KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA

FINAL

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Aircraft Accident Investigation Report

Perkasa Flight School

Piper PA28-161 Warrior II; PK-PBH

Jeruk Legi Village, Cilacap, Central Java

Republic of Indonesia

19 October 2016

2022

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

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

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Jakarta, 15 August 2022
KOMITE NASIONAL
KESELAMATAN TRANSPORTASI
CHAIRMAN

SOERJANTO TJAHJONO

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ABBREVIATIONS AND DEFINITIONS

ATC	:	Air Traffic Control
BMKG	:	*Badan Meteorologi klimatologi dan geofisika*/Bureau of Meteorology, Climatology and Geophysics
CASR	:	Civil Aviation Safety Regulation
CPL	:	Commercial Pilot License
ICAO	:	International Civil Aviation Organization
KHz	:	Kilo Hertz
km	:	kilometers
KNKT	:	Komite Nasional Keselamatan Transportasi
LT	:	Local Time
mb	:	millibars
MHz	:	Mega Hertz
m	:	Meters
MON	:	Motor Octane Number
NDB	:	Non-Directional Beacon
Nm	:	Nautical Mile
RON	:	Research Octane Number
SPL	:	Student Pilot License
UTC	:	Universal Time Coordinate
VHF	:	Very High Frequency
VOR	:	Very High Frequency Omni Range

SYNOPSIS

The Piper PA28-161 Warrior II, registration PK-PBH on 19 October 2016 was being operated by Perkasa Flying School on a dual flight training touch and go exercise in Tunggul Wulung Airport (WAHL) Cilacap, Indonesia.

Several days before the accident the student pilot had injured to left hand wrist and the student pilot did not report the injury to the flying school nor the flight instructor. The 'Internal Cockpit' checklist, the pilot required to ensure the fuel selector valve was selected to the Left Tank. Subsequently, the 'Before Take-off' checklist required the pilots to move the fuel selector to the Right Tank. The injury impaired the ability to operate the fuel selector as required by the checklist.

At 0030 UTC (0730 LT), the student pilot conducted pre-flight check to the aircraft. The student pilot stated that the aircraft was normal and the fuel uplifted was about 190 litres.

At 0831 LT, the aircraft was lining-up and took off from runway 31. After the aircraft airborne, about 300 feet the instructor pilot noticed the engine sound was spooling down. The instructor pilot advanced the throttle to increase the engine power however, the engine RPM did not increase. Thereafter, the instructor pilot also reached the fuel selector valve with the intention to change the fuel selector valve position but the engine RPM continued spooling down and the engine quit.

The instructor pilot decided to conduct the force landing on an open area. The instructor pilot took the aircraft control and declared mayday due to engine quit with the intention to make emergency landing. The controller noticed the aircraft turn right until disappeared behind the trees. During descend to the open area, the instructor pilot attempted to restart the engine without success.

The aircraft landed on paddy field about 1.3 Nm from the beginning of runway 31, on the north of the airport. Both pilots survived and self-evacuated the aircraft. The aircraft was substantially damage.

The engine ground run test found that if the selection of fuel selector performed more than 3 seconds after the engine hesitation, the engine would remain hesitation and quit because of the engine has been decelerating significantly and the engine unable to suck the fuel from the carburettor. The engine ground run test also found that after the fuel in the engine fuel line system was exhausted, the engine restart attempt would be success after minimum of 5 restart attempts.

The investigation concluded the contributing factors in this occurrence are:

1. The injured left wrist arm might have result to improper selection of the fuel selector valve and led to insufficient fuel to the engine during the take-off power resulted in the engine hesitation and quit.
2. The engine recovery and restart attempt were unsuccessful that might be due to the time availability and the insufficient aircraft altitude.

The KNKT had not received any safety action taken. The KNKT issued safety recommendations to the flying school to address safety issues identified in this report.

1 FACTUAL INFORMATION

1.1 History of the Flight

The Piper PA28-161 Warrior II, registration PK-PBH on 19 October 2016 was being operated by Perkasa Flying School on a dual flight training touch and go exercise in Tunggul Wulung[1] Airport (WAHL) Cilacap, Indonesia.

The flight was the first flight of the day, and on board the aircraft was one instructor pilot and one student pilot.

At 0030 UTC[2] (0730 LT), the student pilot conducted pre-flight check to the aircraft. The student pilot stated that the aircraft was normal and subsequently requested for refueling. The fuel uplifted was 50[3] US Gallons (189.27 liters).

At 0815 LT, the student pilot requested engine start and was approved by the Tunggul Wulung Tower controller (the controller). The controller advised the student pilot to report when ready to taxi.

At 0824 LT, the student pilot requested taxi clearance and was approved by the controller and advised the student pilot to hold on short runway 31.

At 0827 LT, the controller confirmed whether the student pilot ready to line up runway 31 and replied by the student pilot that they were ready to line-up runway 31. Afterward the controller instructed the student pilot to line up runway 31.

At 0831 LT, the aircraft was lining-up runway 31 and the student pilot reported ready for departure, and the controller issued take off clearance.

At 0832 LT, the aircraft was airborne. About the same time the controller noticed that wind condition had changed and the controller informed to all pilots that were flying on the area, that the runway in use was changed from runway 31 to 13.

After PK-PBH aircraft airborne, about 300 feet the instructor pilot noticed the engine sound was spooling down and the engine Rotation per Minute (RPM) indicator showed decreasing until approximately 1,000 RPM. The instructor pilot advanced the throttle to increase the engine power however, the engine RPM did not increase. Thereafter, the instructor pilot also reached the fuel selector valve which located on the left panel besides the student pilot seat with the intention to change the fuel selector valve position to find whether any fuel selection problem but the engine RPM continued spooling down and the engine quit.

The instructor pilot decided to conduct the force landing on an open area. At 0834 LT, the instructor pilot took the aircraft control and declared mayday due to engine quit with the intention to make emergency landing. The controller instructed the instructor pilot to circling for approaching runway 13. There was no reply from the pilot. The controller noticed the aircraft turn right until disappeared behind the trees.

During descend to the open area, the instructor pilot attempted to restart the engine.

1 Tunggul Wulung airport (WAHL), Cilacap, Central Java, Indonesia will be named as Tunggul Wulung for the purpose of this report.

2 The 24-hours clock in Universal Time Coordinated (UTC) is used in this report to describe the local time as specific events occured. Local time is UTC+7 hours.

3 Fuel tank capacity of Piper PA28-161 Warrior II is 50 US Gallons equal to about 190 litres.

The engine restart was conducted by activating the fuel pump, positioning the mixture in fully forward position, throttle in the idle position and the activation of the starter motor and ignition by the starter switch. The engine restart attempt did not success. Afterward the instructor pilot kept the fuel selector valve on the 'Left' position and set the flap to full down.

The aircraft landed on paddy field at coordinate 7° 37' 46.58" S; 109° 1' 40.12" E or about 1.3 Nm from the beginning of runway 31, on the north of the airport.

The aircraft position was upside down that might be caused by the nose wheel impacted to the paddy field embankment during the landing roll.

Both pilots survived and self-evacuated the aircraft. The aircraft was substantially damage.

Figure 1: Aircraft last position

1.2 Injuries to Persons

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

The instructor pilot nationality was Spanish and the student pilot was Indonesian. Both occupants were not injured as result of this occurrence.

1.3 Damage to Aircraft

The aircraft was substantially damage which described as follows:

1. The left wing leading edge damaged approximately one meter form the wing tip and buckling approximately 20 centimeters inward
2. The right wing was damage on the wing lower surface at position approximately two meters from the wing tip and buckling approximately two cm depth.
3. The vertical stabilizer was damage on the tip and deformation on the rudder.
4. The right main landing gear torque link broken
5. The nose landing gear detached from its bulkhead with the distance of 25 centimeters.
6. The right side of the lower engine cowling buckled inward with dimension approximately 90 × 30 centimeters.
7. One of the propeller blades bend inward approximately 7° probably due to impact to the ground however, in general, the propeller blades were relatively undamaged.
8. No significant damage to the engine.
9. The cockpit was partly immersed in the water however, all the cockpit instruments were relatively no damage.

The damages to the aircraft are shown in the pictures below.

Figure 2: The damage on the left wing

Figure 3: The nose section of the aircraft

1.4 Other Damage

The paddy field at approximately of 10 × 10 meters was damage.

1.5 Personnel Information

1.5.1 The Instructor Pilot

Gender	:	Male
Age	:	50 years
Nationality	:	Spanish
Marital status	:	Married
Date of joining company	:	30 December 2014
License	:	CPL
Date of issue	:	12 July 2002
Aircraft type rating	:	PA28-161
Instrument rating validity	:	31 December 2016
Medical certificate	:	First Class
Last of medical	:	28 September 2016
Medical limitation	:	None
Last proficiency check	:	27 September 2016
Flying experience		
Total hours	:	2,020 hours
Total on type	:	650 hours
Last 90 days	:	60 hours 25 minutes
Last 30 days	:	55 hours 40 minutes
Last 7 days	:	11 hours 45 minutes

Last 24 hours	:	2 hours 45 minutes
This flight	:	2 minutes

1.5.2 The Student Pilot

Gender	:	Male
Age	:	20 years
Nationality	:	Indonesian
Marital status	:	Single
Date of joining company	:	
License	:	SPL
Date of issue	:	11 October 2016
Aircraft type rating	:	PA 28-161
Instrument rating validity	:	None
Medical certificate	:	Second Class
Last of medical	:	3 May 2016
Validity	:	31 May 2016
Medical limitation	:	None
Last line check	:	None
Last proficiency check	:	None

Flying experience

Total hours	:	11 hours 12 minutes
Total on type	:	11 hours 12 minutes
Last 90 days	:	11 hours 12 minutes
Last 30 days	:	11 hours 12 minutes
Last 7 days	:	5 hours 12 minutes
Last 24 hours	:	1 hours 6 minutes
This flight	:	2 minutes

The student pilot stated that the left wrist arm was injured during futsal game several days before the occurrence and the student pilot did not treat the injury. The student pilot did not report the left hand wrist injury to the flying school. The wrist injury was revealed when the student pilot was performing medical examination and hospitalized after the occurrence. The student pilot stated that the wrist injury affecting the ability to operate the fuel selector valve.

1.6 Aircraft Information

1.6.1 General

Registration Mark	:	PK-PBH
Manufacturer	:	Piper
Country of Manufacturer	:	United States of America
Type/Model	:	PA 28-161 Warrior II
Serial Number	:	28 7816535
Year of Manufacture	:	1978
Certificate of Airworthiness		
Issued	:	12 October 2016
Validity	:	11 October 2017
Category	:	Normal
Limitations	:	VHF Coverage only
Certificate of Registration		
Number	:	3486
Issued	:	1 October 2016
Validity	:	30 September 2019
Time Since New	:	12,135 hours 3 minutes
Cycles Since New	:	
Last Major Check	:	Inspection 100 hour at 18 October 2016
Last Minor Check	:	Inspection 50 hour at 18 October 2016

1.6.2 Engines

Manufacturer	:	Lycoming
Type/Model	:	Lycoming O-320-D3G
Serial Number-1 engine	:	L-7238-39A
▪ Time Since Overhaul	:	905 hours 9 minutes

1.6.3 Maintenance Information

On 18 October 2016 or one day before the occurrence, the inspection for the aircraft was conducted. The inspections consist of 100-hour and 50-hour inspection packages. The inspection packages related to the engine were conducted including the engine external condition, fuel filters, engine control and the cylinder compression check.

The inspection found there was no discrepancy to the aircraft and engine.

1.7 Meteorological Information

The weather information issued by Meteorological, Climatological, and Geophysical Agency (*Badan Meteorologi Klimatologi dan Geofisika* – BMKG) on 19 October 2016 was as follow:

	0700 LT	0800 LT	0900 LT
Wind	290° / 4 knots	290° / 3 knot	290° / 4 knot
Visibility	6 km	7 km	6 km
Weather	NIL	NIL	NIL
Cloud[4]	BKN 1500 feet	FEW 1500 feet	BKN 1500 feet
Temperature / Dew Point	26°C / 24°C	28°C / 24°C	30°C / 25°C
QNH[5] (mb/in Hg)	1010/29.82	1010/29.82	1009/29.79
QFE[6] (mb/in Hg)	1017/30.00	1017/30.00	1016/30.00

Weather satellite image information issued by Meteorological, Climatological, and Geophysical Agency (*Badan Meteorologi Klimatologi dan Geofisika* – BMKG) showed that on 19 October 2016 at 0800 LT and 0900 LT the weather at Tunggul Wulung area was clear as shown in the figure below.

Note: The black colour represented clear weather and the area of occurrence showed in the red square in the figure below.

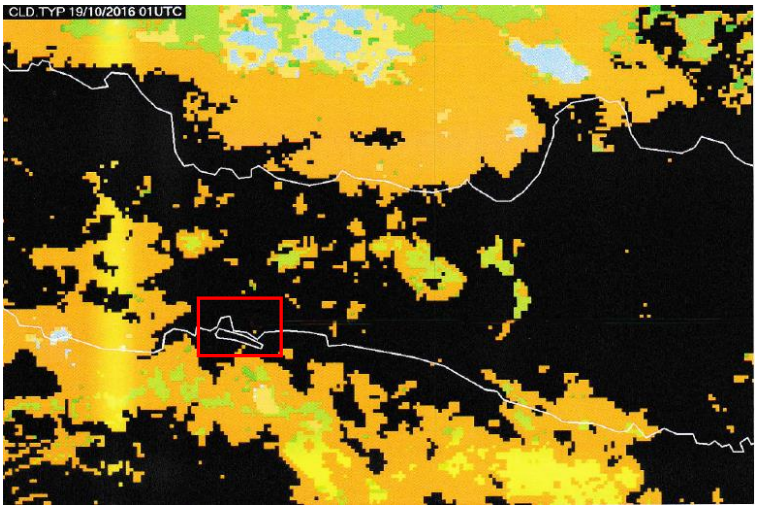


Figure 4: The weather satellite image at 0800 LT

4 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 Few (FEW) is when the clouds cover 1/8 area of the sky, scattered (SCT) is when the clouds cover 3/8 to 4/8 area of the sky and Broken (BKN) is when the clouds cover more than half (5/8 up to 7/8) area of the sky.

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

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

1.8 Aids to Navigation

The aircraft was equipped with the Very High Frequency Omni-Direction Range /Distance Measuring Equipment (VOR/DME) and Automatic Direction Finding (ADF) navigation system. The VOR/DME operation limited in VHF coverage and approved for Visual Flight Rules (VFR) only.

The aerodrome was equipped with the Non-Directional Beacon (NDB) and VOR/DME equipment with the information as follow:

Type of Navigation Aid	NDB	VOR
Identification	CC	CLP
Frequency	235 KHz	114.9 MHz
Operating Hours (UTC)	24 hours	0000 – 0700
Site of Transmitting Antenna Coordinates	07° 38’ 32.7 S; 109° 02’ 07.0 E	07° 38’ 40” S; 109° 02’ 08.0” E
Remark	Coverage 60 Nm, output power 50 Watt	

1.9 Communications

The communication between the controller and the pilot was conducted on frequency of 122.8 MHz. The communication was recorded on the ground based automatic voice recording equipment and the recorded transmission was good. The excerpt of the communication between the controller and the aircraft is shown below.

Time (LT)	Events
0815	The student pilot requested engine start and was approved by the controller. The controller advised the student pilot to report when ready to taxi.
0824	The student pilot requested taxi clearance and was approved by the controller and advised the student pilot to hold on short runway 31.
0827	The controller confirmed whether the student pilot ready to line up runway 31 and replied by the student pilot that they were ready to line-up runway 31. Afterward the controller instructed the student pilot to line up runway 31.
0831	The aircraft was lining-up runway 31 and the student pilot reported ready for departure, and the controller issued take off clearance.
0834	The instructor pilot declare mayday and would make a force landing. The controller instructed the instructor pilot to circling for approaching runway 13.
0835	Another pilot who was flying in vicinity informed to the controller that the pilot of PK-PBH made a mayday call. The controller called the PK-PBH pilot and did not reply.

1.10 Aerodrome Information

Airport Name	:	Tunggul Wulung
Airport Identification	:	WIHL
Airport Operator	:	DGCA
Airport Certificate	:	077/SBU-DBU/XI/2013
Coordinate	:	07 38 40 S 109 02 05 E
Elevation	:	68.9 feets
Runway Direction	:	13 – 31
Runway Length	:	1400 meters
Runway Width	:	30 meters
Surface	:	Asphalt Penetration; PCN 9FCYT;

1.11 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.

1.12 Wreckage and Impact Information

The aircraft was found at Tunggul Wulung village RT01/RW02 Tritih Lor, Jeruk Legi of Cilacap resident, north west of the airport, approximately 1.3 Nm from the beginning of runway 31 at coordinate 7° 37’ 46.58” S 109° 1’ 40.12” E. The aircraft stopped on heading 250°.

The aircraft position on the Google Earth is as follow:

Figure 5: The aircraft position relative to the Tunggul Wulung Airport

The ground mark after the aircraft tumbling was approximately 10 × 2 meters from the embankment of paddy field. The observation of the landing path, after landed the aircraft nose wheel impacted the embankment of paddy field resulted in aircraft upside-down as indicated by the ground marks.

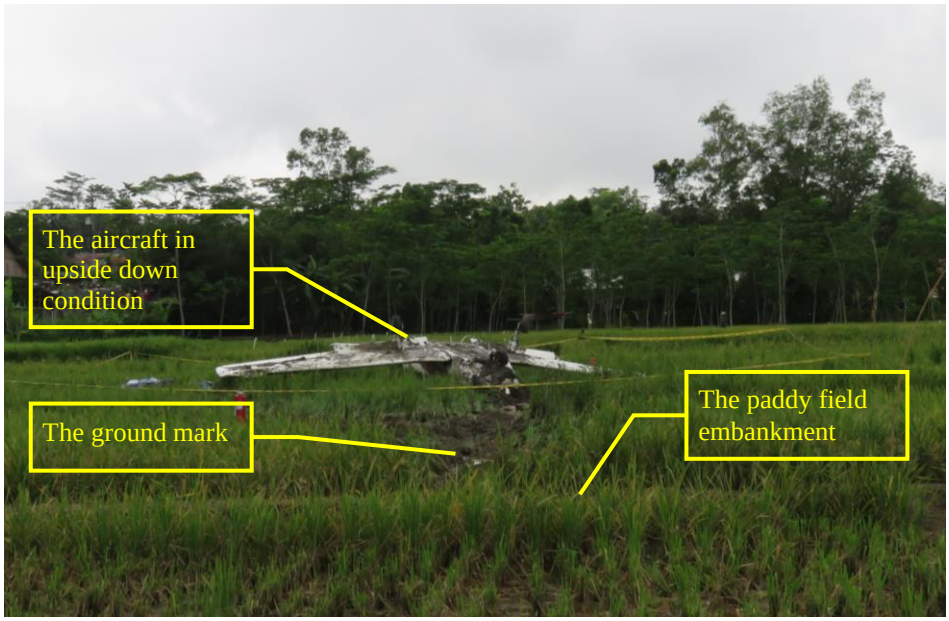


Figure 6: The aircraft at the paddy field

The flap selector has position selections of 0, 10, 25, and 40 degrees flaps position. The flap lever in the cockpit showed on up the deflection position as shown in the figure below.

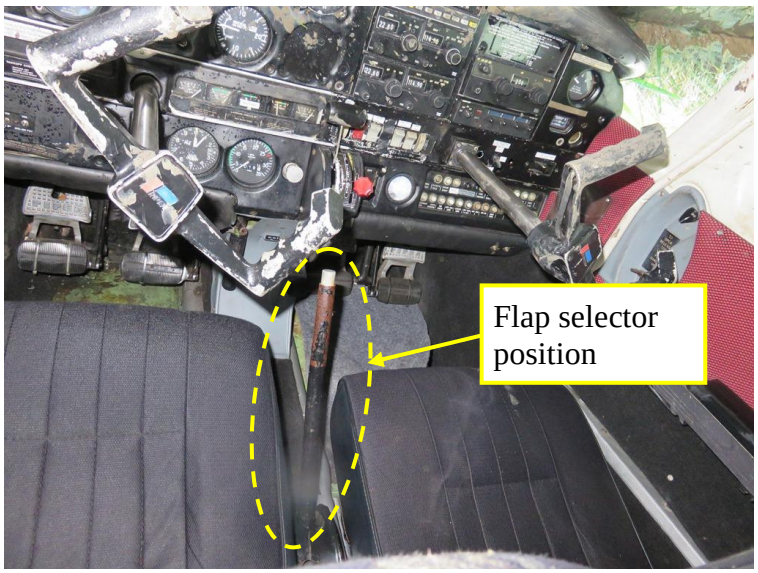


Figure 7: Flap selector

Observation on the accident site found that the flaps were extended however, the deflection angle was unable to be determined as shown in the figure below.

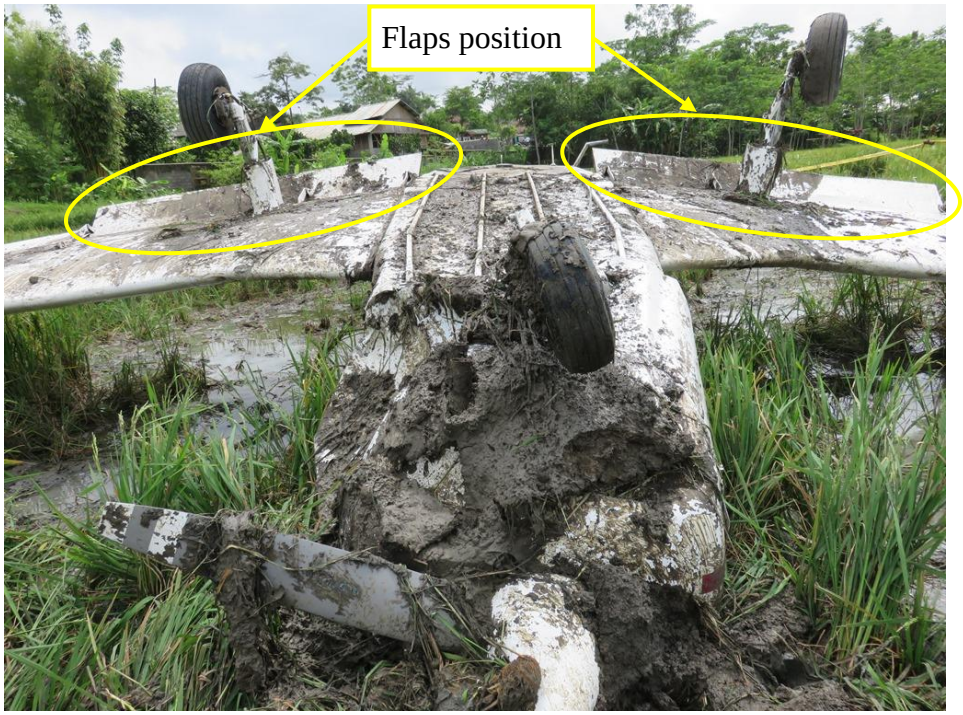


Figure 8: Flaps position

The cockpit was partly immersed in the water however all the cockpit instruments were relatively no damage.

Figure 9: The cockpit instruments

The fuel selector position was on the L TANK position as shown in the figure below.

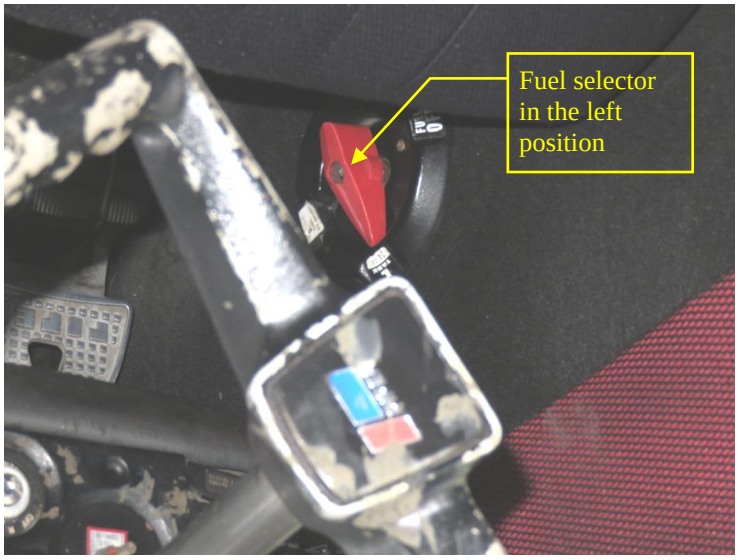


Figure 10: The fuel selector last position

1.13 Medical and Pathological Information

Both pilots were evacuated to the nearest hospital for medical examination and treatment. Both pilots stayed for two days in the hospital however, no medical issues reported.

The student pilot reported having left hand wrist treatment while in the hospital, but it was confirmed that the wrist problem was due to sport incident several days before the occurrence.

1.14 Fire

There was no evidence of fire in-flight or after the aircraft impacted to the paddy field.

1.15 Survival Aspects

Both pilots survived and self-evacuated from the aircraft. The evacuation was handicapped by the mud.

1.16 Tests and Research

1.16.1 Fuel Test

The PA 28-161 Warrior II equipped with the engine Lycoming O-320-D3G with the approved fuel is Aviation Gasoline (Avgas) 100 Green or 100LL Blue Aviation Grade. The investigation conducted the fuel test to the fuel that were retrieved from the aircraft fuel tank.

The result stated that the fuel Research Octane Number (RON) was 100.5 while the Motor Octane Number (MON) was 92.0. The detail result of the fuel test is available in the appendix in this report.

Based on the fuel test, it was concluded that the fuel was confirm to the fuel specification without any contamination.

1.16.2 Flight Control Examination

After the accident, the aircraft wreckage was transported to a storage facility. The investigation conducted the flight control examination and concluded that there was no abnormality found on the flight control system.

1.16.3 Engine examination

The investigation conducted the engine examination after it was transported to the storage facility. The aircraft engine was examined by dismantling the engine to find any abnormality.

Before the engine examination was conducted, the engine was washed to remove dirt.

The figure below showed the recovered engine from the crash site before and after washing.

Figure 11: The engine before and after washed

In general, the engine condition appeared in good condition without significant damage. One of the propeller blades bends inward approximately 7° possibly due to impact to the ground and there was no damage to the propeller leading edge which was consistent with no propeller rotation.

Figure 12: The bend to the propeller blade

All the fuel filters were examined and no debris found or significant residue.

The carburetor was removed for examination. The general condition was good without significant damage. The carburetor heater was deformed due to impact as shown in the figure below.

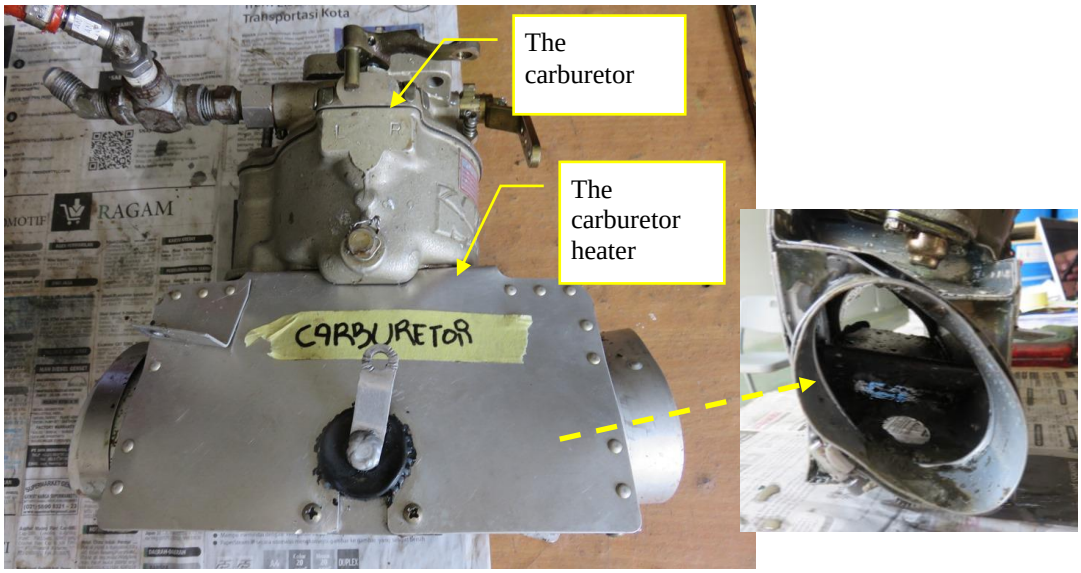


Figure 13: The carburetor and carburetor heater

The water contamination test was applied to the inner part of the carburetor fuel container and no evidence of water contamination found.

The fuel pump was dismantled to expose the inside of the diaphragm system. The diaphragm was good and there was no rubber deformation.

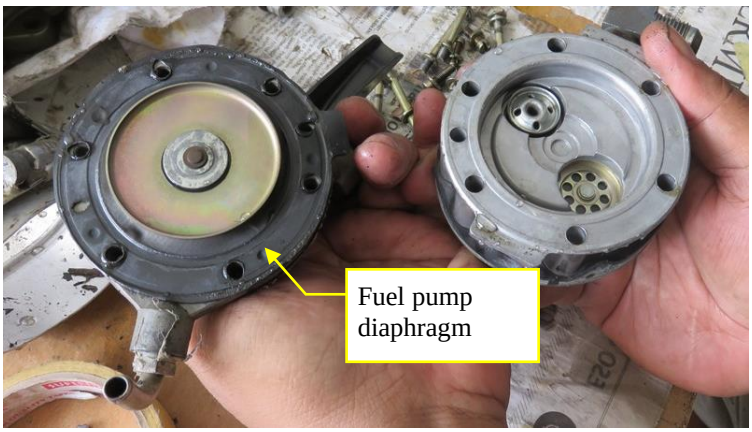


Figure 14: The exposed fuel pump condition

The pistons were removed for examination. The figure below shows the exposed piston.

Figure 15: The exposed piston condition

The piston crowns were covered by carbon deposit which considered normal in the service life of the engine.

The magneto and spark plugs were examined and test in the workshop. The investigation found the magneto and all spark plugs were in normal condition.

The engine examination concluded that the engine considered in normal condition and no abnormality was found.

1.16.4 Engine Run to Conduct Fuel Selector Position Exercise

Fuel tank selector is available on this aircraft to determine the source of the fuel tank supplies to the engine. The fuel tank selector control is located on the left side panel forward besides the pilot seat and required left hand arm to manage the selector.

The Fuel tank selector has three positions; Left Tank (L TANK) and Right Tank (R TANK) which allows the fuel on the respective wing tank to supply to the engine, and OFF position which shut the fuel line and no fuel supply to the engine.

The button on the fuel selector must be pressed and held while the selector is moved to the FUEL OFF position. The button releases automatically when the selector is in the detent of L TANK or R TANK position.

The illustrated of the fuel selector is shown in the figure below.

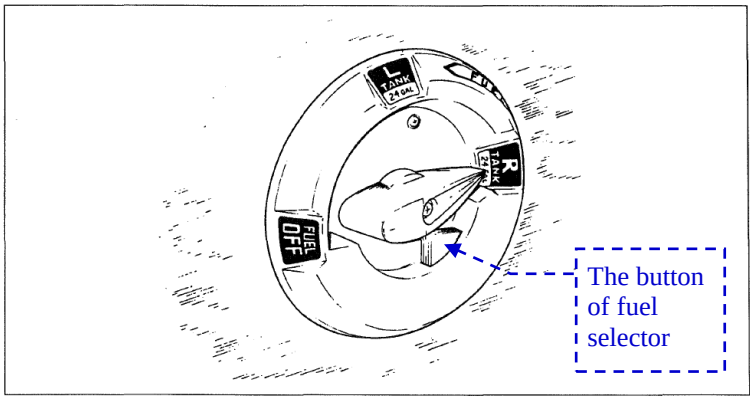


Figure 16: The fuel selector

The investigation found the fuel selector position was at the L TANK position at the crash site. The instructor pilot stated that during the force landing, the engine restart was attempted and the fuel selector was moved from L to R TANK position and finally the instructor pilot placed the fuel selector to the L TANK position. However, the engine restart was unsuccessful.

The investigation conducted the engine run on the similar aircraft type to examine the fuel selector position and the effect to the engine performance.

The investigation exercised the position of the fuel selector in the deliberate improper position (between L TANK and R TANK) as shown in the figure below (Note: The fuel pump was positioned in the ON position during the engine run).

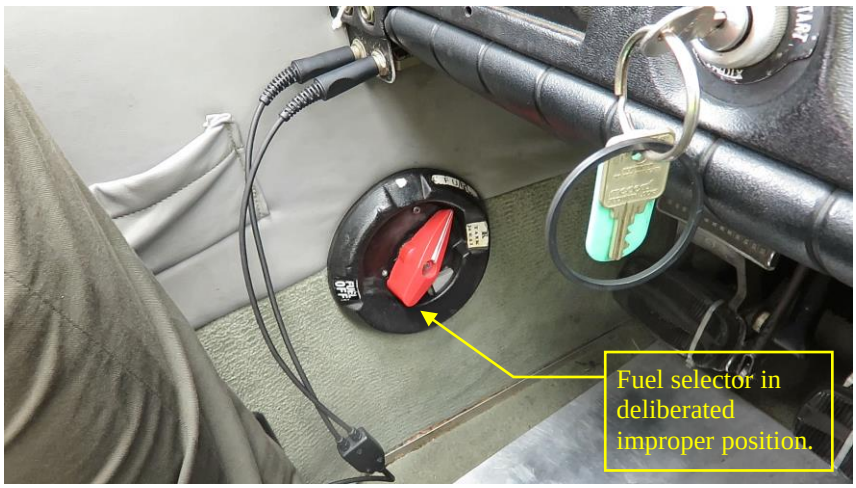


Figure 17: The fuel selector in dedicated improper position

When the fuel selector was between L TANK and R TANK position, the engine was able to be started and run normally. When the throttle set to take off position, after approximately 30 seconds the engine became hesitation[7] and subsequently the engine quit.

The second examination was performed with the similar fuel selector position and during the engine hesitation the fuel selector immediately repositioned to the L TANK. The exercise found that it took approximately 3 seconds for the engine to return to normal run without difficulties. However, if the repositioning of the fuel selector to L TANK position conducted in more than 3 seconds after engine hesitation, the engine would not recover and afterward the engine would quit.

After the engine had quit the engine restart was attempted with the fuel selector was on proper position (L TANK) and the fuel pump was on. The engine restart was conducted by positioning the mixture in fully forward position, throttle in the idle position and the activation of the starter motor and ignition by the starter switch. The engine restart could not run the engine successfully at the first attempt, because the fuel in the engine fuel system including the carburetor was totally unavailable.

The fuel pump has a function to pump the fuel from the fuel tanks to the carburetor. The fuel flows from the carburetor to the engine is the function of fuel suction on the engine which operates during starting and continuously while the engine is running. If the fuel line was empty and the fuel pump was activated, it would require several time engine starting attempts to fill the fuel in the engine fuel system and carburetor. The engine was successfully started after more than 5 times restart attempts.

The examination concluded that if the fuel selector was positioned between L TANK and R TANK the engine would run normally at idle power, when the engine set to take off power after approximately 30 seconds the engine became hesitation and quit. The engine could run back to normal if during the engine hesitation the fuel selector was immediately repositioned back to proper position. However, if the fuel selector repositioned more than 3 seconds, the engine will quit and required more than five times attempts to relight the engine.

7 The engine hesitation is an engine condition where the engine is stumbling and cannot accelerate smoothly. This condition can be caused by sucking too much air, not getting enough fuel, or misfiring.

1.17 Organizational and Management Information

1.17.1 PT. Mitra Aviasi Perkasa (Perkasa Flying School)

Aircraft owner	:	Admal Sdn. Bhd. Malaysia
Aircraft operator	:	PT. Mitra Aviasi Perkasa (Perkasa Flying School) Perkantoran Gandaria Lt. 11 Unit G & H Jl. Sultan Iskandar Muda, Jakarta Selatan Indonesia
Pilot School certificate	:	141 / 017

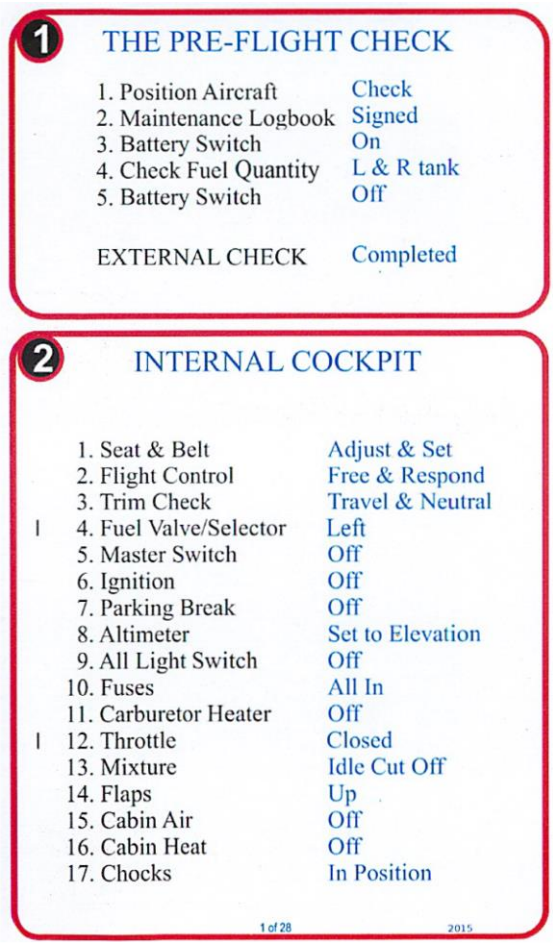
PT. Mitra Aviasi Perkasa (Perkasa Flying School) is certified under CASR 141 as flying school with the main operational office in Tunggul Wulung Airport - Cilacap. The other operation bases were operated at Nusawiru Airport - Pangandaran, HAS Hanandjoeddin Airport - Tanjungpandan, and Raja Isa Fisabilillah Airport - Tanjung Pinang.

At the time of occurrence, Perkasa Flying School operated 17 aircraft consisted of two Cessna 172P and 15 PA28-161 Warrior II aircraft including the accident aircraft.

The Perkasa Flying School operated two simulators in two locations. One flight simulator Redbird Model FMX 1000 located at Tunggul Wulung Cilacap and Redbird Model MCX located at Tanjungpandan.

1.17.2 Normal Checklist

The normal checklist related to the pre-flight and internal cockpit preparation which extracted from the flying school checklist is shown in the figure below.



1

THE PRE-FLIGHT CHECK

1. Position Aircraft	Check
2. Maintenance Logbook	Signed
3. Battery Switch	On
4. Check Fuel Quantity	L & R tank
5. Battery Switch	Off
EXTERNAL CHECK	Completed

2

INTERNAL COCKPIT

	1. Seat & Belt	Adjust & Set
	2. Flight Control	Free & Respond
	3. Trim Check	Travel & Neutral
I	4. Fuel Valve/Selector	Left
	5. Master Switch	Off
	6. Ignition	Off
	7. Parking Break	Off
	8. Altimeter	Set to Elevation
	9. All Light Switch	Off
	10. Fuses	All In
	11. Carburetor Heater	Off
I	12. Throttle	Closed
	13. Mixture	Idle Cut Off
	14. Flaps	Up
	15. Cabin Air	Off
	16. Cabin Heat	Off
	17. Chocks	In Position

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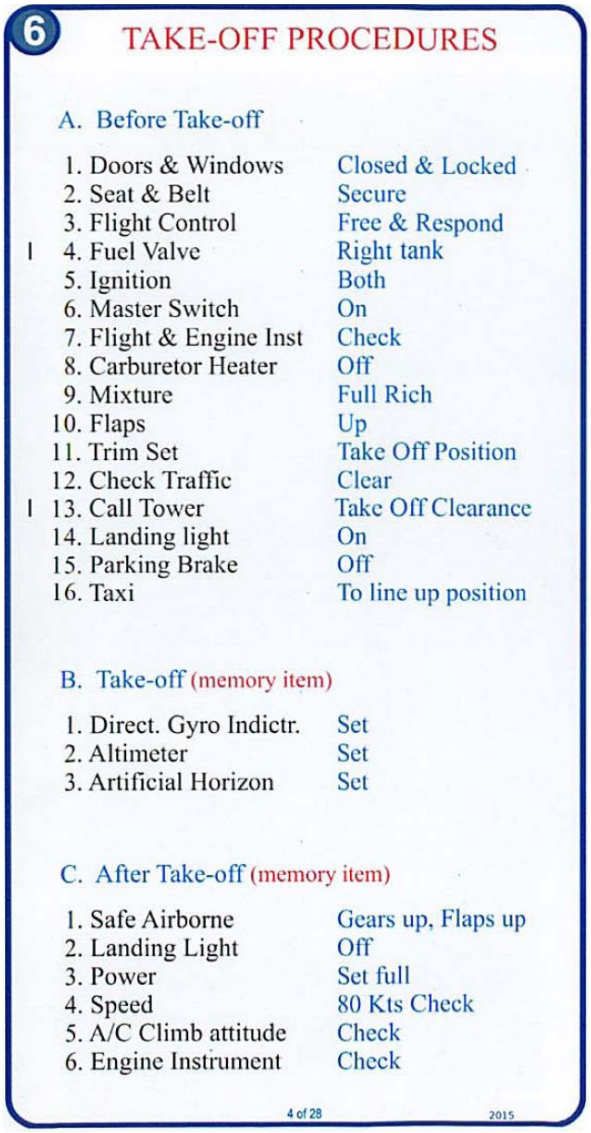
Figure 18: The Pre-flight and Internal Cockpit preparation

The ‘Internal Cockpit’ checklist required the pilot to select the fuel valve/selector to the Left and the ‘Before Take-off’ checklist required the pilot to select the fuel selector to the Right Tank.



6 TAKE-OFF PROCEDURES

A. Before Take-off

1. Doors & Windows	Closed & Locked
2. Seat & Belt	Secure
3. Flight Control	Free & Respond
4. Fuel Valve	Right tank
5. Ignition	Both
6. Master Switch	On
7. Flight & Engine Inst	Check
8. Carburetor Heater	Off
9. Mixture	Full Rich
10. Flaps	Up
11. Trim Set	Take Off Position
12. Check Traffic	Clear
13. Call Tower	Take Off Clearance
14. Landing light	On
15. Parking Brake	Off
16. Taxi	To line up position

B. Take-off (memory item)

1. Direct. Gyro Indictr.	Set
2. Altimeter	Set
3. Artificial Horizon	Set

C. After Take-off (memory item)

1. Safe Airborne	Gears up, Flaps up
2. Landing Light	Off
3. Power	Set full
4. Speed	80 Kts Check
5. A/C Climb attitude	Check
6. Engine Instrument	Check

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Figure 19: The Take-off Procedures

1.17.3 Training Procedure Manual (TPM)

Training Procedure Manual (TPM) Chapter 1
1.8.13 ATTENDANCE/ABSENCE/TARDINESS POLICY
Attendance is expected. Any absence must be approved by the instructor. Students will find that their academic standing in a situation where absences are incurred is jeopardized. However, students WILL NOT be penalized because of sickness/emergency or school approved absence.

Training Procedure Manual (TPM) Chapter 3
3.3.4 ATTENDANCE PROCEDURES
D. Excused Absences

1) No more than 3 (three) days may be approved by the PERKASA FLIGHT SCHOOL for exceptional circumstances during a course period. For requests of more than three days, the request must be endorsed by the Chief Instructor and approved by the Principal.

2) *In support of the mandatory attendance procedures, PERKASA FLIGHT SCHOOL defines excused absences. The following conditions provide the only acceptable reasons for a student's absence (excused absences) from course:*
   a) *Illness - When a student is unable to attend school due to an illness, a note written by a physician documenting the illness will provide evidence of the illness for the PERKASA FLIGHT SCHOOL. If the student does not complete the form or does not provide documentation from a physician of an illness, the Chief Instructor will review the student's attendance for needed services and/or applicable sanctions of the attendance procedures.*

1.17.4 Flight Instructor Guidance and Standard Operating Procedures

The flying school flight operation provides the Flight Instructor Guidance and Standard Operating Procedures manual which was issued on 2015. The purpose of the Flight Instructor Guidance and Standard Operating Procedures manual is to provide guidance for the instructor pilot during the teaching process. This manual contains the detail instructional procedure during the ground and flight training.

In regard the checklist procedure performance by the student pilot, the Flight Instructor Guidance and Standard Operating Procedures manual did not provide the instructor pilot role during the checklist performance.

1.17.5 Piper PA28-161 Warrior II Emergency Checklist

The Piper PA28-161 Warrior II Emergency checklist that extracted from the Pilot Operating Handbook is as follow:

ENGINE POWER LOSS DURING TAKEOFF

If sufficient runway remains for a normal landing, land straight ahead.

If insufficient runway remains:

Maintain safe airspeed.

Make only shallow turn to avoid obstructions.

Flaps as situation requires.

If sufficient altitude has been gained to attempt a restart:

Maintain safe airspeed.

Fuel selector ..... switch to tank containing fuel

Electric fuel pump ..... check ON

Mixture ..... check RICH

Carburetor heat..... ON

Primer ..... locked

If power is not regained, proceed with power off landing.

POWER OFF LANDING

Locate suitable field.

Establish spiral pattern.

1000 ft. above field at downwind position for normal landing approach.

When field can easily be reached slow to 63 KIAS for shortest landing.

Touchdowns should normally be made at lowest possible airspeed with full flaps.

When committed to landing:

Ignition ..... OFF

Master switch ..... OFF

Fuel selector ..... OFF

Mixture ..... idle cut-off

Seat belt and harness..... tight

1.18 Additional Information

There was no other information that considered 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

2.1 The Engine Failure After Take-off

The 100-hour and 50-hour inspection packages were conducted one day prior to the accident, which consisted of engine external condition, fuel filters, engine control and the cylinder compression check. No discrepancy found during the inspection.

Prior to the flight the fuel tanks were at full capacity and the fuel test result indicated that the fuel met the requirement. This can be concluded that the fuel amount and quality did not contribute to this accident. In addition, the examination to the flight controls and engine system after the accident concluded there were no abnormalities to the flights control and engine system.

Three minutes after takeoff, the instructor pilot declared mayday due to engine quit. Engine restart attempted without success. The pilot made emergency landing on paddy field.

The investigation conducted engine ground run with the purpose to simulate the fuel selector valve selection similar to the accident aircraft. The simulation revealed that improper selection of the fuel selector was able to keep the engine running on idle power. However, while the engine was set on takeoff power, after 30 seconds the engine would hesitation and quit. The improper position of the fuel selector made the fuel line in partially open or totally close which restrict the fuel flow from the fuel tank to the engine. The engine hesitation was affected by the disruption of the fuel flow into the engine while the engine was in high power and required certain amount of fuel. If the fuel selector returned to proper position within 3 seconds, the engine would back to running normally, because the fuel would flow and available immediately as required by the engine.

However, if the selection of fuel selector performed more than 3 seconds, the engine would hesitation and quit because of the engine has been decelerating significantly and the engine unable to suck the fuel from the carburetor.

The symptom of the accident flight when the engine quit a few minutes after takeoff power setting was similar to the fuel selector valve improper selection during the engine ground run. Considering the engine examination which did not find any abnormality and the fuel met the requirement, it is most likely that the engine quit was caused by improper position of fuel selector.

During the cockpit preparation, in accordance with the ‘Internal Cockpit’ checklist, the pilot required to ensure the fuel selector valve was selected to the Left Tank. Subsequently, the ‘Before Take-off’ checklist required the pilots to move the fuel selector to the Right Tank. The fuel selector is situated on the left side panel of the left pilot seat and normally operated by the pilot occupying left cockpit seat which would be easier by using the left hand. It was reported that the student pilot left hand wrist was injured several days before the occurrence flight. The student pilot did not report the injury to the flying school or the instructor pilot. The wrist injury affected the ability to operate the fuel selector valve which most likely resulted in the improper fuel selector position during performing the ‘Before Take-off’ checklist.

After takeoff, the engine became hesitation and the instructor pilot assessed the situation. Afterward, the instructor pilot attempted to reposition the fuel selector to the proper position however, the engine was not recovered.

The engine ground run showed that if the repositioning of the fuel selector to proper position conducted in more than 3 seconds after engine hesitation, the engine would not recover and afterward the engine would quit. The unsuccessful engine recovery indicated that the repositioning of the fuel selector valve to proper position likely was performed more than 3 seconds after the engine hesitation. The delay of the selection might be caused by the instructor pilot required to assess the situation after the engine hesitation.

After unsuccessful engine recovery by the repositioning the fuel selector valve, the instructor pilot put the selector valve in the R TANK and tried to restart the engine. The engine restart was conducted by activating the fuel pump, positioning the mixture in fully forward position, throttle in the idle position and the activation of the starter motor and ignition by the starter switch. The engine restart was unsuccessful. The engine ground run test showed that after the fuel in the engine fuel line system was exhausted, the engine restart attempt would be success after minimum of 5 restart attempts. This was due to the time required to transfer from the fuel tank into the carburetor even when the fuel pump was on.

The aircraft that was at low altitude might have led the insufficient time to perform several engine restarts attempts.

2.2 The Perkasa Flying School Procedure

It was reported that the student pilot left hand wrist was injured during futsal game several days before the occurrence flight. The wrist injury was revealed when the student pilot was performing medical examination and hospitalized after the accident. The flying school had the procedure to handle sick student pilot, e.g., the student pilot might proposed a leave permission as mentioned in the flying school training procedure manual in chapter 1.8.13 and 3.3.4. However, the reason why the student pilot did not report the wrist injury to the flying school or the instructor pilot was unknown. Should the injury be reported to the flying school, the student might not be scheduled for flying for recovery.

Regardless the delaying to the learning schedule of the student pilot, nevertheless the insistence to conduct the flight at the day of occurrence with the left hand wrist injury most likely affected the student pilot performance positioning during the flight especially during the selection of the fuel selector from OFF to L TANK position (as stated in the ‘Internal Cockpit Preparation’ checklist) or from the L TANK to R TANK (as stated in the ‘Before Take-off’ checklist).

During the flight training, the student pilots are prone to make mistake, improper task or procedure during the learning process. In this case, the instructor pilot was the last frontier to prevent unwanted situation during the flight.

The flying school provides the instructor pilots with the Flight Instructor Guidance and Standard Operating Procedures manual. The purpose of the Flight Instructor Guidance and Standard Operating Procedures manual is to provide guidance for the instructor pilot during the student pilot learning process. This manual did not contain any guidance for the instructor pilot responsibility to the checklist execution performed by the student pilot. This might lead to the instructor pilot unaware to the completion of the checklist items.

The wrist injury that affected the ability to select the fuel selector was not reported by the student pilot to the flying school nor instructor pilot. The improper position of the fuel selector during the Before Takeoff Checklist execution by the student pilot had been overlooked by the instructor pilot.

3 CONCLUSIONS

3.1 Findings[8]

1. The aircraft had a valid Certificate of Airworthiness.
2. The last inspection for the aircraft was conducted on 18 October 2016 or one day before the occurrence found there was no discrepancy to the aircraft and engine.
3. The instructor pilot and student pilot held current license and medical certificate.
4. Several days before the accident the student pilot had injured to left hand wrist due to sport incident (futsal) and the student pilot did not report the injury to the flying school nor the instructor pilot. Should the injury be reported, the student might not be scheduled for flying for recovery
5. The 'Internal Cockpit' checklist, the pilot required to ensure the fuel selector valve was selected to the Left Tank. Subsequently, the 'Before Take-off' checklist required the pilots to move the fuel selector to the Right Tank.
6. The fuel selector is situated on the left side panel of the left pilot seat and normally operated by the pilot occupying left cockpit seat which would be easier by using the left hand.
7. After the aircraft airborne, about 300 feet the engine sound was spooling down and the engine Rotation per Minute (RPM) indicator showed decreasing. The instructor pilot advanced the throttle to increase the engine power however, the engine RPM did not increase. Thereafter, the instructor pilot also reached the fuel selector valve with the intention to change the fuel selector valve position but the engine RPM continued spooling down and the engine quit.
8. The engine ground run test found that if the selection of fuel selector performed more than 3 seconds after the engine hesitation, the engine would remain hesitation and quit because of the engine has been decelerating significantly and the engine unable to suck the fuel from the carburetor.
9. The instructor pilot decided to conduct the force landing on an open area, took the aircraft control and declared mayday to the controller.
10. During descend to the open area, the instructor pilot attempted to restart the engine. The engine restart was conducted by activating the fuel pump, positioning the mixture in fully forward position, throttle in the idle position and the activation of the starter motor and ignition by the starter switch.
11. The engine ground run test showed that after the fuel in the engine fuel line system was exhausted, the engine restart attempt would be success after minimum of 5 restart attempts. This was due to the time required to transfer from the fuel tank into the carburetor even when the fuel pump was on.
12. The aircraft that was at low altitude might have led the insufficient time to perform several engine restarts attempts.

8 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.

13. The aircraft landed on paddy field about 1.3 Nm from the beginning of runway 31, on the north of the airport.
14. The flight controls and engine examination concluded that there were no abnormalities to the flight controls and engine.
15. The fuel laboratory report showed that the fuel was normal without any contamination found.
16. The symptom of the accident flight when the engine quit a few minutes after takeoff power setting was similar to the fuel selector valve improper selection during the engine ground run. Considering the engine examination which did not find any abnormality and the fuel met the requirement, it is most likely that the engine quit was caused by improper position of fuel selector.
17. The investigation conducted the engine run up exercised by positioning the fuel lever selector to improper position to simulate the engine quit situation. The engine was hesitation and quit if the fuel selector was improper position, after approximately 30 seconds. If the selector was immediately repositioned back to proper position within approximately 3 seconds, the engine was recovered otherwise the if the selector was engine was hesitation and completely quit.
18. The Flight Instructor Guidance and Standard Operating Procedures manual of the flying school, did not contain any guidance for the instructor pilot responsibility to the checklist execution performed by the student pilot. This might lead to the instructor pilot unaware to the completion of the checklist items.

3.2 Contributing Factors[9]

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 contributing factors in this occurrence are as follow:

1. The injured left wrist arm might have result to improper selection of the fuel selector valve and led to insufficient fuel to the engine during the take-off power resulted in the engine hesitation and quit.
2. The engine recovery and restart attempt were unsuccessful that might be due to the time availability and the insufficient aircraft altitude.

9 Contributing factors is defined as events that might cause the occurrence. In the case that the event did not occur then the accident might not happen or result in a less severe occurrence.

4 SAFETY ACTION

The *Komite Nasional Keselamatan Transportasi* (KNKT) did not receive any safety action until issuance of the final report.

5 SAFETY RECOMMENDATIONS

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

5.1 Perkasa Flying School

04.O-2016-35.01

The student pilot left hand wrist was injured several days before the occurrence flight. The injury impaired the ability to operate the fuel selector as required by the checklist. The improper position of the fuel selector valve led to insufficient fuel to the engine during the take-off power resulted in the engine hesitation and quit. The injury was not reported to the flying school nor the instructor pilot.

KNKT recommend the flying school to have fitness for duty monitoring system including self-reporting of the fitness before flight.

04.O-2016-35.02

The Flight Instructor Guidance and Standard Operating Procedures manual of the flying school, did not contain any guidance for the instructor pilot responsibility to the checklist execution performed by the student pilot. This might lead to the instructor pilot unaware to the completion of the checklist items.

KNKT recommend to include in the flying school to include in the manual regarding the responsibility of the instructor pilot during the checklist and procedure performance conducted by the student pilot.

6 APPENDICES

Fuel Sample Test Result

LEMIGAS	PUSAT PENELITIAN DAN PENGEMBANGAN TEKNOLOGI MINYAK DAN GAS BUMI	No. Formulir :
		Revisi : Lampiran
	HASIL UJI	Halaman :

Nomor Seri/ *Serial Number* : 1230/LHU/8.15/X/2016

Nomor/*Number* : 1230/PK/8.1/X/2016

Nomor Percontoh/ *Sample Number* : 1230/SPL/3750/8.1/2016

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No	Parameter Uji	Unit	Hasil Uji	Metode Uji
			Fuel Eks. Pesawat Piper Warrior PA28-161 Reg. PK-PBH 19 Oktober 2016	
1	Angka Oktana Riset	-	100,5	ASTM D 2699
2	Angka Oktana Motor	-	92,0	ASTM D 2700

Laporan ini hanya berdasarkan percontoh yang diuji, tidak untuk diiklankan dan tidak boleh digandakan.
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