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NATIONAL TRANSPORTATION SAFETY COMMITTEE

AIRCRAFT INCIDENT REPORT

PT Awair QZ730

A310-322 PK-AWA

Sepinggan Airport, Balikpapan

19 October 2000



NATIONAL TRANSPORTATION SAFETY COMMITTEE
DEPARTMENT OF COMMUNICATIONS
REPUBLIC OF INDONESIA
2004

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GLOSSARY OF ABBREVIATIONS

AGL	Above Ground Level
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
ATIS	Air Traffic Information System
ATPL	Air Transport Pilot License
CPL	Commercial Pilot License
CSN	Cycles Since New
CVR	Cockpit Voice Recorder
DME	Distance Measuring Equipment
F/O	first officer
FDR	Flight Data Recorder
hrs	time (24 hour clock)
IFR	Instrument Flight Rules
IIC	Investigator-In-Charge
ILS	Instrument Landing System
kg	kilogram(s)
mm	millimetre(s)
MTOW	Maximum Take-Off Weight
nm	nautical mile(s)
NTSC	National Transportation Safety Committee
°C	degrees Celcius
PIC	Pilot-In-Command
RPM	Revolutions Per Minute
TSN	Time Since New
UTC	Universal Time Co-ordinated
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

SYNOPSIS

The Air Air Airbus 310 aircraft with registration PK-AWA, QZ730, on October 19, 2000, was on a scheduled flight from Soekarno-Hatta International Airport of Jakarta (departure at 08:05 local time) to Sepinggan airport of Balikpapan (arrival at 10:58 local time). The airplane landed on Runway 07, with a wind direction of 280° and wind velocity of circa 8 knots. The weather was reported clear and dry with a visibility of 9 kilometers.

Engine stall occurred on both engines at the time of thrust reverser operation, and a tail-pipe-fire phenomenon was observed by Air Traffic Control and fire fighter members.

At the time of the occurrence, the airport authority was holding an airport bomb-threat and fire-fighting training exercise.

After the engine flame-outs, the airplane came to a stop on taxiway B. The fire fighters, began spraying foam in the engine inlets and tailpipes.

A post incident inspection revealed that both the engines suffered damage due to chemical corrosion.

At the time of the occurrence, the fire fighting was involved in an airport bomb threat and fire-fighting training exercise, held by the airport authority.

There were no injuries, and the passengers disembarked normally through the passenger doors.

The flight recorder readouts and analysis were done at the ATSB facilities in Canberra, Australia, and an engine inspection teardown was carried out at the Eagle Services Asia (Singapore). The flight recorder readouts and engine inspections were supervised by the National Transportation Safety Committee.

The investigation revealed that both engine stalls were caused by the pilot-flying not stowing away the thrust reversers on time.

The investigation also revealed that the fire fighters handling of the situation of perceived engine fires occurring during the landing led to action damage both the aircraft engines.

Based on the conclusions, the NTSC provide some recommendations in effort to improve safety level. Some recommendations are pertinent to emergency handling by the airport operator, aircraft operation and maintenance by the airline.

The NTSC proposed recommendations pertaining to flight procedures, and the emergency the airport emergency procedures fire fighting

I FACTUAL INFORMATION

1.1 History of Flight

The aircraft departed from the Soekarno-Hatta International Airport of Jakarta (CGK). Block-off time was at 01.05 UTC or 08:05 LT, with an estimated time of arrival at its destination airport Sepinggan (Balikpapan) of 03:15 UTC or 11:15 LT

At the time of arrival an airport bomb threat and fire-fighting emergency training exercise was underway, scheduled to take place from 01:30 UTC until 05:00 UTC.

On arrival at its destination, and due to departing traffic, Air Traffic Control instructed the flight crew to use runway 07. Weather was reported as clear (Nil). Wind direction was 230⁰ with a wind velocity of 8 knots.

During the landing roll the aircraft with a tailwind of approximately 8 knots, and while the cockpit crew was in the process of stowing the engines thrust reversers, both engines experienced engine flameout simultaneously.

With both engines inoperative, and using its remaining speed, the aircraft left Runway 07 entering taxiway B, where it came to a stop. The cockpit crew reported executing the engine shutdown and fire-extinguishing procedures, meanwhile monitoring the engine gas temperature (EGT).

At about the same time Air Traffic Control informed the flight crew that engine #1 was on fire. The flight crew reported there was no fire warning, and that the Engine Gas Temperature, EGT, was increasing even after the fuel was cut-off. The cockpit crew concluded that apparently a tail pipe fire on both engines had occurred. The cockpit crew requested the assistance of a towing car to tow the aircraft to the parking place. Meanwhile the fire fighting was converging to the aircraft and starting to spray extinguishing foam into both the engine tail pipe nozzles.

Meanwhile fire fighters who were on standby during a bomb threat and fire extinguishing training exercise, started to spray extinguishing foam into both engine inlets and tailpipe nozzles.

All persons on board disembarked through the right forward door using the normal passenger stair, and the aircraft was towed to the parking area for baggage and cargo off-loading.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others	TOTAL
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/ None	12	55	-	67
TOTAL	12	55	-	67

Note: passengers include two infants.

1.3 Damage to Aircraft

The engine teardown revealed that severe corrosion had occurred on engine #1, while engine #2 showed slight corrosion due to chemicals.

The engine #1 teardown showed that all modules in its gas path (i.e. the fan case group, the Low Pressure Compressor, (LPC), the High Pressure Compressor (HPC), the intermediate case, the diffuser case, the High Pressure Turbine (HPT), the Low Pressure Turbine (LPT), and the Tail Exhaust Cone (TEC), were found contaminated with fire extinguishing foam. The ingestion of extinguishing foam in the hot section parts of the engines (i.e. the TEC, Low Pressure and High Pressure Turbine modules) caused severe damage due to chemical corrosion.

The teardown inspection revealed no indications of engine fire.

Engine #2 was serviceable after minor repairs, and engine #1 had to be replaced for repair and overhauling.

1.4 Other Damage

Not relevant.

1.5 Personnel Information

1.5.1 Cockpit Crew

1.5.1.1 Pilot in Command

Gender	: Male
Date of Birth	: 09-12-1962
Nationality	: Russia
Certificate Number	: 002192
License Category	: Airline Transport
Type Rating	: A310
Medical Certificate	: Class I
Date of Last Medical	: 13-09-2000
FLIGHT TIME	[hours]
Total Time	: 7,165
Pilot in Command	: 1,303
Instructor	: -
This Make & Model	: 2,637
Last 90 Days	: 156:23
Last 30 Days	: 13:23
Last 24 Hours	: 01:53
Last Proficiency Check	: 25 April 2000

1.5.1.2 First Officer

Gender	: Male
Date of Birth	: 02-11-1965
Nationality	: Russia
Certificate Number	: 007915
License Category	: Airline Transport
Type Rating	: A310
Medical Certificate	: Class I
Date of Last Medical	: 13-07-2000 (Indonesia) 04-10-2000 (Russia)
FLIGHT TIME	[hours]
Total Time	: 5,050
Pilot in Command	: -
Instructor	: -
This Make & Model	: 1,600
Last 90 Days	: 170:37
Last 30 Days	: 17:33
Last 24 Hours	: 01:53
Last Proficiency Check	: 03 October 2000

1.5.2 Cabin Crew

Ten cabin attendants were on board, supervising the disembarkation through the right forward exit. The attendants reported that misunderstandings and or miscommunications had occurred with the persons on the ground. The cabin attendants reported that the exit door #2 (front and right of the cabin) was force-opened by persons from the outside of the aircraft.

1.6 Aircraft Information

Registration Mark	: PK-AWA
Manufacturer	: Airbus Industry
Type/ Model	: A310-322
Serial Number	: MSN-440
Category	: Transport
Crew (Cockpit/Cabin)	: 2 / 10
Pax seats	: 175
Time Since New	: 45444:23
Cycles Since New	: 16754

Engine Type	: Turbofan
Manufacturer	: Pratt & Whitney
Type/ Model	: JT9D-7R4-E1
Serial Number #1	: 707707
▪ TSN	: 27,310 hours
▪ CSN	: 13,523 cycles
Serial Number #2	: 707710
▪ TSN	: 39023:38
▪ CSN	: 16265

1.6.1 Thrust Reverser System

Engine thrust reverse is obtained by reversing the fan air-stream (see Appendix D). The thrust reverser system employs a two position (i.e. stowed / deployed) pneumatically actuated translating sleeve / cascade / blocker door type reverser (see A310 Region Air Flight Crew Operating Manual). Pneumatic power for thrust reverser operations is provided by the 15th stage high pressure compressor bleed air.

When thrust reverse is selected the locks of each reverser master actuator will be released, and the pneumatic actuator caused the translating sleeves to move to open position, exposing the fixed cascade. Simultaneously, twelve blocked doors extended into the fan air stream to block the normal fan airflow path and reverse the air stream to forward direction to provide reverse thrust to backward.

With the blocked doors deployed, the fan airflow is directed outboard through the fixed cascades which deflect the flow in an outward and forward direction. After receipt of a reverser stow signal from the thrust reverse control lever, the translating sleeves.

1.6.2 Engine Maintenance Record

According to the Sabena JT9D-7R4 Engine Condition Report, (see Appendix E) on October 8, 1998 the engine s/n 707710 has experienced a fire occurrence. The Sabena ground inspection revealed burned wires on RH engine side in the area of fuel pump, fuel heater valve and the area above. The Sabena conclusion said that the fire caused by at least two fuel leaks from the fuel manifolds at high power associated with a hot air leak from the fuel heater hose. The fire extinguished by itself as the fuel leak stopped at lower power.

This information provided just for showing the look like report of fire evidence.

1.7 Meteorological Information

The BMG provided the following information concerning the weather conditions at Balikpapan, Sepinggan Airport at the time of the incident:

Wind	: 230° / 8 knots
Visibility	: 9 km
Weather	: Nil
Cloud	: SCT 2000 ft
TT/TD	: 30 / 24
QNH	: 1009 / 29.81
QFE	: 1008 / 29.78

Information from the Sepinggan Airport about the weather situation between 02:56 and 03:35 on the daylight of the incident indicated that there was no sudden change in wind direction or speed, and no rainfall during this period.

1.8 Aids to Navigation

Not relevant.

1.9 Communications

Communication between the aircraft and air traffic services is recorded by automatic voice recording equipment in tower. The recording quality of the conversation was in good condition.

There was no direct communication between fire fighting and the aircraft.

1.10 Aerodrome Information

Airport Name	: Sepinggan
Airport Identification	: BPN WRLL
Airport Operator	: Angkasa Pura I
Certificate Number	: Data not available *)
Runway Direction	: 07
Runway Length	: 2500m
Runway Width	: 45m
Surface Condition	: Dry

*) The investigations indicated that at the time of investigation the Sepinggan airport was never certificated.

1.10.1 Air Traffic Control

During the descent to 9000', Balikpapan Approach Control advised AWQ730 to expect landing using Runway 07 due to airport exercise activities (see Appendix B), although the aircraft may experience a slight tailwind.

1.10.2 Tower

At the time of occurrence, the airport fire-fighting unit informed the Sepinggan Tower that they observed engine fire on both engines of the airplane during the landing roll. Then the Tower told the fire-fighting unit to intercept the aircraft for possible assistance. The tower also declared the runway closed for operations.

1.10.3 Fire Fighting Unit

At the time of the occurrence, the fire-fighting units was on final phase of an airport bomb threat emergency exercise, and were waiting to start a fire fighting training exercise.

Five moving vehicles were involved in the bomb threat training exercise (a command car, a rescue tender, two foam tenders, and an ambulance).

The crew of the foam tenders reported to have observed flames coming from both the engines of the PK-AWA A310. The fires were reported to the Tower. The two tenders immediately chased the aircraft through taxiway C and when the aircraft came to a stop on taxiway B, both tenders started spraying both engines. Due to only few flames appeared on #2 engine, the fire-fighting then focus heavily on #1 engine.

Meanwhile the third foam tender was on standby when the bomb threat emergency training exercise was held, but immediately joined the first two foam tenders, spraying the #1 engine inlet cowl using also foam extinguisher.

1.11 Flight Recorders

The flight data recorders were sent to the ATSB read out facilities for read outs and analysis under supervision from the NTSC. Both recorders were in good conditions, and provided good data.

1.11.1 Flight Data Recorder (FDR)

The aircraft was equipped with a AlliedSignal Commercial Avionics systems Part No. 980-4100 Universal Flight Data Recorder which is designed to record a minimum of 25 hours of flight time. The FDR read-out is shown in Appendix C - FDR Plot and Transcript.

1.11.2 Cockpit Voice Recorder (CVR)

The aircraft was equipped with a Loral Data Systems (Fairchild) model A100A cockpit voice recorder. The recording duration was about 30 minutes. Sound recorded from a cockpit area microphone and the headsets of the pilot in command and the copilot. Parts of the record of communications from the CVR were reproduced in Appendix B - CVR Transcript.

1.11.3 Video Camera Recorder

There was a video camera used to record the event of bomb threat emergency and fire-fighting training exercise. The camera also captured the movement of the aircraft during touchdown, landing roll and the following fire extinguishing actions. The video tape showed that:

1. White colored smoke was observed originating from the wheels as it made contact with the ground. The wind sock indicated a direct tailwind (3/4 horizontal)
2. The nose landing gear touchdown occurred approximately $\pm 7s$ after the main wheels, also showing white smoke as the wheels contacted the ground.
3. A flame appeared from the exhaust nozzle of engine number two and a black smoke came out from engine number one exhaust. These observed phenomena happened at the final moments of the landing roll, while the aircraft was exiting the runway to turn into, and finally stop on taxiway B.
4. Fire fighting sprayed the left engine exhaust, while smoke was emitted raised from the engine's side. Fire fighting personnel sprayed foam into the inlet cowl and tailpipe section of #1 engine. It was reported that smoke was observed coming from within the engine.
5. Passenger disembarked from the right forward exit using a normal passenger stair. During the rescue and fire fighting efforts, fire fighting personnel is observed attempting to open the right forward exit door by force.

1.12 Wreckage and Impact Information

Not relevant.

1.13 Medical and Pathological Information

Not relevant.

1.14 Fire

An post occurrence inspection of both engines showed no indications of engine fire, and the only evidence was of a fire usually associated with a so called tail-pipe-fire phenomenon. As known, a tail-pipe-fire occurred if the engine stalled. No evidence fire was found outside the fire-designated-zone.

1.15 Survival Aspects

During the spraying, an unauthorized person (DanLanUd) gave the command to the fire fighting personnel to begin an evacuation of the persons on board. The rescue and fire fighting personnel moved a passenger stair to the right forward passenger exit door, and attempted to open the door from the outside, while the slide bar was still in its armed position. Had the door been opened while the slide bar was in its armed position, the bar would automatically deploy and would push the fire

fighting personnel as well as the passenger stair. All the passengers disembarked from the right forward door after the cabin attendants disarmed and hold off the crank of the door.

Approximately at the same time, the tower also requested an evacuation to the PIC, which responded that it was not necessary. However, after several minutes the tower insisted the PIC again to open the left door. The PIC then instructed the purser to do disembarkation through right forward exit door.

1.16 Test and Research

Not applicable.

1.17 Organizational and Management Information

Aircraft Owner	: MSA1/ ILFC
Address	: Wilmington Trust Company Rodney Square North 1100 North Street Wilmington, Delaware, USA
Aircraft Operator	: P.T. AWAIR International
Address	: Graha Aktiva 3 rd floor Jl. H. Rasuna Said Blok X-1 Kav. 3 Jakarta, INDONESIA
Certificate Number	: AOC/ 121-009
Operator Designator	: AWXH

1.18 Other Information

1.18.1 Authority Control

PT. AWAIR is an Indonesian air operator, which operates Airbus A310 under Civil Aviation Safety Regulations Part 121 for scheduled commercial carriers. PT. AWAIR is holding a valid Air Operator Certificate issued and controlled by the Directorate General of Communications.

The flight crews of the occurrence aircraft are of Russian nationality. Directorate of Airworthiness Certification controlled the pilots' licenses-

PT. Angkasa Pura 1 operates the Sepinggan airport, Balikpapan. There is no operating certificate controlled by Minister of Communications.

1.18.2 Aircraft Operational Procedure

The aircraft operational procedures were taken from the Region Air flight crew manual. These manuals were used by PT. AWAIR at the time of the incident. Engine abnormal procedures

The engine abnormal procedures check list instructed that when a tailpipe fire occurred, the flight crew has to do a dry motoring and cut the shutoff fuel lever to closed position until the fire disappears. Caution: Except as last resort, do not use ground fire extinguisher may cause serious engine damage (page 14,rev.29,seq 055).

The following are excerpts from "Crew Operating Manual" of the Region Air (rev 27), regarding Standard Operating Procedures, Aircraft General, Landing.

1. Airport operation limitations: landing tail wind 10kts
2. During full reverse; monitor N1, EGT and IAS; and an 80kts or IAS fluctuations must be announced
3. When an internal tailpipe fire happened, except as a last resort, do not use ground fire extinguisher, as serious engine damage may result (abnormal Procedures of AWAIR, rev 29)

1.18.3 Maintenance Documents

At the time of the occurrence, the Maintenance Program was not yet approved by the DGAC. The engine maintenance is using an "on condition program" procedure. An inspection of the documents indicated that there was no reliability program and no engine condition monitoring which are mandatory for the on-condition program.

1.18.4 Airport Emergency Procedure

At the time of incident, the Airport Emergency Planning was still in the process of obtaining approval by Directorate General of Air Communications and was not approved yet.

1.18.5 Airport Manuals and Procedures

1. The existing Fire fighting Emergency Procedure says that if a pilot reported to have an emergency situation, the tower will inform the emergency to the fire fighting by phone or handy talkie (HT) to proceed to the aircraft location and wait for further instructions. (Balikpapan, 25 April 1994)
2. The ATC emergency manual requires the tower to close the runway during an emergency.

Note: All procedures that mention in section 1.18.5 Airport Manuals and Procedures were local procedures that not approved by DGAC.

2 ANALYSIS

2.1 Engine Stall

Engine tailpipe Fire

Tailpipe fires may happen during engine start-ups, or may be due to unscheduled engine shutdowns, as indicated by a rapidly increasing EGT. This may observe by the cockpit crews through the engine indication or the ground crew can report tailpipe fire.

The DFDR readout revealed that at time frame 22930-22935 (see Appendix D) the deceleration slope airspeed was steeper than ground speed. This condition happened after the thrust reverser had been deployed. Apparently the difference slope caused by the slower airflow velocity around the Pitot tube due to increasing static air pressure in front of the engine. While the ground speed decreased, the air speed accelerated from 44kts - 55kts at frame 22941-22945. This condition indicated that the thrust reverser power was abruptly down, therefore the air disturbance around the pitot tube and static port began to vanish. Where the airspeed was 44 knots (At frame 22942), the engines stall happened almost simultaneously. This was evidence by the black smoke behind the engines as seen from the video camera.

The most likely cause of the stall was re-ingestion of the reversed airflow due to reverse thrust still applied below the reverse thrust minimum limit airspeed (80kts), aggravated by a slight tail wind blowing the reverser efflux forward. The re-ingestion makes the airflow to the intake with a high angle of attack, which is prone to airflow separation at the engine inlet cowl.

2.2 Tail-Pipe-Fire

Had an engine stall or surge happened, an unscheduled engine shutdown will follow. At that condition in the combustion chamber, fuel would continue delivered and it will burn at the engine exhaust. This phenomenon is known as tailpipe-fire, which would be evident to the outside observer. In the cockpit, it would not cause the engine fire warning activated, the only indication of this phenomenon is by the rising of the EGT quickly. When this condition occurred, the crew should immediately shutoff the fuel lever to close position and do dry motoring until the EGT decreasing.

However, a relatively long elapse times after the stall occurred and before the fuel was cut-off by the flight crew. Therefore the unburned fuel in the combustion chamber was blown to the exhaust due to fading out of the HP compressor. This condition can be seen from the DFDR read out, that the EGT remained high ($\pm 500^{\circ}\text{C}$) at 22945-22950 while EPR had reached ± 1.03 and then fuel flow was rapidly decreasing.

The tailpipe fires are frequently happened in normal jet-engine aircraft operation. When this condition occurred the ground crew is in standby to watch the fire is not spread out from the exhaust.

2.3 Rescue and Fire Fighting Procedures

No.	What happened	ICAO Doc 9137-AN/898	Remark
1	The crew of the foam tenders observed flames coming from both the engines of the PK-AWA A310. The two tenders immediately followed the aircraft through taxiway C to extinguish the observed fires on both engine #1 and 2 of the Airbus 310. The fires were reported to the tower, by the command car.	12.1.4 When information is received from a person other than an air traffic control officer on duty that an aircraft accident has occurred or appears to be imminent, the airport rescue and fire fighting service will turn out in the same manner as if the call had been given by air traffic control. Air traffic control must be informed at once of the nature and situation of the emergency.	In compliance with ICAO standard 12.1.4
2	The PK-AWA stopped on taxiway B, with then both foam tenders behind it. The tenders started spraying foam into the engine #1 tailpipe, another foam tenders stopped in front of the #1 engine spraying foam into the engine inlet cowling	12.2.9 Confined turbine engine fires (jet). Fires confined to the combustion chambers of turbine engines best controlled when the flight crew is in a position. To keep the engine turning over and it is safe to do so from the viewpoint of aircraft evacuation and other safety considerations. Fire fighters will have to stand clear of the exhaust but may have to protect combustible from exhaust flames. Fires outside the combustion chambers of turbine engines but confined within the nacelle are best controlled with the aircraft built-in extinguishing system. If the fire persists after the built-in system has been expanded and the turbine shut down, Halon or dry chemical may be used to attempt extinguish	The fire fighters were not trained in the procedures of handling confined turbine fires
3	As the airplane type is certificated by the FAA, JAA, and DGAC, therefore it must have complied with the CASR Rev.0 121.263(a) "Unless the certificate holder shows that equivalent protection against destruction of the airplane in case of fire is provided by the use of fireproof materials in the nacelle and other components that would be subjected to flame, fire extinguishing systems must be provided to serve all designated fire	12.2.10 Foam or water spray should be used externally to keep adjacent aircraft structures cool. Foam should not be used in the intake or exhaust of turbine engines unless control cannot be secured with the other agents and the fire appears to be in danger of spreading.	At the time of occurrence the fire fighting personnel were not trained to handle the situation, and assumed that the way to extinguish the perceived fire is to use chemical agents to contain the fire in the intake or exhaust of turbine engines.

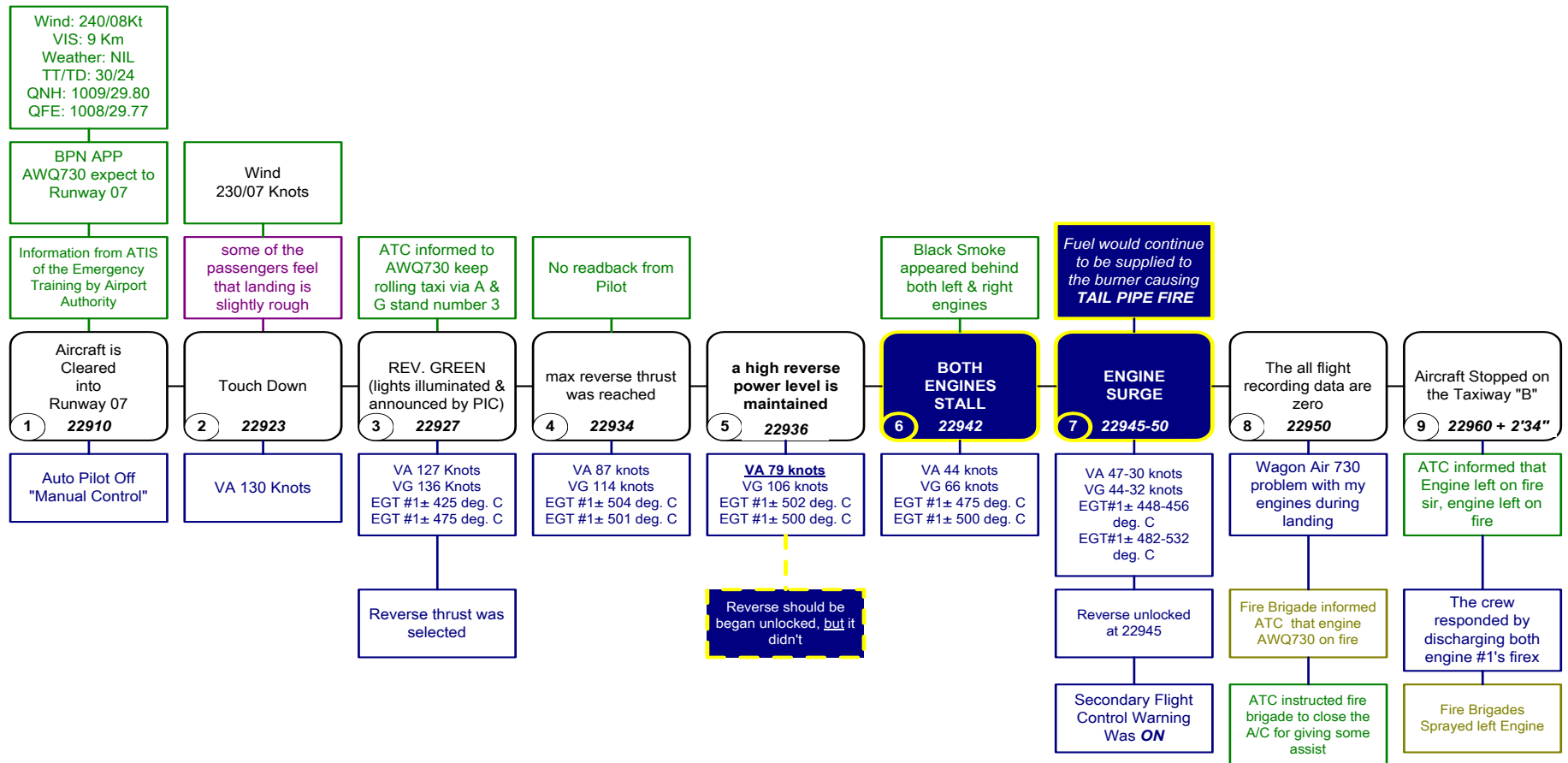
	zones"; and 121.277(a) "except as provided in paragraph (b) of this section, all airplane surfaces aft of the nacelles in the area of one nacelle diameter on both sides of the nacelle centerline must be made of material that is at least fire resistant."		
4	Excerpts from the CVR: "We have to confirm passenger evacuation, just confirm sir!" [F/O] We don't need emergency evacuation, the ground staff shows that everything is O.K. [PIC] "...Evacuation...!". [ATC]	12.3.20(b) Rescue and fire fighting personnel. It will be their duty and responsibility to assist crewmembers in any way possible. Since crew members' visibility is restricted, rescue and fire fighting personnel should make immediate appraisal of the external portion of the aircraft and report unusual conditions to the crewmembers. Protection to the over-all operation is the primary responsibility of the rescue and fire fighting personnel. In the event crewmembers are unable to function, the rescue and fire fighting personnel will be responsible for initiating necessary action.	The fire fighting personnel did not report the unusual conditions to the flight crew, but started to extinguish the perceived tailpipe fire. The initiative to initiate actions was premature as the flight crew was reported still in a position to control the situation.
5	There was no any method of direct communication established between the cockpit and the fire fighting. Moreover, it was made worse by the overriding command of an unauthorized person.	12.3.21 Communications. Due to the necessity for communications between crewmembers and rescue and fire fighting personnel, immediate steps should be taken to establish direct contact between persons in charge of each crew. This will ensure that all factors are properly considered before actions are initiated. Several methods of providing this direct communication are generally available: ...	No compliance to ICAO standard 12.3.2.1 as there was no direct contact or coordination between firefighting personnel and flight crew.
6	The fire fighting personnels moved a pax stair to the right forward door, and then tried force open it from the outside.	12.3.26 Evacuation. As previously stated, the final determination regarding evacuation from the aircraft must be made by the crewmembers with the rescue and fire fighting personnel acting under their direction. Since it is nearly impossible for rescue and fire fighting personnel to become completely familiar with all aircraft and due to extensive training of crew members in aircraft emergency procedures, they are in a much more favorable position to make decision concerning the evacuation from the aircraft.	The crisis management on the ground, and the coordination between cabin crew and fire fighters personnel was not satisfied according to the minimum ICAO Standard.

3 CONCLUSIONS

3.1 Findings

1. The engine stalls were due to the pilot being slightly late in reducing to reduce the reverse thrust to idle position. The engine stalls occurred as a result of late stowing of the reverse thrust to the idle position.
2. The fire fighting personnel failed to recognize a tail pipe fire phenomenon in jet engine operation.
3. No direct communication was established between the cockpit crew and the fire fighting during the occurrence as required according to ICAO doc. No 9137-AN/898
4. The ground coordination during the rescue and fire fighting operations was not according to the minimum standards as set forth by ICAO doc No 9137-AN/898
5. At the time of the occurrence the PT AWAIR maintenance program was still in the process of to obtain approval from the DGAC
6. There were no approved mandatory reliability programs to support the use of a company engine on-condition maintenance program. The engine on-condition maintenance programs was not supported by an approved reliability program .
7. The damage to the engines as a result of the spraying of the chemical foam extinguisher was extensive.

3.2 Event Links of Occurrence



3.3 Safety Threats

1. There was no direct communications established between the cockpit crew and the fire fighting crew during the rescue and fire fighting operations
2. An unauthorized person took over the coordination of the ground emergency operations.
3. There is no Indonesian regulation governs the certification process of airport operation standard and requirement.

4 RECOMMENDATIONS

The National Transportation Safety Committee recommends the DGAC the followings:

1. Establish a regulation for the certification and operating requirements for airport.
2. Ensure that every organization who conduct airport management must has an approved Airport Operator Certificate as prescribed in “Peraturan Pemerintah Republik Indonesia Nomor 3 Tahun 2001; tentang Keamanan dan Keselamatan Penerbangan” (Government Regulation on Aviation Safety and Security).
3. Ensure that an approved Manual for Emergency Procedures is available to every operator in Indonesia to do aviation activities and the safety level contained must not below the minimum ICAO standard.
4. Ensure that every fire fighting personnel must have a valid License of Fire Equipment and Salvage Operation.
5. Requires Angkasa Pura I to take proper actions to improve the education and training of fire fighting personnel on the following areas:
 - a. Knowledge on a tail pipe fire phenomenon and all designated fire zone in every aircraft type served by the airport.
 - b. How to handle confined turbine engine fires (jet) properly.
 - c. Establishing a direct communication system between the fire fighting personnel and the cockpit crew at an emergency situation.
 - d. How to manage rescue operation according to the airport standard operation procedures.
 - e. In the emergency condition, it must be prevented an unauthorized person issuing commands to the emergency team.
6. Requires every operator to give copies of the airport-handling manual of each of type of aircraft to every airport destination.
7. Enforce that every Indonesian air operator to use an Approved Maintenance Program.
8. Ensure that pilots should follow the AOM consistently.

Appendix A - Occurrence Situation



Appendix B - CVR Transcript

No	Action	Time	Description	Remarks
1		00:21	Single Chime	
2	PF (F/O)	01:14	Auto Pilot off "Manual Control"	
		01:31	Glide Slope 4 x	
	PNF (PIC)	01:32	This is wrong indication	
	PF (F/O)		Cancel please	
		01:50	Glide Slope 4x	
3		02:12	Glide Slope 2x	The ILS was installed on RunWay 25
		02:15	Glide Slope 2x	
	PNF (PIC)	02:20	"Reduce Vertical Speed little bit"	
	PF (F/O)		It's O.K., runway is too short	
		02:33	One Hundred	
		02:49	One Hundred	
		02:53	Fifty	
		02:54	Forty	
		02:55	Thirty	
		02:56	Twenty	
		02:57	Ten	
		02:59	Roll out	
3	PNF (PIC)	03:03	Reverser Green	
		03:04	Reverser deploy (Indicate from Graph)	
		03:05	Reverser sound going out	
		03:20	Pilot said sound but not clear	
		03:21.310	Sound "dunk"(first) 2x like engine stall	
		03:21.851	Second "dunk"	
		03:26	Sound "creck" 2x not clear/ unidentified mechanical sound	
	PF (F/O)	03:28	Sound "tink" 2x (like master warning) "What's happened"	
		03:31	Sound "tink" 2x (like master warning)	
		03:33	Second sound "tink"	
	PNF (F/O)	03:34	Second sound "tink" "One engine failed, Both engines failed"	
		03:35	Third sound "tink" coming up	
	PNF (F/O)	03:41	Is nose wheel steering still operative?	
	PF (PIC)		Yes, possible for a while	
		03:44	Third sound of "tink" stop	
	PNF (F/O)	03:46	Set brakes in Alternate OFF	
		03:48	Sound of "tuck" (first)	

	PF (PIC)	03:49	Let's try vacate via "Bravo"
		03:51	Sound of "tuck"(second) (not identified)
	PF (PIC)	03:52	O.K. we still have the speed
	ATC	03:57	Seven three zero Sepinggan (call from ATC – 02:56 UTC)
5	ATC	04:14	"Engine left on fire Sir!"
	PNF (F/O)	04:15	Repetition of ATC:" E. e engine left on fire" (it looks like the Pilot confirm of ATC information read back)
	PNF (F/O)	04:16	He said that we have engine fire
	(PIC)	04:17	Which One?
	(F/O)	04:18	The fourth "tink" (comes on) He said left, but I'm not sure Check once more, I have control
	(PIC)	04:20	Let's check all the parameters again May be EGT overlimit
		04:22	The fourth "tink" stop
		04:25	A single sound "tink"
		04:27	A single sound "tink"
		04:29	A single sound "tink"
	(F/O)	04:35	"Ask the tower which engine is on fire"
	(F/O)	04:40	Everything is O.K., we don't have any fire indication
	(PIC)		You see, emergency brigade already surrounded the aircraft
	(F/O)		What are they going to do? Are they going to extinguish fire?
	(PIC)		They already started Start procedure "On ground engine fire"
	PNF (F/O)	04:58	That confirm engine two in fire
6	ATC	05:02	"Oh,eee...will check with my...."
		05:08	Parking brake set. (05:10)
	(F/O)	05:15	Are we going to perform emergency evacuation?
	(PIC)		Stand by
	(PIC)		Attention crew at stations, attention crew at stations
	(F/O)	05:25	"That what both engine shut down"
	(PIC)		"I think that there is no any real fire"
	PNF (F/O)	05:35	"That confirm engine two on fire"
	PNF (F/O)	05:41	"That confirm left engine still on fire"
	ATC	05:46	"Ee... engine on fire"
	PNF (F/O)	05:49	"We have to confirm passenger evacuation, just confirm sir!"
7	(PIC)	06:00	We don't need emergency evacuation, the ground staff shows that everything is O.K.
	ATC	06:08	"Roger will do sir will do!"
	(F/O)	06:11	Did you find out what has happened with the engines? That was both engines shut down

	(PIC)	06:22	I can't understand why both of them shut down simultaneously May be because of reverse, but we used it in a proper way.
	ATC	06:24	"...Evacuation...!".
	ATC	06:37	"...730...Sepinggan!"
	PNF (F/O)	06:38	"...Go head"
	ATC	06:41	"Please your passenger and the go out of from to the aircraft"
	PNF (F/O)	06:48	"Say again please!"
	ATC	06:52	"Ok..e...your passenger e...to get out from your aircraft!"
8		07:01	"But I think engine is extinguish now we can to evacuate via right side please"
	ATC	07:09	"Ok..ok copy"
		07:10	"Ok we waiting for the trap..!"
	PNF (F/O)	07:15	"Because the ground staff (not clear), to right the engine (not clear) is already extinguish but to the right side please to the right side"
	(F/O)	07:26	You see they show that the engine still on fire Shall we set doors to the "Manual"
	ATC	07:28	"E..copy sir!"
	(PIC)	07:31	Wait for a while
	(PIC)	07:39	We don't need emergency evacuation at the time being, but the door selectors should be still until further instruction.
9	(F/O)	08:05	But may engine is really on fire?
	(PIC)		We have to confirm it more clear, because if we start emergency evacuation the people can be injured
		08:08	"No..no...fire...no fire..oh!"
	Pilot	08:12	"You see that!" To engineer:
	(F/O)	08:15	"...Both engine flame out...and left engine was on fire. what do you think, it is normal?" To Purser...!"
	(PIC)	08:21	"All normal, don't panic, everything is O.K. We don't need emergency evacuation"
	PNF (F/O)	08:34	"...Completed...now on fire"
	ATC	08:38	"...Oh ee...you stand by because... The fifth warning "tink" The fifth warning stopped
	(F/O)		He said left engine again on fire
	(PIC)	08:50	Left?
	(F/O)		Yes, left on fire
	PNF (F/O)	08:52	"Left on fire now!"
		08:55	"Roger roger...(not clear) left left on fire...!"
		09:13	"Not fire now..."

		09:15	It may be fire , but I'm not sure , we don't need to perform emergency evacuation the passenger may be injured
		09:21	"I...ok going just to the right side from the trap evacuation from the side...." (not clear)
	(PIC)	09:35	O.K., only right forward door should be disarmed, the others still armed
	PNF (F/O)		O.K. I'll check Captain
	ATC	09:45	"Please open passenger door e... left side sir e...left side sir..!"
	PNF (F/O)	09:50	"Roger roger from right side and you confirm engine already extinguish". (not clear)
	ATC	09:54	"Ee...ee....(not clear)
11	PNF (F/O)	10:04	The sixth warning "tink" extinguish again.
		10:07	The warning stop
			to Purser:
	(PIC)	10:35	"No panic, everything is O.K., passengers disembarkation through the right forward door. Right forward door disarm and open."
	(PIC)	10:40	I don't like this, may be we need to extinguish second engine as well?"
	(F/O)		No, Captain, everything is O.K. all parameters are good.
			But let me check by myself, may be there is a real fire.
	(F/O)	13:55	Do you think it was a real engine fire?
	(PIC)		But they tried to extinguish something, and you saw that the temperature rise over limit and did you got that smell.
	(F/O)		I think that smell is because of they used fire extinguisher directly into the engine.
	(PIC)	15:13	What do you think may be we missed something?
	(F/O)		I don't think so, it looks like everything was done is O.K..

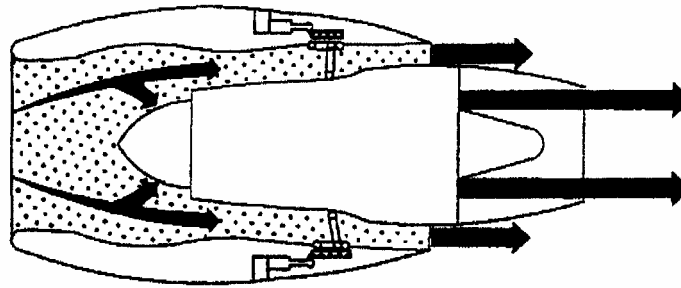
Appendix C - FDR Plot and Transcript

DFDR READOUT			
No	Elapsed time	Recorded	Remarks
1	22900 – 22905	Data begin to be displayed	
2	22905 – 22910	Just normal indication	
3	22910 – 22915	Just normal indication	
4	22915 – 22920	N2 Eng2 80% rpm , and begin to decreasing All EPR parameters began to slightly decrease EGT Eng1 420 C & Eng2 419 C began to slightly decrease	N1 Eng1 data is not available
5	22920 – 22925	touch down , air speed 131 knots , ground speed 146 knots , vertical acceleration 1.5g at 22923 EVM Fan Eng1, 2 & Turbine Eng2 0.2 cm/s ; meanwhile Turbine Eng1 1.5 cm/s and began to decrease	EVM Turbine Eng1 7.5x higher than the others
6	22925 – 22930	T/R Full Reverse began to be deployed at 22927 All Power Level Angle began to increase until 180 degrees (max.) All fuel flow parameters increasing N2 Eng2 stopped decreasing at 65% rpm , and begin to increasing All EVM parameters began to increase All EPR parameters began to slightly increase All EGT parameters began to increase	
7	22930 – 22935	N2 Eng2 became stabilized at 92% rpm Deceleration slope of air speed was steeper than ground speed EPR Eng1 was stabilized slightly higher than Eng2 While EGT Eng2 began to stabilize at 500 C , EGT Eng1 still increasing	
8	22935 – 22940	All Power Level Angle began to decrease till 0 degrees and hereafter all Power Level Angle began to increase till 45 degrees Deceleration slope of air speed was steeper than ground speed EGT Eng1 began to stabilize at 500 C	
9	22940 – 22945	While ground speed still decelerated, the air speed decelerated at 44 knots at 22942 and began accelerated till 55 knots at 22943 ($\pm 15s$ after T/R deployed), hereafter began to decelerate again <u>At 22940</u> fuel flow Eng1 5847.2 kg/h & PLA1 3° while <u>at 22941</u> fuel flow Eng2 4101.6 kg/h & PLA2 6°, hereafter all fuel flow parameters began rapidly decreased N2 Eng2 began decreasing All EPR parameters began to slightly decrease Secondary Flight Control warning began to be on <u>at 22944</u>	
10	22945 – 22950	T/R Full Reverse began to undeployed at 22945 All Power Level Angle began to decrease till 0 degrees N2 ENG2 BEGAN RAPIDLY DECREASED All EVM parameters began to decrease	The warning was on due to the thrust reverser or spoiler were <u>unable</u> to normal position

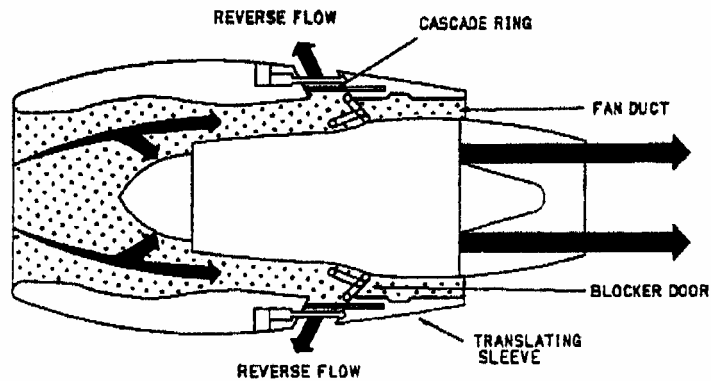
		All EPR parameters was rapidly decreasing (1.04 & 1.025) All EGT parameters just began rapidly decreased (EGT1 456 C & EGT2 532 C) Secondary Flight Control warning was on Magnetic Heading changed from 70 till 0 degrees	The aircraft turned into taxiway B
11	22950 – 22955	air & ground speed became ZERO N2 Eng2 reached ZERO EPR Eng2 reached ZERO EGT Eng2 reached air temp Secondary Flight Control warning was on	
12	22955 – 22960	All EVM parameters reached ZERO EPR Eng1 reached ZERO EGT Eng1 reached air temp	

Appendix D - Thrust Reverser System Schematics

0213809555 EOR08UDUR B CTR		332 P05	NOV 23 '00 13:42
A310 REGIONAIR FLIGHT CREW OPERATING MANUAL	POWER PLANT THRUST REVERSER SYSTEM SCHEMATICS	1.17.50	
		PAGE 2	
		REV 16	SEQ 020



STOWED (VIEW LOOKING DOWN)



DEPLOYED (VIEW LOOKING DOWN)

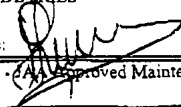
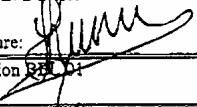
OPS.FCO B1.1750.002-AA.020

PW Eng.: All

RGA ALL

AI / V-F 1000

Appendix E - SABENA JT9D-7R4 Engine Condition Report

*SABENA BELGIUM WORLD AIRLINES ENGINEERING DEPARTEMENT		JT9D-7R4 ENGINE CONDITION REPORT		CUSTOMER REFERENCES ORDER 01/3700067																												
				SABENA REFERENCES CAT No EX052688																												
Customer: <i>swissair</i>		Engine Manufacturer <i>PWA</i>		S/N: <i>707710</i>																												
		Type <i>JT9D-7R4 G2</i>		Date: <i>FEB/10/99</i>																												
Removed A/C Model: <i>A310</i>		Pos: <i>2</i>		Date: <i>9/10/1998</i>																												
Reason: <i>Hot air leak / harness burnt</i>		Place: <i>Dubai</i>		Aircraft: <i>HB-IP1</i>																												
Engine		TT: <i>35149</i>		TSO: <i>2747</i>																												
		TC: <i>14413</i>		CSI: <i>863</i>																												
1. CONDITION AS RECEIVED - General: Entry inspection: PD valve screen damaged VSV rigging check disclosed a 5th stg too opened During boroscope inspection: Small impacts on L.E. 7 th stg HPC blades within E.M. . 3 liners cracked in outer CC at 1 o' clock position within limits 2 liners cracked in inner CC at 12 o' clock position within limits. 1 1 st stg NGV pos 7 o' clock cracked in window within limits and 1 shows black spot on L.E.(not burnt).																																
OIL ANALYSIS: <table border="1"> <thead> <tr> <th></th> <th>Fe</th> <th>Cr</th> <th>Ni</th> <th>Ti</th> <th>Cu</th> <th>Ag</th> <th>LRN</th> <th>Contamination</th> </tr> </thead> <tbody> <tr> <td>OIL TANK</td> <td>1.1</td> <td>0.8</td> <td>0.2</td> <td>0.7</td> <td>0.1</td> <td>2.8</td> <td>/</td> <td>OK</td> </tr> <tr> <td>GEAR BOX</td> <td>1.2</td> <td>1.0</td> <td>0.3</td> <td>0.7</td> <td>0.0</td> <td>1.5</td> <td>/</td> <td>OK</td> </tr> </tbody> </table>							Fe	Cr	Ni	Ti	Cu	Ag	LRN	Contamination	OIL TANK	1.1	0.8	0.2	0.7	0.1	2.8	/	OK	GEAR BOX	1.2	1.0	0.3	0.7	0.0	1.5	/	OK
	Fe	Cr	Ni	Ti	Cu	Ag	LRN	Contamination																								
OIL TANK	1.1	0.8	0.2	0.7	0.1	2.8	/	OK																								
GEAR BOX	1.2	1.0	0.3	0.7	0.0	1.5	/	OK																								
Filter inspection: Not received																																
2. ENGINEERING FINDINGS - General condition and / or cause for removal of the unit : October 8, 1998 on the flight KIH-DBX after 25 min in flight (FL390), nacelle temperature started to rise continuously to 65%. With power reduction, nacelle temp. decreased as well. Normal nacelle temperature indication on this engine is 36-40%. Power lever advanced to 1.2 EPR, nacelle temperature increased to 100% (fire). With reduced power flight continued and A/C landed after 1 3/4 eventually in DXB. Ground inspection revealed burned wires on RH engine side in the area of fuel pump, fuel heater valve and the area above. SWR maintenance had replaced the fuel pump few days ago before the event to fix a fuel leak.																																
Warranty Action Yes ☐ No ☒		Name: L. DEVRIES Prepared Signature: 		Name: L. Devries Approved Signature: 																												
* FAA Repair Station No SBEY 985H - 44A Approved Maintenance Organization RPA																																

SABENA BELGIAN WORLD AIRLINES ENGINEERING DEPARTEMENT	JT9D-7R4 ENGINE CONDITION REPORT Manufacturer <i>PWA</i> S/N: <i>707710</i> Type: <i>JT9D-7R4 G2</i> Operator: <i>swissair</i>		Date: <i>FEB/10/99</i> Page 3 of 11											
<u>3. Summary of work accomplished during this shop visit.</u> Engine has been repaired as necessary. <u>4. Significant conditions found during disassembly and preliminary detail part inspection</u> 4.1. <u>Shop visit at Sabena</u> <table border="0"> <tr> <td><u>Removed</u></td> <td colspan="3">T1 blade condition</td> </tr> <tr> <td>Date</td> <td>Aug 6/97</td> <td>AT. T.T</td> <td>32400</td> </tr> <tr> <td></td> <td></td> <td>T.C.</td> <td>13550</td> </tr> </table> 4.2. <u>Engine sections</u> <u>General remark:</u> Usual deteriorations, such as wear, cracks and deformations, which do not affect performances neither engine reliability, are not taken into consideration in this report. <u>EXTERNAL PARTS</u> - Primary left fuel manifold pos. 20 PN : 672315 leaks at ferrule (ferrule to be replaced) - Secondary left fuel manifold pos. 12 PN : 647036 leaks at ferrule (important deformation, to be replaced) - Primary left fuel manifold pos. 19 PN : 677353 does not leak but exhibit also severe deformation at the ferrule. - fuel heater hose PN: 784965 pierced through the below. - Engine core wire harness PN 21W3072 and PMUX core wire harness were burnt at the terminal bracket and close the U/L bleed valve - By precaution we also repaired the following fuel manifolds, PN's 690358 (sec. lft main), 781228 (sec. RH main) 677298 (pri. lft main), 661668 (pri. RH main), 647046 (pri. pos. 1), 697913 (pr. pos. 6), 647124 (pri. pos. 9) 5007510-01 (pri. pos. 11) has been scrapped, 647034 (pri. po. 12), 647042 (pri. pos. 18), 647136 (sec. pos. 5) and manifold supply PN : 807716.			<u>Removed</u>	T1 blade condition			Date	Aug 6/97	AT. T.T	32400			T.C.	13550
<u>Removed</u>	T1 blade condition													
Date	Aug 6/97	AT. T.T	32400											
		T.C.	13550											

SABENA BELOW WORLD AIRLINES ENGINEERING DEPARTEMENT	JT9D-7R4 ENGINE CONDITION REPORT Manufacturer <i>PWA</i> SN: <i>707710</i> Type: <i>JT9D-7R4 G2</i> Operator: <i>swissair</i>	Date: <i>FEB/10/99</i> Page 2 of 11
At sabena, the investigation was pursued with help of a fire and prevention expertise in order to determine the cause of fire and its propagation as 2 fire area's were already localized (a third were discovered later on, after some accessories removal). We started to investigate the probable 1 st fire-place and came rapidly to the following conclusion: The fire was caused by a fuel leak together with a hot air leak to ignite the fuel. The hot air leak was identified. The hose PN: 784965 providing hot air (appr.350 PSI and 400°C) to the fuel heater, was found damaged and the pressure test revealed a leak already visible at 10 PSI. This hose could have been damaged during last fuel pump replacement. The main fuel hose PN AE708942-1 exhibited a deformed attachment flange which could have lead to a fuel leak but further investigation concluded that this hose was not involved. On test cell: Engine motoring and idle run ,with the cowlings open, did not reveal any fuel leak. With the cowlings close, at higher power , some fuel leaks were observed around the fuel pump and from the fuel heater. We replaced then the fuel heater without success. The fuel pump was then replaced, fuel tubes PN: 221-0853-509 and PN: 785316 were replaced, and the EVBC was also replaced but for other reasons. We found also some fuel nozzles tubes slightly loosed behind the fuel pump that we retorqued. An additional run lead us to suspect a fuel tube FN 804668-01 which was then replaced. Those actions did not eliminate all the leaks. As we could not reproduce leak at idle with open cowlings and as the high power test requires a warm up of the engine, a cool down and a time delay to open the cowlings allowing a partial fuel evaporation in the more hot area, we were not able to determine the exact leak location , we decided to continue the trouble shooting in the shop . A detail air pressure test of the fuel manifolds revealed small leaks on fuel nozzles around the top of the engine. Some fuel manifolds were found loosed at the fuel nozzle connections. One complete turn of the nuts was required to torque them. However those manifolds remained wire locked. This could be explained by a high temperature of the manifold nuts due to the fuel burning, allowing sufficient expansion to the nut to jump one thread. The third fire-place was discovered after some QEC stripping, it was small without causing important damages. The fuel burning came from the top running under the diffuser case heatshield and appearing at pos. 9 o'clock. Conclusion: The fire was caused by at least 2 fuel leaks from the fuel manifolds at high power associated with a hot air leak from the fuel heater hose. The fire was extinguished by itself as the fuel leak stopped at lower power.		