KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA

FINAL

KNKT.19.12.30.04

Aircraft Serious Incident Investigation Report

PT. ASI Pudjiastuti Aviation (Susi Air)

Cessna C208B, PK-BVN

About 32 Nm North of Dili

On coordinate 8°5'5.71"S; 125°30'47.91"E,

Republic of Indonesia

5 December 2019

2023

This Final Report is published 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 initial 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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Jakarta, 30 March 2023
KOMITE NASIONAL
KESELAMATAN TRANSPORTASI
CHAIRMAN

SOERJANTO TJAHJONO

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ABBREVIATIONS AND DEFINITIONS

AOC	:	Air Operator Certificate
C of A	:	Certificate of Airworthiness
C of R	:	Certificate of Registration
CAA	:	Civil Aviation Authority
CASR	:	Civil Aviation Safety Regulation
CPL	:	Commercial Pilot License
DAAO	:	Directorate of Airworthiness and Aircraft Operation
DGCA	:	Directorate General of Civil Aviation
GPIAIA	:	*Gabinete Prevensaun e Investigasacao Insidente e Acidente com Aeronave* (Timor-Leste accident investigation authority)
ICAO	:	International Civil Aviation Organization
KNKT	:	*Komite Nasional Keselamatan Transportasi* (Indonesia accident investigation authority)
LT	:	Local Time
OCC	:	Operations Control Center
OM-Part A	:	Operation Manual Part A
PF	:	Pilot Flying
PIC	:	Pilot in Command
PM	:	Pilot Monitoring
SIC	:	Second in Command
SMM	:	Safety Management Manual
UTC	:	Universal Time Coordinated

SYNOPSIS

On 5 December 2019, a Cessna C208B aircraft registered PK-BVN was operated by PT. ASI Pudjiastuti Aviation (Susi Air) on a schedule passenger flight from John Becker Airport (WATQ), Kisar to El Tari International Airport (WATT), Kupang. On board the aircraft was a crew of two consisting of a Pilot in Command (PIC) and a Second in Command (SIC) accompanied by 12 passengers. The flight was conducted during Visual Meteorological Conditions (VMC) by day.

During the preflight check for the aircraft, there was no record or report of any aircraft system malfunction. The SIC was aware that supplemental oxygen was not available in the aircraft. The supplemental oxygen was not required for unpressurized aircraft flying on cruising altitude at or below 10,000 feet.

At 0359 UTC or 1159 LT, the aircraft departed from Kisar with flight number SQS6161, the PIC acted as pilot monitoring (PM) and the SIC as pilot flying (PF). About 15 minutes after departure, the aircraft reached the cruising altitude of 10,000 feet.

During cruising, both pilots discussed regarding a certain health issue, thereafter, the SIC started to feel anxious and difficult to breath. The SIC's condition deteriorated when he recalled that there was no supplemental oxygen in the aircraft, and his breathing became shorter. The PIC was aware of the SIC's condition then requested to the air traffic controller (ATC) to descend the aircraft. The air traffic controller responded the pilot to standby the descend.

The SIC began to feel dizzy and thereafter started to experience a tunneled vision whereafter he experienced a black out vision and according to the PIC, the SIC experienced loss of consciousness for approximately 20 seconds. The PIC declared MAYDAY and requested to divert to Presidente Nicolau Lobato International Airport (WPDL), Dili, Timor Leste. The decision to divert was based on consideration that the flight to Dili was shorter than continued the flight to Kupang.

The PIC advised the air traffic controller that the SIC has experience a heart attack and requested ambulance to be standby for their arrival. The air traffic control acknowledged and approved the pilot request. The PIC diverted to Dili and started descending. The SIC regained the consciousness and drank water. Afterwards, the SIC was aware that the aircraft was on descend and he was able to take deep breaths and felt better.

At 0457 UTC, the aircraft landed at Dili and the SIC was taken to the hospital by road which was near the airport for medical treatment.

There was no injury to person and no damage to the aircraft in this occurrence.

At the time of issuing this Final Report, the KNKT had not been informed safety actions taken by the Susi Air and the KNKT issued safety recommendations to the Susi Air resulting from this occurrence.

The investigation involved the participation of South Africa Civil Aviation Authority and the Timor-Leste *Gabinete Prevensaun e Investigasacao Insidente e Acidente com Aeronave* (GPIAIA) as the State providing information to the KNKT. All agencies have appointed their accredited representatives and advisers to assist in this investigation in accordance with the provisions in ICAO Annex 13.

1 FACTUAL INFORMATION

1.1 History of the Flight

On 5 December 2019, a Cessna C208B aircraft registered PK-BVN was operated by PT. ASI Pudjiastuti Aviation (Susi Air) on a schedule passenger flight on Nusa Tenggara and Maluku area, Indonesia. According to the available information on the flight plan, the aircraft upon departure was scheduled to route to El Tari International Airport (WATT), Kupang[1] to Tardamu Airport (WATS), Sabu[2] and then return to Kupang. From Kupang the flight will continue to John Becker Airport (WATQ), Kisar[3] and then return for a final full stop landing at Kupang. The flight was conducted during Visual Meteorological Conditions (VMC) by day.

Prior to the first flight, the SIC conducted preflight check for the aircraft. There was no record or report of any aircraft system malfunction. During the preflight check, the SIC was aware that supplemental oxygen was not available in the aircraft, and it was not required for unpressurized aircraft flying on cruising altitude at or below 10,000 feet.

At 0712 LT (2312 UTC[4]), during daylight the aircraft departed from Kupang with destination to Sabu, at a cruise altitude of 10,000 feet. During this flight the PIC was the Pilot Flying (PF) and the SIC was the Pilot Monitoring (PM). At 2352 UTC, the aircraft landed on Sabu. The flights conducted as the schedule and the subsequent flights until landed on Kisar were uneventful.

At 0359 UTC, the aircraft departed from Kisar with flight number SQS6161, on board the aircraft was two pilots and 12 passengers. The PIC acted as PM and the SIC as PF. The flight plan route for this flight was from Kisar directed to coordinate 08°05'S; 125°27'E (point 1) then to 08°10'S; 125°14'E (point 2) and to Kupang (see figure 1). About 15 minutes after departure, the aircraft reached the cruising altitude of 10,000 feet.

During cruise phase, the crew had a discussion regarding a certain health related topic where-after the SIC started to feel anxious and experienced shortness of breather. The SIC became more anxious when he recalled that there was no supplemental oxygen in the aircraft. The PIC was aware of the SIC's condition then requested to the air traffic controller (ATC) to descend the aircraft. The air traffic controller responded the pilot to standby the descend.

The SIC felt dizzy, tunneled vision followed by black out vision and then loss of consciousness about 20 seconds. The PIC declared MAYDAY and requested to divert to Presidente Nicolau Lobato International Airport (WPDL), Dili, Timor Leste[5]. The decision to divert was based on consideration that the flight to Dili was shorter than continued the flight to Kupang.

1 El Tari International Airport (WATT), Kupang will be named as Kupang for the purpose of this report.

2 Tardamu Airport (WATS), Sabu will be named as Sabu for the purpose of this report.

3 John Becker Airport (WATQ), Kisar will be named as Kisar for the purpose of this report.

4 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 in Kupang is UTC+8 hours.

5 Presidente Nicolau Lobato International Airport (WPDL), Dili, Timor Leste will be named as Dili for the purpose of this report.

The PIC advised the air traffic controller that the SIC has experience a heart attack and requested ambulance to be standby for their arrival. The air traffic control acknowledged and approved the pilot request. The PIC diverted the flight to Dili and started descending. During the descend, the SIC regained the consciousness and drank water. Thereafter, the SIC was aware that the aircraft was on descend and he was able to take deep breaths and felt better.

At 0449 UTC, when the aircraft passed altitude of 6,000 feet the PIC activated the Quick Position report[6] of the flight following system installed in the aircraft.

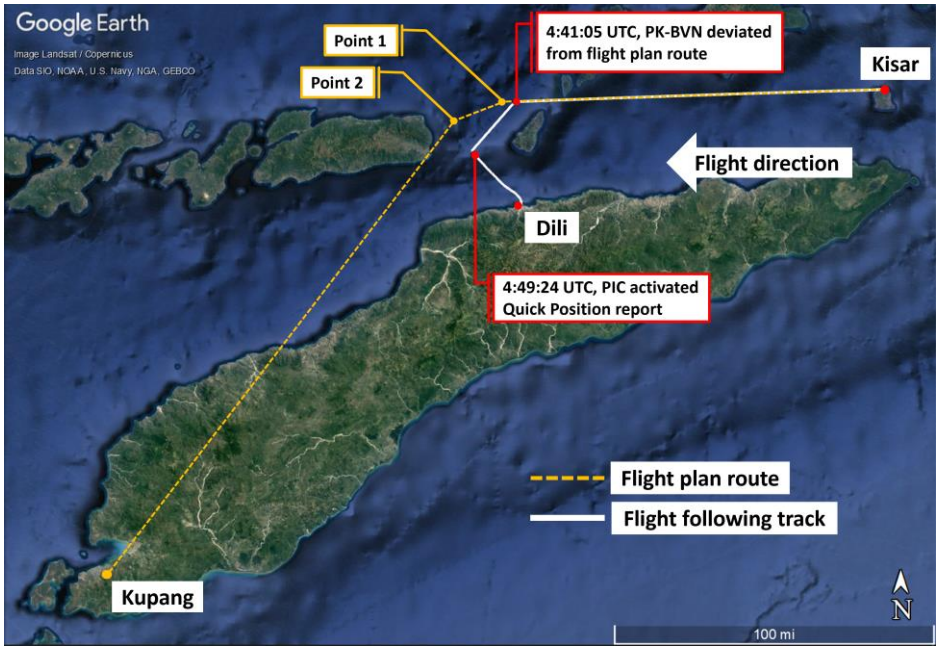

Figure 1: The flight profile based on flight following data

At 0457 UTC, the aircraft landed safely at Dili. The SIC was taken to the hospital by road which was near the airport for medical treatment. According to the medical report, the SIC's blood sugar level, blood pressure, oxygen levels in blood and heart rate were tested, and the result were normal. The details physical examination could not be carried out due to the SIC refused it as he felt the condition had improved and preferred to be conducted in Kupang. The pilots decided to continue flying to Kupang.

At 0733 UTC, the aircraft departed from Dili to Kupang with cruising altitude of 6,000 feet. The flight was uneventfully and landed safely at 0832 UTC.

There was no injury to person and no damage to the aircraft in this occurrence.

6 The Quick Position report is feature on the flight following system to increase the reporting interval to 15 second interval. The detail of flight following system can be found in subchapter 1.7.1.3.

1.2 Personnel Information

1.2.1 Pilot in Command

The Pilot in Command (PIC) is 27 years old Uruguayan national who had a valid Commercial Pilot License (CPL) issued by Uruguay National Directorate of Civil Aviation and Aeronautical Infrastructure with an expiry date of 8 August 2014 which was validated by Indonesia Directorate General of Civil Aviation (DGCA) with qualification as Single Engine Land (SEL) aircraft pilot, on which the aircraft (Cessna 208B) was endorsed on his license. The PIC had valid first-class medical certificate without any limitation/restriction.

The PIC had accumulated total flying hours of 2,170 hours including 1,870 hours on Cessna 208B.

1.2.2 Second in Command

The Second in Command (SIC) is 23 years old South African who is a holder of valid CPL issued by South African Civil Aviation Authority (CAA) of South Africa on 28 January 2019 with an expiry date of 30 April 2020 with qualification as Single Engine Land aircraft, including Cessna 208B aircraft which had been validated by the Indonesia Directorate General of Civil Aviation (DGCA) on 6 August 2019. The SIC had valid first-class medical certificate issued by the South African CAA on 6 August 2019 with expiry date of 28 February 2020.

On 22 May 2019, the SIC conducted medical examination in the *Balai Kesehatan Penerbangan* (Indonesia Aviation Medical Center) as part of the requirement for foreign CPL validation. The SIC met the medical standard requirement and received first-class medical certificate without any limitation which valid until 22 November 2019. This was the last medical examination performed on aviation medical facility prior the occurrence.

The SIC had accumulated total flying hours of 599.5 hours including 153.5 hours on Cessna 208B.

About one week before the occurrence, the SIC received information regarding certain health issue of his family and friends then he started becoming very concern about it. Thereafter when thinking about that health issue, the SIC felt anxiety and often unable to get proper sleep. This health issue was the same issue that was discussed with the PIC during the occurrence flight.

On 29 November 2019 – seven days before the occurrence, the SIC completed 6 flight sectors with total flight hour of 4 hours 24 minutes. The SIC then had three days off from 30 November until 2 December 2019. On 1 December 2019 the SIC conducted physical activity by exploring a beach which 3-hours-drive away. On 2 December 2019, the SIC was advised by a company check pilot who also the PIC of the occurrence flight, to conduct Instrument Landing system (ILS) approach check.

On 3 December 2019 – two days before the occurrence, the SIC was scheduled for a flight on two sectors and accumulated a total of 1.8 hours (1 hour 50 minutes).

On 4 December 2019 – one day before the occurrence, the SIC did not have any significant physical activity. The SIC prepared the ILS approach check and slept about 2000 LT.

On 5 December 2019 – the day of the occurrence, the SIC woke up about 0500 LT. The SIC had slices of papaya for breakfast. The SIC arrived at the airport and signed on for duty at 0650 LT (2250 UTC). Thereafter, the SIC conducted blood pressure and alcohol test, the blood pressure was normal and the alcohol test result indicated the pilot was not under the influence of alcohol. Prior the occurrence, there was no report or indication that SIC was unfit to perform his duty.

The flight schedule for that day was 4 sectors. (Kupang – Sabu – Kupang – Kisar – Kupang). The SIC prepared 1.5 liters of mineral water in the cockpit for the flight.

Prior to the occurrence flight, the SIC had undertaken a flight of 3 hours 30 minutes and during the occurrence flight, the SIC had flown approximately 48 minutes.

1.3 Aircraft Information

The Cessna 208B registered PK-BVN was manufactured by Textron Aviation Inc. in 2010 with serial number of 208B2214. The aircraft had valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R). The total time since new of the aircraft was 10,806.9 hours and the total cycle since new was 13,773 cycles.

The aircraft is unpressurized aircraft, equipped with supplemental oxygen. During the day of the occurrence, supplemental oxygen was not available in the aircraft. It was not required by current Indonesian aviation regulations as the PK-BVN would be flown at and below 10,000 feet.

There was no report or record of aircraft system malfunction during the occurrence.

1.4 Communications

All communications between air traffic control and the crew were recorded by ground based automatic voice recording equipment. The quality of the aircraft recorded transmissions was good.

1.5 Flight Recorders

The aircraft was not fitted with a flight data recorder or cockpit voice recorder. Neither recorder was required by current Indonesian aviation regulations.

1.6 Medical and Pathological Information

On 5 December 2019, soon after the occurrence, the SIC was carried to a hospital near Dili airport. The vital sign was within normal limit, and further physical examination was not carried out as the SIC felt the condition had improved. The SIC asked to leave the hospital and continued to fly to Kupang.

After landed at Kupang, the aircraft operator asked the SIC to conduct medical examination. SIC was admitted to a hospital at Kupang. The chest X-ray was normal, no significant findings on laboratory test result, while the CT brain showed a slight edema cerebri[7]. The SIC was allowed to leave the hospital on the next day, suggested to conduct further medical examination in Jakarta.

On 11 December 2019, the SIC underwent several medical examinations at a hospital in Jakarta such as Magnetic Resonance Imaging (MRI), blood and urine test, resting ECG, treadmill test, echocardiography and electroencephalography. All the medical examinations result did not find any significant health issues that could have contributed to the conditions experienced by the SIC during flight.

On 26 December 2019, the SIC conducted medical examination at the Aviation Medical Center to reevaluate the medical fitness of the SIC. The result of the examination required the SIC to conduct advanced examinations by referring the SIC to ear nose and throat specialist, psychiatrist, and neurologist.

According to evaluation conducted by neurology and ear nose and throat specialists, the SIC was in normal condition, there was no significant finding and considered to be able to resume his flying duty. The ear nose and throat specialist also evaluated that the turbinate hypertrophy and the deviation of nose septum toward the right side did not interfere the SIC for flying duty.

During the psychiatric examination, the psychiatrist provoked the SIC to repeatedly discuss the same health issue topic which was discussed during the occurrence flight. The SIC stated to the psychiatrist that he has been able to manage his emotion while discussing the same health issue topic. Based on the comprehensive psychiatric examination, the psychiatrist considered the SIC was mentally fit for flying duty.

1.7 Organizational and Management Information

1.7.1 Aircraft Operator

The PK-BVN is operated by PT. ASI Pudjiastuti Aviation (Susi Air) which had valid Air Operator Certificate (AOC) number 135-028. The Susi Air authorized to conduct air transportation carrying passengers and cargo in scheduled and non-scheduled operation within and outside Indonesia for aircraft operations under Civil Aviation Safety Regulation (CASR) Part 135.

The Susi Air has established a centralized Operations Control Center (OCC) in the company headquarter in Pangandaran, West Java. All information and communication of the flight operation are collected, processed and passed through the OCC, includes the flight operation monitoring.

7 Edema cerebri or brain edema is swelling of the brain caused by the accumulation of fluid in the brain substance. The details explanation could be found in the following link https://medical-dictionary.thefreedictionary.com/brain+edema

The Susi Air published Operation Manual Part A (OM-Part A) which contain policies and procedures approved by the Directorate General of Civil Aviation. Pilot

1.7.1.1 Incapacitation Procedure

The Susi Air described procedure of pilot incapacitation in the OM-Part A subchapter 4.8. This subchapter defines flight incapacitation as any condition which affects the health of a crewmember during the performance of duties which renders him or her incapable of performing the assigned duties.

The subchapter described that early recognition of incapacitation is essential and requires pilot to advise the paired pilot. During routine monitoring and cross-checking of flight instruments, especially during critical phases of flight, pilot should be alert to subtle incapacitation as follows:

- *If a crewmember does not respond appropriately to two verbal communications, or*
- *If a crewmember does not respond to a verbal communication associated with a significant deviation from a standard flight profile*

Other symptoms of the beginning of incapacitation are:

- *Incoherent speech*
- *Strange behavior*
- *Irregular breathing*
- *Pale fixed facial expression*
- *Jerky motions that are either delayed or too rapid*

The OM-Part A subchapter 4.8.3 described action to be followed if pilot incapacitation is detected as follows:

- *The fit pilot must assume control and return the aircraft to a safe flight path, announce "I have control" and engage the autopilot,*
- *The fit pilot must take whatever steps are possible to ensure that the incapacitated pilot cannot interfere with the handling of the aircraft,*
- *The fit pilot must land as soon as practicable considering all pertinent factors,*
- *Arrange medical assistance after landing, giving as many relevant details about the condition of the crewmember as possible.*

1.7.1.2 Supplemental Oxygen in the Aircraft

The Susi Air complied with the requirement of the CASR Part 135, described in the OM-Part A subchapter 13.6 which requires pilot to:

> *"ensure that they must be equipped with oxygen mask(s) when flying an aircraft at an altitude above 10,000 feet MSL through 15,000 feet MSL – for a maximum of 30-minute duration – as well as at least 10 percent of the passengers on board the said aircraft."*

1.7.1.3 Aircraft Flight Following System

The aircraft operator utilizes flight following system provided by Blue Sky Network. The device has capability to report several aircraft parameters including altitude, heading, speed and coordinate position of the aircraft in interval time.

For the PK-BVN aircraft, the reporting capability was as follows:

- 4 minutes interval reporting when aircraft is below 5,000 feet; and
- 8 minutes interval reporting when aircraft is above 5,000 feet.

The device has Quick Position report button to increase the interval reporting to 15 seconds interval. The Susi Air OM-Part A subchapter 18.3 requires pilot to activate the Quick Position report during distress and urgency situation. Should the Quick Position report have been activated, aural alert will be sounded in the OCC. Thereafter, the dedicated flight following personnel must perform emergency procedure Phase 2 (Aircraft Alert – ALERFA).

1.7.1.4 Serious Incident Reporting

The Susi Air OM-Part A chapter 17 described the requirement when accident and incident occur in the Susi Air which require the company personnel to notify, by the quickest means available to the Operation Manager and, the Safety and Quality Manager.

The serious incident described in the Susi Air Safety Management Manual (SMM) as follows:

> *"an incident involving circumstances indicating that an accident nearly occurred."*

The SMM did not describe more detail of the serious incident and only mentioned that the classification of serious incident is based on the International Civil Aviation Organization (ICAO) Annex 13. There was no list of examples of serious incident in the SMM.

The SMM subchapter 3.5 described serious incident as mandatory occurrence to be reported to the DGCA and *Komite Nasional Keselamatan Transportasi* (KNKT) as soon as possible.

On 10 December 2019, the KNKT received the occurrence report from Indonesia Ministry of Foreign Affair. Afterwards the KNKT contacted the Susi Air to get the detail chronological report and on 13 December 2019, the Susi Air reported this occurrence to KNKT. Based on the reports, the KNKT determined the occurrence as serious incident and conducts ICAO Annex 13 investigation.

1.7.2 Indonesia Civil Aviation Authority

The civil aviation in Indonesia is regulated by Directorate General of Civil Aviation (DGCA) which is government agency under the Ministry of Transportation. The DGCA has several directorates including the Directorate of Airworthiness and Aircraft Operation (DAAO) that responsible in formulating policy and standard including oversight of aircraft operation under CASR Part 135.

1.7.3 Medical Standard and Certification

The CASR Part 67 described medical standard and certification in Indonesia, according to CASR Part 67 subchapter 67.9:

> *The flight crew, air traffic controller, and flight operation personnel other than pilot shall not exercise the privileges of their license unless they hold a current medical certificate appropriate to the license.*

The CASR Part 67 subchapter 67.21 described that Commercial Pilot License (CPL) holder is required to have valid Class 1 medical certificate which will valid for six months. The subchapter 67.21 also described requirement of medical certification for holder foreign license as follows:

> *Holder of foreign license issued by ICAO contracting states who applies for license validation shall have medical certification under this part.*

1.7.4 Serious Incident of Indonesia Civil Aircraft

According to the Aviation Law Number 1 of 2009 and Government Decree Number 62 of 2013 described that KNKT has the responsibility to conduct investigation on serious incident of Indonesia civil aircraft occurred within and outside the territory of Republic of Indonesia.

The CASR Part 830 subpart 830.2 defines serious incident as:

> *An incident involving circumstances indicating that there was a high probability of an accident and associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down.*

The Appendix B of the CASR Part 830 described that flight crew incapacitation in flight is included in the list examples of serious incident.

In the case of Indonesia civil aircraft experienced serious incident, the CASR Part 830 subpart 830.06 requires person, organization or enterprise engaged in or offering to engage in an aircraft operation, with minimum delay and by the most suitable and quickest means available, must report to the KNKT.

1.8 Additional Information

1.8.1 Hypoxia and Hyperventilation[8]

Hypoxia is a state in which available oxygen supply is inadequate or below the requirement of the tissues, whether in quantity or molecular concentration.

According to the primary mechanism involved, hypoxia may be classified as follows:

1. Hypoxic hypoxia: Reduction in oxygen tension in the arterial blood.
2. Anaemic hypoxia: Reduction in the oxygen-carrying capacity of the blood.
3. Ischaemic or stagnant hypoxia: Reduction in blood flow through the tissues.
4. Histotoxic hypoxia: Interference with the ability of the tissues to utilize a normal oxygen supply.

Hyperventilation is a state in which excess removal of carbon dioxide from the blood by rapid or deep breathing. The hyperventilation can occur on certain conditions including emotional stress such as anxiety or panic. The anxiety or panic could lead to over breathing condition which cause reduction of carbon dioxide tension in alveolar and arterial. The natural response of the body to prevent this is by inducing vasoconstriction[9] of the cerebral arterioles and the vessels of the skin, while blood flow through skeletal muscle is increased. Hyperventilation produces a significant impairment of the ability to perform psychomotor tasks and can cause unconsciousness. When the blood flow to the brain is reduced, oxygen supply to the brain tissue does not meet the normal requirement, resulting a condition of stagnant hypoxia.

1.9 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.

8 The description of this subchapter is based on Ernsting's Aviation and Space Medicine Book Fifth Edition chapter 4 edited by Professor David P. Gradwell and Air Commodore David J. Rainford.

9 Vasoconstriction is an active narrowing of small arteries as a result of contraction of the circular smooth muscle fibres in their walls. This severely reduces the flow of blood through them. The definition is taken from Collins Dictionary of Medicine on the following link https://medical-dictionary.thefreedictionary.com/vasoconstriction

2 ANALYSIS

Prior and during the flight there was no record or report of the aircraft system malfunction. The investigation determined the aircraft system was not an issue in this occurrence. Therefore, the analysis would discuss about the Second in Command (SIC) medical condition which have made the SIC experiencing loss of consciousness about 20 seconds during the flight.

About one week before the occurrence, the SIC received information regarding certain health issue of his family and friends then became very concern about it. Thereafter when thinking about those health issues, the SIC felt anxiety and often unable to get proper sleep. During the occurrence flight, the SIC discussed the same certain health issue with the PIC and became anxious. The discussion of the health issue is considered as a trigger which made the SIC became anxious. The SIC became more anxious when he recalled that there was no supplemental oxygen in the aircraft as the operation altitude did not require the use of the supplementary oxygen. The SIC breath then became shorter.

The Ernsting's Aviation and Space Medicine stated that emotional stress such as anxiety could led to hyperventilation which indicated by shorter breathing. The shorter breath of the SIC indicated that the SIC anxiety has led to hyperventilation The condition was worsened due to less air density environment as the aircraft was unpressurized and flew at altitude of 10,000 feet.

The shorter breath made the body compensated the excessive CO_2 excretion by reducing the arterial CO_2 pressure and led to vasoconstriction of blood vessels in the brain. The vasoconstriction of blood vessels in the brain then increased the blood flow to the muscles, resulting in lack of oxygen supply to the brain. Lack of oxygen supply to the brain made the SIC experience tunnel vision and loss of consciousness. The availability of the supplementary oxygen might provide sufficient oxygen which prevent the loss of consciousness, although the company and the CASR did not require it during flight at altitude of 10,000 feet.

The SIC did not experience unconsciousness during the flight from Dili to Kupang that might due no anxiety occurred and the flight was at lower altitude.

The SIC underwent several medical examinations by the medical specialists after the occurrence, including psychiatric examination and there were no significant findings from the examinations. The investigation believed that there was no physiological problem of the SIC.

During the psychiatric examination, the psychiatrist provoked the SIC to repeatedly discuss the same health issue topic which was discussed during the occurrence flight. The SIC stated to the psychiatrist that he has been able to cope his emotion while discussing the same certain health issue topic.

It is evidence that at the time of the occurrence, the SIC was still unable to manage his emotional stress from the news of the health issue of his family and friends. This has been highlighted by the fact that during discussion the conditions were triggered which led to him becoming unconscious.

The unmanaged emotional stress which led to hyperventilation while flying in less air density environment might have made the SIC became incapacitation.

3 CONCLUSION

The 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.

In this occurrence, the KNKT identified several findings as follows:

3.1 Findings

1. The aircraft had valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R). Prior to the departure, there was no record or report of aircraft system malfunction.
2. The pilots had valid commercial pilot licenses which qualified as single engine land pilot and valid first-class medical certificates. The SIC had valid first-class medical certificate issued by the South African Civil Aviation Authority and Balai Kesehatan Penerbangan (Indonesia Aviation Medical Center).
3. About one week before the occurrence, the SIC received information regarding health issue of his family and friends then he started becoming very concern about it. Thereafter when thinking about that health issue, the SIC felt anxiety and often unable to get proper sleep. This health issue was the same issue that was discussed with the PIC during the occurrence flight.
4. Prior duty, the SIC conducted blood pressure and alcohol test. The blood pressure was normal and the alcohol test result indicated the pilot was not under the influence of alcohol. Prior the occurrence, there was no report or indication that SIC was unfit to perform his duty.
5. During the preflight check, the SIC was aware that the supplemental oxygen was not available in the aircraft, and it was not required for unpressurized aircraft flying on cruising altitude at or below 10,000 feet.
6. During cruise phase, the crew had a discussion regarding a certain health related topic where-after the SIC started to feel anxious and experienced shortness of breather. The SIC became more anxious when he recalled that there was no supplemental oxygen in the aircraft as the operation altitude did not require the use of the supplementary oxygen. The SIC's breathe then became shorter.
7. The PIC who was aware of the SIC's condition decided to divert to Dili considering the flight to Dili was shorter than continuing the flight to Kupang.
8. The SIC felt dizzy, tunneled vision followed by black out vision and then loss of consciousness about 20 seconds.
9. When the aircraft passed altitude of 6,000 feet, the PIC activated the Quick Position report of the flight following system installed in the aircraft.

10. The OM-Part A subchapter 4.8.3 described that if pilot incapacitation is detected, the fit pilot must land as soon as practicable considering all pertinent factors and arrange medical assistance after landing, giving as many relevant details about the condition of the pilot as possible.
11. The OM-Part A subchapter 18.3 requires pilot to activate the Quick Position report during distress and urgency situation. Should the Quick Position report have been activated, the dedicated flight following personnel must perform emergency procedure Phase 2 (Aircraft Alert – ALERFA).
12. After regained the consciousness, the SIC drank water and was aware that the aircraft was on descend, thereafter the SIC was able to take deep breaths and felt better.
13. After the occurrence, the SIC underwent several medical examinations by the medical specialists after the occurrence, including psychiatric examination and there were no significant findings from the examinations. The investigation believed that there was no physiological problem of the SIC.
14. During the psychiatric examination after the occurrence, the psychiatrist provoked the SIC to repeatedly discuss the same health issue topic which was discussed during the occurrence flight. The SIC stated to the psychiatrist that he has been able to manage his emotion while discussing the same certain health issue topic.
15. The emotional stress such as anxiety could led to hyperventilation. The shorter breathing during hyperventilation condition in less air density environment made the SIC experience tunnel vision and loss of consciousness.
16. The unmanaged emotional stress which led to hyperventilation while flying in less air density environment might have made the SIC became incapacitation.
17. The Susi Air SMSM described the definition of serious incident, however, did not include the list of examples of serious incident.
18. The SMM subchapter 3.5 described serious incident as mandatory occurrence to be reported to the Directorate General of Civil Aviation and Komite Nasional Keselamatan Transportasi (KNKT) as soon as possible.
19. The KNKT received the report of the PK-BVN pilot incapacitation from Indonesia Ministry of Foreign Affair five days after the occurrence. Afterwards the KNKT contacted the Susi Air to get the detail chronological report and on 13 December 2019, the Susi Air reported this occurrence to KNKT.

3.2 Conclusion

Contributing factors is defined 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 identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability. The presentation of the contributing factors is based on chronological order and not to show the degree of contribution.

The KNKT concluded the contributing factors as follows:

The unmanaged emotional stress which led to hyperventilation while flying in less air density environment might have made the SIC became incapacitation.

4 SAFETY ACTION

At the time of issuing this investigation report, the KNKT had not been informed of any safety actions resulting from this occurrence.

5 SAFETY RECOMMENDATIONS

The safety recommendation in this investigation report is made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident.

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.

5.1 PT ASI Pudjiastuti Aviation (Susi Air)

- **04.O-2019-30.01**

  In January 2020, KNKT issued recommendation in the preliminary report as follows:

  In the case of Indonesia civil aircraft experienced serious incident, the CASR Part 830 subpart 830.06 requires person, organization or enterprise engaged in or offering to engage in an aircraft operation, with minimum delay and by the most suitable and quickest means available, must report to the KNKT. The Appendix B of the CASR Part 830 described that flight crew incapacitation in flight is included in the list examples of serious incident.

  The Susi Air Safety Management System Manual (SMSM) described the definition of serious incident, however the list of examples of serious incident has not included. The KNKT received the report of the PK-BVN pilot incapacitation from Indonesia Ministry of Foreign Affair five days after the occurrence.

  The delay of serious incident could affect the availability of information especially that came from data which easily might be removed, effaced, lost or destroyed.

  Therefore, the KNKT recommend Susi Air to review and amend procedure of occurrence reporting to ensure serious incident can be identified and reported to KNKT by the most suitable and quickest means available.

  At the time of issuing this report, the KNKT had not been informed of any response from the mentioned recommendation. Therefore, KNKT recommends Susi Air to implement the KNKT recommendation mentioned in the preliminary report.

- **04.O-2019-30.02**

  During the occurrence flight, a discussion of certain health issue triggered anxiety for the SIC. The Ernsting's Aviation and Space Medicine stated that emotional stress such as anxiety could led to hyperventilation. The shorter breathing during hyperventilation condition in less air density environment made the SIC experience tunnel vision and loss of consciousness.

  The unmanaged emotional stress which led to hyperventilation while flying in less air density environment might have made the SIC became incapacitation.

  Therefore, KNKT recommends Susi Air to provide awareness of the flight crew that unmanaged emotional stress condition while flying in less air density environment could lead to hyperventilation which might have made pilot incapacitation.

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