AIR ACCIDENTS INVESTIGATION INSTITUTE
Beranových 130
199 00 Praha – Letňany

CZ-23-1016

FINAL REPORT

**of serious incident
of aircraft Boeing 767-332ER(WL)
registration N175DN
on 1st of September 2023
during initial climb from LKPR**

Prague
January 2026

Contents

Acronyms and Abbreviations

AAII	Air Accidents Investigation Institute
ACCREP	Accredited Representative
AGL	Above Ground Level
ALT	Altitude
AMM	Aircraft Maintenance Manual
AMSL	Above Mean Sea Level
APU	Auxiliary Power Unit
ARP	Airport Reference Point
ATC	Air Traffic Control
ATCo	Air Traffic Control Officer
BFU	Federal Bureau of Aircraft Accident Investigation, Germany
BKN	Broken clouds
CMD/CPT	Commander/Captain
CSN	Cycles Since New
CSO	Cycles Since Overhaul
CVR	Cockpit Voice Recorder
DFDR	Digital Flight Data Recorder
E	East
EASA	European Union Aviation Safety Agency
EGT	Engine Gas Temperature
ENG	Engine
FAA	Federal Aviation Administration, USA
FO	First Officer
FOD	Foreign Object Debris
GS	Ground Speed
HPC	High Pressure Compressor
HPT	High Pressure Turbine
ICAO	International Civil Aviation Organization
IFSD	In-Flight Shut Down
ILS	Instrument Landing System
IGV	Inlet Guide Vanes
KJFK/JFK	John F. Kennedy International Airport, New York
LKPR/PRG	Václav Havel International Airport, Prague
LPC	Low Pressure Compressor
LPT	Low Pressure Turbine
METAR	Meteorological Aerodrome Report
MSL	Mean Sea Level
N	North
N/A	Not Applicable

NOSIG	No Significant changes
NRT	Narita International Airport, Tokyo
NTSB	National Transportation Safety Board, USA
PF	Pilot Flying
PIC	Pilot In Command
PM	Pilot Monitoring
PN	Part Number
RWY	Runway
QRH	Quick Reference Handbook
SPECI	Special Meteorological Report
TEC	Tower Executive Controller
THR	Threshold
TSN	Time Since New
TSO	Time Since Overhaul
TWR	Aerodrome Control Tower
TWY	Taxiway
UTC	Universal Coordinated Time
VMC	Visual Meteorological Conditions

A) Introduction

Operator type:	Commercial Air Transport
Aircraft manufacturer:	The Boeing Company, USA
Aircraft type:	Boeing 767-332ER(WL)
Registration mark:	N175DN
Location:	during the initial climb from RWY 24 LKPR
Date and time:	1 September 2023, 10:32 UTC (all times in UTC)

B) Information Summary

On September 1st, 2023, the AAII was notified of an occurrence of the flight DL79, aircraft Boeing 767-332ER(WL), registration N175DN. The aircraft experienced a right engine failure during the initial climb from RWY 24 LKPR. The flight crew decided to return to LKPR. The flight crew and the passengers did not suffer any injuries.

The occurrence had been notified to EASA, European Commission, ICAO and NTSB as the State of Registration, the State of the Operator, the State of Design/Manufacturer of both the aircraft and engines. NTSB appointed the Accredited Representative.

The cause of the serious incident has been determined by:

chair:	Lada Ouhrabková
member:	Vladimír Plos

Final Report has been issued by:

AIR ACCIDENTS INVESTIGATION INSTITUTE
Beranových 130
199 00 Praha – Letňany

Report date: 7. 1. 2026

Report content:

1 Factual Information

The factual information had been derived based on crew testimonies, radio communication aircraft-ATC, DFDR records, documents of the crew members and the aircraft, documents and information provided by LKPR, and analysis made by the engine manufacturer.

1.1 History of Flight

1.1.1 Description of the flight

The flight DL79, planned from LKPR to KJFK, had been scheduled as a regular flight. There were 4 flight crew members on board, Captain seated in the left seat, FO seated in the right seat, FO seated in the center jump seat and FO seated in the jump seat behind the captain. Captain was Pilot Monitoring, FO seated in the right seat was Pilot Flying.

The pre-flight procedures were performed in standard way.

The aircraft took-off at 10:31 from RWY 24 LKPR. At approximately 1,500 ft AMSL, the flight crew observed a loud bang along from the right side of the aircraft with indications of a right engine failure. The right engine flamed out and shut down. There was only engine failure indication, no fire indication.

The flight crew continued the climb, declared an emergency and performed the appropriate QRH procedures. Then subsequently levelled the aircraft at 3,000 ft MSL, informed company dispatch and maintenance and initiated a return to LKPR.

Prague airport initiated full emergency procedures.

The flight crew performed overweight landing and landed uneventfully on RWY 24 LKPR where were met by airport firefighter personnel. The flight crew shut down the left engine and kept APU running. The firefighter personnel provided the temperature measurement of both engines and main landing gear without any non-standard findings.

The aircraft had been then towed to the gate and passengers disembarked.

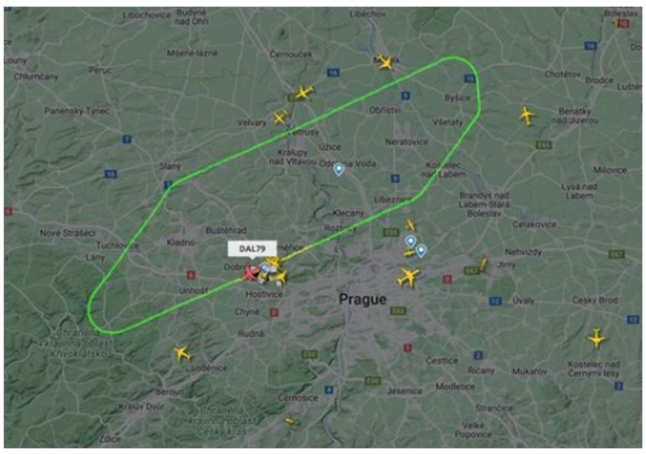


Fig. 1: Flight path of the event flight[1]

1 Source: flightradar24.com

1.1.2 Crew testimonies

1.1.2.1 Testimony of the Captain/PM, seated in the left seat

I was Captain of Delta Air Lines Flight 79 from PRG-JFK on 01SEP23.

During departure climb from PRG runway 24 we experienced a right engine failure at approximately 1,500 feet MSL. We declared an emergency, requested to fly straight ahead and, subsequently, requested vectors back to a landing on runway 24.

After passing through 2,200 feet MSL we performed our engine failure/shutdown procedure, then returned to the airport for an ILS and landing to runway 24.

After landing we stopped on the runway. We then shut down the left engine at the request of Airport Rescue and Firefighting personnel so they could perform an exterior inspection of the aircraft.

After the completion of their inspection, we were towed back to the gate.

1.1.2.2 Testimony of the FO/PF, seated in the right seat

I was First Officer on board Delta Air Lines Flight 79 from PRG-JFK on 01SEP23.

All normal preflight checklist items and procedures were completed prior to taking the runway. FO (name of the FO) conducted the exterior preflight as the relief pilot. Engine start was normal and the right engine had approximately 6 minutes of warm up prior to taking the runway. I took control of the aircraft from the Captain once cleared for take-off and all indications of engine performance were normal as we began our roll through aircraft rotation and clean up.

Shortly after take-off I heard an audible bang from the right side of the aircraft and soon after noted that N1 and N2 indications were dropping and the EGT was rapidly rising. As the pilot flying (PF) I maintained control of the aircraft through application of left rudder and aileron to the left as we continued to fly straight ahead. The crew worked together to accomplish the engine failure checklist and coordinated with PRG ATC for an immediate air return to runway 24 at PRG. The Captain along with the relief pilot (RP) and our 4th pilot, a Lead Line Validation Pilot (LLVP) coordinated with Dispatch, ATC, the Flight Attendants (FAs) as well as made a PA to the passengers of our situation and intent to return to PRG.

We accomplished all pertinent QRH checklist items, including consulting the ODM for our landing performance at the prescribed flaps 20, VREF speed (168KIAS) in preparation for landing. I conducted the NATS brief as we set up for ILS Rwy 24 at PRG and then ran descent and approach checklists. Once we were on final, we complied with the QRH for remaining landing checklist items once configured for landing.

The autopilot remained engaged until 500' AGL at which point I de-selected command (CMD) to fly the remainder of the approach and landing by hand using the flight director (FD). Touchdown occurred approximately 1000' down the runway at approximately 300 feet per minute rate of descent. I touched down using autobrakes 2 due to the overall length of the runway to prevent possible brake issues due to the excessive heat buildup. On touchdown I selected full reverse thrust on the left engine and minimized braking on the right brake. We came to a stop on the runway centerline, and I held the aircraft in place by applying on left brakes as the right brakes indicated 5s and 6s temperature readings.

ATC asked us to shut down the left engine while crash-fire-rescue (CFR) inspected the engine and brakes. CFR placed chocks on the gear to hold the aircraft in place until the tug arrived to take the aircraft to a hard stand to deplane the passengers.

1.1.2.3 Testimony of the FO, seated in the jump seat behind the Captain

I was First Officer on board Delta Air Lines Flight 79 from PRG-JFK on 01SEP23.

Preflight was completely routine as well as pushback, startup, and taxi to the runway for take-off. We started our take-off roll on runway 24 at 1031Z. I was in the jumpseat behind the Captain for take-off as we had a 4-man crew in the flight deck. Take-off and rotation were normal with the First Officer (FO) as the pilot flying in the right seat. As the gear was being retracted at approximately 2-300ft agl, we all heard a loud bang. I had been watching the instruments as my role on take-off and quickly realized we had a right engine failure.

The engine failure callout was made and the pilot flying quickly stabilized the aircraft from yawing. Air Traffic Control (ATC) gave us a radio call to switch to departure frequency. The Captain (the pilot monitoring) declared an emergency due to an engine failure and requested to climb straight out on runway heading. The crew then worked together to accomplish multiple checklists. We stated our intentions with ATC for radar vectors to an emergency return at PRG on runway 24. We divided tasks and communicated with ATC, and the Company when time permitted.

Inside the aircraft we then communicated with the passengers and flight attendants (FAs) to prepare for an emergency landing in Prague. We did not anticipate the need for evacuation. We carefully completed our checklists and went over additional information concerning an overweight landing for our arrival. We received vectors for the ILS 24 and performed a flaps 20 landing touching down at 1055Z. We stopped on the runway and quickly communicated with the FAs and passengers to remain seated as per Company policy.

Responding emergency vehicles inspected the right engine and wheels and brakes for any possible fire. We were told to shut down the remaining engine before the rescue vehicles approached. All was suitable and we had direct communication with the lead vehicle and crew. We asked to have the aircraft chocked on the nose wheel so we could help the brakes and gear assembly cool while we sat. This was preventative as brake temperatures were acceptable for taxi.

After about 20 minutes we received the all-clear from the responding vehicles and we elected at this point to be towed to parking. We arrived at the parking stand and coordinated with the local Delta station personnel to have our passengers deplane via buses to the terminal. After coordination and debrief with Delta, we made all applicable logbook entries before disembarking the aircraft to meet with local Czech airport authorities.

1.1.2.4 Testimony of the FO, seated in the center jump seat

I was the First Officer (FO) in the center jumpseat on board Delta Air Lines Flight 79 from PRG-JFK on 01SEP23.

All operations were normal from Preflight through take-off roll.

The Captain (pilot monitoring) called “positive rate” and FO (name of the FO) responded “gear up.” At that point I heard a loud bang and felt the aircraft yaw. After looking

at the engine instruments I saw the right engine had failed and observed FO (name of the FO) making inputs and calling for the application of rudder trim. At 400 feet AGL the Captain called the tower and declared an emergency. We were then told to climb to 3000 MSL and to maintain runway heading.

The Captain asked that I run the engine failure checklist from the QRH. He and I completed the confirm and action items. Upon completing the checklist up to the deferred items, I reviewed the ODM for landing data. PRG's runway was clearly satisfactory for our needs.

We were given vectors from ATC to make a box pattern and they set us up for an ILS 24. FO (name of the FO) landed the aircraft without incident, and we rolled to approximately 9000 feet down the runway. The fire trucks came to the front of the aircraft and stopped. We remained in communication with ATC, and they asked that we shut down the left engine for inspection. The fire marshal then plugged his headset into the communications port and spoke to the Captain. The fire marshal informed us that temperatures were 100-200C and said evacuation was not recommended. We agreed with the assessment.

The Captain elected to be towed to the parking space since both engines were already shut down.

Passengers deplaned using air stairs in an orderly fashion, and we were taken back to the terminal by bus.

1.2 Injury

There were no injuries reported by the crew or by the passengers.

Tab. 1: Injuries

Injury	Crew	Passengers	Others (on ground, etc.)
Fatal	0	0	0
Serious	0	0	0
Minor/None	0/13	0/208	0/0

1.3 Aircraft Damage

1.3.1 Aircraft damage

There was no damage found to the aircraft except on the right engine.

1.3.2 Engine damage

Post flight inspection

A preliminary maintenance inspection of the right engine performed immediately after the flight identified contained damage and metal fragments in the engine exhaust/tailpipe.

Operator's maintenance personnel arrived at LKPR on September 2nd and subsequently September 3rd, 2023. Limited borescope inspection of HPC, LPC, HPT had been performed per B767 AMM 72-00-00 on September 3rd, 2023 and identified the following:

- LPC stages 1 through 3 – intact, no liberated damage found;
- LPC stage 4 – first stage damaged;
- HPC stages 5 through 15 – completely damaged beyond repair;

- Combustion Liners and Nozzle Guide Vanes for HPT stage 1 – damaged beyond repair;
- HPT stage 1 – damaged beyond repair;
- HPT stage 2 – all blades missing;
- The engine was damaged beyond repair.
- The engine damage was contained.
- In main oil chip detector was found large amount of metal particles.

On September 3rd, 2023 the right engine was changed onsite at LKPR.

The aircraft departed out of LKPR on September 5th, 2023 after engine change.

The affected engine had been seized preventing any rotation from the LPC/LPT and HPC/HPT and had been shipped to Atlanta, USA for detailed borescope inspection and teardown in assistance of the operator, engine manufacturer and NTSB as ACCREP.

Fig. 2: State of the engine exhaust/tailpipe after landing at LKPR

1.4 Other Damage

No other damage was reported to the AAII till the issuance of this Final Report.

1.5 Personnel Information

Crew was in composition of four pilots:

1.5.1 PIC

CPT, citizen of the USA, 59 years old

- Affected flight position: CPT, PM
- Flight crew license Airline Transport Pilot, issued by FAA – valid
  - ratings: Airplane Multiengine Land
  - type ratings: B-757, B-767, BA-3100, SD-3, SF-340
  - limitations: English proficient; B-757, B-767 circ. apch. – VMC only
- Medical certificate – Class 1 – valid
- Flown hours as of the incident[2]:

Hours total	17,392 hrs
Hours on type B757/767	13,286 hrs
Last 90 days	161 hrs
Last 24 hrs	0 hrs

- Rest time as of the incident: 25 hrs layover in PRG

1.5.2 FO

FO, citizen of the USA, 45 years old

- Affected flight position: FO, PF
- Flight crew license Airline Transport Pilot, issued by FAA – valid
  - ratings: Airplane Multiengine Land
  - type ratings: B-757, B-767
  - limitations: English proficient; B-757, B-767 circ. apch. – VMC only
- Medical certificate – Class 1 – valid
- Flown hours as of the incident[2]:

Hours total	891 hrs
Hours on type B757/767	891 hrs
Last 90 days	162 hrs
Last 24 hrs	0 hrs

- Rest time as of the incident: 25 hrs layover in PRG

1.5.3 FO

FO, center jump seat, citizen of the USA, 43 years old

- Affected flight position: FO
- Flight crew license Airline Transport Pilot, issued by FAA – valid

2 The listed hours flown reflect the flight time accumulated by the CPT and FO only while at the incident and do not include flight time prior to the employment at the incident operator.

- ratings: Airplane Multiengine Land
- type ratings: B-757, B-767, CL-65, DC-9, ERJ-170, ERJ-190
- limitations: English proficient; ATP circ. apch. – VMC only; B-757, B-767, CL-65, DC-9, ERJ-170 circ. apch. – VMC only

- Medical certificate – Class 1 – valid

1.5.4 FO

FO, left jumpseat behind the CPT, citizen of the USA, 40 years old

- Affected flight position: FO
- Flight crew license Airline Transport Pilot, issued by FAA – valid
  - ratings: Airplane Multiengine Land
  - type ratings: A-320, B-757, B-767, BE-400, DC-9, DC-10, ERJ-170, ERJ-190, MU-300
  - limitations: English proficient; A-320, B-757, B-767 circ. apch. – VMC only
- Medical certificate – Class 1 – valid

1.6 Aircraft Information

The Boeing 767-332ER is twin-engine transport aircraft powered by two Pratt & Whitney PW4060 turbofan engines.

1.6.1 Aircraft general information

- Registration: N175DN
- Manufacturer / model: The Boeing Company, USA / 767-332 ER
- Year built: 1990
- Serial number: 24803

Standard airworthiness certificate was issued on July 19th, 1990 by FAA.

1.6.2 Engine general information

The PW4060 is a part of the PW4000-94 engine series with certified thrust 60,000 lb. It is a high bypass ratio axial flow turbofan engine and features a 1-stage 94-inch diameter fan, a 4-stage low pressure compressor (LPC), an 11-stage high pressure compressor (HPC), combustion chamber, a 2-stage high pressure turbine (HPT) that drives the HPC, and 4-stage low pressure turbine (LPT) that drives the LPC and the fan.

The engine stages numbering convention is as follows[3]:

- The fan is considered stage 1 of the compressor
- The LPC stage numbers are 1.6, 2, 3, 4
- The HPC stages are numbered 5 through 15
- The HPT stages are numbered 1 and 2
- The LPT stages are numbered 3, 4, 5, 6

Engine stages are abbreviated in numerical order: LPC/HPC/HPT/LPT S1, S2, S3, etc.

3 All directional references to front and rear, right and left, top and bottom, and clockwise and counterclockwise are made aft looking forward.

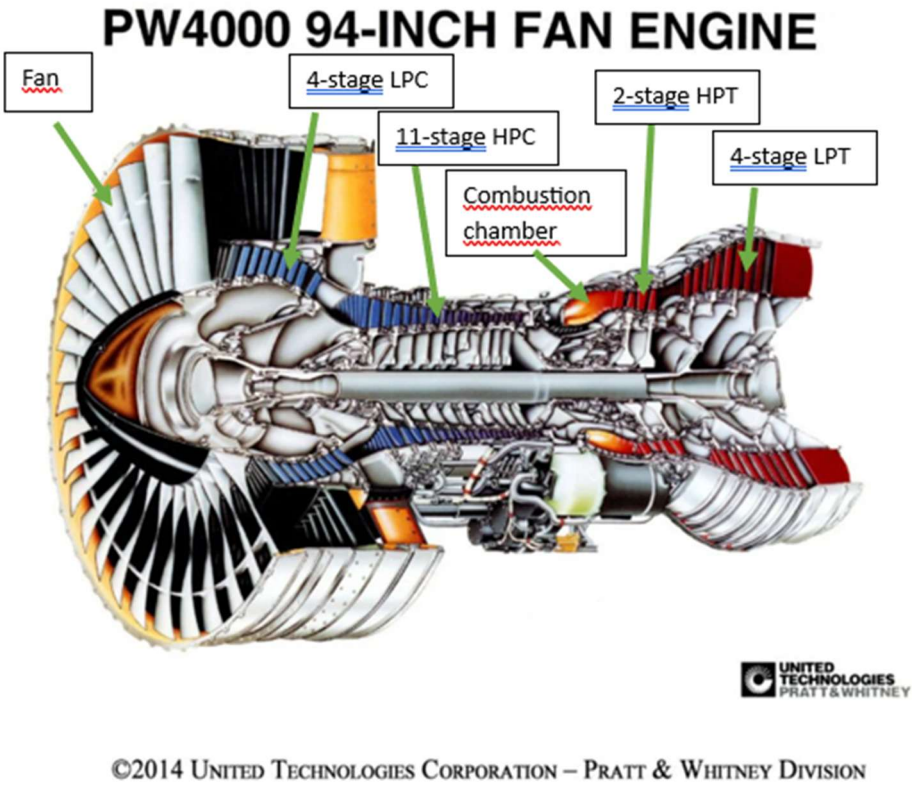


Fig. 3: Cutaway diagram of PW4000 94 Inch Fan Engine

1.6.3 Affected engine information

- Manufacturer and model: Pratt & Whitney (USA), PW4060-3
- Engine Serial Number: 727649
- Engine Install Date: August 3rd, 2022
- TSN/CSN: 93,611 hrs / 13,751
- TSO/CSO: 4,043 hrs / 730
- Last Shop Visit: May 2022, Work Scope: Heavy maintenance on all modules
- According to the operator's records the overhauled HPC S5 blades were installed in the S5 disk in March 2022.

There were neither defects nor any elevated vibrations levels reported during the flights preceding the critical event flight.

1.7 Meteorological Information

METAR/SPECI from LKPR, Praha / Ruzyně (Czech Republic)

SA 01/09/2023 10:00->

METAR LKPR 011000Z 19007KT 150V230 9999 BKN022 16/11 Q1017 NOSIG=

SA 01/09/2023 10:30->

METAR LKPR 011030Z 20007KT 160V240 9999 BKN022 17/12 Q1017 NOSIG=

SA 01/09/2023 11:00->

METAR LKPR 011100Z 22010KT 180V250 9999 BKN022 17/12 Q1017 NOSIG=

1.8 Aids to Navigation

The aircraft took off from LKPR at 10:31 and landed uneventfully on RWY 24 using the ILS navigation at 10:53. During the full flight the crew used the vectoring from ATCo.

1.9 Radio Communication

AAII received the ATC communication transcript between LKPR TWR and the aircraft.

Tab. 2: Transcript of the radio communication

TIME	FREQ	FROM	MESSAGE
10:30:26	134,560	DAL79	TOWER, DELTA79 HOLDING POINT FOR 24
10:30:30	134,560	TEC	DELTA79, RUZYNĚ TOWER HELLO, READY FOR DEPARTURE?
10:30:34	134,560	DAL79	AFFIRM, DELTA79
10:30:35	134,560	TEC	DELTA 79 LINE UP RUNWAY 24 AND CLEAR FOR TAKE OFF WIND 210 DEGREES, 6 KNOTS
10:30:40	134,560	DAL79	CLEAR TAKE OFF RWY 24 DELTA79
10:32:40	134,560	TEC	DELTA79 CONTACT PRAHA RADAR GOODBYE
10:32:44	134,560	DAL79	DELTA79 EMERGENCY AIRCRAFT ENGINE FAIL WE WILL CALL YOU BACK WE WOULD LIKE TO STRAIGHT OUT
10:34:16	134,560	DAL79	DELTA79 WE WOULD LIKE TO CLIMB TO 3000
10:34:21	134,560	TEC	DELTA79 CLIMB AND MAINTAIN 3000 FEET
10:34:24	134,560	DAL79	3000 FEET DELTA79
10:34:27	134,560	TEC	AND REPORT INTENTIONS
10:34:28	134,560	DAL79	STAND BY

10:34:53	134,560	TEC	DELTA79 IN 1 MIN YOU NEED TO CLIMB TO 3400 FEET OR I NEED YOU TO TURN BECAUSE THERE IS MINIMUM ALTITUDE FOR VECTORING
10:35:06	134,560	DAL79	ALRIGHT DELTA79 WE COULD START THE TURN IF YOU WOULD LIKE
10:35:11	134,560	TEC	DELTA79 TURN RIGHT HEADING 030 NOW
10:35:17	134,560	DAL79	RIGHT TURN HEADING 030 DELTA79
10:38:22	134,560	TEC	DELTA79 TURN RIGHT HEADING 060, WHEN ABLE REPORT INTENTIONS
10:38:28	134,560	DAL79	060 FOR DELTA79, WE WILL BE INTENDING TO COME BACK AND LAND RWY 24
10:38:39	134,560	TEC	ROGER SO ABLE FOR THE APPROACH NOW OR DO YOU NEED HOLD?
10:38:44	134,560	DAL79	WE WILL HAVE TO HOLD JUST FOR FEW MORE MINUTES DELTA79
10:38:47	134,560	TEC	ROGER
10:39:54	134,560	TEC	AND DELTA79 WHEN READY REPORT POB, REMAINING FUEL AND IF ANY DANGEROUS GOODS ON BOARD
10:40:02	134,560	DAL79	DELTA79 WILCO
10:40:16	134,560	DAL79	FOR DELTA79 EMERGENCY SOULS ON BOARD 221 FUEL REMAINING 12 HOURS 7 MINUTES, NO HAZARDOUS MATERIAL ON BOARD
10:40:26	134,560	TEC	ROGER, POB 221, FUEL FOR 12 HOURS, DO YOU HAVE IT IN KILOGRAMS?
10:40:36	134,560	DAL79	WE WILL GET YOU THAT
10:40:38	134,560	TEC	THANK YOU
10:40:46	134,560	DAL79	49 000 KILOGRAMS DELTA79 EMERGENCY
10:40:52	134,560	TEC	CONFIRM 49 OR 41 TONS
10:40:57	134,560	DAL79	FOUR NINER THOUSAND

10:40:59	134,560	TEC	FOUR NINER THOUSAND, THANK YOU
10:42:51	134,560	TEC	DELTA79 JUST ADVISE WHEN READY FOR APPROACH
10:42:56	134,560	DAL79	WE WILL ADVISE THANK YOU DELTA79
10:42:58	134,560	TEC	OK IF YOU WANT TO HOLD LONGER I CAN GIVE YOU 2 MINUTES ON THIS HEADING, OR HOLD AT ERASU. ITS ON YOUR RIGHT SIDE, ERASU AND YOU HAVE ENOUGH TIME THERE
10:43:10	134,560	DAL79	WE WOULD LIKE 2 MINUTES ON THIS HEADING AND PROBABLY AT THAT TIME WE CAN CONTINUE AT THAT POINT, 2 MINUTES STRAIGHT AHEAD WOULD BE FANTASTIC
10:43:17	134,560	TEC	OK EXPECT RIGHT TURN IN 2 MINUTES
10:43:20	134,560	DAL79	THANK YOU
10:44:35	134,560	TEC	OK DELTA79 NOW TURN RIGHT HEADING 170
10:44:39	134,560	DAL79	TURN RIGHT HEADIN 170 DELTA79
10:45:55	134,560	DAL79	JUST TO INFORM DELTA79 EMERGENCY WE ARE READY FOR THE ILS TO 24
10:46:01	134,560	TEC	DELTA79 ROGER, TURN RIGHT HEADING 210 CLEARED ILS APPROACH RUNWAY 24
10:46:06	134,560	DAL79	RIGHT TURN HEADING 210 CLEARED ILS RUNWAY 24 DELTA79
10:49:14	134,560	TEC	DELTA79, RUZYNĚ TOWER?
10:49:18	134,560	DAL79	GO AHEAD DELTA79
10:49:20	134,560	TEC	REQUEST FROM FIREFIGHTERS AFTER LANDING, STOP ON THE RUNWAY AS SOON AS POSSIBLE AND THEY WILL APPROACH YOU, THE AIRCRAFT AND INSPECT THE ENGINE AND AIRCRAFT
10:49:32	134,560	DAL79	WE WILL COME TO A STOP ON THE RUNWAY AND WILL BE TOWARDS THE END WE CHOOSE TO MITIGATE THE HARD BREAKS SO WE WILL ROLL PRETTY LONG

10:49:41	134,560	TEC	ROGER UNDERSTOOD, AND DELTA79 RWY 24 CLEARED TO LAND WIND 210 DEGREES 10 KNOTS
10:49:46	134,560	DAL79	CLEARED TO LAND WE WILL REMAIN ON THIS FREQUENCY DELTA79 EMERGENCY
10:52:17	134,560	DAL79	WIND CHECK
10:52:19	134,560	TEC	220 DEGREES 10 KNOTS
10:54:10	134,560	DAL79	DELTA79 WE HAVE COME TO A COMPLETE STOP, ENGINES ARE AT IDLE, PARKING BREAK IS …(PAUZA) NOT SET
10:54:21	134,560	TEC	REQUEST FROM FIREFIGHTERS, PLEASE SHUT DOWN THE ENGINE
10:54:28	134,560	DAL79	STAND BY DELTA79
10:54:30	134,560	TEC	ROGER
10:54:48	134,560	DAL79	DELTA79 LEFT ENGINE RIGHT ENGINE SHUT DOWN, APU RUNNING
10:54:52	134,560	TEC	ROGER THANK YOU
10:55:46	134,560	DAL79	FOR DELTA79 DO YOU REQUIRE ANYTHING FURTHER FOR INSPECTION?
10:55:53	134,560	TEC	SORRY SAY AGAIN WHAT WE REQUIRE?
10:55:54	134,560	DAL79	WILL FIREFIGHTERS TALK TO US ON THIS FREQUENCY IS MY QUESTION
10:56:02	134,560	TEC	THEY'RE ON DIFFERENT FREQUENCY, THEY ARE CHECKING THE AIRCRAFT NOW. THEY TOLD US THAT THEY DON'T HAVE A VISUAL FIRE OR SOMETHING. STAND BY
10:56:12	134,560	DAL79	OK NO PROBLEM WE SEE HIM HE'S COMING TO THE AIRCRAFT, WE SUSPECT HE'S GONNA TALK TO THE CAPTAIN VIA THE HEADSET, THANK YOU SO MUCH
10:57:08	134,560	TEC	DELTA79 TOWER?
10:57:12	134,560	DAL79	GO FOR DELTA79

10:57:13	134,560	TEC	PLEASE CONFIRM IT WAS ENGINE NUMBER 2 FAILURE
10:57:17	134,560	DAL79	CORRECT, NUMBER 2, THE RIGHT ENGINE. NUMBER 2
10:57:20	134,560	TEC	THANK YOU
10:58:09	134,560	TEC	DELTA79 MESSAGE FROM FIREFIGHTERS. INSPECTION IS STILL IN PROGRESS AND FROM THEIR SIDE THERE'S NO NEED FOR EVACUATION OF THE AIRCRAFT
10:58:20	134,560	DAL79	COPY, INSPECTION IN PROGRESS, NO NEED FOR EVACUATION EXCELLENT NEWS, THANK YOU DELTA79

1.10 Aerodrome Information

LKPR is a public international aerodrome with two runways – 06/24 and 12/30.

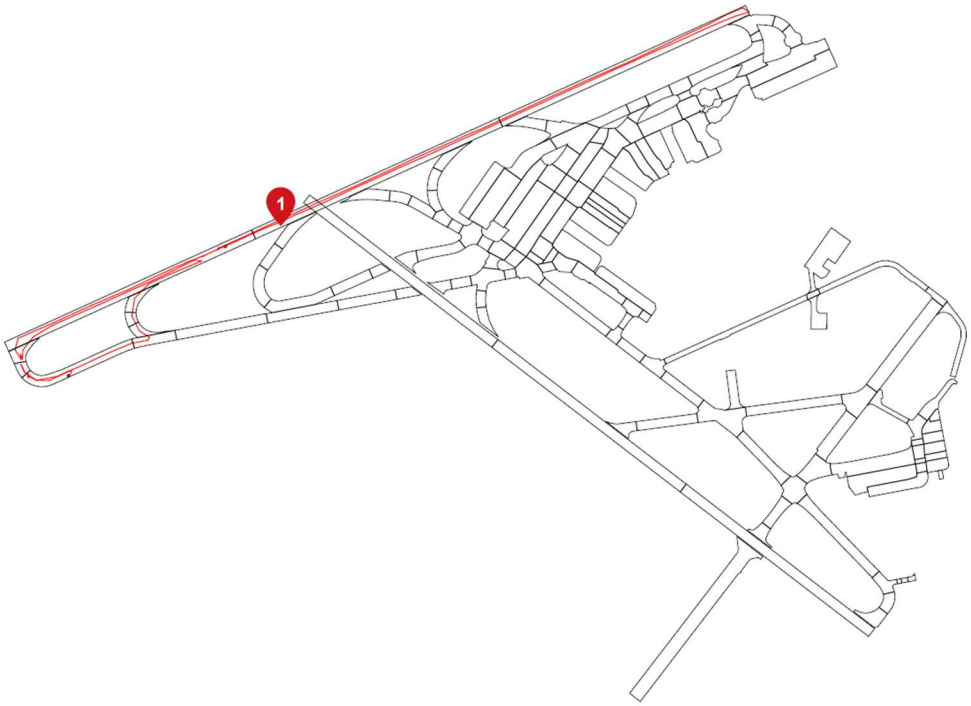
RWY 06/24 – concrete surface, dimensions 3,715 x 45 m.

RWY 12/30 – concrete surface (between THR 12 and TWY F antiskid), dimensions 3,250 x 45 m.

LKPR ARP location is 50° 06' 03" N, 14° 15' 36" E, 1 234 ft / 376 m.

Prague Airport performed runway and taxiway inspection after the landing of the event aircraft (11:09 – 11:33) with the following finding:

11:26: Metal fragment found approx. 150 m behind the cross RWY 06/24 and RWY 12/30 in the direction of RWY 24 on the right side from the runway centreline.



RWY 06/24 was closed for approx. 30 minutes due to the inspection.

1.11 Flight recorders

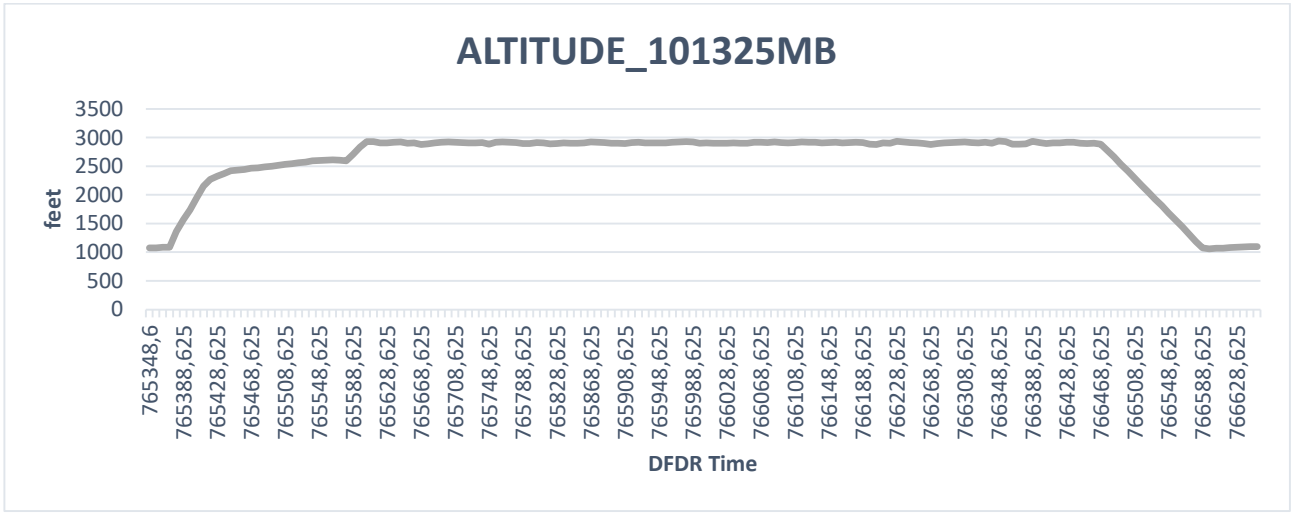
The flight data recorder as well as the cockpit voice recorder have been secured immediately after the flight by the operator.

1.11.1 DFDR analysis

The AAII received the electronic raw data from the flight data recorder and analysed them in cooperation with BFU based on Memorandum of Understanding.

The DFDR showed the following:

DFDR time	Action	ALT (ft)	GS (kts)	ENG 1 N1 %	ENG 2 N1 %	EGT ENG 2 (°C)
765379	Take off	1075	176	98	97	545
765385	Landing gear retraction	1237	180	98	97	545
765390	First reduction in N1 on ENG 2	1441	180	98	24	557
765394	Followed N2 ENG 2 reduction	1539	176	101	14	593
765394	ENG 2 flameout – temporary increase of EGT	1539	176	101	14	593
765400	ENG 2 oil low press indication	1651	172	101	12	577
765408	ENG 2 ESC packs switched off	1840	168	102	11	569
765469	ENG 2 fuel valve closed	2447	176	101	11	657
766598	Landing	1069	160	57	10	108


ALTITUDE_101325MB
feet
3500
3000
2500
2000
1500
1000
500
0
765348,6
765388,625
765428,625
765468,625
765508,625
765548,625
765588,625
765628,625
765668,625
765708,625
765748,625
765788,625
765828,625
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765948,625
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766308,625
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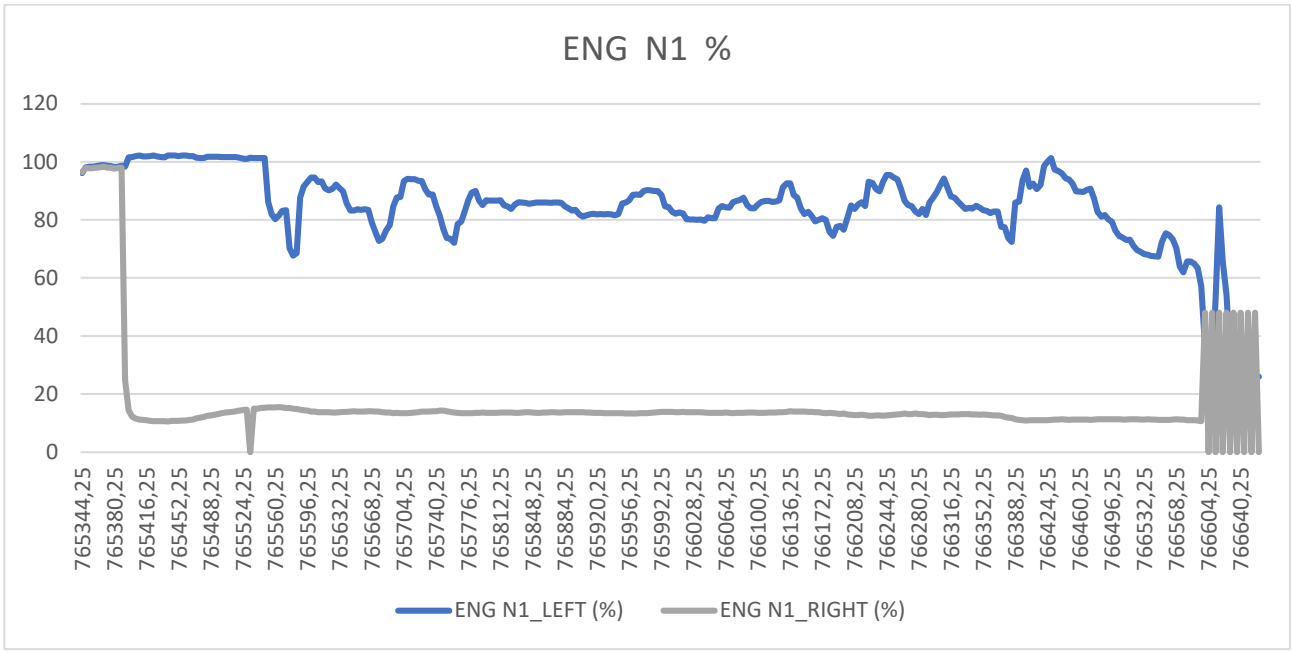
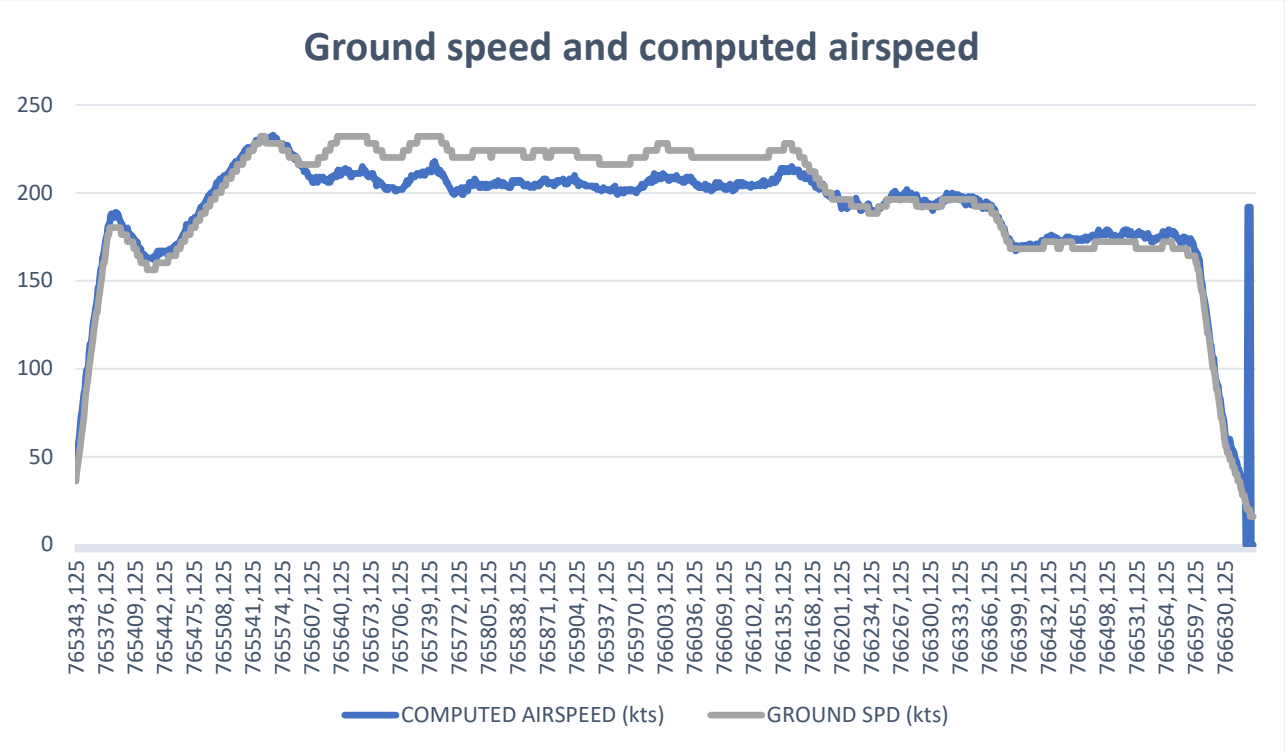
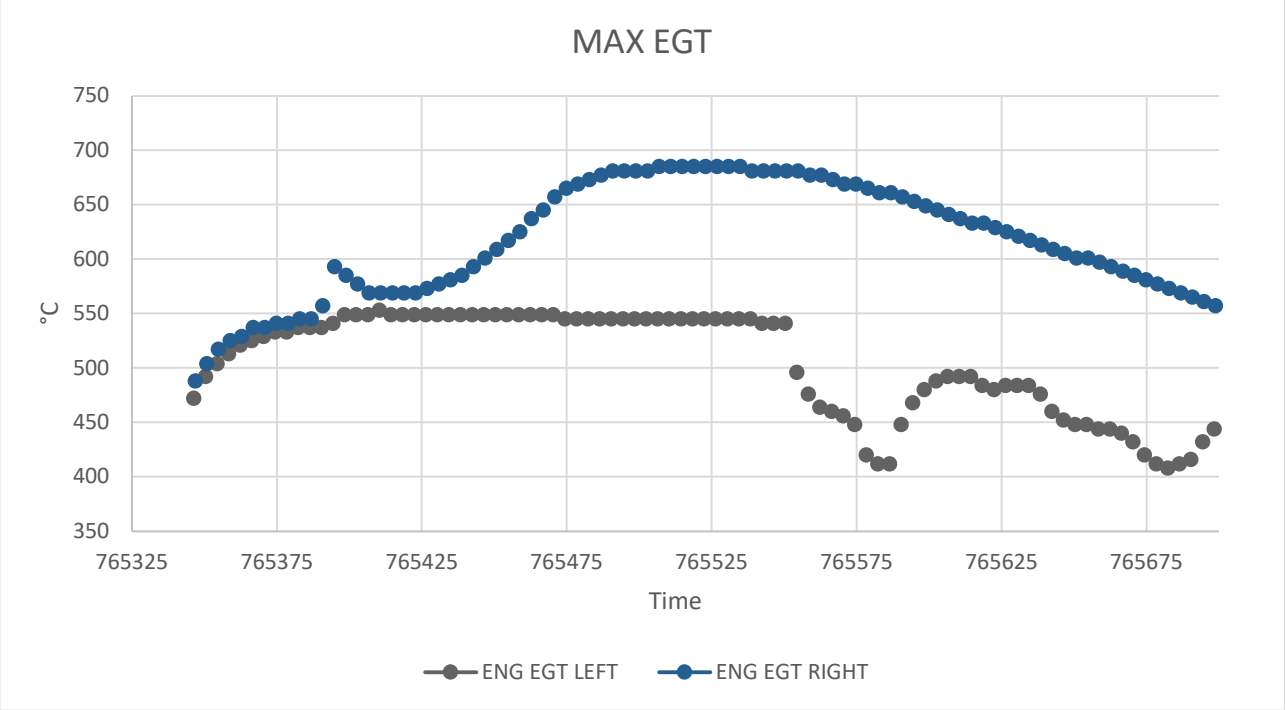
766548,625
766588,625
766628,625
DFDR Time


ENG N1 %
120
100
80
60
40
20
0
765344,25
765380,25
765416,25
765452,25
765488,25
765524,25
765560,25
765596,25
765632,25
765668,25
765704,25
765740,25
765776,25
765812,25
765848,25
765884,25
765920,25
765956,25
765992,25
766028,25
766064,25
766100,25
766136,25
766172,25
766208,25
766244,25
766280,25
766316,25
766352,25
766388,25
766424,25
766460,25
766496,25
766532,25
766568,25
766604,25
766640,25
ENG N1_LEFT (%)
ENG N1_RIGHT (%)





1.11.2 Engine manufacturer analysis of DFDR data:

Background:

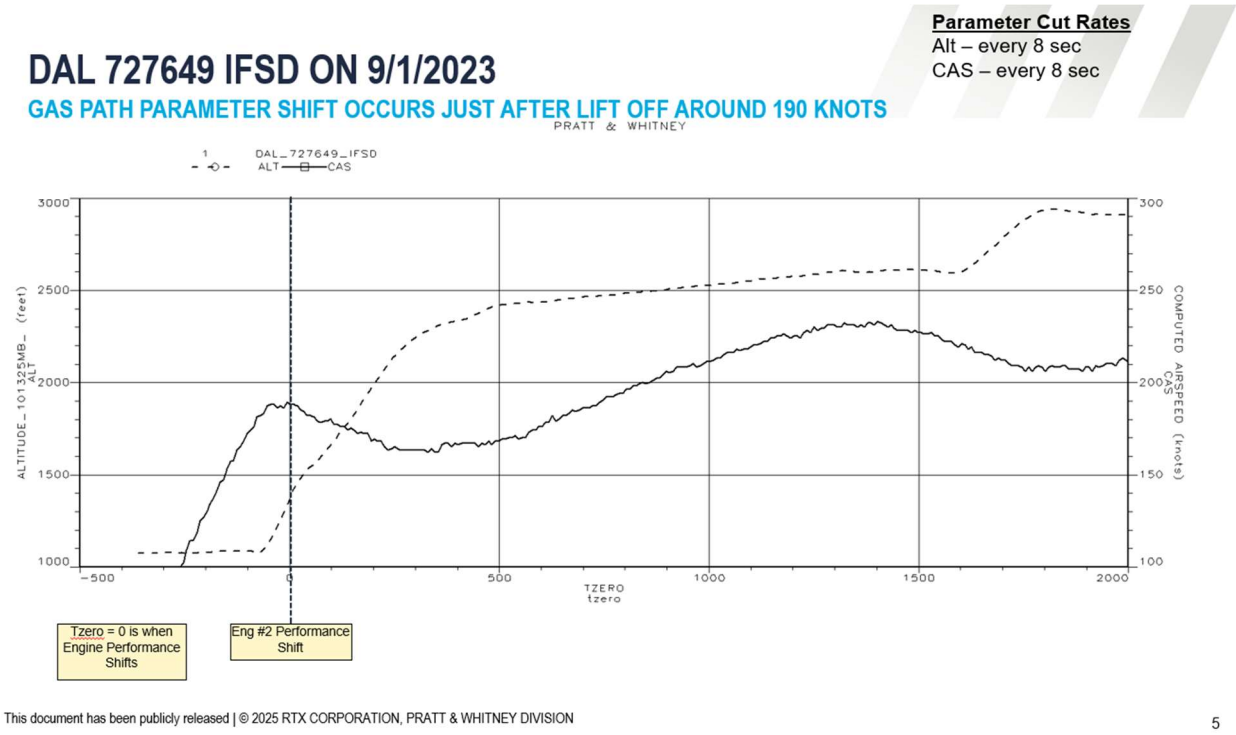
- *After take-off engine rolled back and was IFSD*
- *Aircraft landed safely*
- *No fire or uncontainment noted*

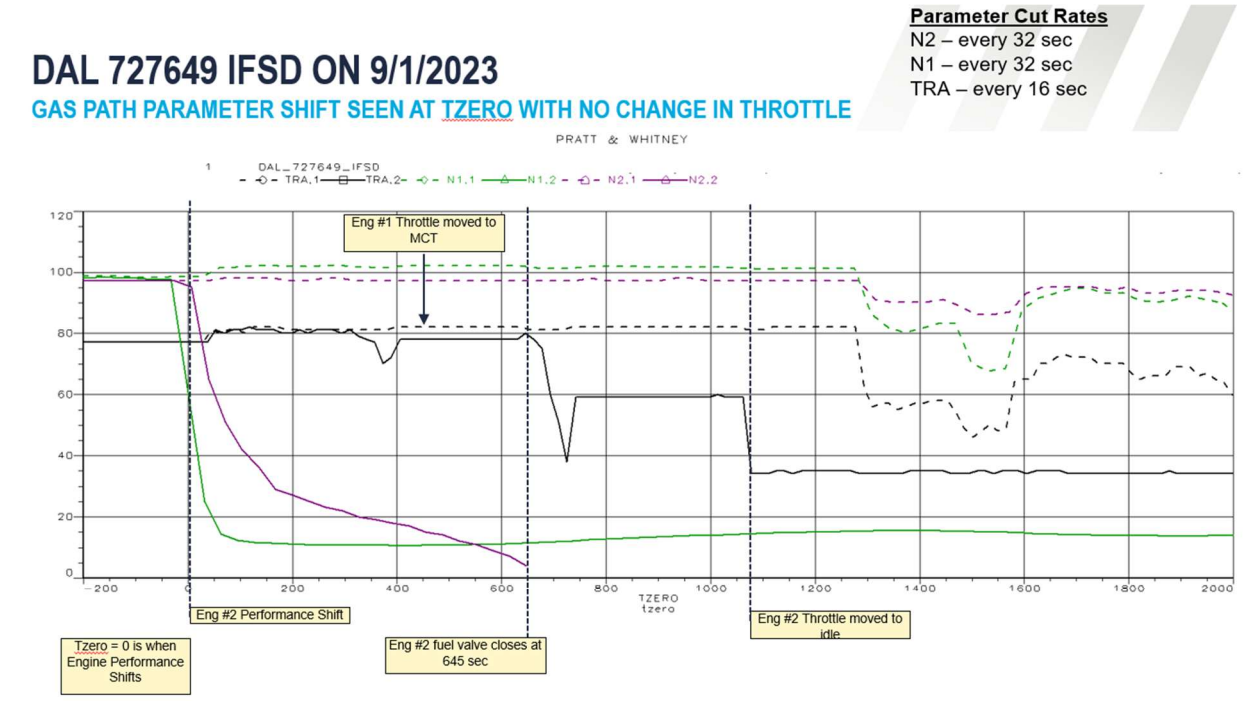
Troubleshooting completed:

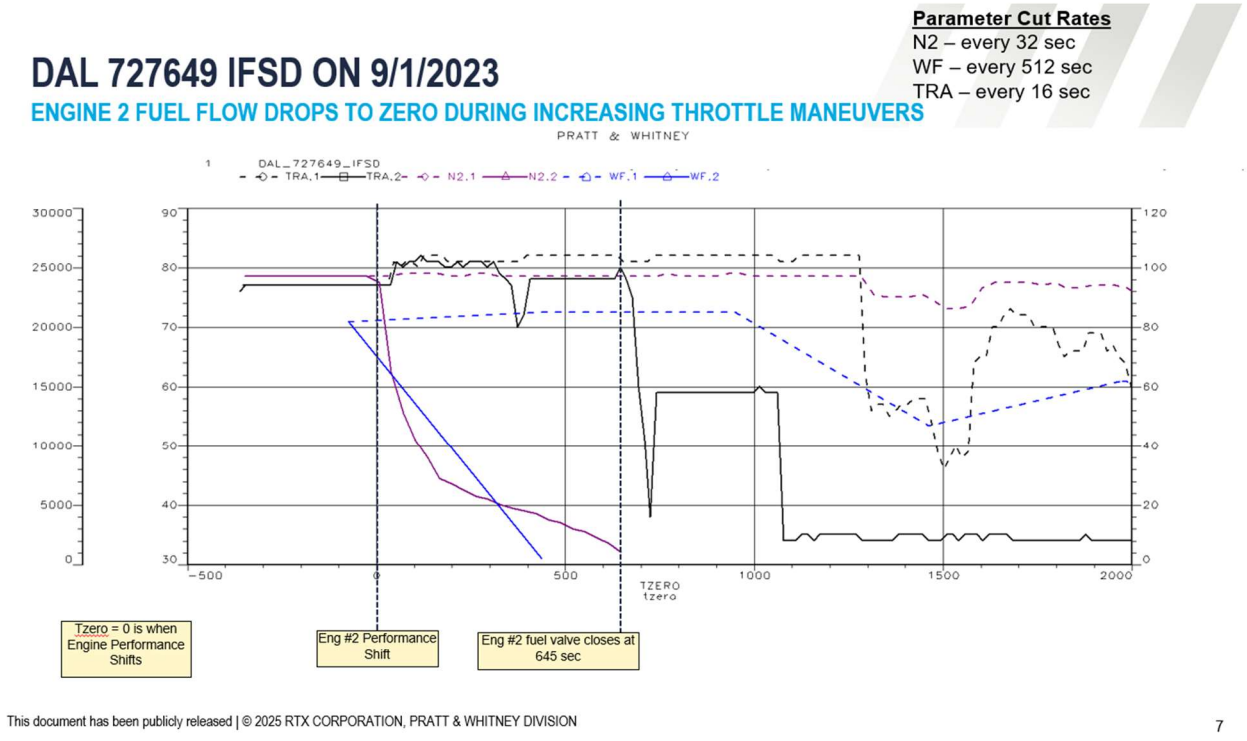
- *Engine removed from aircraft, metal in tailpipe*
- *Engine examination confirmed 5th blade HPC initiating event*

DFDR Analysis:

- *Gas path parameter shift occurs just after lift-off around 190 knots at Tzero (when Engine Performance Shifts)*
- *Gas path parameter shift seen at Tzero with no change in throttle position*
- *Engine 2 fuel flow drops to zero with no change in throttle values*
- *Fuel valve closes at 645 sec after Tzero*
- *Decrease in oil pressure due to roll back in engine 2 power at Tzero, oil parameter cut rate over 500 sec*
- *EGT Max 685 deg C reached, EGT stayed above redline for 992 secs*
- *Inconclusive vibration data due to parameter cut rates over 500 sec apart*







1.11.3 CVR

DFDR analysis confirmed the testimonies of the crew members and the radiocommunications thus the CVR records haven't been requested by AAII. The radiocommunication as well as pilots' testimonies provided sufficient information about the crew workload, processes and course of actions.

1.12 Accident side and findings on the wreckage

The critical situation happened during the initial climb after take-off from LKPR. The aircraft returned back to LKPR after about 22 min flight. The operator's maintenance organization inspected the aircraft one day after the incident at LKPR. There were no findings except on the affected right engine.

1.13 Medical and Pathological Information

N/A

1.14 Fire

There was no evidence of in-flight engine fire. The recorded engine fire parameters did not indicate a fire at any point during the flight.

The affected engine suffered in flight failure and the flameout was the effect of the malfunction.

Fig. 4: Photo taken during the take-off[4]

1.15 Survival Aspects

There was no evacuation needed. The passengers disembarked the aircraft at the parking position.

1.16 Tests and Research

The affected engine examination and disassembly was performed on May 7–8th, 2024 in operator's maintenance facility in Atlanta, USA, with representative members from Pratt & Whitney, NTSB as the ACCREP and the operator.

The respective report stated:

There was no evidence of radial uncontainment, undercowl fire, or flammable fluid leakage. The fan blades were individually inspected and were in good condition and unremarkable. There was no indication of fan blade leading edge foreign object damage or fan blade shroud shingling. The fan blade rub strip had light rub in plane with the fan plane of rotation that was typical of similar service run engines according to P&W and DAL. The LPT S6 blades viewed through the exhaust were all complete with no trailing edge damage visible. Fine metal debris was collected along the bottom of the turbine exhaust case and against

4 Source: online youtube canal SlowTV

the case struts. The LPT S6 vanes all had light metal spray on the suction side vane surfaces.

Low pressure compressor

There was no visible leading edge damage on the LPC S1.6, S2, or S3 blades.

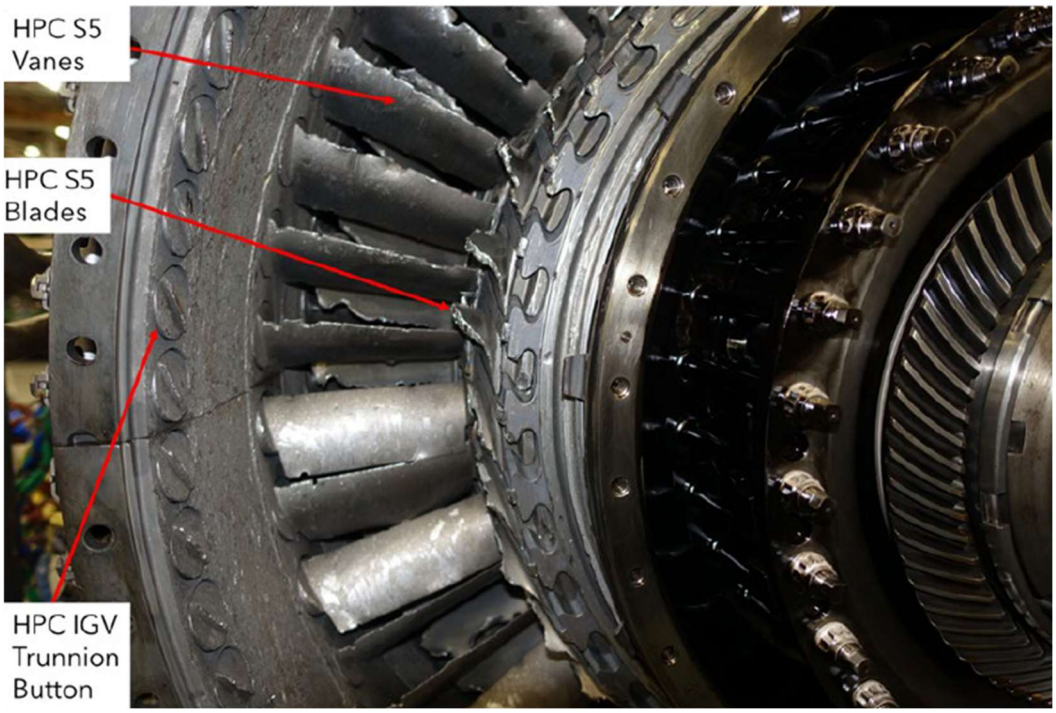
The LPC S4 blades exhibited 360 degree trailing edge impact damage including material loss and tearing. One LPC S4 blade tip was separated at approximately 3/4 blade span. The LPC S4 blade leading edge and LPC S3 vane trailing edge surfaces had minor nicks and gouges at random locations.

LPC S4 Rotor Blades – Trailing Edge Damage, Blade Tip Separation

The LPC S4 vanes (LPC Exit Vanes) were all full length but exhibited 360 degree leading edge nicks/gouges along the full airfoil span. The 2.5 bleed valve ring was intact. The 2.5 bleed vanes along the outer diameter of the LPC S4 vanes also exhibited impact damage.

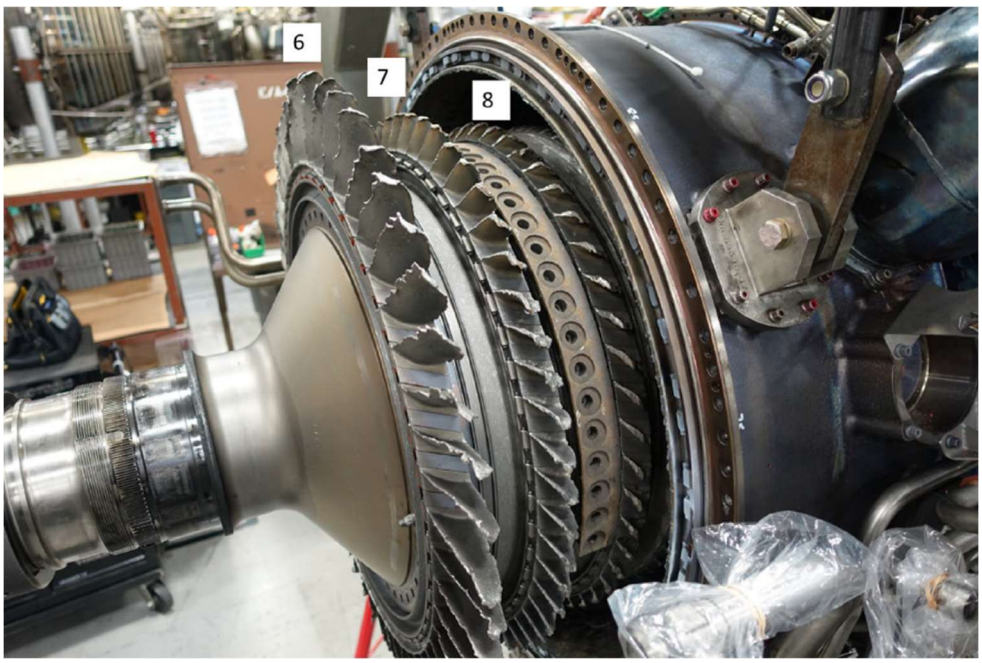
High pressure compressor

The HPC inlet guide vanes airfoils were all separated and fragmented. The HPC S5 blades were all fractured near the blade platform. The blade fracture surfaces all appeared jagged and irregular in shape.



HPC IGV Trunnion Buttons, HPC S5 Blade Fractures, HPC S5 Vanes

The HPC S6 blades appeared to be all full length but exhibited deformation and material loss on the leading edge, trailing edge, and tip. The HPC S7 blades were all separated at the midspan, and what remained of the blade airfoils was smeared with indications of incipient melting.



HPC S6, S7 and S8 damage

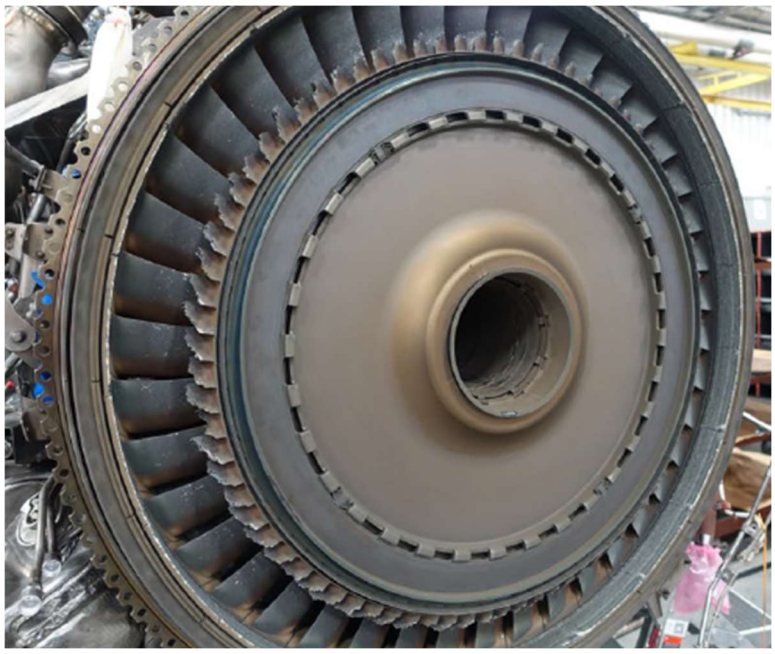
The visible HPC blades and vane stages aft of S7 were consumed consistent with a compressor fire. Resolidified metal slag was adhered around the HPC aft case outer

flowpath from HPC S7 aft. Loose debris was accumulated 360 degrees around the aft stages of the HPC.

The HPC S5 vanes were all full length but exhibited leading and trailing edge impact deformation. Three consecutive HPC S5 vanes were rotated out of schedule relative to the other vanes between the 3 and 4 o'clock positions, consistent with secondary impact damage. Three consecutive HPC S6 vanes between the 5 and 6 o'clock position were missing. The trailing edge of all remaining HPC S6 vanes were thermally damaged and partially consumed in a scallop shaped pattern from the midspan to the outer diameter platform. The HPC S7 vanes were thermally consumed. Resolidified metal slag was adhered to the case halves from the HPC S6 vane trailing edge aft. There were no punctures or burn through on the HPC split case outer air seals.

High pressure turbine

The HPT S2 blades were all fractured at 1/4 span and the fracture surfaces appeared jagged and irregular. There were no punctures or deformation observed on the HPT S2 blade outer air seals. With the exception of minor chipping, the blade outer air seal thermal barrier coating was intact. The HPT S2 vanes were all intact with light suction (aft) side impact damage. Light metal spray was adhered to the HPT S2 vane surfaces. The HPT S1 blades visible forward of the HPT S2 vanes, had resolidified metal slag accumulated along the trailing edge blade path 360 degrees around the engine.



HPT S2 Blades and Vanes

Low pressure turbine

The LPT shaft was in good condition with no evidence of rub damage. The LPT S3 vanes were full length with indications of thermal distress including bubbling/flaking of the diffused aluminide blade coating. The LPT S3 vanes also had material buildup on the suction side of the vanes near the leading edge. HPT S2 blade fragments were collected at the 6 o'clock position of the LPT/transition duct and on the pressure side of the LPT S3 vanes from the 5 to 9 o'clock positions. There was leading edge impact damage and material loss visible

on the LPT S3 blades visible behind the LPT S3 vanes. The LPT was not further disassembled due to a lack of evidence that it contributed to the primary failure.

LPT S3 Vane, Thermal Damage and Vane Coating Flaking

Metal Debris Accumulation on LPT Module Transition Liner

Metallurgical investigation of the 5th stage HPC blades and disk in the laboratories of
Pratt & Whitney followed up on September 30th, 2024 with following conclusion:

Visual examination of the high pressure compressor (HPC) 5th stage blade set revealed all the blades fractured transversely through the airfoil, the majority of which were fractures directly adjacent to the root platform (ARP). No evidence of primary fatigue progression was identified. However, all fracture surfaces exhibited degrees of secondary damage that could have obscured primary features. Secondary fatigue cracking thumbnails were observed on the fractures at the suction side maximum root thickness (MRT) location near mid-chord airfoil on some blades. Blades exhibited secondary rubbing/machining damage on the trailing edge airfoils, platform edge, and root surfaces. The 5th stage disk exhibited secondary impact damage and scuffing damage on the bottoms of the blade slots.

Four HPC 5th stage blades were analysed deeply. No evidence of primary fatigue progression was identified.

The material evaluation and electron microscope scanning were not performed. The statement from the engine manufacturer:

The lab analysis of the Delta 727649 High Pressure Compressor 5th stage blade did not include Scanning Electron Microscope (SEM) work or material microstructure/property evaluation. After completion of a limited workscope for the event hardware, it was determined that sufficient similarities existed to prior investigations involving the same part that a more extensive evaluation was not warranted.

1.17 Organisational Information

The operator was holder of the Air Carrier Certificate issued by FAA. The flight was scheduled flight LKPR – KJFK.

1.18 Additional Information

The PW4000 94'' engine HPC 5th stage blades history:

The HPC 5th stage blades installed on the affected engine were part number PN 58H305 and were already investigated by NTSB – the Final report of Boeing 747-451 aircraft at NRT on June 7, 2017, report published by NTSB in 2020.

The respective NTSB report stated:

The PW4000 94-inch fan engine has had a long history of 5th stage compressor blade fractures. The fractured 5th stage compressor blade was part number (PN) 58H305. According to P&W, the PN 58H305 blade has had 16 airfoil fractures. The PN 58H305 blade superseded another part numbered blade that had 22 airfoil fractures. The PN 58H305 was itself superseded by the PN 50S805 blade in 2011 that according to P&W has not yet had a reported blade fracture.

The PN 58H305 blade as well as the superseded blade has also had a number of blade root fractures. Although the PW4000 94-inch engine has had a number of 5th stage compressor blade fractures in the airfoil and root, only one was reportable to the NTSB in accordance with 49 CFR 830.5 and subsequently investigated. That incident involved a Delta Air Lines

Boeing 747-451 airplane that had a 5th compressor blade, which was a PN 58H305 blade, fracture through the root shank during take off from Atlanta. (Reference: ENG14IA027) The resultant vibration following the blade fracture loosened the B-nut on a hydraulic line causing a leak and leaking the hydraulic fluid ignited off of the hot engine cases. The blade fractured from a fatigue crack that was caused by the improper grit blasting of the blade's root shank during the overhaul of the blade by a repair vendor.

The manufacturer updated the HPC 5th stage blade history as follows:

Since the PW4000-94" blade history was compiled for the NTSB in 2020, there have still been no airfoil fractures reported to Pratt & Whitney involving the Part Number (P/N) 50S805 blade. The history that Pratt & Whitney compiles is a best effort based on what is returned to us for investigation or reported to us by our customers. There are fracture events where the blade part number was not identified, and therefore the history relative to the P/N in question may be incomplete.

1.19 Useful or Effective Investigation Techniques

N/A

2 Analysis

2.1 Flight crew

Both PIC and FO held the required and valid ratings and qualifications and were experienced on type.

The critical flight was their first flight of the day and they had enough rest before.

The PIC was PM and FO was PF.

The whole pilots' crew, including the relief pilots sitting in the jump seats, managed the situation properly in manners that were trained for. They followed the QRH procedures and managed to land safely back at LKPR.

2.2 Critical phase of flight

Preflight checklists and procedures as well as pushback, engines start up and taxi to runway were carried out standardly.

Critical phase of flight occurred during initial climb after take-off from RWY 24 LKPR. The right engine N1 started to dropped down at 1 441 ft ALT and 180 kts ground speed, resp. 188 kts computed airspeed. The crew heard a loud bang sound along with the right engine failure indication.

Immediately after determination of the engine failure, the FO as PF stabilized the aircraft to prevent it from yawing. The respective checklists have been performed and the crew decided to return back to LKPR. The FO continued to climb and levelled the aircraft at 3,000 ft MSL.

Prague airport initiated full emergency procedures. Emergency services had been notified that the aircraft would stop at the end of the runway due to the overweight landing.

Once the aircraft came to complete stop, the firefighters initiated the first steps. No fire or smoke was visible. Both main landing brakes temperatures were measured as well as temperatures of both engines. All measurements were within the limits. Evacuation on runway was not necessary and the aircraft was towed to the stand.

2.3 Aircraft

There were no faults or malfunctions reported on the flights preceding the critical flight. There was no other damage to the aircraft except the affected right engine.

2.3.1 Right engine

During the early stages of the event flight one of the 5th stage high-pressure compressor blades fractured.

The DFDR data showed that following the loss of power after the 5th stage compressor blade fractured, the engine failed to produce thrust and flameout. The detached blade caused damage to a further stages of HPC, HPT and LPT. The engine was damaged beyond repair.

There was no foreign object nor any birdstrike evidence found during the post-flight inspection and borescope inspection.

The material evaluation and electron microscope scanning were not performed due to the lack of primary fracture features that warranted examination because of secondary

damage to the fracture surfaces. Additionally, because the engine manufacturer determined that there were sufficient similarities existed to prior investigations involving the same part.

2.4 ATC

The flight crew stayed on the LKPR TWR frequency for the whole flight. The crew didn't use the distress callout MAY DAY, but the phraseology used was understandable to the air traffic controller.

The air traffic controller provided the flight crew with enough time to work through the checklists and to manage the situation.

3 Conclusion

3.1 Findings

3.1.1 Flight crew

Held the required type ratings and were experienced on type.

Flight duty times and rest periods were adhered to.

Flight crew actively reacted during the engine failure and related warnings and landed safely at LKPR.

3.1.2 Aircraft and engine

The aircraft had the required airworthiness certificate and was properly maintained.

The engine failure was caused by 5th stage HPC blade fracture, followed by the engine shutdown.

The engine was damaged beyond repair.

There was no evidence of FOD or birdstrike found in the engine.

The presence of primary fatigue crack cannot be determined due to secondary damage of the blade.

3.1.3 Meteorological conditions

The weather conditions were appropriate for the flight conduction and had no influence on the occurrence.

3.2 Causes

The cause of the engine failure was a fracture of a 5th stage of high pressure compressor blade. The cause of the fracture could not be determined due to the secondary damage of the blade.

4 Safety Recommendations

AAII issue following safety recommendation:

CZ-2026-0001

AAII recommends to the engine manufacturer Pratt & Whitney to perform the Electron Microscope Scanning and evaluation on every engine blade fracture whenever there is a suspicion, that the blade failure is the initiating event of the occurrence. The nature of the fracture and the primary defects around the initiation can be possibly better detected.