial 065 from Timika toward Ilaga Cut, the highest elevation was below 12,000 feet (see figure 16 about the terrain before the distance of 45 Nm), while the flight maintained the cruise altitude of 13,000 feet.

At 23:17:51 UTC, the SIC broadcasted a message that the aircraft was maintaining 13,000 feet, and the position was about 6 Nm to Ilaga Cut with estimated time arrival Ilaga was 2327 UTC.

Afterward, the PIC briefed the SIC that if the aircraft too high for approach, the PIC intended to fly over the Ilaga and then join left downwind.

At 23:18:18 UTC, the PIC communicated with a pilot of another aircraft and stated that PK-SWW “was diving”. This term commonly used to describe that the aircraft is flying in the cloud.

At 23:20:11 UTC, after passing Ilaga Cut, the PIC stated ‘just leave it 054 for a while’. The track 054 was the bearing to Jila Pass from the aircraft current position. It means that the PIC probably intended to fly via Jila Pass, while the direct bearing to Ilaga from the aircraft current position was about 023 (see figure 16).

At 23:22:43 UTC, the SIC informed that the aircraft was descending passing altitude 12,500 feet and position at 7 Nm from Ilaga.

The route flown during the flight was deviate from the flight plan, which might be based on the weather observation of the first flight.

The weather condition had changed compare to the first flight referring to the PIC statement that the aircraft ‘was diving’ which can be assumed that the aircraft was flying in the cloud.

Flying at cruising altitude of 13,000 feet was safe for the route from Timika up to Ilaga Cut with the highest elevation of 12,000 feet. However, after passed Ilaga Cut, the flight appeared to fly to Jila Pass. On this route segment, the highest terrain elevation was more than 13,000 feet.

After passed Ilaga Cut, about 11 seconds prior to the impact, the SIC informed that the aircraft was descending passing altitude 12,500 feet and position at 7 Nm from Ilaga. The location of the accident site that was 7 Nm from Ilaga at the elevation about 13,000 feet indicated that the pilots were not aware to the surrounding terrain condition. If the TAWS was functioning normally, these surrounding terrain conditions should have been displayed in amber or red on the GTN750 multifunction display and should have attracted the pilot attention.

The investigation noticed the aircraft had been modified to equip with the TAWS which integrated to the GTN750 multifunction display system and the terrain situation should have been displayed in any imminent arising terrain. When the terrain proximity was imminent and the Terrain page is not displayed or when “TERR INHB” button was selected, a pop-up alert of the terrain information will be displayed in any page being viewed and the TAWS annunciator light will illuminate.

The PIC statement that the aircraft ‘was diving’ which can be assumed the aircraft was flying in the cloud. During this condition, the GTN750 multifunction display might have been selected to weather page. When the terrain was imminent, the display should have been changed to the terrain display to display the surrounding terrain condition.

The GTN750 multifunction display would show the surrounding terrain condition that threatening the flight on red. This would attract the pilot attention and the pilots would make comments or discussion which should had been recorded in the CVR. Considering the TAWS function normally, the 60 seconds TAWS caution and the 30 seconds TAWS warning should have been active prior to the impact.

The CVR did not record any pilot comment regarding to TAWS terrain situation nor TAWS caution or warning. The absence of pilot discussion and TAWS caution or warning might have made the pilot assumed that the flight would not encounter any arising terrain.

Nevertheless, the SIC reported that the aircraft was on descend passing 12,500 feet and 7 Nm from Ilaga Airport also indicated that the pilots did not aware of the surrounding terrain condition.

At 23:22:52 UTC or 2 seconds before the aircraft impacted into the terrain, the CVR recorded the PIC exclaimed something which might indicate that the PIC reacted immediately to a danger situation. This was the only evidence indicated that the pilot aware to a danger situation which could be the terrain.

Since the CAM channel in the CVR was covered with the engines noise therefore any sound in the cockpit including any aural warning could not be heard. The investigation could not determine whether any warning was activated by the TAWS when the aircraft approaching the terrain. This condition was contrary to the FAA AC 25-23 regarding the aural warning whenever the terrain was imminent the aural warning of any TAWS Class A or B should be clear, concise, and unambiguous.

The investigation did not find the test result of the TAWS after the aircraft had been modified therefore it was difficult to determine the result of the modification. Moreover, the investigation did not find line operation test related to the TAWS system. Even though the aircraft might be dispatched with the TAWS unserviceable (refer to the Master Minimum Equipment List (MMEL)), the operator stated that at the time of occurrence, there was no deferred item regarding the TAWS system.

The absence of pilot discussion to the terrain display nor the TAWS warning or caution indicated that the TAWS did not function normally. The investigation could not determine whether the system was not functioning nor it was deactivated by the pilot.

It was very likely that the pilot did not aware to the surrounding terrain condition as the aircraft was flying into the cloud and the TAWS did not function normally.

2.2 The Cockpit Voice Recorder (CVR) Modification

The investigation noticed that the aircraft had been modified from the standard DHC-4A Caribou into the DHC-4A Caribou Turbo. The modification covered almost all the aircraft systems including the airframe, engine systems, instruments, radio communication, and avionics, including installation of the Cockpit Voice Recorder (CVR).

The audio information from the CVR revealed that the pilot voices were recorded in the CVR while the other audio such as tower communication and other aircraft system audio were not recorded. During the flight, the Cockpit Area Microphone (CAM) channel in the CVR was covered by the engine noise.

The review to the aircraft wiring after the aircraft modification, revealed that the input lines of pilot channels in the CVR was directly connected to the pilot microphone line (for further detail see appendix 6.2.1 and 6.2.2) while the audio line to the headphones or cockpit speakers was not connected to any channel in the CVR.

The communication made by any other station calling or the aural warning (if any) which might be heard in the cockpit only recorded in the CAM channel. The filtering on the CAM channel to eliminate the engine noise and to discover any audio was performed without success.

Normally, in the aircraft which equipped with the CVR, the pilot microphone, any audio line to the headphones or cockpit speaker will be mixed in separate audio mixer to ensure all audio are recorded in respective input channels of the CVR.

It seems that to provide the audio other than pilot’s voice, the modification expected that any audio in the cockpit only rely on the area microphone line to be recorded into the CAM channel of the CVR. It was found when the aircraft was on ground with the electrical system activated and the engines were not operated, the sound surrounding the cockpit was clearly heard from the CAM channel of the CVR, however when the engine were operated, the audio was covered the engine noise. This design resulted in the audio in the cockpit was covered by engine noise while the engines were running.

3 CONCLUSIONS

3.1 Findings

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.

1. The aircraft had valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R).
2. The aircraft had just undergone major inspection and performed modification. The modification was to replace the previous piston engine with the PT6A-67T, to replace the aircraft instruments and avionics including installing the GA-EGPWS (TAWS) and CVR.
3. The crew held valid licenses and medical certificates.
4. The aircraft was operated within the weight operating envelope. The aircraft weight and balance were not considered the factor of the occurrence.
5. The flight was second flight of three scheduled flights to serve Timika to Ilaga and return on the day of occurrence.
6. During the first flight from Timika to Ilaga, the aircraft flew on radial 060 from Timika VOR via Jila, Jila Pass and direct to Ilaga. The aircraft landed safely.
7. On the second flight, the aircraft flew on radial 065 via Ilaga Cut and intended to fly via Jila Pass.
8. At 23:18:18 UTC the PIC communicated with another aircraft pilot stated that the aircraft ‘was diving’ which can be assumed that the aircraft was flying in the cloud.
9. While on the accident flight, at 2323 UTC, the pilot made first contact with Ilaga FISO and reported that the aircraft position was at Ilaga Cut and informed the estimate time of arrival Ilaga would be on 2327 UTC.
10. At 2330 UTC, the Ilaga FISO contacted the pilot of PK-SWW without replied. The Ilaga FISO asked another pilot in the vicinity to contact the pilot of PK-SWW aircraft and did not get any reply.
11. At 0022 UTC, Timika Tower controller received information from a pilot of another aircraft that Emergency Locator Transmitter (ELT) signal was detected approximately at 40 – 45 Nm with radial 060° from Timika VOR or approximately at coordinate 4° 7’ 46” S; 137° 38’11” E.
12. At 0053 UTC, Sentani AIS officer the aircraft declared the occurrence as DETRESFA.
13. One day after the occurrence, the aircraft wreckage was found on a ridge of mountain between Ilaga Cut and Jila Pass at coordinate 4°5’55.10” S; 137°38’47.60” E or approximately 7.5 Nm from Ilaga at elevation of approximately of 13,000 feet.

14. The aircraft wreckage spread approximately 100 m long on direction of about 080° indicated that the aircraft impacted into terrain with the high speed.

15. The pilot probably did not aware to the surrounding terrain condition as the aircraft was flying into the cloud and the TAWS did not function normally.

16. The TAWS test result after the aircraft had been modified and the line operation test related to the TAWS system were not available therefore it was difficult to determine the result of the modification. In addition, the investigation could not determine whether any warning activated by the TAWS when the aircraft approaching the terrain as the voice was not recorded on the CVR.

17. When flying in the mountainous area with the terrain database resolution is 30 arcs second, the TAWS or EGPWS issues caution or warning, even though the distance margin to the terrain is sufficient and safe to conduct the flight. This unnecessary caution or warning generated nuisance that may annoy the pilot and several pilots flying in Papua area, sometime elected to inhibit or pull the TAWS circuit breaker to silent the nuisance.

18. To avoid unnecessary nuisance terrain warning in Papua, the terrain database resolution is required to be in 15 arcs second (or even 6 arcs second) in the area within 30 Nm from an aerodrome.

19. Since the aircraft was destroyed in this occurrence, the investigation could not define the TAWS switches position including whether the TAWS circuit breaker was pulled or inhibited during the flight.

20. The audio information from the CVR revealed that the pilot voices were recorded in the CVR while the other audio such as tower communication and other aircraft system audio were not recorded.

21. The review to the aircraft wiring after the aircraft modification, revealed that the input lines of pilot channels in the CVR was directly connected to the pilot microphone line while the audio line to the headphones or cockpit speakers was not connected to any channel in the CVR.

22. To record audio in the cockpit to the CAM channel of the CVR, the modification probably only rely on the cockpit area microphone input. This design resulted in the any audio in the cockpit was covered by engine noise while the engines were running.

3.2 Contributing Factors

Contributing factors defines as actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident or incident occurring, or mitigated the severity of the consequences of the accident or incident. The presentation is based on chronological order and not to show the degree of contribution. The contributing factor in this occurrence is as follow.

It was very likely that the pilot did not aware to the surrounding terrain condition as the aircraft was flying into the cloud and the TAWS did not function normally resulted in the aircraft impacted to the terrain.

4 SAFETY ACTION

4.1 Aircraft Operator Safety Action

At the time of issuing this draft Final Report, the KNKT had not been informed of any safety actions resulting from this occurrence from the operator.

4.2 Directorate General of Civil Aviation (DGCA)

On 9 November 2016 the Directorate General of Civil Aviation (DGCA) issued the safety action as result of the accident in the Safety Circular SE.24 of 2016. The summary of the circular is shown below and the detail safety circular is described in the Appendix in this report.

1. Ensure to cancel the flight or return to base if the destination meteorological condition below minima.
2. The pilot required to follows the stabilized approach in any VMC or IMC and executed the go around if the criteria could not be achieved.
3. Ensure the operator and pilot follow the aircraft performance operation limitation which might be affected by the environment situation such as elevation, temperature, air density, runway lengths, etc.
4. The operator required to ensure that the pilot qualification related to the training and experience for the mountainous flight operation.
5. The operator required to conduct the hazard identification and assessment as the implementation of the Safety Management System the before conducted the mountainous flight operation.
6. Ensure the operator fulfill the aircraft airworthiness requirement as stipulated in the documents approved by DGCA.
7. The operator required to operate the aircraft within the authorization and limitation as stipulated in the AOC, Operation Specification (Opspec), ACL and other document approved by the DGCA.
8. The operator required to conduct the safety oversight for the fleet operation and placed the oversight personnel at the Papua area.

5 SAFETY RECOMMENDATIONS

5.1 Directorate General of Civil Aviation (DGCA)

The KNKT acknowledges the safety actions taken by DGCA and considered that the safety actions were relevant to improve safety, however there still safety issues remain to be considered. Therefore, the KNKT issued safety recommendations to address safety issues identified in this report.

Note: *The following safety recommendations are proposed safety recommendation which could be changed or deleted if the factual information is changed during the consultation process of the draft report.*

04.R-2016-38.02

The TAWS or EGPWS terrain database in Papua area mostly provided in low resolution. The low-resolution terrain database resulted in un-necessary caution or warning whenever the aircraft flies to the mountainous area even though the flight able to be conducted safely. The pilot tends to inhibit or deactivate the TAWS or EGPWS system to avoid the un-necessary caution or warning. The flight with inactive TAWS or EGPWS is contrary to the purpose of the installation of the equipment and jeopardize the safety of the flight.

Therefore, KNKT recommends:

a. To coordinate with the TAWS or EGPWS manufacturer to provide the high-resolution terrain database to meet the requirement of Technical Standard Order (TSO) number TSO-C151c Terrain Awareness and Warning System (TAWS) for Papua area.

b. To review the regulation of implementation the high resolution terrain database in the Papua area.

04.R-2016-38-03

The test result of the modification of the aircraft by the installation of CVR, TAWS or other system after the aircraft had been modified were not available. The absence of the modification test result made the successful installation and functionality of the systems could not be ascertained. The investigation found that the voice that should be recorded on the CAM channel was covered by engine noise. The investigation could not determine whether the TAWS was functioning during the flight. The improper installation of a system makes the function of an equipment could not be utilized.

Therefore, KNKT recommends to ensure that after a modification, the system operates according to their function and supported with proper documentation.

04.R-2016-38-04

During the investigation, it was found that the CVR CAM channel was covered by the engine noise and the voice in the cockpit could not be heard. The other station communication and aircraft system alert or warning sound were not recorded in the CVR. The review to the wiring design found that the CVR wiring interconnection had caused in the improper CVR recording.

The improper CVR recording was in accordance with the purpose of the CVR and led the important information which store in the CVR was unavailable.

Therefore, KNKT recommend to review the CVR initial and annual download by the operator was examined properly to ensure that all channels were functioning properly and clearly readable during the whole aircraft operation (in all flight phase).

5.2 Pen Turbo Aviation Inc., USA

04.MO-2016-38-05

After completion of the modification, the investigation revealed that in the modified CVR wiring system of the aircraft, the microphones lines of the SIC, PIC and spare line, were directly hooked to the channel 1 (SIC), 2 (PIC) and 3 (spare) of CVR audio line respectively. As the result, the incoming audio communication and other audio which generated by the aircraft system were not accommodated into the CVR. In addition, it was found that the CVR CAM channel was filled by the engine noise therefore the other station calling or aircraft system sound was not recorded in the CVR. To record audio in the cockpit to the CAM channel of the CVR, the modification probably only rely on the cockpit area microphone input. This design resulted in the any audio in the cockpit was covered by engine noise while the engines were running. The improper modification leads to the CVR important information was unavailable during the investigation.

Therefore, KNKT recommend to review the CVR wiring design so all of the required voices are accommodated in the CVR in all flight phase.

5.3 Aircraft Operator

04.O-2016-38-06

During the flight, the PIC communicated with another aircraft pilot stated that the aircraft ‘was diving’ which can be assumed that the aircraft was flying in the cloud. The CASR Part 91.155 Basic VFR Weather Minimums, restricts the pilot to maintain certain distance with the cloud during flying in VFR flight. Flying in the cloud during VFR flight reduces the pilot awareness to the surrounding terrain and traffic condition.

Therefore, KNKT recommends the operator to ensure all pilots conduct the flight according to the basic VFR weather minimum.

04.O-2016-38-07

The TAWS or EGPWS terrain database in Papua area mostly provided in low resolution. The low-resolution terrain database resulted in un-necessary caution or warning whenever the aircraft flies to the mountainous area even though the flight able to be conducted safely. The pilot tends to inhibit or deactivate the TAWS or EGPWS system to avoid the un-necessary caution or warning. The flight with inactive TAWS or EGPWS is contrary to the purpose of the installation of the equipment and jeopardize the safety of the flight.

Therefore, KNKT recommends to coordinate with the TAWS or EGPWS manufacturer to provide the high-resolution terrain database to meet the requirement of Technical Standard Order (TSO) number TSO-C151c Terrain Awareness and Warning System (TAWS) for Papua area.

04.O-2016-38-08

During the investigation, it was found that the CVR CAM channel was covered by the engine noise and the voice in the cockpit could not be heard. The other station communication and aircraft system alert or warning sound were not recorded in the CVR. The review to the wiring design found that the CVR wiring interconnection had caused in the improper CVR recording. The improper CVR recording was in accordance with the purpose of the CVR and led the important information which store in the CVR was unavailable.

Therefore, KNKT recommend to ensure the CVR initial and annual download was examined properly and all channels were functioning properly and clearly readable during the whole aircraft operation (in all flight phase).

6 APPENDICES

6.1 Flight Plan

PERKUMPULAN PENERBANGAN ALFA INDONESIA	P O B		FROM (POINT of DEP)	TIMIKA	TIM / WAYY	S.T.D	:
FLIGHT OPERATION		IL :	TO (POINT of DESTN)	ILAGA	ILA / WAYL	BLOCK OFF	:
AIRCRAFT REG : PK -	V-SPEEDS	V1 / V2 / VR	ALTERNATE Airport	TIMIKA	TIM / WAYY	BLOCK ON	:

AIRBORN	:	ACFT TYPE / ENG	DHC 4A TURBO CARIBOU	
TOCH DOWN	:	EST TOW	12 472 / 27 500	KG / LBS
FLIGHT TIME	:	ACT TOW		KG / LBS

FLIGHT TIME INT	ACC	ETA	ATA	FUEL KG BURNS	ACT FUEL KG / LBS BURNS	REMAIN	AWY	WAY POINTS	COORDINATE	MAGN TRACK	DISTANCE INTV	ACC	F.L 130	TAS	WIND COMP	G/S	MEA X 100
								MOZES KILANGIN APT									
3	0:03						SID	112.7 TMK	S 04 31 00 E 136 53 00	EXT	5	5	CLB	100	-10	90	
21	0:24							TOC		070	31	36	150	100	-10	90	
4	0:28							JILA	S 04 15 00 E 137 38 00	070	10	46		165	-10	155	
1	0:29						VFR	TOD		070	3	49		165	-10	155	
6	0:35							JILA PZ	S 04 05 00 E 137 40 00	010	15	64	DSC	163	-10	153	
3	0:38						VFR	OHD ILAGA	S 03 59 00 E 137 37 00	330	7	71		163	-10	153	
1	0:39						APP	ILAGA APO	S 03 58 61 E 137 37 33	LDG	3	74		163	-10	153	

FUEL	FUEL WEIGHT KG	LBS	END
CLIMB	163	360	0:22
CRUISE	34	75	0:05
DESC + APCH	68	150	0:10
TRIP	265	585	0:37
CONTINGENCY	34	75	0:05
ALTERNATE	452	996	1:05
REQ TAKE OFF	751	1656	1:47
TAXY	34	75	0:05
REQ BLOCK	785	1731	1:52
ADD TO DBL U/L	866	1910	2:10
REQ BLK DBL U/L	1132	2495	4:02
ACTUAL BLOCK			

REMARKS :

ALTERNATE : TIMIKA - MOSES KILANGIN APT — FL 120

INT	ACC	AWY	WAY POINTS	COORDINATE	MAGN TRACK	INTV	ACC	F.L	TAS	WIND COMP	G/S	MEA X 100
			ILAGA APO	S 03 58 61 E 137 37 33								
2	0:02	DEP	OVHD ILAGA	S 03 59 00 E 137 37 00	EXT	3	3	CLB	90	-5	85	022
4	0:06	VFR	JILA PZ	S 04 05 00 E 137 40 00	150	5	8		90	-5	85	
4	0:10	VFR	TOC / JILA	S 04 15 00 E 137 38 00	190	10	18	120	168	-5	163	
3	0:13	VFR	TOD		250	9	27		168	-5	163	
15	0:28		112.7 TMK	S 04 31.0 E 136 52.0	250	40	67	DSC	165	-5	160	030
2	0:30	STAR	MOSEZ KILANGIN	S 0431.7 E 136 53.3	ENT	5	72		165	-5	160	

	KG	LBS	END
GO AROUND	40	88	0:05
CLIMB	72	158	0:10
CRUISE	20	45	0:03
DESCEND	116	255	0:17
FINAL RESERVE	204	450	0:30
TOTAL	452	996	1:05

I certify that I have satisfied my self that all factors which from the basis of flight preparations are in accordance with the pertinent Regulations laid down by the INDONESIAN CIVIL AVIATION.

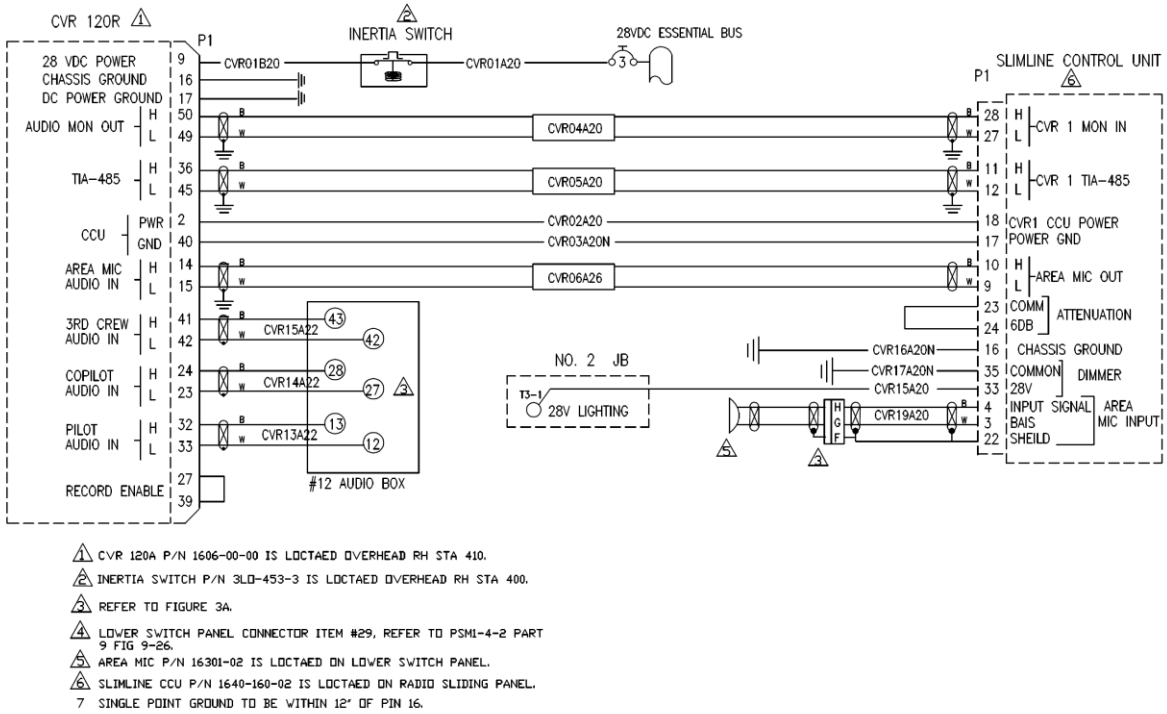
INFORMATION			
FRANS TWR :	118.1 MHZ	KILANGIN TWR :	118.3 MHZ
BIAK APP	121.2 MHZ	TIM RADIO :	8834 KHZ
BIAK APP	119.1 MHZ	NDB	ZF 300
BIAK INFO :	8834 KHZ		
ATIS BIK	126.5 MHZ		

		DATE	
PREPARED BY FOO :		APPROVED BY PIC :	
NAME		NAME	CAPT.
LICENCE NO.		LICENCE NO.	ATPL.
SIGN		SIGN	

OPS/FL/DHC-4A T.CARIBOU — REV 000 / SEP 2016

6.2 CVR Wiring

6.2.1 CVR Wiring

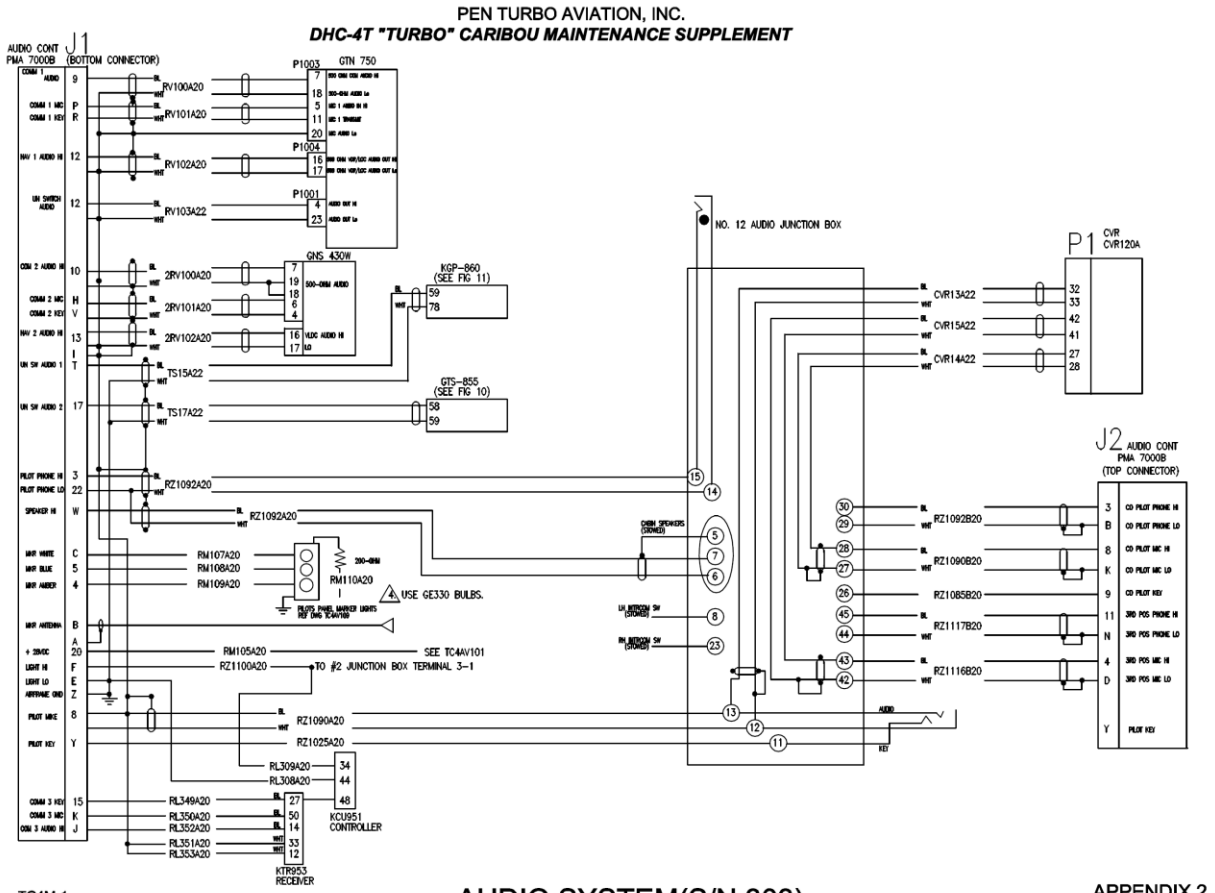


1. CVR 120A P/N 1606-00-00 IS LOCTAED OVERHEAD RH STA 410.
2. INERTIA SWITCH P/N 3LD-453-3 IS LOCTAED OVERHEAD RH STA 400.
3. REFER TO FIGURE 3A.
4. LOWER SWITCH PANEL CONNECTOR ITEM #29, REFER TO PSM1-4-2 PART 9 FIG 9-26.
5. AREA MIC P/N 16301-02 IS LOCTAED ON LOWER SWITCH PANEL.
6. SLIMLINE CCU P/N 1640-160-02 IS LOCTAED ON RADIO SLIDING PANEL.
7. SINGLE POINT GROUND TO BE WITHIN 12" OF PIN 16.

COCKPIT VOICE RECORDER. CVR (S/N 303)

FIGURE 13

6.2.2 Audio System and CVR Wiring Interconnection



TC4M-1

AUDIO SYSTEM(S/N 303)

FIGURE 3A

APPENDIX 2
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MAR 20/16

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