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Aircraft Serious Incident Investigation Report

Perkasa Flying School

PA28-161 Warrior III; PK-PBC

Cemara Sewu Coastline, Cilacap

Republic of Indonesia

11 November 2024

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Jakarta, 3 March 2026

KOMITE NASIONAL KESELAMATAN TRANSPORTASI

CHAIRMAN

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ABBREVIATIONS AND DEFINITIONS

ATC	:	Air Traffic Control
CMM	:	Company Maintenance Manual
C of A	:	Certificate of Airworthiness
C of R	:	Certificate of Registration
CMM	:	Company Maintenance Manual
DGCA	:	Directorate General of Civil Aviation
DOHC	:	Double Overhead Camshaft
ELT	:	Emergency Locator Transmitter
FADEC	:	Full Authority Digital Engine Control
KNKT	:	*Komite Nasional Keselamatan Transportasi*
kW	:	Kilowatt
LT	:	Local Time
PF	:	Pilot Flying
PM	:	Pilot Monitoring
PPL	:	Private Pilot License
QSS	:	Quality, Safety, Security
SE-Land	:	Single Engine-Land
SOP	:	Standard Operating Procedure
TCO	:	Training Course Outline
UTC	:	Universal Time Coordinate
VOR	:	VHF Omnidirectional Range

SYNOPSIS

On 11 November 2024, a PA-28-161 Warrior III aircraft, registered as PK-PBC, was operated for mutual training. The flight was planned to depart from Tunggul Wulung Airport (WAHL), Cilacap, to the NANGUN Training Area, which is located on bearing 095º at approximately 14 NM east of Tunggul Wulung, before returning to the airport.

At about 0149 UTC (0849 LT), the aircraft departed from Tunggul Wulung and proceeded toward the NANGUN Training Area via MAOS and ADI Training Area (see figure 1). One of the student pilots acted as Pilot Flying (PF) and the other student pilot acted as Pilot Monitoring (PM).

Upon arriving at NANGUN training area, the aircraft experienced rough engine running, followed by both FADEC A and B warning lights flashing, indicating an engine system malfunction. The PF attempted to reset the FADEC system by pressing the FADEC test button for two seconds; however, the FADEC lights did not extinguish. The PF then activated the FORCE B switch, but neither action was able to restore the engine to normal operation.

The PM declared a MAYDAY call to Tunggul Wulung Air Traffic Control (ATC), reporting the engine failure and that the aircraft was losing altitude. The student pilots decided to land along the Cemara Sewu coastline after determining that the aircraft could not reach the airport.

At about 0231 UTC, the aircraft touched down on the coastline. The pilots did not apply braking during landing but pulled back on the control stick to keep the nose wheel off the surface and to reduce the landing impact. After a landing roll of about 180 meters, the nose wheel sank into soft sand, and the aircraft came to a complete stop.

Following the occurrence, the aircraft engine was examined at the manufacturer's facility in Germany. A series of controlled engine test runs was performed on a bench stand under various configurations of the FADEC and injectors. The engine ran test result indicated an internal malfunction in Injector No. 2.

The occurrence took place during a mutual training flight, highlighting the importance of immediate decision-making and forced landing skills. Although the student pilot responded appropriately by executing a forced landing in a suitable area, the occurrence underscores the need to identify and mitigate potential technical malfunctions before flight.

At the time of issuing this investigation report, KNKT had been informed of several safety actions taken by Perkasa Flying School in response to this occurrence. The flying school revised its Company Maintenance Manual by adding a Maintenance Ground Run-Up Procedure that must be performed by an engineer. The revised manual also included several new procedures, such as the Anomalies Monitoring Procedures and the Maintenance Pre-Flight Procedure.

1 FACTUAL INFORMATION

1.1 History of the Flight

On 11 November 2024, a PA-28-161 Warrior III aircraft, registered as PK-PBC, was operated by PT Mitra Aviasi Perkasa (Perkasa Flight School) for mutual training.[1]. The flight was planned to depart from Tunggul Wulung Airport (WAHL)[2], Cilacap, to the NANGUN Training Area, which is located on bearing 095º at approximately 14 NM east of Tunggul Wulung, before returning to the airport.

The planned training exercises on that day included basic maneuvers, such as climbing and descending turns, as well as Very High Frequency Omnidirectional Range (VOR)[3] radial tracking.

During the pre-flight check, the student pilots did not identify any aircraft system malfunction. Prior to the flight, the engine running and warm-up were conducted by the student pilots.

At about 0149 UTC[4] (0849 LT), the aircraft departed from Tunggul Wulung and proceeded toward the NANGUN Training Area via MAOS and ADI Training Area (see figure 1). One of the student pilots acted as Pilot Flying (PF) and the other student pilot acted as Pilot Monitoring (PM).

Figure 1: Aircraft flight path based on flight following data

[1] Mutual training is a training session of a student pilot flies with another student pilot.
[2] Tunggul Wulung Airport (WAHL), Cilacap will be named as Tunggul Wulung for the purpose of this report.
[3] VHF Omnidirectional Radio Range (VOR) is an aircraft navigation system operating in the VHF band. VORs broadcast a VHF radio composite signal including the station's Morse Code identifier (and sometimes a voice identifier), and data that allows the airborne receiving equipment to derive the magnetic bearing from the station to the aircraft.
[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 is UTC+7 hours.

The aircraft initially climbed to an altitude of 2,000 feet and, upon reaching the MAOS Training Area, continued to climb to 3,000 feet. Upon arrival at NANGUN Training Area, the student pilots conducted exercises of descending and climbing turns, followed by a VOR radial tracking at an altitude of 2,000 feet.

During the VOR radial tracking exercise, the aircraft experienced rough engine running, followed by both FADEC[5] A and B warning lights are flashing, indicating an engine system malfunction. The PF attempted to reset the FADEC system by pressing the FADEC test button for two seconds; however, the FADEC lights did not extinguish. The PF then activated the FORCE B[6] switch, but neither action was able to restore the engine to normal operation.

While the aircraft was descending from 2,000 to 1,500 feet, the student pilots observed a gradual loss of engine power, as indicated by decreasing RPM and load. The PF moved the throttle lever; however, there was no corresponding change in engine power. The PF did not attempt an engine restart because the altitude had already dropped below 1,000 feet and continued to decrease. The PF subsequently decided to perform an emergency landing.

The PM declared a MAYDAY call to Tunggul Wulung Air Traffic Control (ATC), reporting the engine failure and that the aircraft was losing altitude. The aircraft maintained a glide speed of between 75 and 80 knots, and the student pilots decided to land along the Cemara Sewu coastline after determining that the aircraft could not reach the airport.

Initially, the student pilots planned to land in a westbound direction, but they subsequently changed to an eastbound direction after observing people in the intended landing area. The aircraft was configured with flaps up, the landing area was confirmed clear, and the PF shut down and secured the engine before touchdown.

At about 0231 UTC, the aircraft touched down on the coastline. The pilots did not apply braking during landing but pulled back on the control stick to keep the nose wheel off the surface and reduce the landing impact. After a landing roll of about 180 meters, the nose wheel sank into soft sand, and the aircraft came to a complete stop.

The PF activated the Emergency Locator Transmitter (ELT) and reported to the ATC that the aircraft had landed. The student pilots then evacuated the aircraft by themselves. After reaching a safe place, the PF notified their flight instructor by phone about the occurrence.

No injuries were reported as a result of the event.

1.2 Damage to Aircraft

The aircraft sustained minor damage, including fractured 2 of 3 propeller blades, the nose shock strut and wheel were detached, the transponder antenna was separated, and the engine cowling was dented.

[5] FADEC stands for Full Authority Digital Engine Control, a system that automatically manages and optimizes all engine parameters to achieve the power settings commanded by the pilot.

[6] The FORCE B switch is manually used to transfer control to the FADEC B channel, if the FADEC does not automatically switch over to FADEC B

Figure 2: Damaged Aircraft Parts

1.3 Personnel Information

1.3.1 Pilot Flying

The Pilot Flying (PF) is a Libyan national who held a valid Private Pilot License (PPL) with a Single Engine Land (SE-Land) rating. The PF also held a valid Class I medical certificate with no medical limitation.

The PF had accumulated a total flying experience of 111 hours and 30 minutes, including 99 hours and 24 minutes on the Piper PA-28 type aircraft. The PF had flown for 42 minutes prior to the occurrence. The PF's last proficiency check was conducted on 27 March 2024, with a satisfactory result.

1.3.2 Pilot Monitoring

The Pilot Monitoring (PM) is a Libyan national who held a valid Private Pilot License (PPL) with a Single Engine Land (SE-Land) rating. The PM also held a valid Class I medical certificate with no medical limitations.

The PM had accumulated a total flying experience of 112 hours, including 94 hours and 18 minutes on the Piper PA-28 type aircraft. The PM had flown for 42 minutes prior to the occurrence. The PM's last proficiency check was conducted on 7 May 2024, with a satisfactory result.

1.4 Aircraft Information

The Piper PA-28-161 Warrior III with serial number 28-42133 was manufactured by Piper Inc. in the United States of America in 2001. The aircraft was registered as PK-PBC and had a valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R).

The aircraft had accumulated a total time since new of 11,072 hours.

The engine installed on the aircraft was a Technify Motors GmbH Diesel CD-135 (TAE 125-02-99) with serial number 02-02-05166. The total time of the engine since new was 2,036 hours and 3 minutes.

This engine is a liquid-cooled, four-cylinder, in-line, four-stroke diesel engine equipped with DOHC (Double Overhead Camshaft). The valves are actuated by cam followers. The fuel system is a direct diesel-injection using a common-rail fuel injection system and is turbocharged. Engine control is fully managed by a FADEC (Full Authority Digital Engine Control) system. Power is transmitted to the propeller through an integrated gearbox with a reduction ratio of 1.69:1, incorporating a clutch or dual-mass flywheel.

The propeller installed on the aircraft was an MT-Propeller MTV-6-A with serial number 170083. The total time of the propeller since new was 1,306 hours and 7 minutes.

1.4.1 FADEC Operation

The TAE 125 series diesel engine is controlled by a FADEC system (Full Authority Digital Engine Control). The FADEC automatically adjusts all engine parameters to deliver the commanded performance from the pilot.

The FADEC system comprises two identical and independent channels, known as FADEC A and FADEC B, which continuously monitor each other’s status.

During normal operation, the FORCE B switch remained in the “A” position, meaning FADEC A (Engine Control Unit A) actively controls the engine while FADEC B remains on standby.

If the FADEC system detected a malfunction in channel A, the FADEC A light would begin flashing, and the system would automatically switch to FADEC B. Conversely, if a malfunction is detected in channel B, the FADEC B light would flash, and the system would automatically switch to whichever channel was the healthiest (FADEC A). If the FADEC system detected a malfunction in both channels, the FADEC A and FADEC B lights would flash.

When the FORCE B switch is activated, meaning that the switch is in the “B” position, the system loses its automatic switching capability between channels A and B. This manual selection is intended for use only when the FADEC system fails to automatically transfer control to the healthiest channel in the event of abnormal engine behavior.

The FADEC system provides onboard logger recordings as well as event log information, which can be downloaded to support engine maintenance and diagnostics.

1.4.2 Injectors

The TAE 125-02-99 engine has four injectors, with one injector for each cylinder. The injectors are solenoid-operation injectors actuated by FADEC. They inject the fuel out of the common rail[7] into the combustion chamber of each cylinder. The fuel was fed from the high-pressure connection to the nozzle through the passage and to the control chamber through the feed orifice, which is opened by the solenoid valve.

[7] Common rail is a high-pressure fuel reservoir that supplies fuel to the injectors

1.5 Tests and Research

On 16 April 2024, the aircraft engine was examined at the manufacturer's facility in Germany. A series of controlled engine test runs was performed on a bench stand under various configurations of the FADEC and injectors.

Figure 3: Engine on Test Bench

The summary of the engine run test is as follows:

Test Run No.	Configuration	Condition	Result / Observation	Remarks
1	• Engine unchanged • PK-PBC loom[8] • PK-PBC FADEC	Intentionally started without fuel injection	Oil pressure normal	Baseline check only
2	• Engine unchanged • PK-PBC loom • PK-PBC FADEC	Normal run	Engine power did not exceed 71 kW. Based on engine operating limits, the expected result was 99 kW. Disconnecting Injector No. 1, No. 3, and No. 4 caused a significant	Suspected Injector No. 2 malfunction

[8] The loom refers to the bundle of electrical wiring that connects the engine sensors, actuators, and the FADEC system.

Test Run No.	Configuration	Condition	Result / Observation	Remarks
			power drop; Injector No. 2 had no effect.	
3	• Engine unchanged • PK-PBC loom • Test bench FADEC	Normal run	Engine power remained ≤71 kW. The connector plug of Injector No. 2 was tested, and the result was OK.	Confirmed problem not FADEC-related
4	• Engine with new Injector No. 2 • PK-PBC loom • Test bench FADEC	Normal run	Engine power exceeded 99 kW	Performance restored
5	• Engine with new Injector No. 2 • PK-PBC loom • PK-PBC FADEC	Normal run	Engine power exceeded 99 kW	Confirmed that both FADECs function normally with a good injector
6	• Engine with suspected malfunction of injector No. 2 installed on cylinder No. 3 • PK-PBC loom • PK-PBC FADEC	Normal run	Engine power did not exceed 71 kW. Disconnecting Injector No. 1, No. 2, and No. 4 reduced power. Injector No. 3 had no effect.	Confirmed malfunction inherent to Injector No. 2

The engine ran test result, suspecting a problem on Injector No. 2. The test continued to measure the resistance of the coil in Injector No. 2, and the result was 0.2 Ohm.

Considering that the resistance of the coil in the new injector was between 0.4 to 0.5 Ohm[9], the result indicated an internal malfunction in the Injector No. 2.

Figure 4: Injector No. 2

Injector No. 2 was re-examined in detail to assess its condition and to identify any anomalies. Within the limits of the achievable geometric resolution, damage was identified on one solenoid coil terminal pin, accompanied by degradation of the adjacent sealing element.
Particulate and foreign material were observed in the affected area, which may indicate localized thermal effects, such as melting or thermal residue.
No evidence of connector rotation relative to the injector housing was found. In addition, no significant structural damage or functional abnormality was identified in the solenoid coil assembly as a whole.

1.6 Organizational and Management Information

Perkasa Flight School held a valid certificate of approval for a pilot training organization, issued by the Directorate General of Civil Aviation (DGCA). The school was authorized to conduct flight training using eight single-engine aircrafts, including PK-PBC and two multi-engine aircrafts.

1.6.1 Ground Run Up Procedure

Perkasa Flying School Standard Operating Manual Subchapter 3.3 requires the engineer to perform a ground run up before the aircraft's first flight of the day. The ground run procedures require the engineer to verify the engine ground operating limits in accordance with the Static RPM Run Procedure PA 28-161 Series – Engine TAE 125-02-99. This procedure requires the engineer to check engine acceleration behavior and performance by moving the load selector quickly to the full-load position. The engineer must verify that the load indicator shows more than 95% for 30 seconds. If the load indicator is showing less than 95%, the engineer shall conduct the troubleshooting in accordance with the Aircraft Maintenance Manual.

[9] The manufacturer's specification for the normal electrical resistance of a new injector coil is approximately 0.4 to 0.5 Ohm.

1.6.2 Emergency Landing with Engine Out

The Supplement Pilot Operating Handbook for the PA-28-140/150/151/160/161/180 provides procedures to be followed in the event of a loss of engine power during flight and conducting an emergency landing due to engine failure, as follows:

LOSS OF ENGINE POWER DURING FLIGHT

(1)Push Thrust Lever full forward (Take-off position).

(2)Fuel Selector to tank with sufficient fuel quantity and temperature

(3)Electric Fuel Pump - ON

(4)Establish Best Glide Speed

(5)Check engine parameters (FADEC lights, oil pressure and temperature, fuel quantity)

If normal engine performance is not achieved, the pilot should:

i) Land as soon as possible.
ii) Be prepared for an emergency landing
iii) Expect an engine failure.

EMERGENCY LANDING WITH ENGINE OUT

If all attempts to restart the engine fail and an emergency landing is imminent, select suitable site and proceed as follows:

(1) When field can easily be reached, slow down to 63 KIAS for the shortest landing.

(2) Fuel Selector - CLOSED

(3) Engine Master - OFF

(4) Flaps - as required (40° is recommended)

(5) Alternator, Main Bus, and Battery switch - OFF

(6) Seat belts and harnesses - TIGHT

(7) Touch-down-slightly nose up attitude

(8) Brake firmly

1.7 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 SAFETY MESSAGES

The post-occurrence engine examination revealed that Injector No. 2 had malfunctioned, producing abnormal electrical resistance that resulted in reduced fuel injection to the corresponding cylinder. This malfunction might have led to abnormal combustion performance, limiting the available engine power to approximately 71 kW instead of the expected 99 kW.

The occurrence took place during a mutual training flight, highlighting the importance of immediate decision-making and forced landing skills. Although the student pilot responded appropriately by executing a forced landing in a suitable area, the occurrence underscores the need to identify and mitigate potential technical malfunctions before flight.

According to the Subchapter 3.3 of the Perkasa Flying School Standard Operating Procedure (SOP) Manual, a ground run-up shall be conducted by an engineer before the aircraft is operated on the first flight of the day. On the day of the occurrence, however, the engine ground run-up was conducted by the student pilots. This highlights the importance of clearly defined roles and consistent implementation of maintenance-related procedures, particularly where specialized technical knowledge and experience are intended to support the early detection of potential engine abnormalities.

The aircraft was equipped with a FADEC system capable of recording event log data retrievable through download. Examination of these event logs provides valuable insight for identifying potential technical anomalies before they develop into in-flight failures.

3 SAFETY ACTION

At the time of issuing this investigation report, KNKT had been informed of several safety actions taken by Perkasa Flying School in response to this occurrence. The flying school revised its Company Maintenance Manual by adding a Maintenance Ground Run-Up Procedure that must be performed by an engineer.

The revised manual also included several new procedures, such as the Anomalies Monitoring Procedures and the Maintenance Pre-Flight Procedure.

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