KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA

FINAL

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Aircraft Serious Incident] Investigation Report

PT. Wings Abadi Airlines

ATR 72-212A; PK-WFK

Adisutjipto Airport – Yogyakarta

Republic of Indonesia

17 July 2012

2018

This draft final investigation report is published by the Komite Nasional Keselamatan Transportasi (KNKT), 3rd Floor Ministry of Transportation, Jalan Medan Merdeka Timur No. 5 Jakarta 10110, Indonesia.

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

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Jakarta, February 2019

KOMITE NASIONAL
KESELAMATAN TRANSPORTASI
CHAIRMAN

SOERJANTO TJAHJONO

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ABBREVIATIONS AND DEFINITIONS

AOC	:	Air Operator Certificate
ATPL	:	Airline Transport Pilot License
CAMP	:	Continuous Airworthiness Maintenance Program
C of A	:	Certificate of Airworthiness
C of R	:	Certificate of Registration
CCAS	:	Centralized Crew Alerting System
CPL	:	Commercial Pilot License
CVR	:	Cockpit Voice Recorder
CRC	:	Continuous Repetitive Chime
EWD	:	Engine Warning Display
FDR	:	Flight Data Recorder
KNKT	:	*Komite Nasional Keselamatan Transportasi* (National Transportation Safety Committee) is the Indonesia investigation authority.
LT	:	Local Time
LP	:	Low Pressure
MFC	:	Multi Functions Computer
MSDS	:	Material Safety Data Sheet
PWC	:	Pratt & Whitney Canada
SOV	:	Shut Off Valve
TAT	:	Total Air Temperature
UTC	:	Universal Time Coordinated
WIB	:	*Waktu Indonesia Barat* (Western Indonesia Time)
VHF	:	Very High Frequency
VOR	:	Very High Frequency Omni Range

SYNOPSIS

On 17 July 2012, an ATR 72-212A (500 version) registered PK-WFK was being operated by PT. Wings Abadi Airlines (Wings Air) as scheduled passenger flight from Juanda International Airport (WARR) Surabaya to Adisutjipto International Airport (WARJ) Yogyakarta with flight number WON-1843. On board the aircraft were two pilots, two flight attendants and 59 passengers. This flight was the second flight of the day.

At 0020 UTC (0720 LT) the aircraft departed from Juanda and at 0115 UTC, the aircraft landed at Adisutjipto after held approximately 20 minutes. The flight form departure until landing was uneventful.

At 0117 UTC, the aircraft parked and flight crew shut down the left engine and activated the propeller brake on the right engine. After instructed the flight attendant to open the door, few seconds later, the NAC 2 OVHT (Engine Nacelles Overheat) warning at Centralized Crew Alerting System (CCAS) illuminated and the aural warning activated. The pilot cancelled the warning and NAC 2 OVHT warning was extinguished.

After few second, the pilot heard somebody from the outside of the aircraft screamed requesting the fire extinguisher and in the cockpit the NAC 2 OVHT warning illuminated again followed by the right engine fire warning activated. The pilot pulled the right engine fire handle and discharged extinguisher agent of bottle number 1. After 30 seconds, the fire warning still illuminated and the pilot discharged extinguisher agent of bottle number 2. Afterward, the fire warning extinguished.

No one injured as a result of this occurrence.

The investigation considers the contribution factors of this accident was the fire initiated from the significant amount of accumulated fuel on the engine nacelle floor which then evaporated and reached auto ignited condition due to the high temperature in the right engine nacelle.

As result of the investigation, the aircraft operator had performed safety action by updated the Engineering Authorization to accommodate the utilizing the special tools as required by the manufacture. The Komite Nasional Keselamatan Transportasi (KNKT) consider the safety action taken by the aircraft operator was sufficient to prevent similar occurrence in the future. Therefore, KNKT is not issue safety recommendations in this report.

1 FACTUAL INFORMATION

1.1 History of the Flight

On 17 July 2012, an ATR 72-212A (500 version) registered PK-WFK was being operated by PT. Wings Abadi Airlines (Wings Air) as scheduled passenger flight from Juanda[1] International Airport (WARR) Surabaya to Adisutjipto[2] International Airport (WARJ) Yogyakarta with flight number WON-1843. On board the aircraft was two pilots, two flight attendants and 59 passengers. This flight was the second flight of the day.

At 0020 UTC (0720 LT[3]) the aircraft departed from Juanda. The flight until the aircraft landed was uneventful.

At 0815 LT, the aircraft landed at Adisutjipto after holding approximately 20 minutes at JOG VOR due to traffic.

At 0817 LT, the aircraft parked and flight crew shut down the left engine while kept the right engine running by utilized propeller brake (prop brake)[4] to stop the right engine propeller rotation. The pilot instructed to the flight attendant to open the door, few seconds later, the NAC 2 OVHT (Engine Nacelles Overheat) warning at Centralized Crew Alerting System (CCAS) illuminated and the aural warning activated. The pilot cancelled the warning and NAC 2 OVHT warning stopped.

The pilot heard somebody from the outside of the aircraft shouted requesting the fire extinguisher. Few seconds later, the NAC 2 OVHT warning illuminated again followed by the right engine fire warning illuminated. The pilot pulled engine 2 fire handle and discharged extinguisher agent from bottle number 1. After 30 seconds, the fire warning was still illuminated and the pilot discharged extinguisher agent from bottle number 2. Afterward, the fire warning stopped.

The engineer conducted walk around inspection after the passenger disembarked and found smoke on the right engine appeared from lower engine cowling.

No one injured as a result of this occurrence.

1 Juanda International Airport (WARR), Surabaya will be named as Juanda for the purpose of this report.

2 Adisutjipto International Airport (WARJ), Yogyakarta will be named as Adisutjipto for the purpose of this report.

3 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.

4 Propeller brake (prop brake) or also named as Hotel Mode is feature to stop the propeller rotation of right engine only while allowing the turbine to run to provide electrical power and bleed air.

Figure 1: PK-WFK Aircraft

1.2 Damage to Aircraft

There was no evidence of aircraft damage. The right engine lower cowl exhibited soot consistent with the sign of fire as shown in figure below.

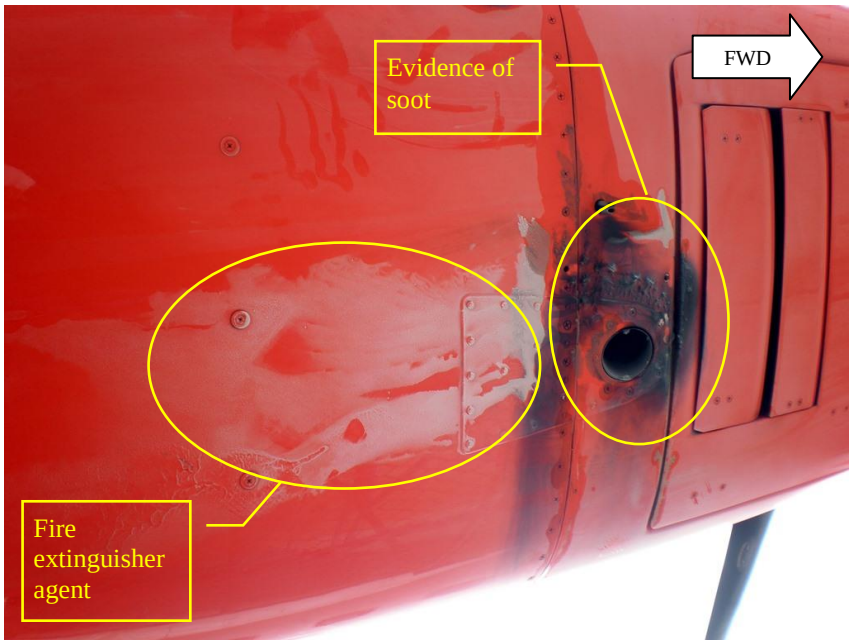

Figure 2: Sign of burn and fire extinguisher agent on the right engine lower cowl.

Inside of the right engine cowl there was evidence of soot on the lower engine as shown in the figure below.

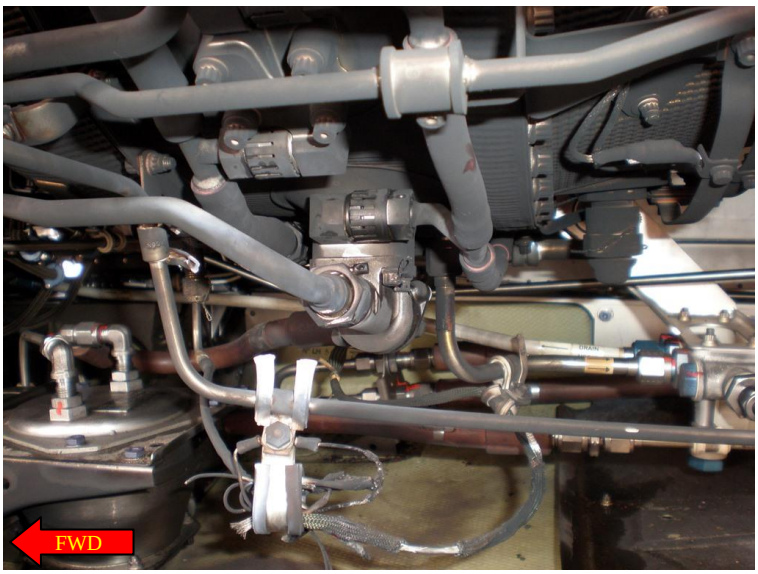

Figure 3: Right engine lower part

Several minutes after the occurrence, the engineer conducted motoring to the right engine in according Job Instruction Card (JIC) number 72-00-00 ERI 10020. There was evidence of fuel exposure on the engine cowling floor.

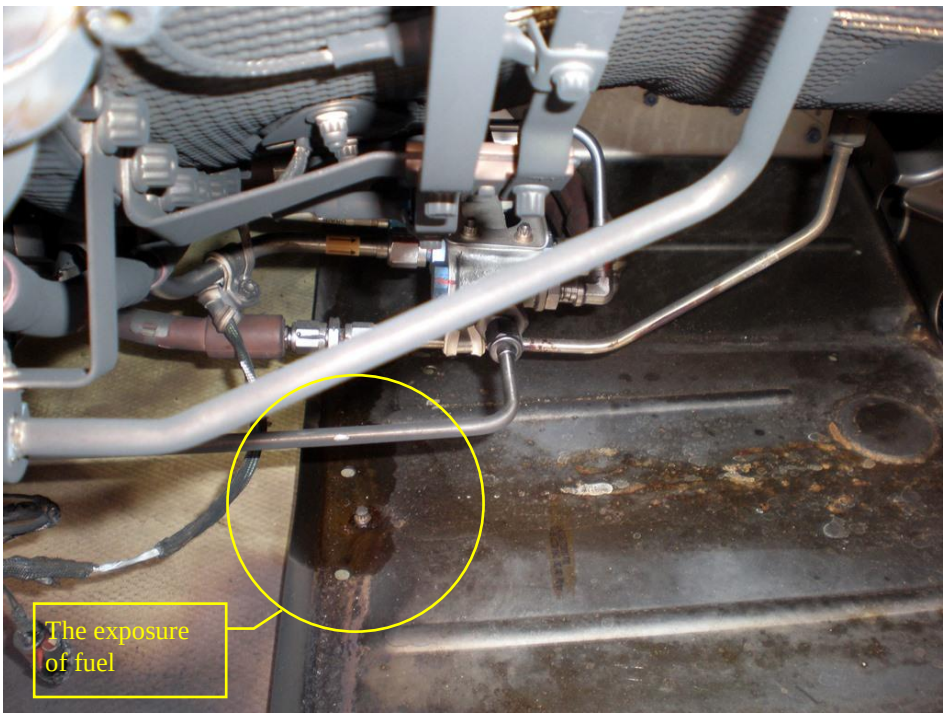

Figure 4: The evidence of fuel exposure on the right engine nacelle floor

There was evidence of wetting on the fuel nozzle connector fitting at fuel nozzle on position 1 as shown in the figure below.

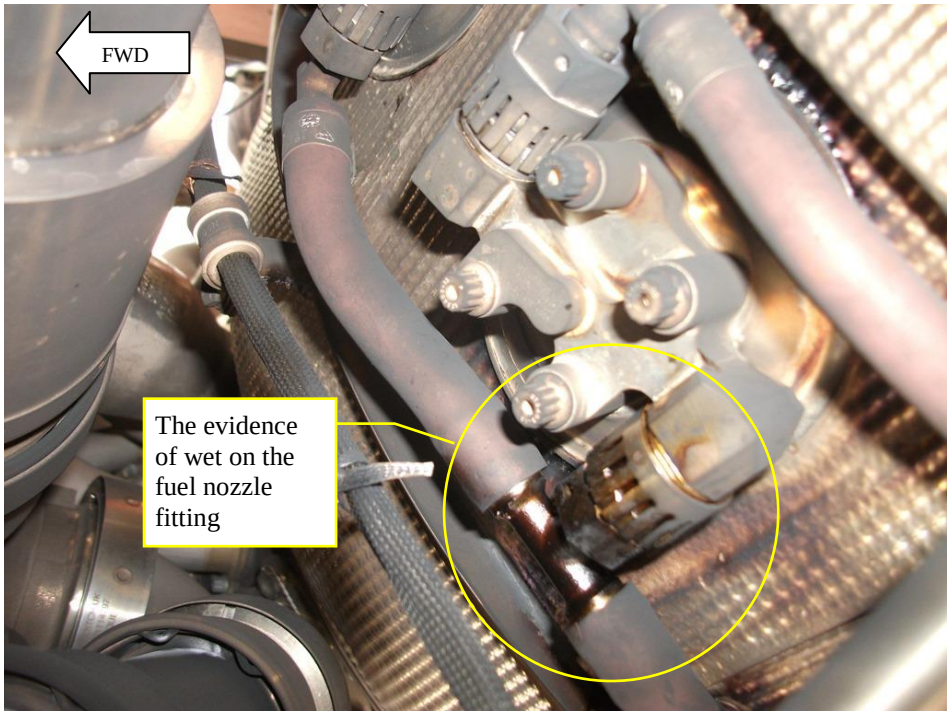

Figure 5: Wet on the fuel nozzle position 1

1.3 Pilot Information

1.3.1 Pilot in Command

The Pilot in Command (PIC) was 42 years old, joined the company since 2009 and held valid Airlines Transport Pilot License (ATPL) and valid instrument rating. The pilot held first class medical certificate valid up to September 2012 without limitation.

The flying experiences of the pilot were as follows:

Total hours	:	about 11,400 hours
Last 90 days	:	192 hours 40 minutes
Last 60 days	:	108 hours
Last 24 hours	:	5 hours 40 minutes
This flight	:	1 hour 20 minutes

1.3.2 Second in Command

The Second in Command (SIC) was 33 years old, joined the company since March 2012 and held Commercial Pilot License (CPL) and valid instrument rating. The pilot held first class medical certificate valid up to October 2012 without limitation.

The flying experiences of the pilot were as follows:

Total hours	:	320 hours
Last 90 days	:	153 hours 20 minutes
Last 60 days	:	70 hours 30 minutes

Last 24 hours : 5 hours 40 minutes

This flight : 1 hour 20 minutes

1.4 Aircraft Information

The aircraft was manufactured by Avions de Transport Regionale (ATR) in France at 24 June 2010 with serial number 905 and the type/model was ATR 72-212A (500 version). The aircraft registered PK-WFK and had valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R).

At the time of occurrence, the total hour of the aircraft was 4,500 hours 43 minutes and the total cycle was 4,796 cycles. The last routine maintenance check was A-01 inspection that was performed on 13 July 2012. There was no discrepancy on aircraft prior to the flight.

The engine was manufactured by Pratt & Whitney Canada (PWC) with the type/model was PW127M. The engine number 1 serial number was PCE-ED0265 with the total hour was 4,500 hours 43 minutes and the total cycle was 4,796 cycles. The engine number 2 serial number was PCE-ED0261 with the total hour was 4,500 hours 43 minutes and the total cycle was 4,796 cycles.

On 13 June 2012, the engineer replaced all of 14 fuel nozzles of the right engine as part of the Continuous Airworthiness Maintenance Program (CAMP) task number 731361-RAI-10000-1 to restore the fuel nozzle. The replacement of the fuel nozzles did not utilize the PWC special tool PWC56616. The special tool was required for accessing the fuel nozzle especially at the position 1 and 14. The special tool PWC56616 is shown in the figure below.

Figure 6: PWC Special Tool PWC56616

On 13 July 2012 or four days prior to the occurrence, the engineer conducted the A01 inspection, which contain visual inspection to the engine including fuel nozzles and there was no discrepancy reported.

1.5 Flight Recorders

1.5.1 Flight Data Recorder (FDR)

The aircraft was equipped with Flight Data recorder (FDR) and Cockpit Voice Recorder (CVR). The FDR was L-3 recorder with part number 2100-4043-00 and serial number 00637111. The CVR was L-3 recorder with part number 2100-1020-02 and serial number 00590604.

Both recorders were transported to KNKT recorder facility for data downloading and analysis process. The FDR recorded 431 parameters and approximately 191 hours of aircraft operation, which was containing 150 flights including this occurrence.

The significant FDR events as shown on figure 3 are as follows:

1. The FDR shows that the right engine fuel flow was higher than the left engine, when the throttle lever position, torque, Inlet Turbine Temperature (ITT), NH and N1 were relatively equal.
2. At 1:15:56 UTC, the aircraft touch down.
3. At 1:17:21 UTC, the left engine shutdown.
4. At 1:17:53 UTC, the propeller brake at right engine was activated.
5. At 1:17:57 UTC, the right engine fire warning was activated and at the same time the right engine was shut-down. The Total Air Temperature (TAT) recorded 36° Celsius.

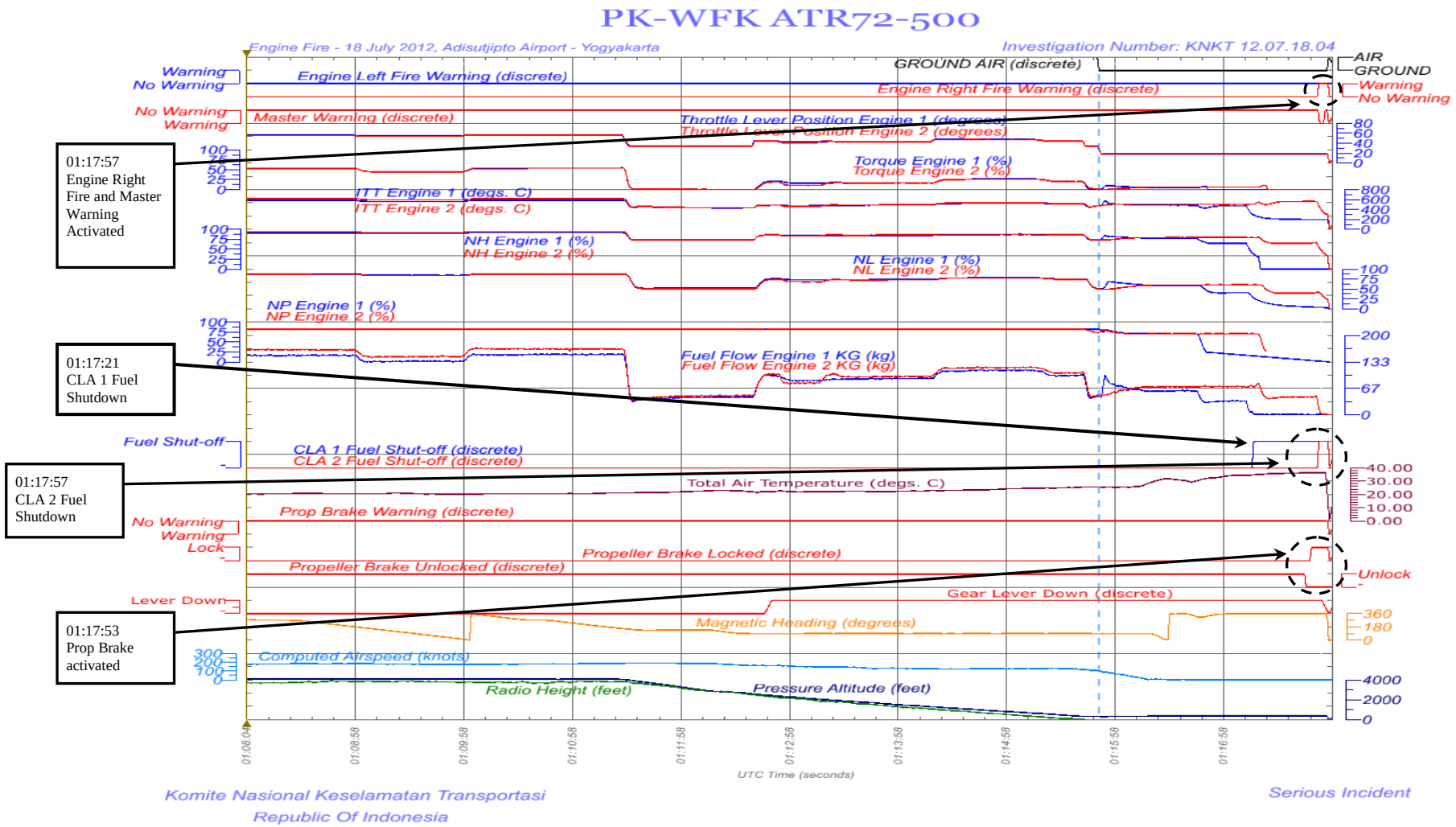

Figure 7: Significant FDR Parameters of the serious incident flight

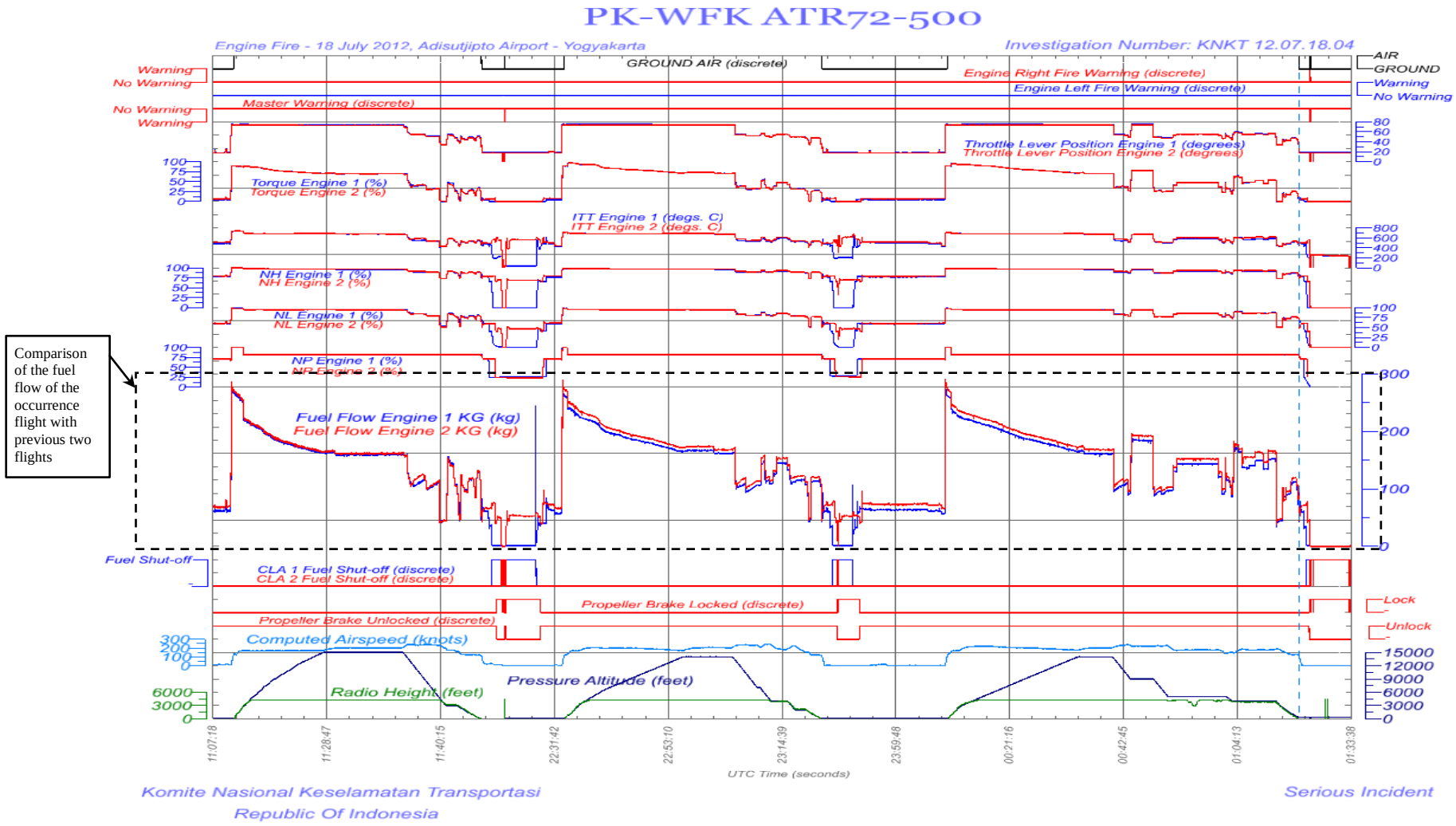

Figure 8: Comparison of the occurrence flight with two previous flights

The FDR data showed the differences of the fuel flow on both engines occurred since the last two flights prior to the serious incident flight. The fuel differences initiated on the last flight of 16 July 2012. The investigation calculated the differential fuel flow between left and right engines in these three flights. The differential fuel is shown in the table below.

Fuel flow on previous two flights:

PERIODE	LEFT ENGINE (kg/hour)	RIGHT ENGINE (kg/hour)	DIFFERENCES (kg/hour)
T/O – 4000 feet	242.96	246.14	3.18
4000 feet – TOD	170.99	173.06	2.07
TOD – 4000 feet	110.83	114.12	3.28
4000 feet – Landing	104.54	103.05	-1.49

Fuel flow on previous flight:

PERIODE	LEFT ENGINE (kg/hour)	RIGHT ENGINE (kg/hour)	DIFFERENCES (kg/hour)
T/O – 4000 feet	234.89	244.90	10.01
4000 feet – TOD	180.38	187.86	7.47
TOD – 4000 feet	120.70	128.33	7.63
4000 feet – LDG	107.70	114.34	6.65

Fuel flow on serious incident flight:

PERIODE	LEFT ENGINE (kg/hour)	RIGHT ENGINE (kg/hour)	DIFFERENCES (kg/hour)
T/O – 4000 feet	230.34	240.53	10.20
4000 feet – TOD	183.09	191.29	8.20
TOD – 4000 feet	136.60	145.56	8.96
4000 feet – LDG	82.25	86.54	4.29

1.5.2 Cockpit Voice Recorder (CVR)

The CVR recorded 2 hours of good quality recording data. After the fire warning activated, the pilot pulled the engine 2 fire handle and the electrical source for the CVR was interrupted. Several seconds later, the electrical source was recovered therefore the CVR continued to record the cockpit communication. The excerpt

communication is shown below.

TIME (UTC)	DESCRIPTION
1:15:54	Aircraft touchdown.
1:16:13	The ATC provided the landing time and instructed to taxi and proceed to stand number 4.
1:17:53	The pilot instructed to the Flight Attendant to open the door.
1:17:56	Sound of Continuous Repetitive Chime (CRC), indicated NAC overheat warning active.
1:17:59	Sound of the CRC stop.
1:18:02	Sound similar to electrical power source interrupted.
1:18:29	Pilot exclaimed (“ooh wow!”).
1:18:32	Sound similar to electrical power source interrupted.
1:19:10	The pilot contacted to the Adisitjipto Tower controller requested to tow the aircraft to gate 7.
1:19:57	The tower approved the pilot request to move to gate 7.
1:19:38 – 1:23:58	The pilots discussed about the NAC overheat.
1:25:39	End of recording

1.6 Organizational and Management Information

1.6.1 Aircraft Operator

The aircraft was owned by Blue Horizon Investment 8B Ltd of Cayman Island and was operated by PT. Wings Abadi Airlines (Wings Air).

PT. Wings Abadi Airlines (Wings Air) has business address in Jl. A. M. Sangaji number 17, Jakarta Pusat and had valid Aircraft Operator Certificate (AOC) number 121-012 which approved to conduct scheduled passenger flight operation within Indonesian territorial airspace. The Wings Air was operating 20 ATR 72-212A (500 version) aircraft and 32 ATR 72-212A (600 version) aircraft.

1.6.2 Aircraft Manual

1.6.2.1 Aircraft Maintenance Manual

Chapter 26-16 NAC OVHT

When the right nacelle temperature reaches 170°C ± 5 °C (338°F ± 41 °F), a red reverse video NAC OVHT label is displayed on the SD Engine page at the top of the right NP2 indication. Simultaneously, the NAC OVHT warning alert is displayed with the associated procedure on the EWD, accompanied with the Master Warning lights flashing and the CRC sounds.

Should the nacelle overheat signal be invalid, amber crossed "NAC OVHT" label is

displayed at the same place as red reverse video "NAC OVHT" label.

On wheel touch down, a 30 second time delay (located in the MFC's) inhibits NAC OVHT label display on the SD Engine Page and the NAC OVHT warning on the EWD.

The reason for this time delay is to avoid untimely warnings.

Chapter 26-21-00

A. Fire Extinguishing Procedure

In case of engine fire detection (Ref. 26-12) the following procedure must be applied:

- *place the power lever in idle position*
- *place the condition lever in OFF position*

  (FUEL SOV red light on condition lever goes off).
- *pull fire handle. This has for effect to:*
  - *close the LP fuel shut off valve*
  - *close the bleed valve*
  - *close pressure regulating and shut off valve*
  - *close de-icing shut off valve*
  - *de-energize the AC and DC generators*
  - *enable percussion of the fire extinguisher bottles (the corresponding SQUIB legend comes on).*
- *Squib the first bottle, by pressing AGENT 1 pushbutton switch (discharge of the bottle is indicated by the illumination of amber DISCH legend). If the FIRE warning does not disappear within 30 following seconds, the second bottle must be squibbed.*
- *The ENG FIRE red warning light illuminates on the fire handle when the temperature exceeds 250 °C (±10%) on the two loops or on only one loop if the other fails. The light remains illuminated as long as the temperature measured in the nacelle is greater than 250 °C (±10%) or if a short circuit occurs on one of the two loops.*

1.7 Additional Information

1.7.1 PWC Service Experience

On 31 March 2010, Pratt & Whitney Canada (PWC) issued Service Experience for Flexible Fuel Manifold to provide the operator the proper installation of flexible fuel manifold with the proper Special Tool PWC56616.

The Service Experience also provides the correct alignment of the fuel nozzle locking devices that referred as “B-Nut”.

The B-Nut consists of the crowned ring (Mueller ring) and lock ring (Moeller Fingers) as shown in the figure below.

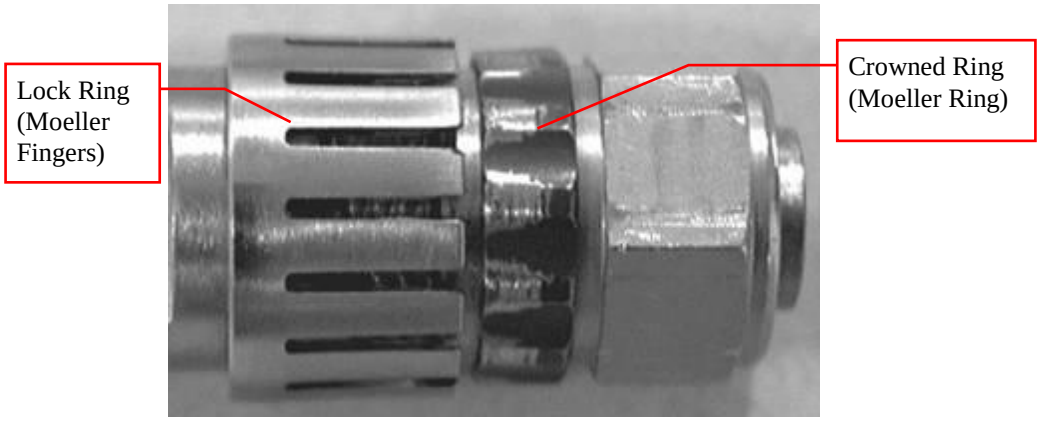

Figure 9: Fuel Nozzle locking devices

The service experience is also to provide the awareness of the O-ring as part of the sealing to the fuel nozzle since the O-ring prone to wear if the installation is not proper.

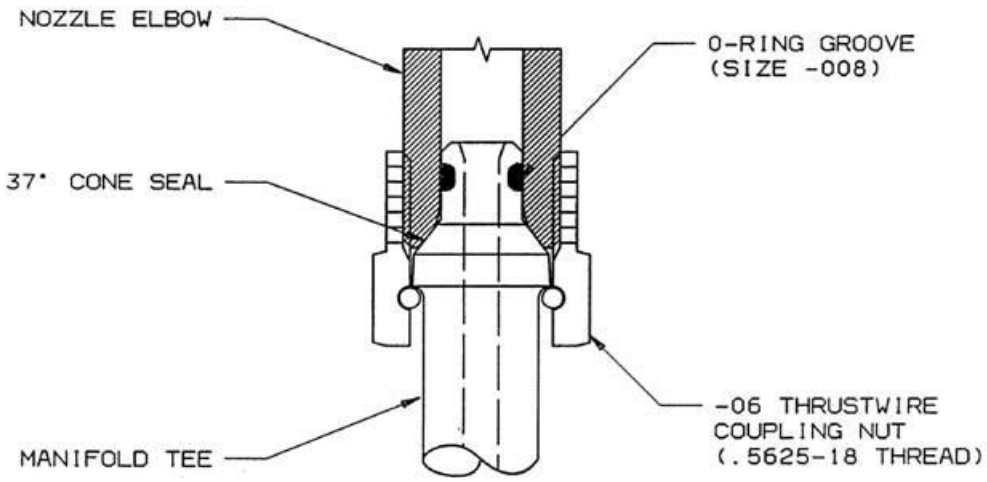

Figure 10: Sealing configuration of the fuel nozzle

1.7.2 The Aviation Turbine Engine Fuel (Jet A-1)

The aviation turbine engine fuel (Jet A-1) in Indonesia is supplied by the Pertamina. The characteristic of the aviation turbine engine fuel is stated in the Material Safety Data Sheet (MSDS) published by Pertamina. The flash point[5] of the jet A-1 referred in the MSDS is less than 38° C and the auto-ignition[6] of this fuel is more than 220° C.

5 The flash point is temperature at and above which a liquid gives off enough flammable vapor to form a mixture with air that can be ignited by contact with a hot surface, spark, or flame. Lower the flash point, greater the fire hazard.

6 Auto-ignition temperature is the temperature at which the vapour ignites spontaneously without an ignition source.

2 ANALYSIS

On the day of the occurrence, the FDR recorded that the aircraft touchdown at 1:15:56 UTC and at 1:17:21 UTC the left engine was shut down. The CVR data showed that at 1:17:53 UTC, the pilot instructed the flight attendant to open the passenger door indicated that the aircraft had stopped at the gate. At the same time, FDR recorded that the propeller brake of right engine was activated.

At 1:17:56 UTC, the CVR recorded the repetitive continuous chime, indicated the warning of right engine overheat (NAC 2 OVHT) and one second later, the FDR recorded the right engine fire warning active. At the same time the right engine was shut-down which likely due to the pilot action to pulling the engine fire handle. Afterward the CVR recorded the sound like electrical interruption. Pulling the fire handle will de-energized the electrical source.

The CVR was stop recording twice and back alive until end of recording. The first electrical interruption most likely was after the pilot pulled the fire handle but the second electrical interruption was unknown.

The soot at the lower part of right engine and thermal discoloration at the lower surface of nacelle indicated that the fuel was burn from the nacelle floor. The burned fuel most likely activated the fire detection sensing that triggered the right engine fire warning.

Several minutes after the occurrence, the engineer conducted motoring to the right engine and found fuel exposure on the engine cowling floor and wetting on the fuel nozzle connector fitting at fuel nozzle on position 1. It was most likely that the fuel exposure on the engine cowling floor was from the leak on the connector fitting of fuel nozzle on position 1.

The FDR data showed, on two previous flights indicated increasing fuel flow of the right engine compared to the left engine. However, the observation on the flight and maintenance log after replacement of the fuel nozzle on two flights before the occurrence, did not find abnormality refer to the physical condition on both engines.

On 13 June 2012, all of 14 fuel nozzles of the right engine replaced as restoration program stated in the CAMP. The replacement of the fuel nozzles did not utilize special tool PWC56616 that is specified for the fuel nozzle replacement especially fuel nozzle position 1 and 14.

On 13 July 2012 or four days prior to the occurrence, the engineer conducted the A01 inspection, which contain visual inspection to the engine including fuel nozzles and there was no discrepancy reported.

On 16 July 2012, the FDR recorded fuel flow differences between left and right engines. The differential fuel flow was greater in the occurrence flight which was on 17 July 2012. The FDR recorded that the difference of fuel flow between left and right engine approximately up to 10 kg per hour while the other engine parameters relatively similar. The similarity of the engine parameters indicated that the amount of fuel burned to both engines was similar. Therefore, the difference of fuel flow most likely due to the leak of the fuel from the fuel nozzle position 1, that was found wet during the engine motoring.

The fuel leakage occurred more than one month after the last replacement of the fuel

nozzle which was conducted without recommended special tool. The installation without proper tool might cause by improper installation of the fuel nozzle. During the operation, the fuel nozzle might have become loosen due to the vibration. The visual inspection on 13 July 2012 did not identify the loosening fuel nozzle since there might be no wetting on the fuel nozzle or any other visual indication. The loosening fuel nozzle resulted in fuel leakage which then accumulated in the nacelle floor.

At the time of occurrence, the FDR recorded the environment temperature was 36°C, while the temperature inside the engine nacelle might have been greater which radiated from the engine heat. The temperature inside the engine nacelle might have been reached above the flash point of the fuel which was 38°C.

During parking, the fuel leak accumulated on the nacelle and evaporated as the temperature inside the engine nacelle was above flash point. The engine was running with prop brake, which means the propeller was not rotating, therefore no air flow from propeller to wash the evaporated fuel overboard. The running engine was also radiated heat to the nacelle. The NAC 2 OVHT warning will active when temperature in the engine nacelle is more than 170°C. The evaporated fuel became auto ignited when the temperature reached 220°C.

The fire initiated from the significant amount of accumulated fuel on the engine nacelle floor which then evaporated and reached auto ignited condition due to the high temperature in the right engine nacelle.

Compared to the previous flight which was also experiencing fuel leakage, however no fire had occurred. This might be caused by the amount of accumulated fuel in the nacelle was not sufficient to auto ignited.

3 CONCLUSIONS

3.1 Findings[7]

According to factual information during the investigation, the Komite Nasional Keselamatan Transportasi identified findings as follows:

1. The aircraft had valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R). There was no evidence that the aircraft had any system malfunction prior to the occurrence.
2. The pilots held valid licenses and medical certificates.
3. On 13 June 2012, the engineer replaced the fuel nozzle without the proper tool which might resulted in improper installation. Improper installation of the fuel nozzle resulted in fuel leakage indicated by the increasing of fuel flow as recorded in the FDR however all other engine indicator on both engines showed similar values.
4. On 13 July 2012, the engineer conducted A01 inspection and there was no discrepancy reported.
5. After the passengers disembark, the NAC 2 OVHT warning activated and the pilot cancelled the warning. Several seconds later the NAC 2 OVHT warning activated again followed by the right engine fire warning activation. The pilot pulled the fire handle and discharged the fire extinguisher until the fire extinguished.
6. Several minutes after the occurrence, the engineer conducted motoring to the right engine which found evidence of fuel exposure on the engine cowling floor and wetting on the fuel nozzle connector fitting at fuel nozzle on position 1.
7. The FDR recorded that the difference of fuel flow between left and right engine while the other engine parameters relatively similar. The similarity of the engine parameters indicated that the amount of fuel burned to both engines was similar. Therefore, the difference of fuel flow most likely due to the leak of the fuel from the fuel nozzle position 1, that was found wet during the engine motoring.
8. The leakage fuel was accumulated on the nacelle floor. The temperature in the nacelle led to the accumulated fuel evaporated.
9. The evaporated fuel reaches the auto ignited condition and initiated the fire.

7 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.

3.2 Contributing Factors[8]

The fire initiated from the significant amount of accumulated fuel on the engine nacelle floor which then evaporated and reached auto ignited condition due to the high temperature in the right engine nacelle.

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

4 SAFETY ACTION

At the time of issuing this draft final investigation report, the Komite Nasional Keselamatan Transportasi had been informed of safety actions resulting from this occurrence.

4.1 Wings Air

On 19 September 2012, Wings Air updated the Engineering Authorization No. ATR72-EA-73-013R3 to ATR72-EA-73-013R4 with subject "PW127M Engine Fuel Nozzle Adapters Periodic Restoration" that applied to ATR72-212A equipped with PW172M engine in their fleet and to ensure that the replacement of the fuel nozzles are utilize the special tools as required by the manufacture.

5 SAFETY RECOMMENDATIONS

As a result of this investigation and reviewing the safety action taken by the aircraft operator the Komite Nasional Keselamatan Transportasi consider sufficient to prevent similar occurrence in the future. Therefore, KNKT is not issue safety recommendations in this report.

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