Taiwan Transportation Safety Board

Aviation Occurrence Investigation Factual Data Report

13 August 2025

UPS Airlines Flight 5X61

Boeing 747-8F, N613UP

Engine Nacelle Strike during Landing at Taipei/Taiwan Taoyuan International Airport

TTSB-AFR-26-01-001

January, 2026

According to the Transportation Occurrences Investigation Act of the Republic of China and the International Civil Aviation Organization (ICAO) Annex 13, this report is only for the improvements of flight safety.

Transportation Occurrences Investigation Act of the Republic of China, Article 5：

The objective of the TTSB's investigation of major transportation occurrence is to prevent the recurrence of similar occurrences. It is not the purpose of such investigation to apportion blame or liability.

ICAO Annex 13, Chapter 3, Section 3.1：

The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

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Abbreviation

ACM	Additional Crew Member
AIP	Aeronautical Information Publication
AMM	Aircraft Maintenance Manual
AOM	Aircraft Operating Manual
APU	Auxiliary Power Unit
AQP	Advanced Qualification Program
ATIS	Automatic Terminal Information Service
ATMP	Air Traffic Management Procedures
ATP	Airline Transport Pilot
AWOS	Automated Weather Observation System
BCF	Boeing Converted Freighter
CAM	Cockpit Area Microphone
CG	Center of Gravity
CMC	Central Maintenance Computer
CMC-L	Left Central Maintenance Computer
CQP	Continuing Qualification Proficiency
CVR	Cockpit Voice Recorder
DDM	Difference in Depth Modulation
DME	Distance Measuring Equipment
EEC	Electronic Engine Control
EICAS	Engine Indicating and Crew Alerting System
FAA	Federal Aviation Administration
FCTM	Flight Crew Training Manual
FDR	Flight Data Recorder
FIR	Flight Information Region
FOM	Flight Operations Manual
FPM	Feet Per Minute
G/S	Glideslope
HAT	Height Above Touchdown
ILES	Inboard Leading-Edge Station
ILS	Instrument Landing System
LLWAS	Low-Level Wind Shear Alert System
LOC	Localizer
LOE	Line Operational Evaluation
MAC	Mean Aerodynamic Chord
METAR	Meteorological Aerodrome Report
NM	Nautical Mile
NOSIG	No Significant Change
PF	Pilot Flying
PM	Pilot Monitoring
QAR	Quick Access Recorder
QNH	Altimeter Sub-Scale Setting to Obtain Elevation when on the Ground

QRH	Quick Reference Handbook
RA	Radio Altitude
RCAM	Runway Condition Assessment Matrix
RCTP	Taipei/Taiwan Taoyuan International Airport
RCR	Runway Condition Report
RESA	Runway End Safety Area
RPM	Revolutions Per Minute
RSA	Runway Safety Area
RTO	Rejected Takeoff
RWY	Runway
RWYCC	Runway Condition Code
S-25R	Stringer 25 Right (Fuselage)
SIGMET	Significant Meteorological Information
SPECI	Aerodrome Special Meteorological Report
STA	Station
TAF	The Aerodrome Forecasts
TLA	Thrust Lever Angle
TLPR	Thrust Lever Position Resolver
TRA	Throttle Resolver Angle
U-18R	Upper No.18 Right (Wing)
UPS	United Parcel Service
UTC	Coordinated Universal Time
VCF	Variable Camber Flap
VHHH	Hong Kong International Airport
WS	Wing Station

Chapter 1 Factual Information

1.1 History of the Flight

On August 13, 2025, UPS Airlines[1] flight 5X61, a Boeing 747-8 freighter (B747-8F[2]) registered in the United States as N613UP, was operating a cargo flight from Hong Kong International Airport (VHHH) to Taipei/Taiwan Taoyuan International Airport (RCTP) with three flight crew members onboard. At 2008 Taipei local time[3], during landing on Runway 05L at RCTP, the aircraft sustained a No. 4 engine nacelle strike, which resulted in damage to the No. 4 engine, as well as multiple areas of the right wing and fuselage. No injury to any person involved in the flight or to any third party.

The captain occupied the left seat in the cockpit and was the Pilot Flying (PF) for the occurrence flight, while the first officer occupied the right seat and was the Pilot Monitoring (PM), and an Additional Crew Member (ACM), who was positioning as a non-operating crew member, was seated in the observer's seat. The flight was originally scheduled to depart from VHHH at 1605, but due to weather conditions at RCTP and air traffic flow control, the actual takeoff time was delayed until 1750. In the hours around the estimated arrival time, weather conditions at RCTP were influenced by the passage of Typhoon Podul. According to the Meteorological Aerodrome Report (METAR) for RCTP valid at 1730, the

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[1] It is an American cargo airline owned by United Parcel Service, Inc.

[2] Hereafter, references to Boeing aircraft will be abbreviated with the prefix "B" for simplicity.

[3] Unless otherwise noted, the 24-hour clock is used in this report to describe the local time of day, Taipei Local Time, as particular events occurred. Taipei Local Time is Coordinated Universal Time (UTC) + 8 hours.

wind was from 090 degrees at 27 knots, gusting to 44 knots, with visibility greater than 10 kilometers. The cloud coverage[4] was few at 800 feet and broken at 18,000 feet. The temperature was 30 degrees Celsius, dew point 22 degrees Celsius, and the altimeter setting (QNH) was 999 hPa. Windshear was reported on all runways, and No Significant Change (NOSIG) was forecast.

According to the crew interviews, while en route to RCTP, the crew maneuvered around the Typhoon Podul and entered a brief holding prior to vectoring for the approach. The approach in use at RCTP was the ILS[5] (Instrument Landing System) Runway 05L.

First Approach

According to the Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) data, at 1916:23, Taipei tower cleared the occurrence flight to land on Runway 05L with the wind from 100 degrees at 21 knots gusting to 45 knots. After discussion, the crew agreed to check the wind before reaching 500 feet and execute a go-around if the crosswind limitation[6] was exceeded. At 1919:41, at 682 feet radio altitude (RA)[7], the crew obtained the reported wind from 090 degrees at 29 knots gusting to

[4] Cloud amounts are reported in oktas. An oktas is a unit of sky equal to one-eighth of total sky visible to the celestial horizon. Few = 1 to 2 oktas, scattered = 3 to 4 oktas, broken = 5 to 7 oktas and overcast = 8 oktas. The METAR reports the height of the cloud base in hundreds of feet above aerodrome elevation.

[5] An ILS is a standard ground aid to landing, comprising two directional radio transmitters: the localizer, which provides directional in the horizontal plane or lateral flightpath tracking guidance; and the glideslope for vertical plane direction or vertical flightpath tracking guidance usually at an inclination of 3° Distance Measuring Equipment (DME) or marker beacons along the approach provide distance information.

[6] According to the UPS B747 Aircraft Operating Manual (AOM), the crosswind component limit for landing on a dry runway, including gusts, is 30 knots.

[7] Radio altitude is the height of an airplane above terrain immediately below the airplane as measured by a radio altimeter.

45 knots. At 1920:03 while the aircraft was at 370 feet RA, the crew noted an increase in wind speed and initiated a go-around. The flight was then vectored for a second approach for ILS Runway 05L.

Second Approach

At 1932:15, the flight was cleared to land on Runway 05L with the wind from 090 degrees at 30 knots gusting to 39 knots. At 1934:44, at 527 feet RA, the crew obtained the wind report of 100 degrees at 29 knots gusting to 43 knots, and subsequently commenced a second go-around at 1934:52.

After the second go-around, while in holding, the crew consulted the company for a suitable alternate airport, discussed the situation, and decided to attempt another approach.

Third Approach

At 2000, the RCTP Automatic Terminal Information Service (ATIS) information "Tango" was current, with winds reported from 100 degrees at 23 knots gusting to 36 knots. At 2003:55, the flight was cleared to land on Runway 05L with the wind 090 degrees at 26 knots gusting to 38 knots. The crew discussed the option of conducting an autoland during the approach and decided to check the winds at a lower altitude. At 2005:50, at 2,010 feet RA, the reported wind for Runway 05L was 090 degrees at 28 knots gusting to 38 knots, which exceeded the autoland headwind limitation[8] but remained within the landing crosswind limit. The crew subsequently decided to conduct a manual landing.

Data from the FDR, CVR, and crew interviews indicated that the

[8] According to the UPS B747 Aircraft Operating Manual (AOM), the autoland headwind and crosswind limitations are both 25 knots.

approach was normal and stabilized below 1,000 feet RA. At 2007:43, the PF disconnected the autopilot at 430 feet RA, and at 2008:05, the autothrottle was disconnected at 185 feet RA. From 1,000 feet RA to 50 feet RA, the aircraft maintained a right crab angle that gradually decreased from approximately 12 degrees to 8 degrees. The PF initiated the flare at around 40 feet RA and decrabbed the aircraft before touchdown. All four forward thrust levers were retarded to the idle position at approximately 15 feet RA prior to touchdown.

At 2008:21, the aircraft touched down at an airspeed of 174 knots, with a pitch angle of 1.1 degrees nose-up, a heading of 058.4 degrees, and a roll angle of 2.5 degrees left-wing-down. The left wing landing gear contacted the ground first, followed shortly by the remaining three main landing gears, as indicated by the Quick Access Recorder (QAR) data.

After Touchdown

Immediately after touchdown, at 2008:23, the reverse thrust levers of No. 2, No. 3, and No. 4 engines were pulled up to the idle reverse position, while the forward thrust lever of No. 1 engine was advanced to a Throttle Resolver Angle (TRA)[9] of approximately 57 degrees[10]. At the same time, the aircraft roll angle started to increase from approximately 3.9 degrees left to a maximum of 9.2 degrees left, placing the aircraft in a right-wing-up attitude. At 2008:24, the right wing landing gear and right body gear were momentarily off the ground, and one second later, the PM called out "right wing down". Although the right wing rising tendency was

[9] Throttle Resolver Angle (TRA) is the analog electrical signal generated by thrust lever resolvers, which convert the pilot's forward and reverse thrust lever position into an input that is sent to the Electronic Engine Control (EEC) to determine commanded thrust.

[10] A TRA value of 57 degrees corresponds to a forward Thrust Lever Angle (TLA) of approximately 22 degrees according to the B747-8 Aircraft Maintenance Manual (AMM).

momentarily corrected, the aircraft began rolling to the left again after 2008:26. Simultaneously, the aircraft started to yaw to the right with the differential thrust condition.

At 2008:29, the control wheel position was at a maximum of 67.8 degrees to the right. One second later, at 2008:30, the aircraft reached an attitude of 1.4 degrees pitch up and a roll angle of 9.2 degrees to the right, while unidentified impact sounds possibly associated with the engine nacelle strike were recorded on the CVR. At the same time, No.1 forward thrust lever was pulled to idle position while No. 2, No. 3, and No. 4 reverse thrust lever to maximum reverse thrust. At 2008:40, the ACM called “no reverse number one” and the No. 1 reverse thrust lever was then pulled at 2008:41 hours.

According to crew interviews, an Engine Indicating and Crew Alerting System (EICAS) message “ENG 4 REVERSER” was momentarily displayed while the aircraft was vacating the runway. The aircraft then taxied to the parking bay without further incident.

During the post-landing walk-around, the crew discovered damage on the No. 4 engine and notified RCTP tower of the occurrence. Figure 1.1-1 shows the external appearance of the damage to No. 4 engine, while Figure 1.1-2 illustrates the FDR flight path of the occurrence flight.

Figure 1.1-1 External appearance of the damage to No. 4 engine

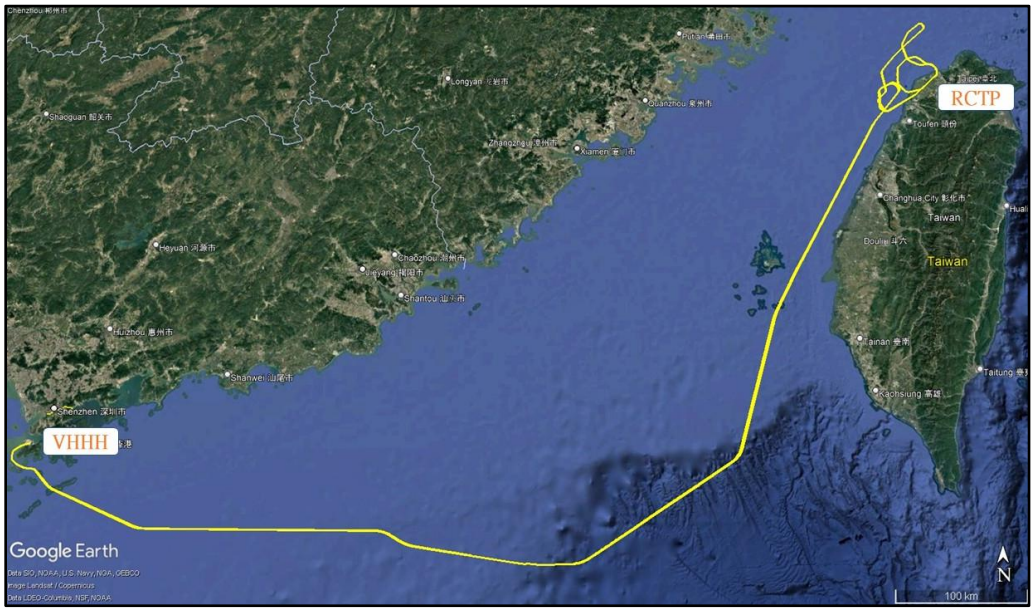


Figure 1.1-2 FDR recorded flight path of occurrence flight

1.2 Injuries to Persons

There was no injury to any person involved in the flight or to any third party.

1.3 Damage to Aircraft

The occurrence aircraft sustained damage to the lower portions of the No. 4 engine, the No. 4 engine nacelle, and the No. 3 engine nacelle as a result of ground impact. Subsequently, separated components caused minor damage to the right wing and fuselage. Detailed information is provided in Section 1.12.1.

1.4 Other Damage

Debris and components detached from the occurrence aircraft were scattered along the runway surface. Consequently, a B777F cargo aircraft (flight BR6032, registration B-16790) that landed subsequently sustained damage to three main landing gear tires and multiple scratches and punctures to its belly composite panels.

1.5 Personnel Information

1.5.1 The Flight Crew

The flight crew basic information is shown in Table 1.5-1.

Table 1.5-1 Flight crew basic information

Item	Captain	First Officer
Gender	Male	Male
Age as of the occurrence	63	51
Commenced employment with UPS Airlines	July 31, 2017	March 2, 2021
License date of issue	FAA ATP Certificate November 5, 2017	FAA ATP Certificate November 7, 2018
Type ratings	B747-400, B757, B767, B777	B737, B747-400, B777
Medical certificate date of examination	FAA first class March 28, 2025	FAA first class April 8, 2025
Total flight time	14,767 hrs	7,779 hrs
Total flight time on B747	2,685 hrs	2,105 hrs
Total flight time last 12 months	250 hrs	598 hrs
Total flight time last 90 days	61 hrs	93 hrs
Total flight time last 30 days	61 hrs	62 hrs
Total flight time last 7 days	14 hrs	11 hrs
Total flight time last 24 hours	2 hrs 41 mins	2 hrs 41 mins
Rest period before the occurrence	20 hrs 30 mins	20 hrs 30 mins

1.5.1.1 The Captain

The captain had a military background and entered civil aviation in 1997. He initially flew corporate aircraft, Hawker 125, for approximately 1.5 years. He later achieved his first command on the B757 and subsequently flew the B767, B777, and B747. He joined UPS Airlines in 2017 and has flown the B747 for the past eight years, including the -8F, -400F, and -BCF[11] variants. He had accumulated 14,767 total flight hours, of which 2,685 hours were on the B747.

The captain held an Airline Transport Pilot (ATP) Certificate issued by the Federal Aviation Administration (FAA) with ratings for airplane multiengine land and type ratings for B747-400[12], B757, B767 and B777.

[11] Boeing Converted Freighter (BCF) denotes a B747 aircraft that has been converted from a passenger configuration to a freighter configuration.

[12] The B747-400 pilot type rating is valid for both B747-400 series and B747-8 series.

He also held valid FAA Flight Instructor and Ground Instructor Certificates.

UPS Airlines operates under an FAA-approved Advanced Qualification Program (AQP), utilizing a Continuing Qualification (CQ) system that functions on a 24-month cycle divided into two 12-month evaluation periods. A midpoint CQ Proficiency (CQP) session is conducted within each 12-month evaluation period to sustain operational proficiency. The captain completed his most recent 3-day CQ recurrent session, which included recurrent ground and flight training and a Line Operational Evaluation (LOE), on September 30, 2024. His most recent recurrent line check was completed on May 4, 2024 [13], confirming satisfactory operational performance during line operations. In addition, he completed the CQP session on March 14, 2025 to maintain operational proficiency between CQ evaluations.

The captain held a first class medical certificate issued by the FAA on March 28, 2025, with no limitations.

The result of the captain's alcohol test, conducted by the RCTP operations officer after the occurrence, indicated a reading of 0.00 mg/L.

1.5.1.2 The First Officer

The first officer had a military background and entered civil aviation in 2017. He joined UPS Airlines in 2021. His commercial experience included three aircraft types, the B737, B777, and B747, and he had been operating the B747 for approximately four and a half years. He had accumulated 7,779 total flight hours, of which 2,105 hours on the B747.

The first officer held an ATP Certificate issued by the FAA with

[13] UPS is approved to conduct CQ line checks under the no-notice provision of the approved AQP per 14 CFR 121.915. Line checks for the pilot in command occur at least once every 24 months.

ratings for airplane multiengine land and type ratings for B737, B747-400 and B777.

The first officer completed his most recent 3-day CQ recurrent session, which included recurrent ground and flight training and a LOE, on March 26, 2025. His most recent recurrent line check was completed on August 25, 2024, confirming satisfactory operational performance during line operations. In addition, he completed the CQP session on July 21, 2025 to maintain operational proficiency between CQ evaluations.

The first officer held a first class medical certificate issued by the FAA on April 8, 2025, with the limitation: "Must use corrective lens(es) to meet vision standards at all required distances."

The result of the first officer's alcohol test, conducted by the RCTP operations officer after the occurrence, indicated a reading of 0.00 mg/L.

1.5.2 Flight Crew Activities within 72 hours Before the Occurrence

1.5.2.1 The Captain

August 11, 2025 – Anchorage time (UTC-8)

0900L Trip pairing began.
1140L Flight departed Anchorage.

August 12, 2025 – Shenzhen time (UTC+8)

1430L Arrived in Shenzhen and was transported to the hotel. Had a meal and went to sleep until after midnight.

August 13, 2025 – Shenzhen time (UTC+8)

0630L Worked out in the hotel gym, followed by breakfast. Rested afterwards in the hotel room for about 2.5 hours of light sleep.

1205L Checked out. Ground transportation was arranged from Shenzhen to Hong Kong Airport for the onward flight to Taipei. Upon arrival at Hong Kong Airport, had lunch with the first officer in the terminal.

1500L Proceeded to the aircraft. Departure was delayed until 1730L due to flow control.

1750L The aircraft was airborne.

1.5.2.2 The First Officer

August 10, 2025 – Anchorage time (UTC-8)

2100L Arrived in Anchorage and proceeded to the apartment. Went to sleep shortly after arrival.

August 11, 2025 – Anchorage time (UTC-8)

0700L Awoke, completed some errands, and picked up breakfast before reporting for pre-flight briefing. Operated UPS flight 76 as first officer from Anchorage to Shenzhen.

August 12, 2025 – Shenzhen time (UTC+8)

1430L Arrived in Shenzhen. Had dinner and went to sleep by 2200L.

August 13, 2025 – Shenzhen time (UTC+8)

0800L Awoke and had breakfast.

1200L Departed the Shenzhen hotel by ground transport to Hong Kong Airport. Had lunch at an airport restaurant with the captain. Proceeded to the aircraft and received an official delay of about 1.5 hours due to flow control.

1750L The aircraft was airborne.

1.6 Aircraft Information

1.6.1 Aircraft and Engine Basic Information

The aircraft basic information is shown in Table 1.6-1.

Table 1.6-1 Aircraft basic information

Aircraft basic information (till August 13 2025, through the end of the occurrence flight)	
Nationality	USA
Aircraft Registration Marks	N613UP
Manufacturer	Boeing
Aircraft model	B747-8F
Manufacturer's Serial Number	64259
Manufactured Date	11/2018
Received Date	11/08/2018
Owner	CCE
Operator	UPS
Certificate of Airworthiness Date	11/05/2018
Total Airframe Hours/Cycles	26,098.83 hours / 3,852 cycles
Maximum Takeoff Weight (MTOW)	987,000 lbs.
Maximum Landing Weight (MLW)	763,000 lbs.

The engine basic information is shown in Table 1.6-2.

Table 1.6-2 Engine basic information

Engine basic information (till August 13 2025, through the end of the occurrence flight)				
Number/Position	1	2	3	4
Manufacturer	GE Aviation			
Model	GENX-2B67/P			
Serial number	959770	959484	959763	959748
Manufacture date	1/31/2020	8/18/2014	9/28/2019	4/16/2019
Time since last maintenance	19.5	419.6	19.5	403.3
Cycle since last maintenance	3	63	3	59
Time since new	17,545	27,980	19,113	22,513
Cycle since new	2,633	4,119	2,855	3,344

1.6.2 Aircraft Maintenance Records

A review of the aircraft's Central Maintenance Computer (CMC) fault history and the records of the three flight legs prior to the occurrence revealed no anomalies related to the event.

The Present Legs Fault Summary Report from the Left CMC (CMC-L) recorded two faults during the occurrence flight:

- Initial Climb: An intermittent "CARGO SMOKE DETECTION MAIN DECK MID DETECTOR 32 FAIL."
- Taxi-in: A "ENG 4 REVERSER" fault recorded after landing.

The Existing Faults Summary Report from the CMC-L indicated six active faults remaining after landing. Four were associated with the stow locking mechanisms of the left and right thrust reversers on the No. 4 Engine. The remaining two involved the No. 4 Engine's starter pressure sensor and fuel filter pressure sensor. All six existing faults were logged following the engine nacelle strike.

1.6.3 Weight and Balance Information

According to the loading documentation provided by UPS Airlines and FDR data, the zero fuel weight of the occurrence aircraft was 605,300 lbs. The aircraft's zero fuel weight Center of Gravity (CG) was located at 20.0% Mean Aerodynamic Chord (MAC). The takeoff weight of the occurrence aircraft was 748,343 lbs. and the takeoff CG was located at 21.7% MAC. The zero fuel weight CG envelope and the takeoff CG envelope for B747-8F are depicted in Figures 1.6-1 and 1.6-2. Table 1.6-1 shows the occurrence aircraft's weight and balance data. The occurrence aircraft took off with approximately 142,835 lbs. of fuel on board and

landed with approximately 86,421 lbs. remaining.

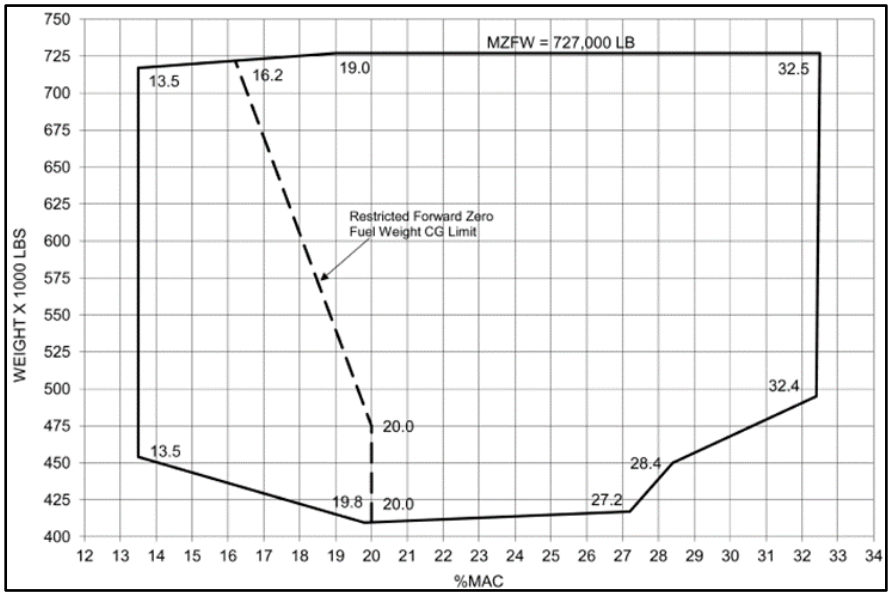


Figure 1.6-1 B747-8F zero fuel weight CG envelope[14]

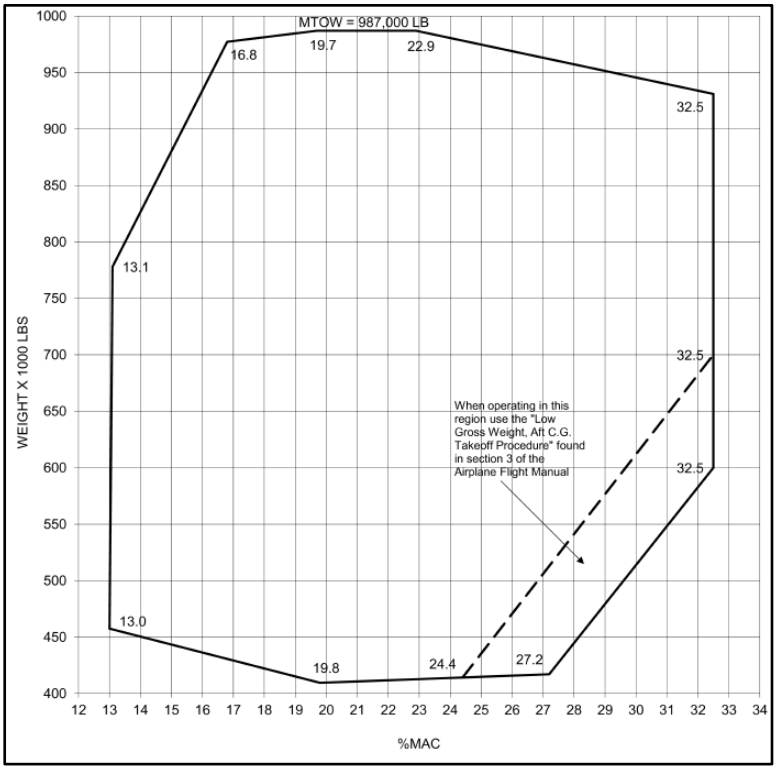


Figure 1.6-2 B747-8F takeoff CG envelope

[14] For takeoff weight ≤ 753,000 lbs.

Table 1.6-3 Weight and balance data

Max. zero fuel weight	727,000 lbs.
Zero fuel weight	605,300 lbs.
Max. takeoff weight	987,000 lbs.
Takeoff weight	748,343 lbs.
Takeoff fuel	142,835 lbs.
Estimated trip fuel	30,800 lbs.
Max. landing weight	763,000 lbs.
Landing weight	691,689 lbs.
Zero fuel weight CG	20.0% MAC
Takeoff CG	21.7% MAC
CG: Center of Gravity MAC: Mean Aerodynamic Chord	

1.6.4 Aircraft System

The B747-8 P9 control stand diagram is shown in Figure 1.6-3.

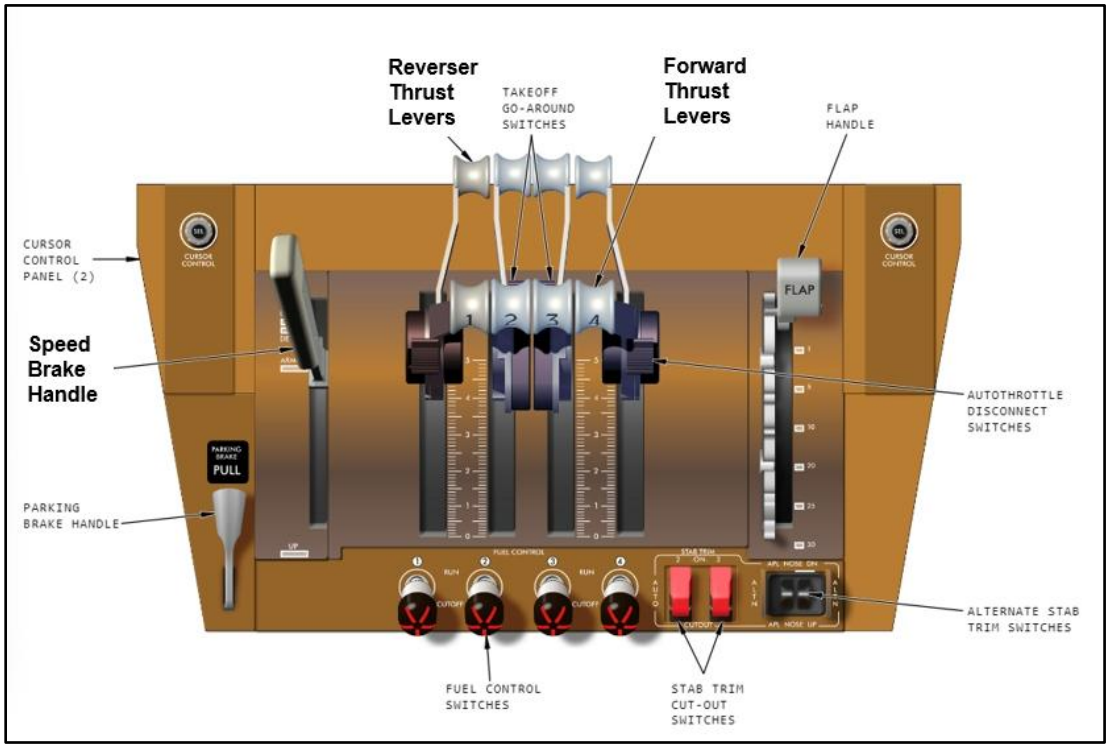


Figure 1.6-3 B747-8 P9 control stand diagram

1.6.4.1 Engine Thrust Control

Each engine is equipped with an independent thrust control system,

utilizing an architecture with no mechanical connections between the thrust levers and the engines. All thrust commands are transmitted electrically. Each thrust lever is mechanically connected to a Thrust Lever Position Resolver (TLPR). Whether the lever is moved manually by the crew or automatically by the autothrottle via a servo motor, the thrust lever and TLPR move in unison.

The TLPR converts the Thrust Lever Angle (TLA) into an electrical signal sent to the Electronic Engine Control (EEC), which regulates fuel flow to produce the commanded thrust. The thrust lever assembly provides manual control of both forward and reverse thrust and includes switches for autothrottle disengagement and go-around engagement. Continuous feedback from the TLPR ensures engine output accurately matches the commanded input.

The operational ranges for the levers are defined as follows:

- Forward Thrust: Travel is 50 degrees from idle to full forward thrust.
- Reverse Thrust: Travel is 89 degrees from idle to full reverse thrust.

1.6.4.2 Thrust Reverser Operation and Interlocks

Each engine is equipped with a hydraulic fan air thrust reverser system, restricted to ground operations while the engines are running. To ensure safety, a mechanical interlock prevents simultaneous forward and reverse thrust; the thrust levers must be at idle before reverse levers can be raised, and thrust levers remain locked until reverse levers are fully stowed.

When reverse levers are raised to the idle detent, hydraulic pressure

deploys the reversers, and an amber “REV” indication appears above the N1 gauge during transit. Once fully deployed, the indication turns green, signaling that the interlock is released and higher reverse thrust may be applied. During stowing, the “REV” indication reverts to amber and disappears once the unit is fully locked. An auto-stow feature automatically applies hydraulic pressure to lock the reverser if it unlocks without a command.

1.6.4.3 Speedbrake System Logic

The speedbrake system uses spoiler panels to modulate drag in flight and maximize braking on the ground.

- In-Flight Operation: Moving the lever to the flight detent partially extends inboard and middle spoilers. Beyond the flight detent, further movement is mechanically prevented to avoid excessive lift loss.
- Automatic Deployment: Deployment occurs if the lever is ARMED and thrust levers 1 and 3 are at idle upon main gear touchdown.
- Fail-Safe Backup: If unarmed, the lever is automatically driven to UP if thrust levers 1 and 3 are at idle and either reverse lever 2 or 4 is pulled to the idle detent while on the ground.
- Retraction Override: If thrust lever 1 or 3 is advanced from idle, the speedbrake lever is automatically driven to the down position for go-around protection.

1.6.4.4 Autobrake System and Disarm Logic

The autobrake system provides automated deceleration through

preselected rates.

- Rejected Takeoff (RTO) Mode: Commands maximum braking pressure if groundspeed exceeds 85 knots and all thrust levers are closed. It remains inactive below this threshold.
- Landing Mode: Application begins upon touchdown if all thrust levers are closed, ground mode is sensed, and wheel spin-up is detected. The system reduces brake pressure as thrust reversers and spoilers contribute to deceleration.
- Disarm Logic: The system disarms immediately if manual pedal braking is applied, any thrust lever is advanced, the speedbrake lever is stowed after deployment, or a system failure (e.g., antiskid fault) occurs.

1.7 Meteorological Information

1.7.1 Synopsis

At the time of the occurrence, the center of Typhoon Podul was located approximately 163 nautical miles (NM) southwest of RCTP, with a radius of approximately 70 NM. The relevant typhoon warning[15] is shown in Figure 1.7-1. The northern, southern, and southeastern areas of Taiwan were within the strong wind warning area associated with the outer circulation of the typhoon.

[15] Issued by the Taipei Aeronautical Meteorological Center at 2100 based on data valid at 2000.

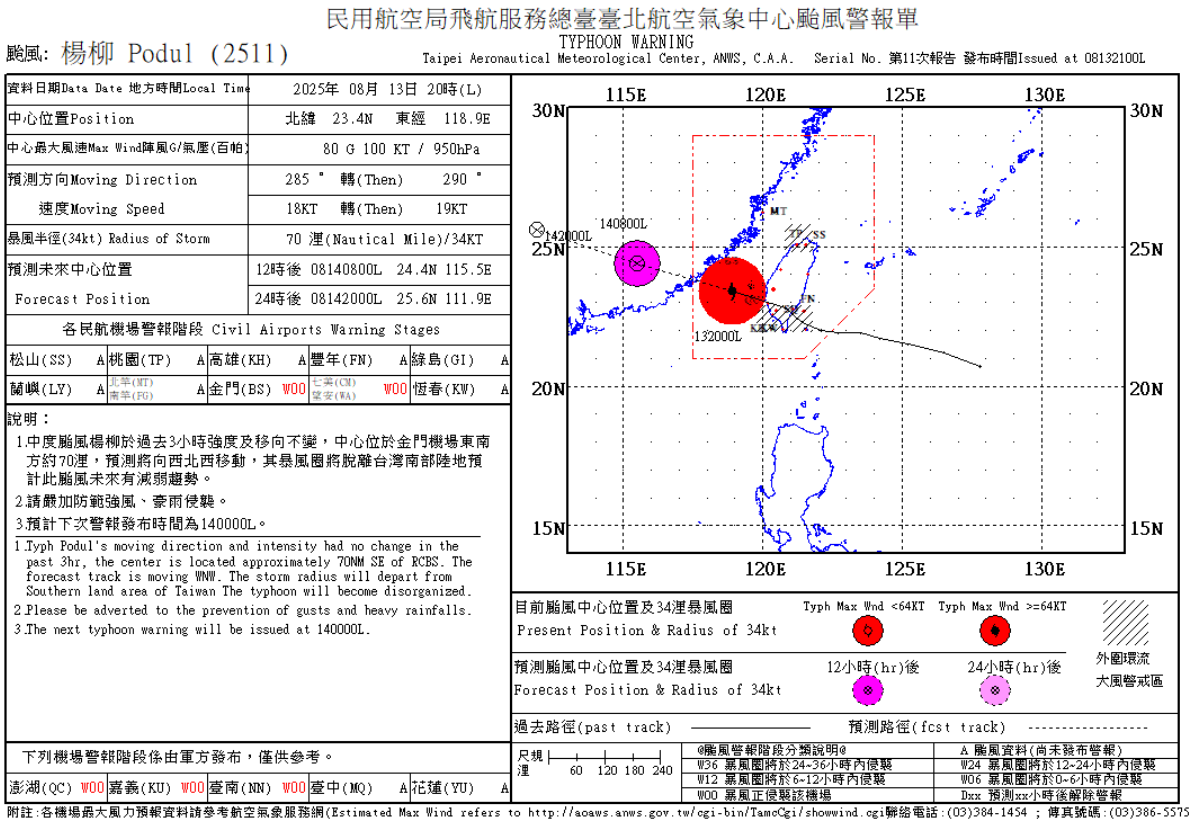


Figure 1.7-1 The typhoon warning

The following warnings, issued by RCTP Weather Station and valid at the time of the occurrence, were in effect:

Aerodrome Warning 2: valid from 1430 to 2020, surface wind from 090 degrees at 32 knots gusting to 46 knots observed at 1430.

Wind Shear Warning 4: valid from 1853 to 2253, severe wind shears all runway observed at 1853.

The Taipei Aeronautical Meteorological Center issued multiple Significant Meteorological Information (SIGMET)[16] advisories for the

[16] Information concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of aircraft operations.

Taipei Flight Information Region (FIR) on the day of the occurrence. Two SIGMETs remained in effect at the time of the occurrence, as detailed below:

SIGMET 7: valid from 1800 to 2100; tropical cyclone Podul at N2312 E11948; cumulonimbus was observed at 1700 within 70 nautical miles of the center of the tropical cyclone with top above flight level 450; no changes in intensity are expected; at 2000 the center of the tropical cyclone is forecast to be located at N2324 E11906, cumulonimbus is within 70 nautical miles of the center.

SIGMET 8: valid from 1800 to 2100; embedded thunderstorms are forecasted to be within N2400 E11730 - N2600 E12100 - N2600 E12400 - N2330 E12400 - N2100 E12130 - N2100 E11730 - N2400 E11730, with cloud tops above flight level 450 and moving westward at 10 knots; no changes in intensity are expected.

1.7.2 Surface Weather Observations

The METAR issued for RCTP before and after the occurrence were as follows:

METAR at 2000: wind from 100 degrees at 23 knots gusting to 36 knots, visibility greater than 10 kilometers, few clouds at 1,500 feet, scattered clouds at 18,000 feet, temperature 31°C; dew point temperature

22°C, altimeter setting 1,000 hPa, wind shear all runway, trend forecast - no significant change. Remarks: altimeter setting 29.55 in-Hg (ATIS T).

METAR at 2030: wind from 100 degrees at 28 knots gusting to 41 knots, visibility greater than 10 kilometers, few clouds at 1,500 feet, scattered clouds at 18,000 feet, temperature 31°C; dew point temperature 22°C, altimeter setting 1,000 hPa, wind shear all runway, trend forecast - no significant change. Remarks: altimeter setting 29.55 in-Hg (ATIS U).

1.7.3 Surface Weather Forecasts

The Aerodrome Forecasts (TAF) issued for RCTP, which valid at the time of the occurrence, were as follows:

TAF issued at 1300 valid from 1400 on August 13 to 2000 on August 14; wind from 080 degrees at 25 knots gusting to 40 knots, visibility 6,000 meters, few clouds at 1,200 feet, broken clouds at 3,200 feet;

temporarily between 1400 and 1600 on August 13, wind from 100 degrees at 37 knots gusting to 55 knots, visibility 4,000 meters with shower rain, few clouds at 1,000 feet, few cumulonimbus clouds at 1,200 feet, broken clouds at 1,600 feet, broken clouds at 3,000 feet;

temporarily between 1600 and 2000 on August 13, wind from 090 degrees at 30 knots gusting to 45 knots, visibility 4,000 meters with shower rain, few clouds at 1,000 feet, few cumulonimbus clouds at

1,200 feet, broken clouds at 1,600 feet, broken clouds at 3,000 feet;

becoming between 2200 and 2400 on August 13, wind from 140 degrees at 10 knots;

temporarily between 0200 and 0800 on August 14, wind from 030 degrees at 5 knots;

becoming between 0800 and 1000 on August 14, wind from 330 degrees at 8 knots;

becoming between 1800 and 2000 on August 14, wind from 140 degrees at 8 knots.

1.7.4 Surface Wind Observations

The locations of the anemometers associated with the Automated Weather Observation System (AWOS) and the Low-Level Wind Shear Alert System (LLWAS) at RCTP are shown in Figure 1.7-2. The AWOS anemometer height is 10 meters, while the LLWAS anemometer heights range from approximately 20 to 30 meters.

AWOS wind observations recorded between 2007 and 2009 are presented in Figure 1.7-3. Wind data from LLWAS sensors #3, #4, #5, #9, #10, #14, and #15, covering the period from 2007:05 to 2008:55, are shown in Figure 1.7-4.

Figure 1.7-2 AWOS and LLWAS anemometer locations at RCTP

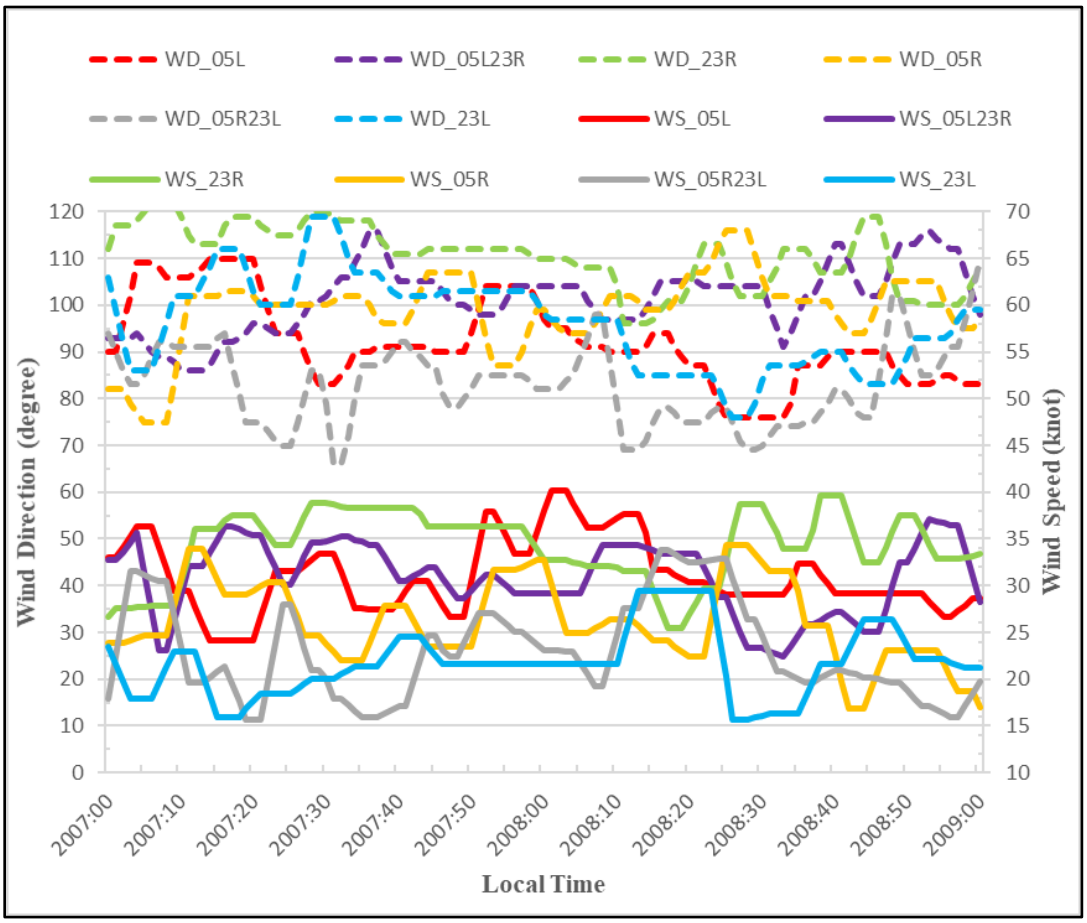


Figure 1.7-3 AWOS wind direction/speed

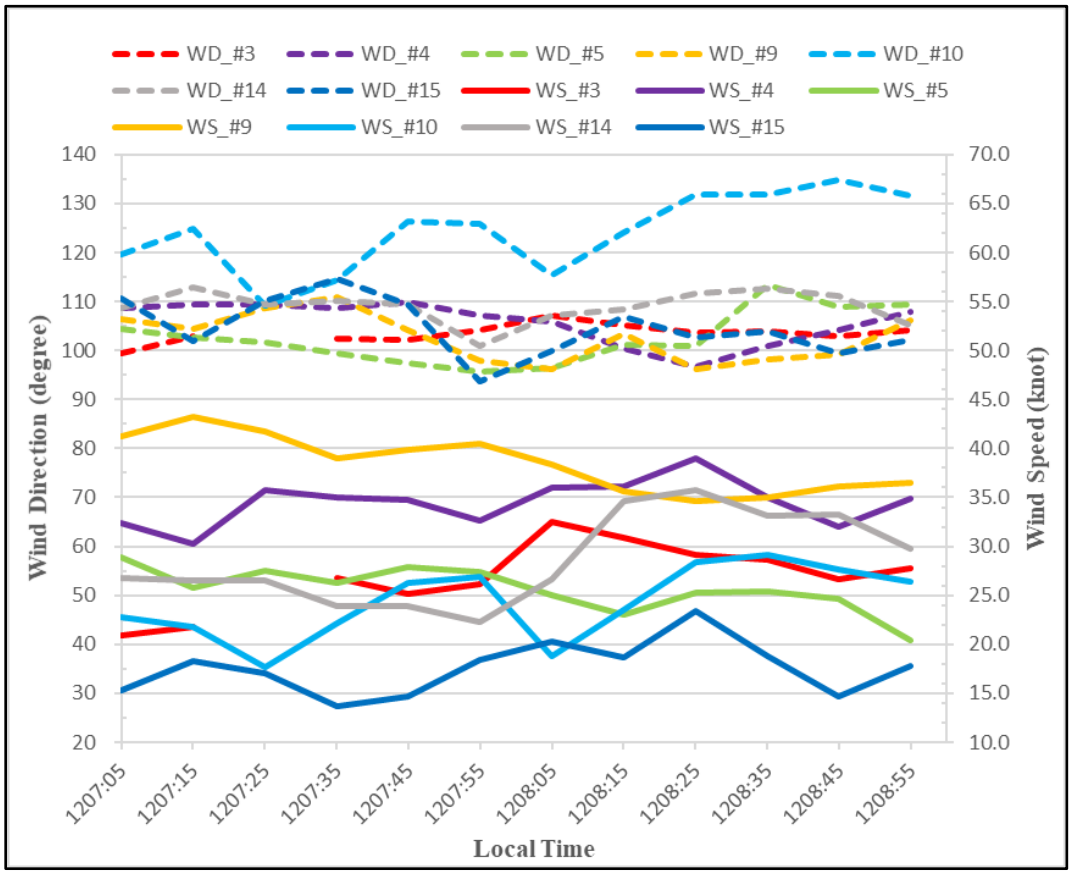


Figure 1.7-4 LLWAS wind direction/speed

1.7.5 Weather Information Summary

The weather information provided by RCTP Weather Station, AWOS, LLWAS, ATIS, and ATC units was summarized in Table 1.7-1.

Table 1.7-1 Summarized weather information

Time	Source	Details
1500	METAR	wind 090 degrees 33 knots gusting 50 knots directional variations 060 to 120 degrees, visibility 9,000 meters, QNH 999, wind shear all runway (ATIS I)
1600	METAR	wind 090 degrees 34 knots gusting 50 knots, visibility greater than 10 kilometers, minimum visibility 4500 meters (to south), QNH 998, wind shear all runway (ATIS K)
1700	METAR	wind 090 degrees 30 knots gusting 42 knots, visibility greater than 10 kilometers, minimum visibility 4500 meters (to south), QNH 998, wind shear all runway (ATIS M)
1730	METAR	wind 090 degrees 27 knots gusting 44 knots, visibility greater than 10 kilometers, QNH 999, wind shear all runway (ATIS N)
1800	METAR	wind 100 degrees 25 knots gusting 40 knots, visibility greater than 10 kilometers, QNH 999, wind shear all runway (ATIS O)
1830	METAR	wind 100 degrees 27 knots gusting 40 knots, visibility greater than 10 kilometers, QNH 1000, wind shear all runway (ATIS P)
1900	METAR	wind 110 degrees 22 knots gusting 35 knots, visibility greater than 10 kilometers, QNH 1000, wind shear all runway (ATIS Q)
1916	Taipei tower	Runway 05L wind 100 degrees 21 knots gusting 45 knots QNH 1000
1917	SPECI[17]	wind 100 degrees 27 knots gusting 45 knots, visibility greater than 10 kilometers, QNH 999, wind shear all runway (ATIS R)
1919	Taipei tower	Runway 05L wind 090 degrees 29 knots gusting 45
1930	METAR	wind 090 degrees 28 knots gusting 39 knots, visibility greater than 10 kilometers, QNH 999, wind shear all runway (ATIS S)
1931	ATIS S	wind 090 degrees 28 knots gusting 39 knots QNH 999, wind shear all runway
1932	Taipei tower	Runway 05L wind 090 degrees 30 knots gusting 39 QNH 999
1932	Taipei tower	Runway 05L arrival wind shear alert, 25 knots gain 2 miles final
1934	Taipei tower	Runway 05L wind 100 degrees 29 knots gusting 43 knots
1948	Taipei approach	Runway 05L wind 100 degrees 21 knots gusting 36 knots
2000	METAR	wind 100 degrees 23 knots gusting 36 knots, visibility

[17] Aerodrome special meteorological report.

Time	Source	Details
		greater than 10 kilometers, QNH 1000, wind shear all runway (ATIS T)
2000	Taipei approach	ATIS T QNH 1000
2001	ATIS T	wind 100 degrees 23 knots gusting 36 knots QNH 1000, wind shear all runway
2003	Taipei tower	Runway 05L wind 090 degrees 26 knots gusting 38 knots QNH 1000
2004	Taipei tower	Runway 05L arrival wind shear alert, 25 knots gain 2 miles final. R05R arrival wind shear alert, 15 knots loss 2 miles final
2005	Taipei tower	Runway 05L wind 090 degrees 28 knots gusting 38 knots
2006:35-2008:25	LLWAS	Runway 05L arrival wind shear alert, 15 knots loss on runway
2006	Taipei tower	Runway 05L arrival wind shear alert, 15 knots loss on runway

1.8 Aids to Navigation

There were no reported difficulties with navigational aids along the occurrence aircraft's flight path.

1.9 Communications

There were no communications issues related to this occurrence.

1.10 Aerodrome Information

1.10.1 Airside Basic Information

According to the Aeronautical Information Publication (AIP)[18] of Taipei FIR, RCTP is located 16.7 nautical miles (30.9 kilometers) west of Taipei City. Two runways are deployed in parallel, oriented northeast to southwest, designated as Runway 05L/23R and Runway 05R/23L. Runway 05L/23R has declared dimensions of 3,660 meters in length and 60 meters

[18] Effective date: 10 July, 2025.

in width. Runway 05L's true bearing is 49.08°, and the threshold elevation is 74 feet. It has neither a clearway nor a stopway. Runway 23R's true bearing is 229.08°, and the threshold elevation is 63 feet. It also has neither a clearway nor a stopway. Runway End Safety Area (RESA) with a length of 240 meters and a width of 150 meters is provided at both ends (See Figure 1.10-1). The mean profile slope of Runway 05L is about -0.09%.

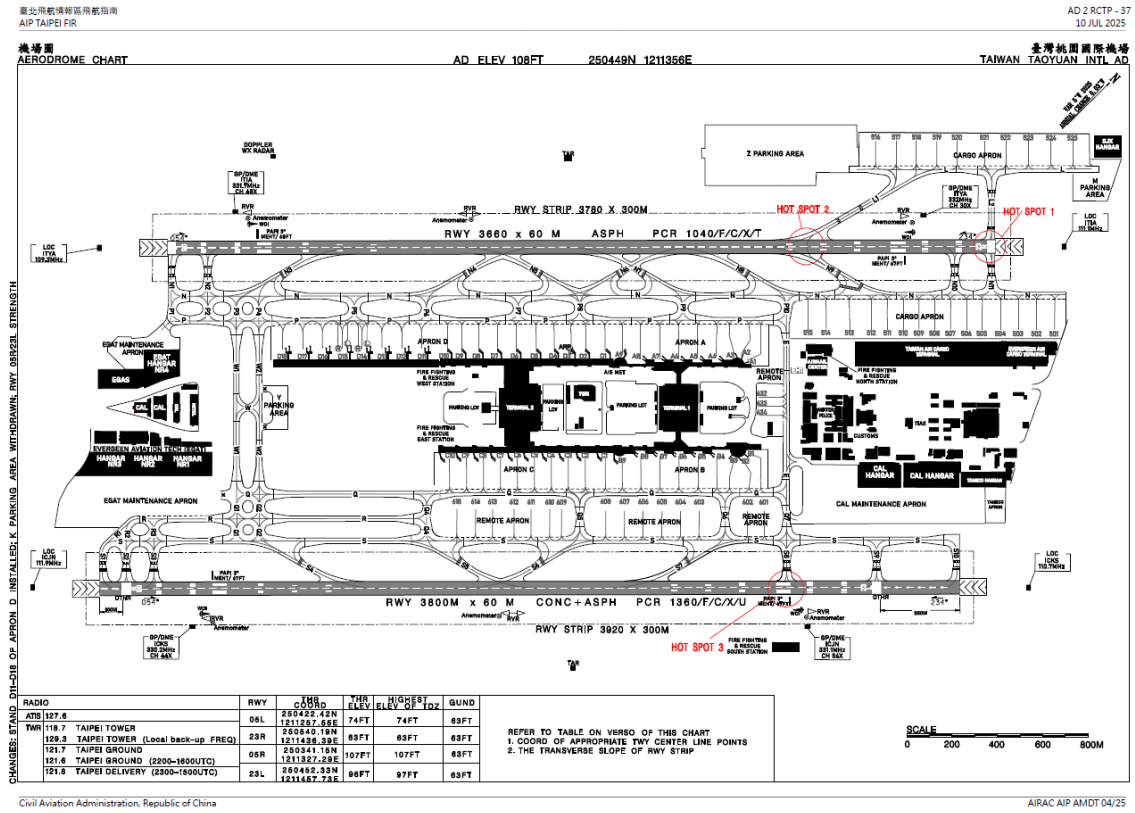


Figure 1.10-1 Aerodrome chart of RCTP

Runway 05L/23R is equipped with CAT II approach and runway lighting, as well as CAT II ILS. At the time of the occurrence, the systems were functioning normally, with no reported difficulties.

1.11 Flight Recorders

1.11.1 Cockpit Voice Recorder

This Cockpit Voice Recorder (CVR), the L3Harris FA2100-1025-22,

serial number 001209462, is a solid-state CVR capable of recording the most recent 2 hours of operation and contains 4-channel high-quality recording. The 4 channels of audio information recorded are: one channel for each flight crew, one channel for a cockpit observer, and one channel for the Cockpit Area Microphone (CAM). An examination of the downloaded CVR recording indicated each of the 4-channel contained 124 minutes and 0.3 seconds of audio information that pertained to the occurrence. The CVR audio quality of each channel was found to be either good or excellent. The investigation team prepared a summary of the CVR recording for about 30 minutes on two miss approaches, and a transcript related to the occurrence for about 13 minutes of audio recording.

Timings for the CVR recording were established by correlating the CVR events to common events on the FDR and then synchronizing those events with the FDR recorded time.

1.11.2 Flight Data Recorder

This Flight Data Recorder (FDR), the L3Harris FA2100-4945-22, serial number 001211412, is a solid-state FDR capable of recording more than 25 hours of flight data. The FDR data readout was performed based on the interpretation document[19] provided by the Boeing Company. The FDR recorded about 124 hours 58 minutes and 3 seconds of data with approximately 1,100 parameters.

Data from Quick Access Recorder (QAR), made by Teledyne Controls, which includes the relevant landing gear tilt position of the aircraft, is also available. Those corresponded QAR parameters were

[19] FDR data interpretation – Digital Flight Data Acquisition Card (DFDAC) interface control document, d243u316, revision:s.

readout[20] and then time synchronized with the FDR recorded time.

Additionally, wind information was obtained from AWOS data of the RCTP Runway 05L.

A review of the flight data related to the occurrence is summarized as follows, time shown refers to Taipei local time (UTC+8):

1. Between 2007:05 and 2008:10, the aircraft had its radio altitude descend from 1,000 to 110 feet, airspeed from 181 to 173 knots, groundspeed from 161 to 158 knots, pitch attitude between 1.1 degrees down and 0.7 degrees up, roll attitude between 0.4 and 0.7 degrees left, magnetic heading altering between 65.8 to 63.7 degrees, Throttle Resolver Angle (TRA)[21] of all engines between 53.5 and 55.6 degrees, Glideslope (G/S) deviation between 0.01 Difference in Depth Modulation (DDM) below and 0.1 DDM above, and Localizer (LOC) deviation between 0 to 0.01 DDM right. Autopilot was disengaged at 2007:43 at radio altitude of 430 feet. Windspeed varied between 25.6 and 33.3 knots, and wind direction changed between 85 and 93 degrees. At 2008:05 autothrottle was disconnected at radio altitude of 185 feet.

2. Between 2008:11 and 2008:15, the aircraft had its radio altitude descend from 92 to 36 feet, airspeed between 173 and 179 knots, groundspeed between 163 and 164 knots, rate of descent between 1,040 Feet Per Minute (FPM) and 752 FPM down, pitch attitude between 1.7 degrees and 0.7 degrees up, roll attitude between 0.7 degrees left and 3.1 degrees right, magnetic heading altering between 60.5 and 63.6

[20] QAR data interpretation – application requirements document for IDMU P/N 2252000-26 (Collins P/N 822-1799-102) acms application for Rockwell Collins, ard-col0053oprtr, revision:c.

[21] Corresponded TRA of all engine indicated throttle position, which is refered to Aircraft Maintenance Manual, Part I, UPS Rev48. 15 Jul 2025. D633U8101-UPS Chapter 76-11-00-212 ENGINE CONTROL SYSTEM-THRUST LEVER POSTION RESOLVER-FUNCTIONAL DESCRIPTION.

degrees, G/S deviation between 0.08 DDM above and 0.1 DDM above, and LOC deviation between 0 and 0.01 DDM right. TRA of all engines from 55 degrees to 48 degrees. Windspeed varied between 25.6 and 33.3 knots, and wind direction changed between 85 and 93 degrees.

3. At 2008:16, the aircraft had its radio altitude at 31 feet, airspeed 177 knots, groundspeed 164 knots, rate of descent 672 FPM down, pitch attitude 1.7 degrees up, roll attitude 0.4 degrees left, magnetic heading 60.1 degrees, G/S deviation at 0, and LOC deviation at 0.01 DDM right. TRAs were 40.3 degrees (ENG 1), 39.2 degrees (ENG 2), 36.2 degrees (ENG 3), and 34.5 degrees (ENG 4). N1 were 65.5% Revolutions Per Minute (RPM) (ENG 1), 64.4% RPM (ENG 2), 63.2% RPM (ENG 3), and 61.5% RPM (ENG 4), as it flew over Runway 05L threshold. Windspeed recorded at 27.4 knots with wind direction at 90 degrees.

4. Between 2008:17 and 2008:20, the aircraft continued to descend at airspeed 169 knots, then increased to 184 knots, it had its groundspeed between 164 and 160 knots, with a rate of descent reducing from 448 FPM to 240 FPM down, pitch attitude between 0 and 1.7 degrees up, and roll attitude between 1.8 degrees right to 2.5 degrees left. Magnetic heading altered between 60.2 and 59.5 degrees, G/S deviation remained neutral, and LOC deviation was 0.05 DDM right. TRA remained at the same position. Wind conditions approximately remained.

5. Following 2008:21, the aircraft's left wing gear touched down as the recorded gear status changed from "air" to "ground" and QAR "landing gear tilt" changed from "tilt" to "notilt." LOC deviation was at 0.04 DDM right. Vertical acceleration recorded a maximum value of 1.2g's. The aircraft had its airspeed 174 knots, groundspeed 160 knots, pitch attitude 1.1 degrees up, roll attitude 2.5 degrees left, and magnetic

heading 58.4 degrees.

6. Between 2008:21 and 2008:34, selected recorded parameters related to aircraft control inputs and attitude are listed in Table 1.11-1. At 2008:30 the aircraft had its largest roll angle during landing roll at 9.2 degrees right.

7. Engine TRAs and N1 variation between 2008:21 and 2008:40 are as follows:

   - Upon aircraft touchdown, ENG 1 TRA gradually increased from 36.4 degrees to 57.2 degrees while those of others remained approximately at the same positions between 34.3 degrees and 37.30 degrees.

   - Between 2008:23 and 2008:28, TRA of engines 2, 3, and 4 were reduced to between 23.9 degrees and 25.2 degrees while ENG 1 TRA remained between 57.9 degrees and 55.6 degrees. During the period, ENG 1 N1 increased from 39.9% to 70.2% while those of other engines remained between 36.9% and 39.6% RPM.

   - At 2008:29, ENG 1 TRA was reduced from 55.6 degrees to 35.4 degrees in 2 seconds, while ENG 2 TRA was reduced from 24.5 degrees to 5.1 degrees, ENG 3 TRA was reduced from 23.8 degrees to 4.8 degrees, and ENG 4 TRA was reduced from 23.9 degrees to 5.1 degrees. ENG 1 N1 was recorded between 70.2% RPM and 60.7% RPM in the same period of time.

   - Between 2008:38 and 2008:40, ENG 1 TRA began to reduce from 35.0 degrees to 4.9 degrees.

8. At 2008:59, the aircraft vacated Runway 05L.

9. The FDR stopped recording at 2011:51.

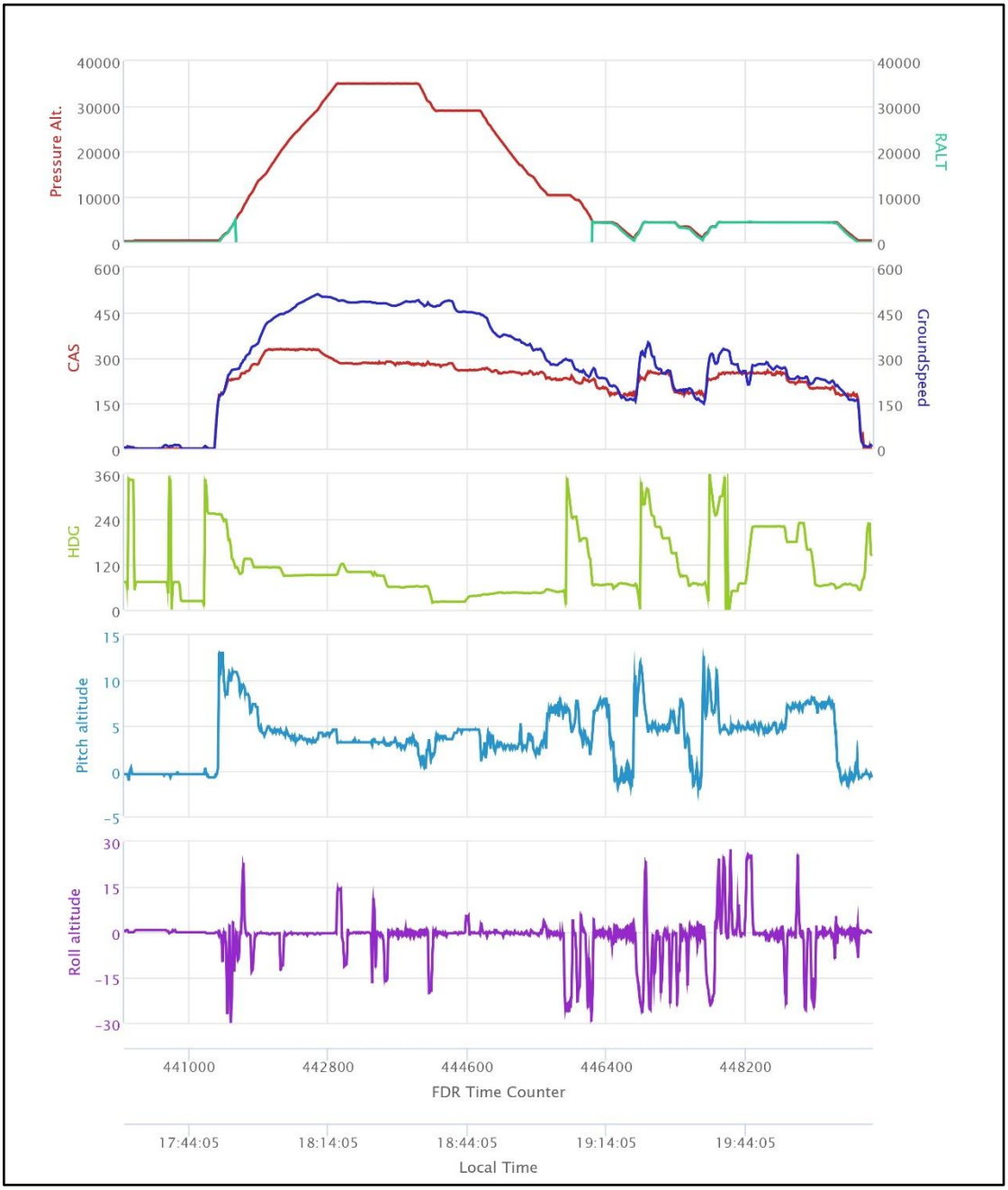
10. The following figures outline the phases of the flight occurrence:

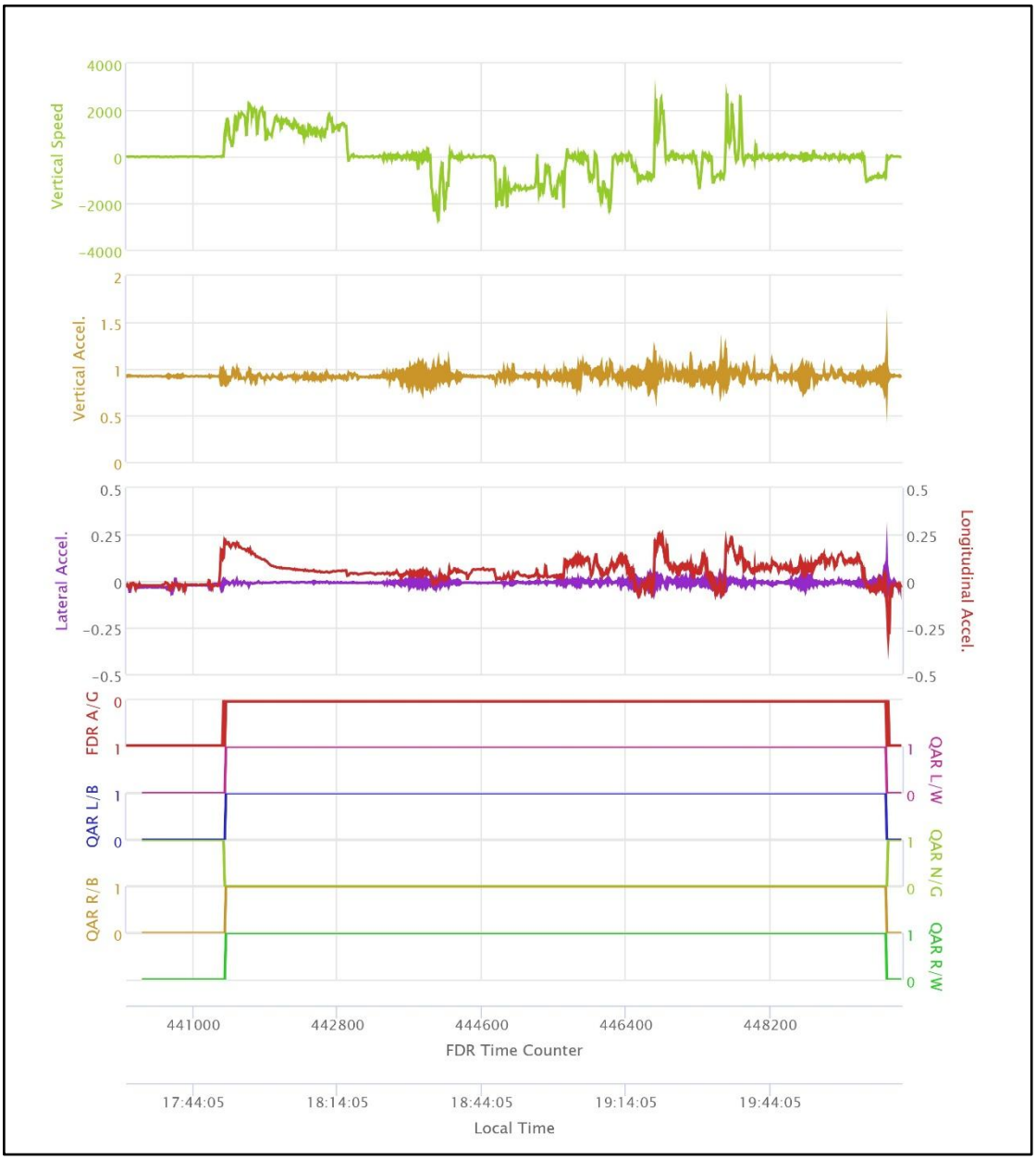
- Figure 1.11-1 shows selected FDR parameters of the occurrence flight;
- Figure 1.11-2 shows selected parameters of stabilized approach criteria when the aircraft was between 1,000 and 50 feet in radio altitude;
- Figure 1.11-3 shows selected FDR parameters of the occurrence flight when the aircraft was below radio altitude of 500 feet; and
- Figure 1.11-4 shows selected FDR parameters for the duration from the aircraft's left wing gear touching down at 2008:21 until the aircraft vacated Runway 05L at 2008:39.

Table 1.11-1 Selected parameters related to aircraft control inputs and attitude during landing

Time	CAS/GND speed (kts)	Magnetic heading (deg.)	Rudder pedal Pos. (deg.)	Roll attitude (deg.)	Control wheel pos. (deg.)	Landing gear	Nose Gear Wow	Left wing gear	Left body gear	Right body gear	Right wing gear
						FDR	QAR				
								0= “notilt” / 1= “tilt”			
2008:21	174/160	58.4	2.4 left	2.5 left	12.7 right	GND	AIR	1→0	1→0	1→0	1→0
2008:22	174/159	58.4	2.1 left	0.4 left	32.7 left	GND	AIR	0	0	0	0
2008:23	167/157	58.1	2.7 left	3.9 left	1.2 left	GND	AIR	0	0	0	0
2008:24	158/156	57.4	3.7 left	9.2 left	0.6 right	AIR	AIR	0	0	0→1	0→1
2008:25	164/155	57.0	2.2 left	7.1 left	47.1 right	AIR	AIR	0	0	1→0	1→0
2008:26	166/154	57.4	2.0 left	2.1 left	12.5 left	GND	AIR	0	0	0→1	0→1
2008:27	169/153	57.7	1.5 left	4.2 left	7.0 right	AIR	AIR	0	1	1	1
2008:28	162/152	58.8	2.5 left	3.9 left	28.9 right	GND	AIR	0	0	1→0	1→0
2008:29	158/151	60.5	12.4 left	1.1 right	67.8 right	AIR	AIR	0→1	0	0	0
2008:30*	158/149	61.9	15.8 left	9.2 right	24.1 left	AIR	AIR	1	1	0	0
2008:31*	162/145	59.8	13.1 left	2.8 right	28.2 right	GND	AIR	1→0	1→0	0	0
2008:32*	149/142	57.4	21.2 left	6.3 left	35.4 right	GND	GND	0	0	0→1→0	0
2008:33*	144/139	55.6	21.3 left	2.1 left	25.2 right	GND	AIR	0	0	0	0
2008:34*	141/136	53.1	18.0 left	2.8 right	49.5 right	GND	GND	0	0	0	0

*ENG2, ENG3, and ENG4 thrust reversers deployed.


Pressure Alt.
RALT
CAS
GroundSpeed
HDG
Pitch altitude
Roll altitude
441000
442800
444600
446400
448200
FDR Time Counter
17:44:05
18:14:05
18:44:05
19:14:05
19:44:05
Local Time


Vertical Speed
4000
2000
0
-2000
-4000
Vertical Accel.
2
1.5
1
0.5
0
Lateral Accel.
Longitudinal Accel.
0.5
0.25
0
-0.25
-0.5
FDR A/G
QAR L/B
QAR R/B
QAR L/W
QAR N/G
QAR R/W
441000
442800
444600
446400
448200
FDR Time Counter
17:44:05
18:14:05
18:44:05
19:14:05
19:44:05
Local Time

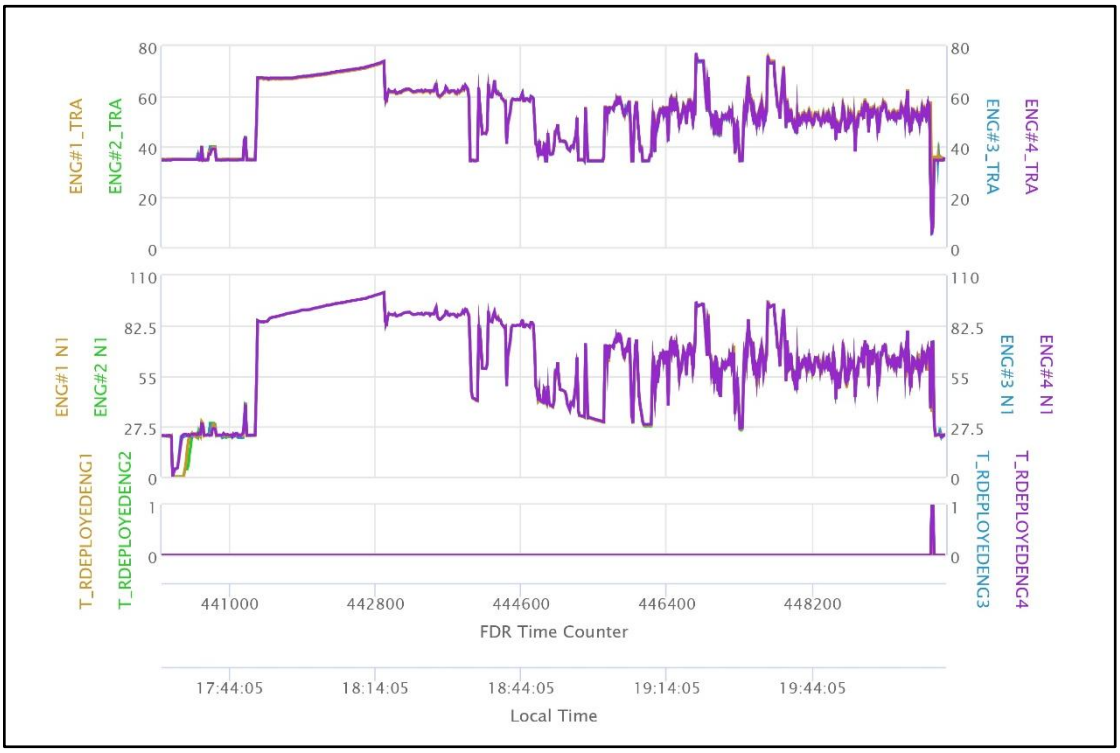


Figure 1.11-1 Selected FDR parameter readout from the occurrence flight

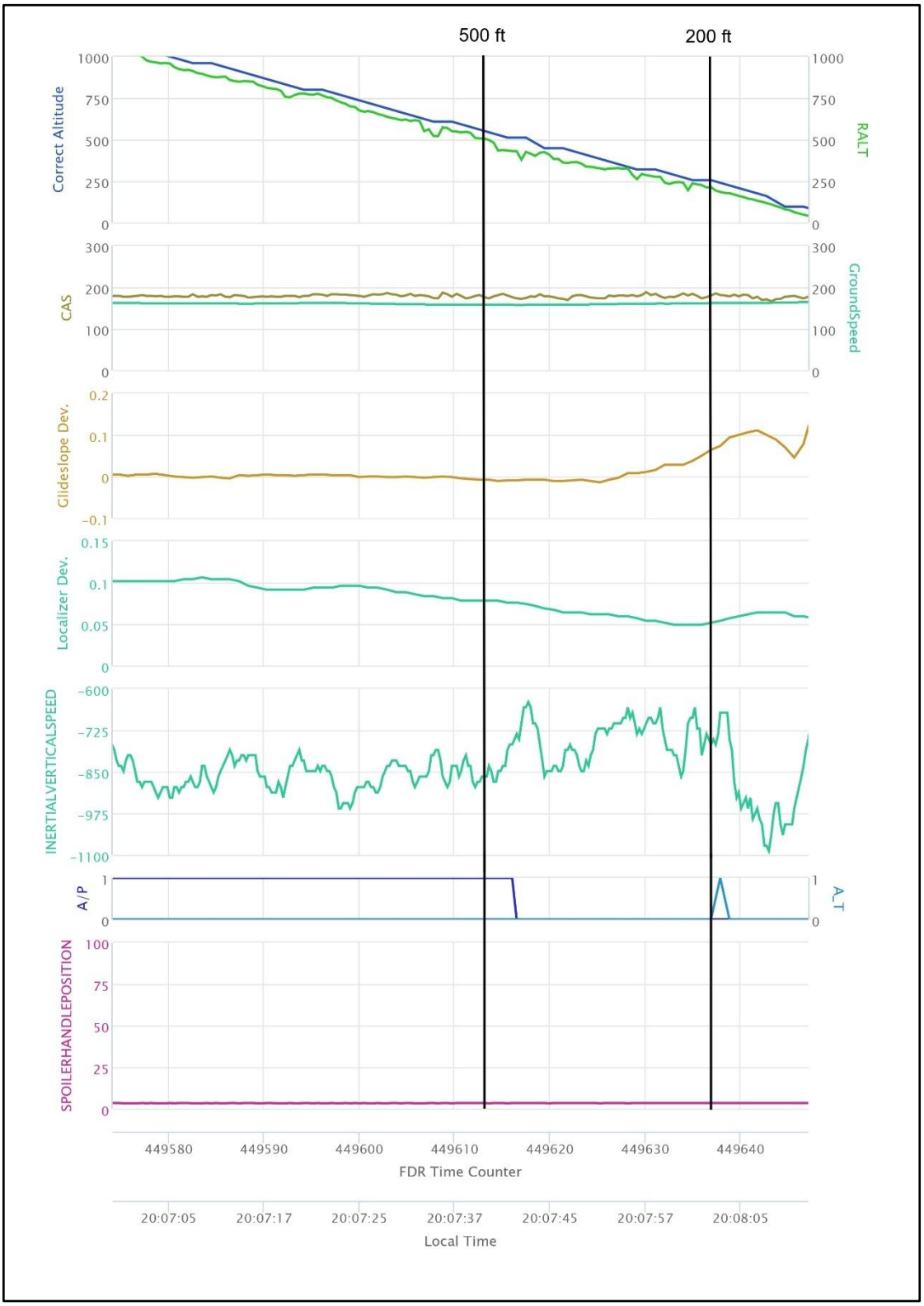


Figure 1.11-2 Selected FDR parameter readout of stabilized approach criteria


Pressure Alt.
RALT
CAS
GroundSpeed
Rudder Pedal Pos.
HDG
Control column Pos.
Pitch attitude
Control WHL Pos.
Roll attitude
Wind Speed
WS (AWOS)
Wind Direction
WD (AWOS)
449620
449630
449640
449650
449660
FDR Time Counter
20:07:45
20:07:57
20:08:05
20:08:17
20:08:25
Local Time

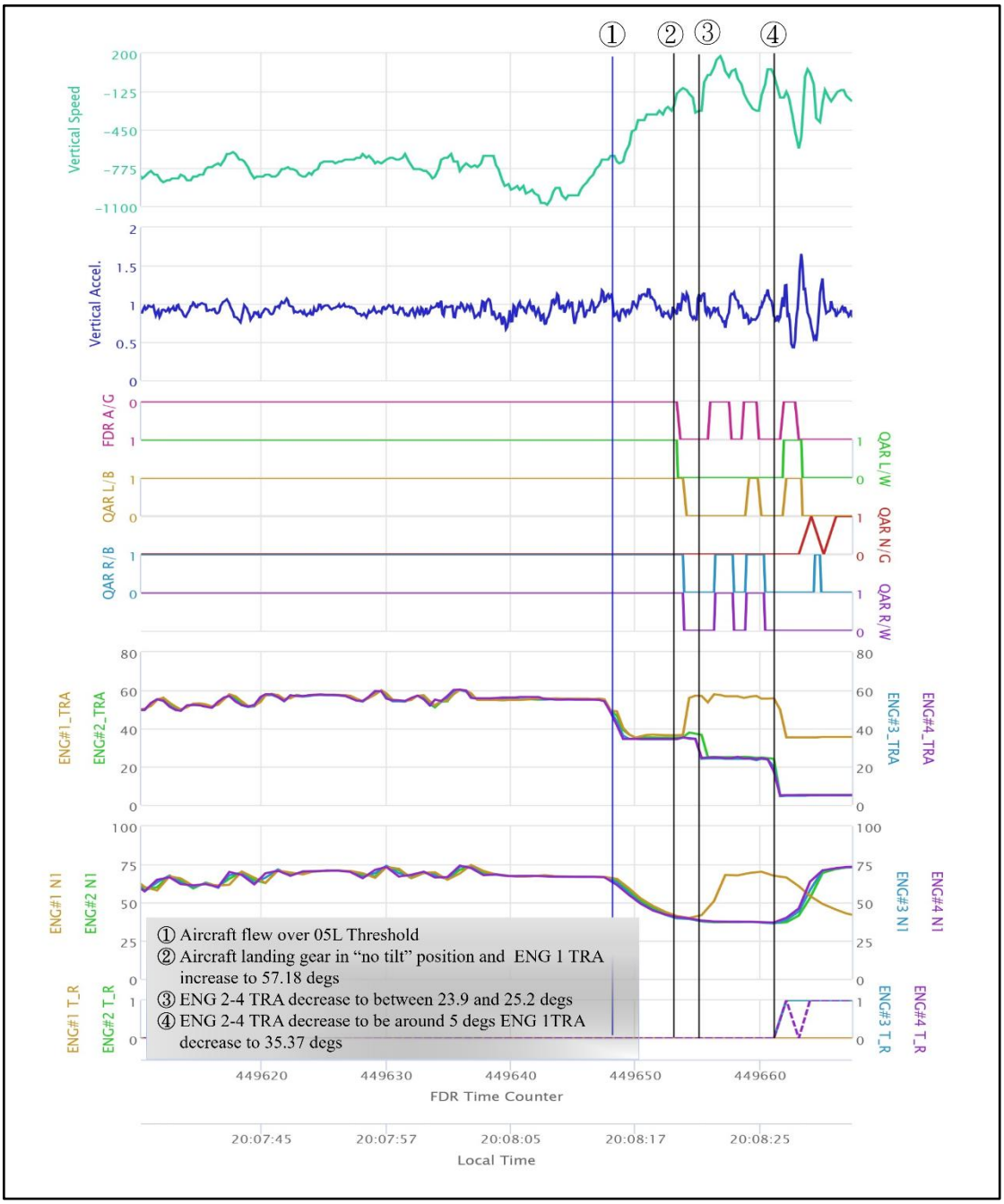
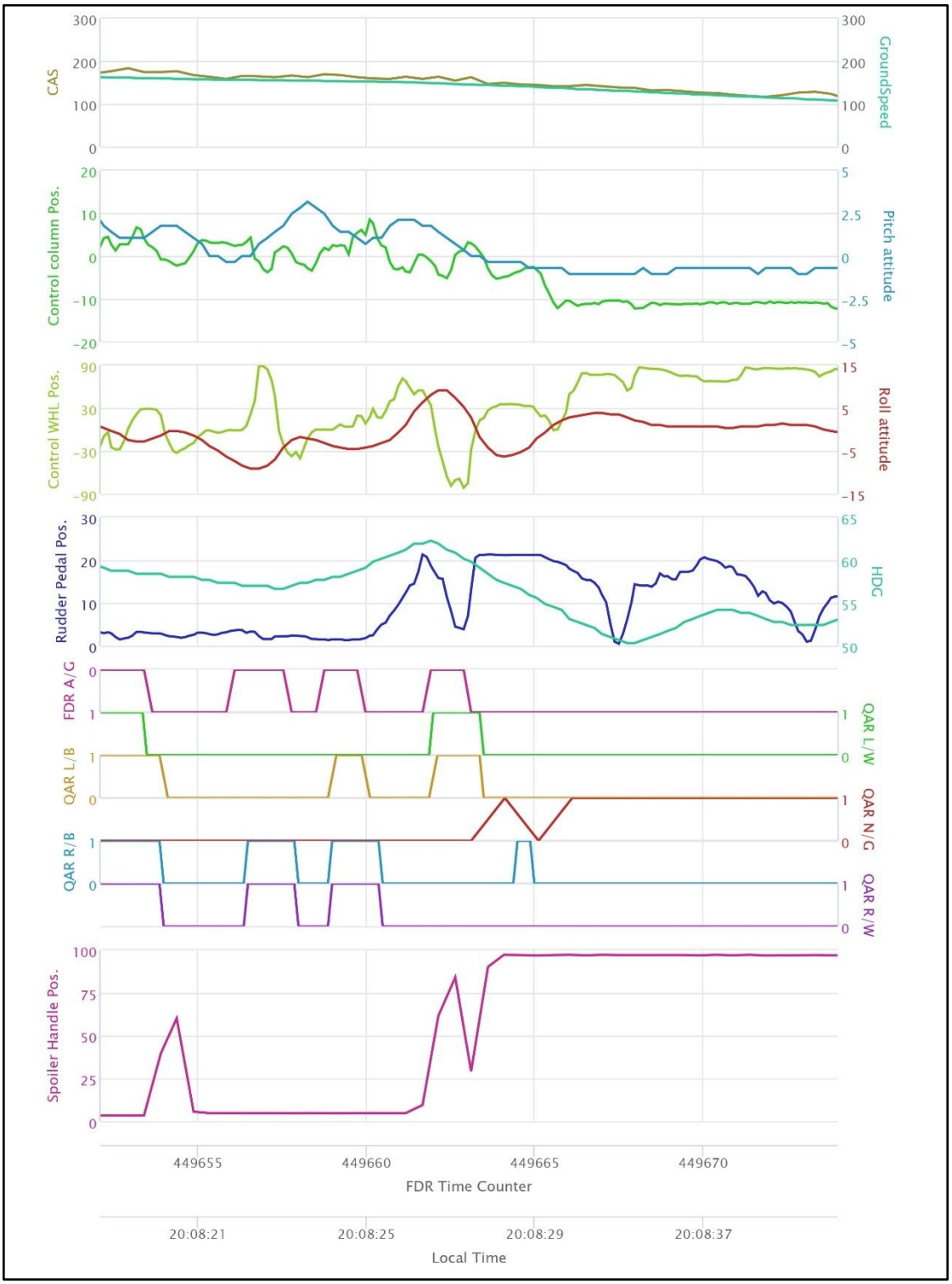


Figure 1.11-3 Selected FDR readouts during landing phase (below RA 500 ft)


CAS
GroundSpeed
Control column Pos.
Pitch attitude
Control WHL Pos.
Roll attitude
Rudder Pedal Pos.
HDG
FDR A/G
QAR L/W
QAR L/B
QAR N/G
QAR R/B
QAR R/W
Spoiler Handle Pos.
449655
449660
449665
449670
FDR Time Counter
20:08:21
20:08:25
20:08:29
20:08:37
Local Time

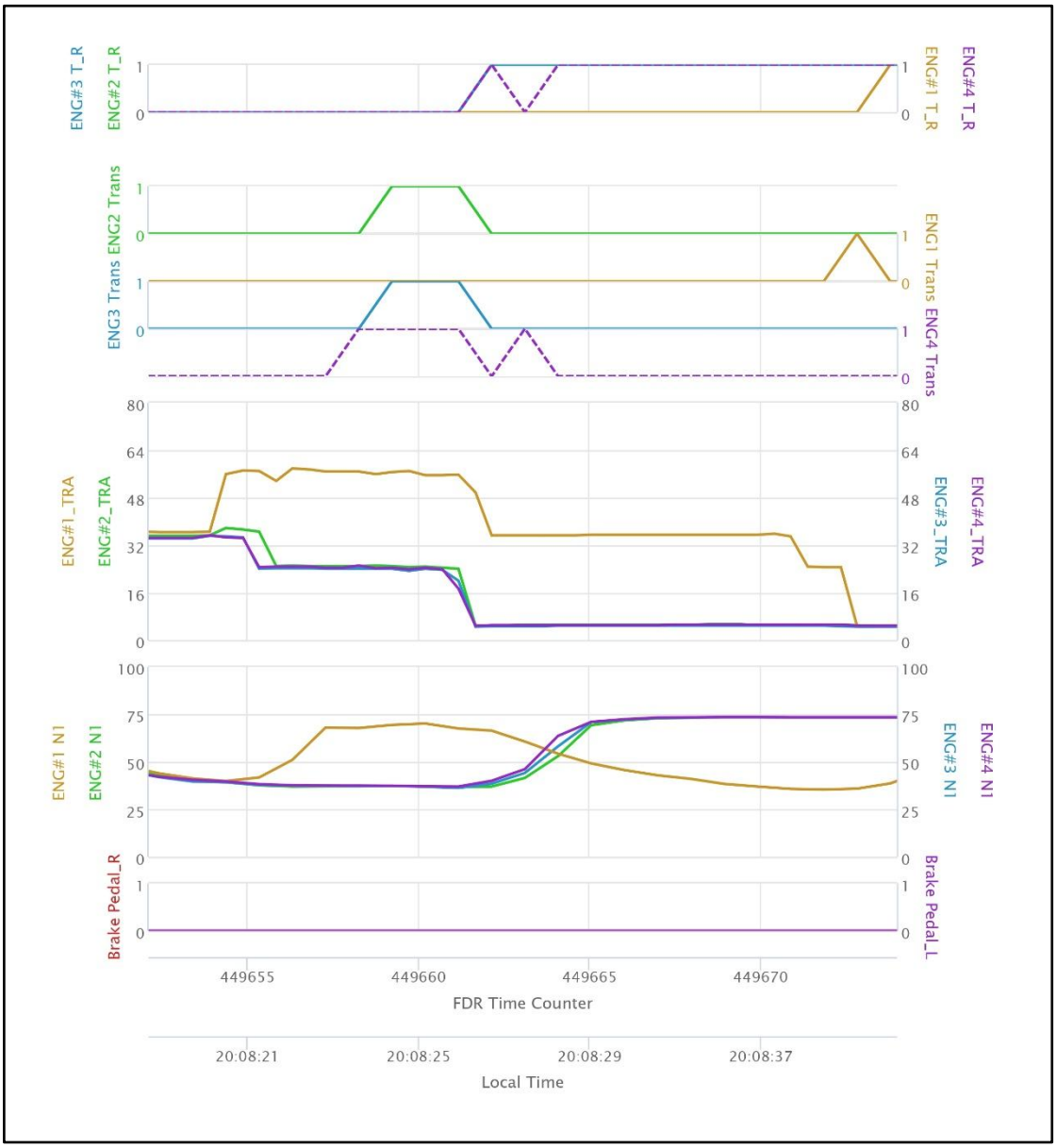


Figure 1.11-4 Selected FDR readouts for the duration from the left wing gear touched down until the aircraft vacated Runway 05L

1.12 Wreckage and Impact Information

1.12.1 Aircraft Damage

The damage sustained by the occurrence aircraft can be categorized into four major areas: the No. 4 engine and nacelle, the No. 3 engine nacelle, the wing, and the fuselage. These are described in detail below.

1.12.1.1 No. 4 Engine and Nacelle

The nacelle consists of the inlet cowl, fan cowl, and thrust reverser cowl. Following the occurrence, the inlet cowl remained attached to the engine, and the thrust reverser cowl remained attached to the pylon; however, both exhibited impact and abrasion damage on their lower surfaces due to ground contact.

The four latch assemblies on the lower side of the fan cowl separated from the cowl structure, causing the fan cowl to become unsecured. Consequently, both the inboard and outboard halves detached from the pylon and were scattered across the runway surface and adjacent grass areas.

The No. 4 engine itself was compressed by the displaced inlet and thrust reverser cowls. The thrust reverser channel, attached to the aft portion of the fan case, was found fractured and separated. Several tubes and support brackets located in the lower section of the engine were deformed due to compression. Notably, the air starter was forced upward, causing a crack in the aft face of the accessory gearbox casing.

Although the lower portion of the engine sustained damage, data recorded in the FDR indicates that the No. 4 engine continued to operate normally until it was shut down after taxi-in. The data also indicated that, following the ground impact, the engine oil quantity was approximately five quarts lower than that of the other engines.

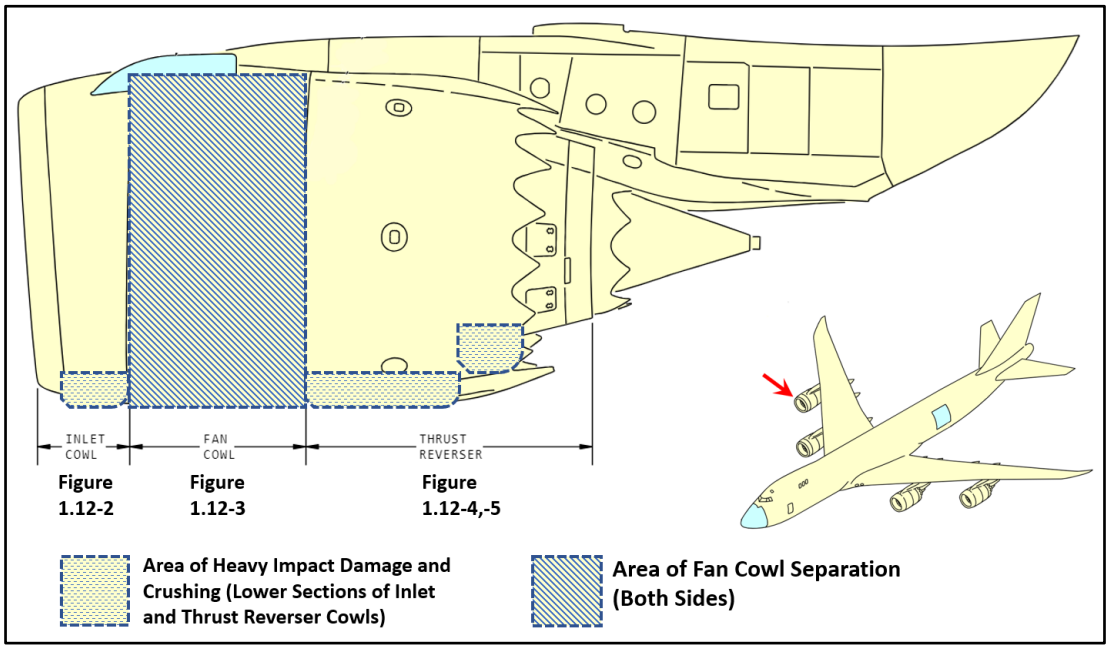


Figure 1.12-1 No. 4 engine nacelle damage areas

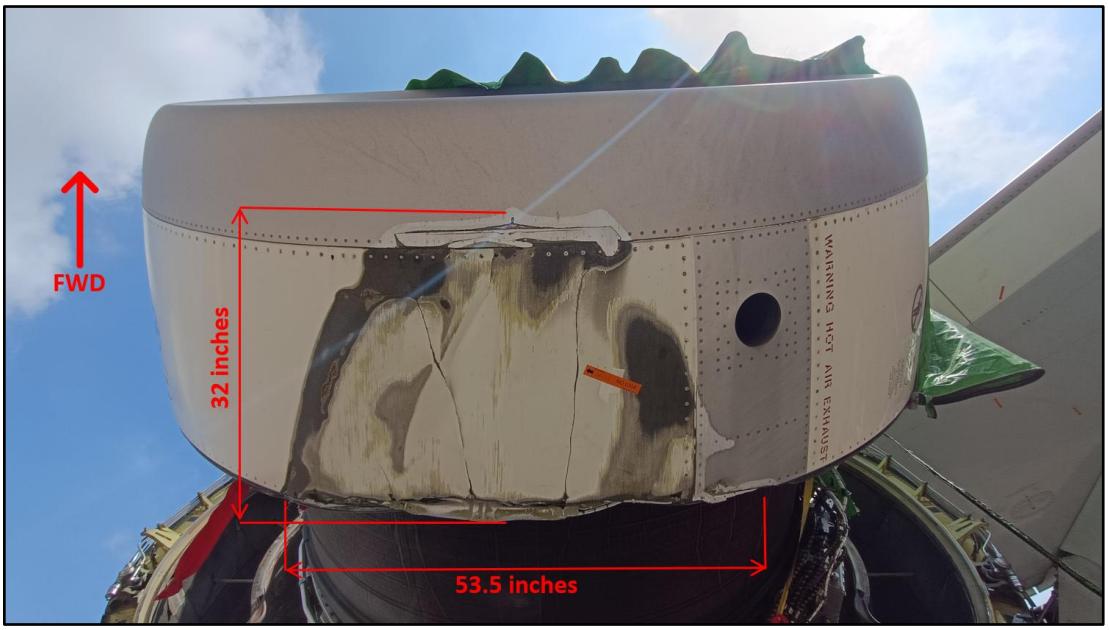


Figure 1.12-2 No. 4 engine inlet cowl damage areas (bottom view)

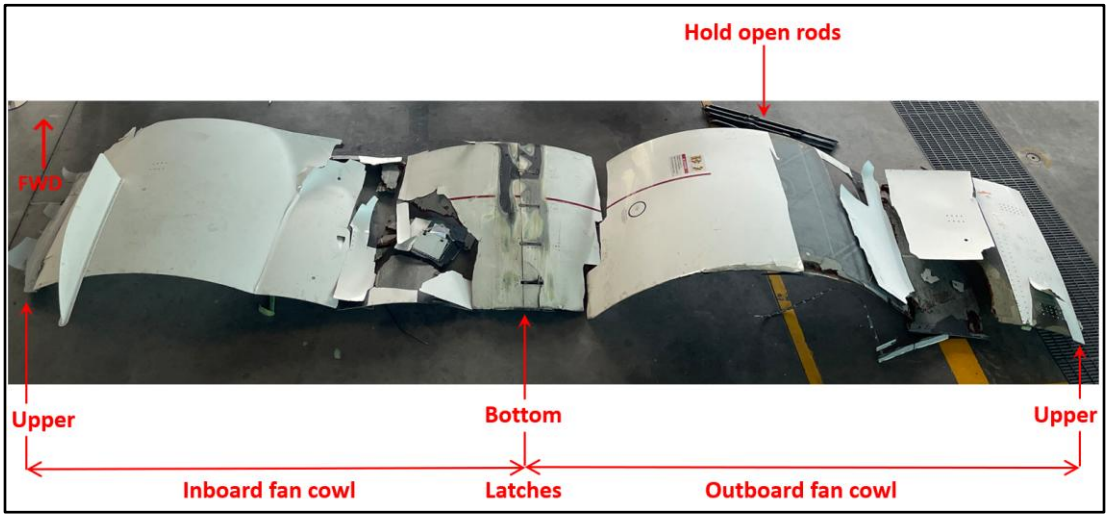


Figure 1.12-3 Reassembled fragments of the No. 4 engine fan cowl

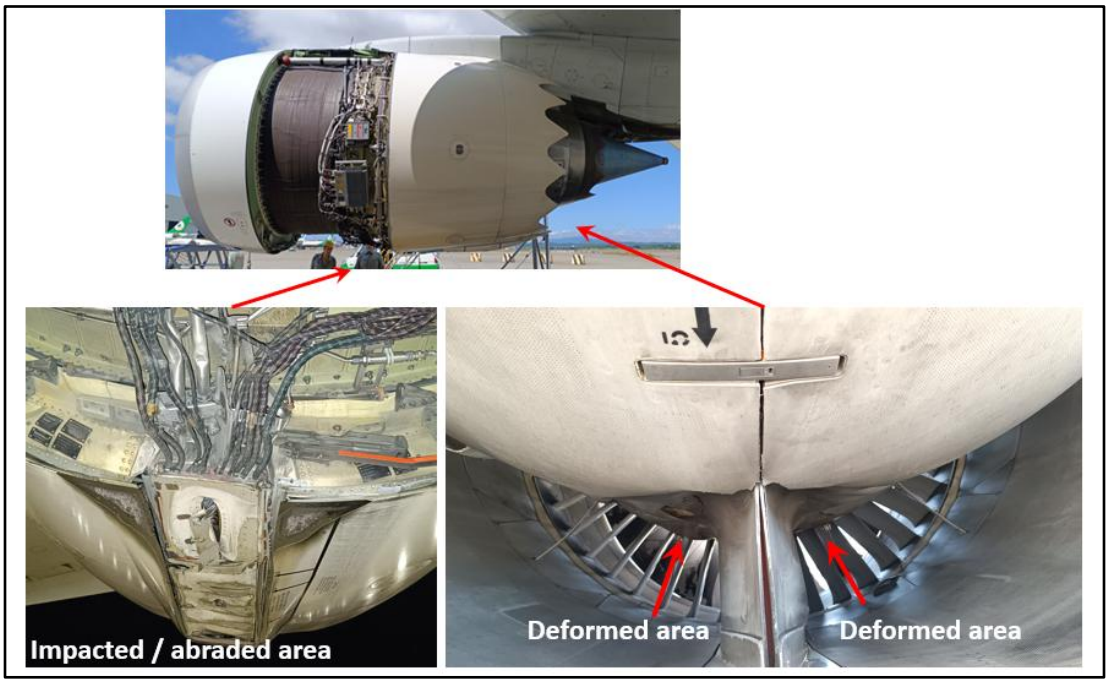


Figure 1.12-4 No. 4 engine thrust reverser cowl damage areas

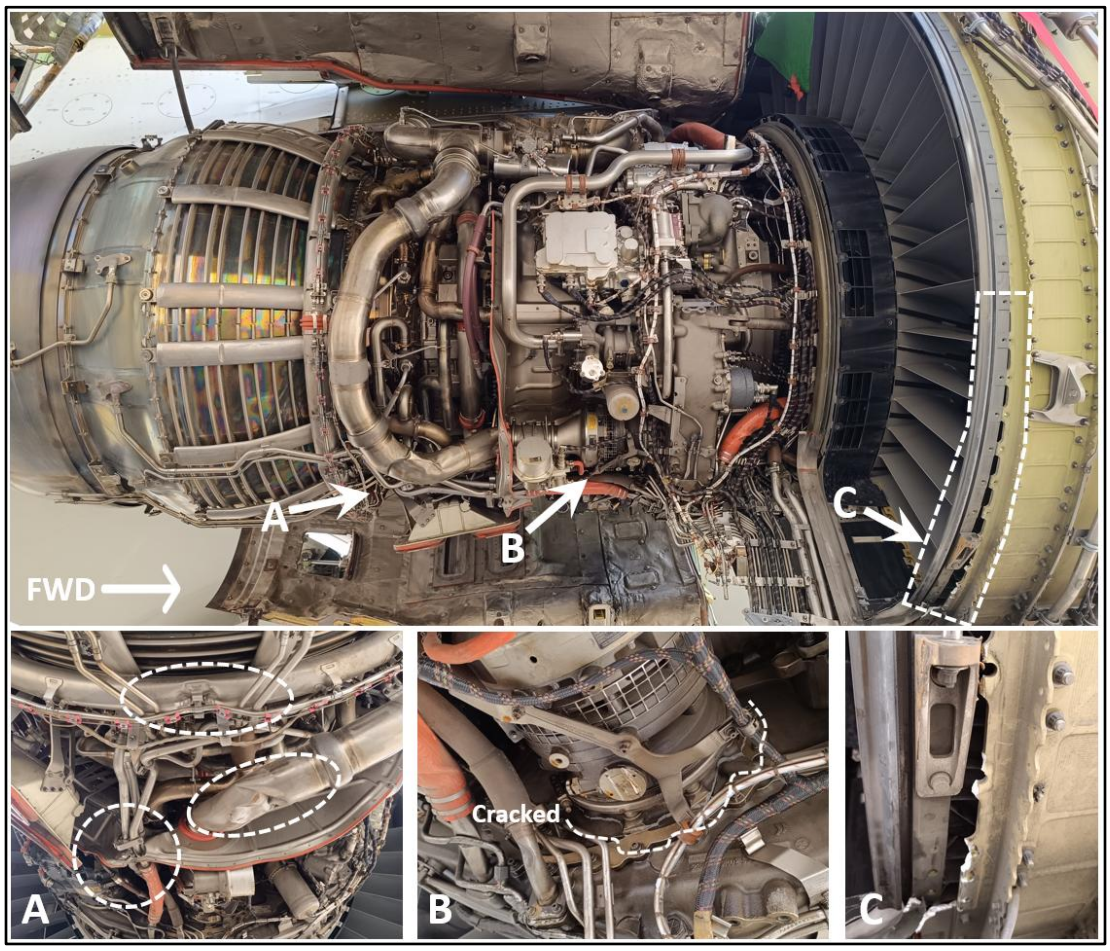


Figure 1.12-5 No. 4 engine damage areas (right side view)

1.12.1.2 No. 3 Engine Nacelle

The No. 3 engine nacelle sustained contact damage to the lower surface of the reverser cowl at the 6 o'clock position, specifically beneath the drain mast, due to ground abrasion.

1.12.1.3 Wing

The right wing sustained minor damage. Components detaching from the No. 4 engine nacelle struck the right wing, causing minor dents and scratches to the leading edge at Inboard Leading-Edge Station (ILES) 975, the panel of Variable Camber Flap (VCF) 21, and the wing surface at Wing Station (WS) 947 (Panel U-18R).

1.12.1.4 Fuselage

The fuselage sustained minor damage concentrated in three specific areas:

- Dents and scratches on the forward upper side of the right-hand Auxiliary Power Unit (APU) door skin external surface near Station (STA) 2658.
- Damage on the fuselage bonded skin assembly external surface between STA 2638 and 2658 at Stringer 25 Right (S-25R).
- Two dents on the right-hand fuselage skin near STA 1760, located between Stringer 20 Right (S-20R) and 22 Right (S-22R).

1.12.2 Site Survey

Examination of Runway 05L at RCTP revealed two scrape marks, one indicative of contact with the No. 4 engine nacelle, and the other with the No. 3 engine nacelle drain mast.

The scrape mark from the No. 4 engine nacelle (labeled as R1) started at approximately 3,880 feet from the runway threshold and 50 feet to the right of the centerline, and terminated at approximately 4,090 feet from the runway threshold and 60 feet to the right of the centerline, with a total length of 210 feet. The mark veered 3 degrees to the right of the runway centerline direction.

The scrape mark from the No. 3 engine nacelle drain mast (labeled as R2) started at approximately 3,965 feet from the runway threshold and 27 feet to the right of the centerline, and terminated at approximately 3,985 feet from the runway threshold and 28 feet to the right of the centerline, with a total length of 20 feet. The mark veered 3 degrees to the right of the

runway centerline direction.

In addition to the two scrape marks, approximately 40 pieces of aircraft debris[22], marked by the airport operations officers, were identified as debris from the No. 4 engine and were distributed along the runway surface between 4,080 and 5,300 feet from the runway threshold.

The site survey item list and its distribution on Runway 05L are shown in Table 1.12-1 and Figure 1.12-6, respectively. Figure 1.12-7 shows photographs of the two scrape marks.

Table 1.12-1 Site survey item list

No.	Site survey item	Distance from Runway 05L threshold (ft)	Length (ft)
1	Scrape mark of No. 4 engine nacelle (R1)	3,880~4,090	210
2	Scrape mark of No. 3 engine nacelle drain mast (R2)	3,965~3,985	20
3	About 40 debris from No. 4 engine	4,080~5,300	n/a

[22] After 2 weeks from occurrence day, there are about 40 more smaller pieces debris found at nearby grass field (Runway Safety Area, RSA) northern from the paved runway.

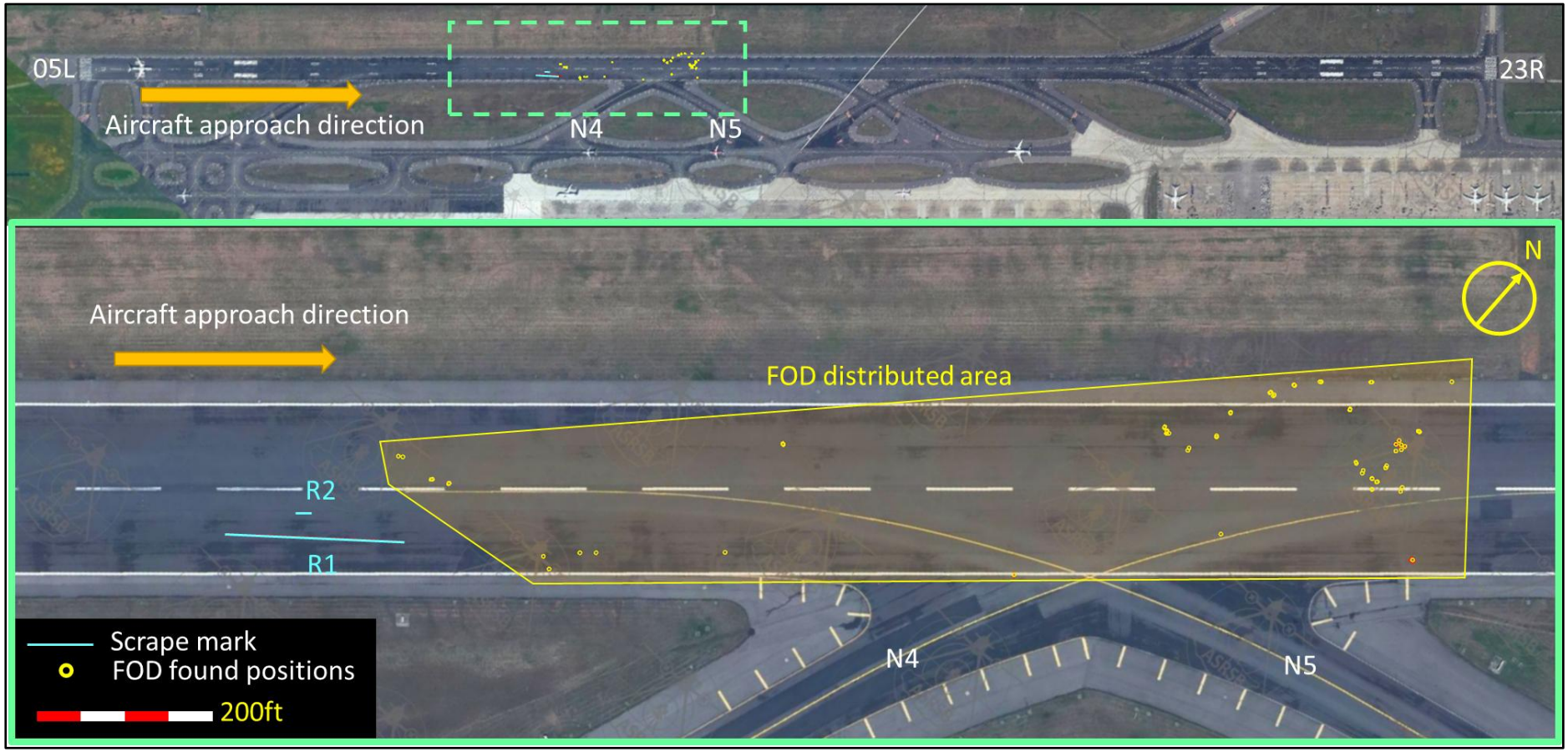


Figure 1.12-6 Distribution of site survey items on Runway 05L

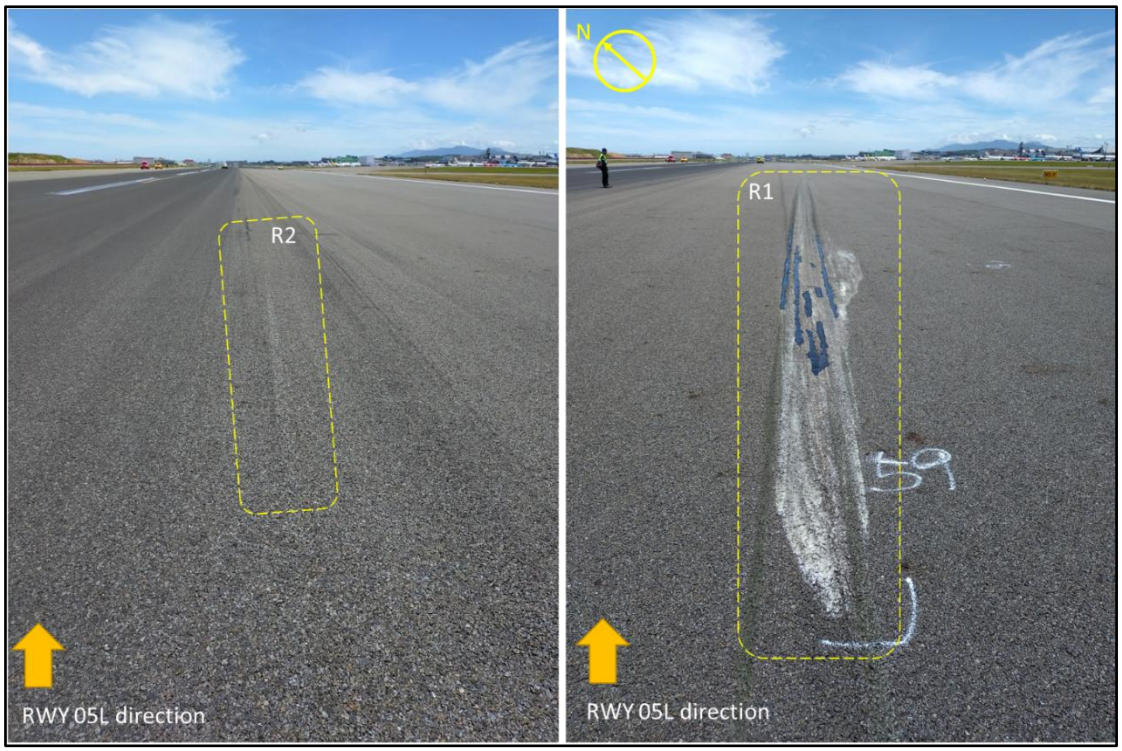


Figure 1.12-7 Scrape marks observed on Runway 05L

1.13 Medical and Pathological Information

No medical or pathological investigations were conducted as a result of this occurrence, nor were they required.

1.14 Fire

There was no fire damage on the aircraft.

1.15 Survival Aspects

No search and evacuation were required as a result of this occurrence.

1.16 Tests and Research

There were no specific tests and research done in this investigation.

1.17 Organizational and Management Information

UPS Airlines, established in 1988, is an American cargo airline owned by United Parcel Service, Inc. Headquartered in Louisville, Kentucky, it operates as one of the world's largest air freight carriers, managing a global hub-and-spoke network that connects major regional and international centers. The airline provides scheduled cargo services to more than 220 countries and territories, forming a core component of UPS's international logistics operations. As of 2025, UPS Airlines operates a fleet of 292 owned aircraft and about 210 leased or chartered aircraft, including B747-8F, B747-400F, B767-300F, B757-200F, Airbus A300-600F, and McDonnell Douglas MD-11F.

1.18 Additional Information

1.18.1 Interview Summaries

1.18.1.1 The Captain

The occurrence flight was delayed due to the weather in Taipei. The crew received a flow time of 0930 UTC, at which the aircraft pushed back and was airborne at 0950 UTC. The captain served as PF of the flight. The flight deviated for weather, descended early, and was instructed to hold at JAMMY. After descending into the hold, the crew received vectors for the approach.

The captain stated that the crosswind limit of SOP is 30 knots, including gusts. On the first approach, the wind exceeded the limits, so the crew performed a missed approach and was vectored around for a second approach. The winds were also out of limits for the second approach, so the crew went around again. After the second missed approach, the crew contacted the company to consider options. The alternate was Clark in the Philippines, and the aircraft carried sufficient fuel to continue holding and to attempt further approaches.

Later, the wind became within limits, and the crew discussed and decided to try another approach. The last ATIS was Tango with winds being reported as 100 at 23 gusting to 36. This resulted in a maximum crosswind component of 28 knots and a headwind of 23 knots. The calculated crosswind component was within operational limits, and the crew decided to continue the approach. The third approach was stable, despite gusts, windshear, and turbulence, all within limits and compliant with the stable approach criteria.

The captain stated that the company's stabilized approach policy allows a max target speed of V_{APP}+20 knots on approach. The stabilized approach criteria require V_{APP}+20/−5 knots at 1,000 feet, and within 5 knots below 500 feet. Because the final approach was manually flown with the autothrottle disconnected, the crew carried V_{APP} of V_{REF}+20, requiring additional energy dissipation during flare. The autopilot was disconnected below 1,000 feet, and the autothrottle was disconnected prior to landing, in accordance with company procedures.

The captain stated that, after all four thrust levers were retarded to idle and touchdown was confirmed by the first officer's "speedbrakes up" call, he removed his hand from the thrust levers to immediately raise all thrust reverser levers to the interlock position and applied light pressure until release. A "reversers normal" call was then made by the first officer, followed shortly by a "no reverse engine one" call from the ACM. The captain stated that he was not aware that only three, rather than all four, thrust reversers had been raised, and that he may have inadvertently advanced the No. 1 forward thrust lever while responding to the "no reverse engine one" call. He further stated that his primary focus at that time was maintaining directional control of the aircraft, which most likely became an issue as a result of the retraction of the speedbrakes following the inadvertent advancement of the No. 1 thrust lever.

The captain's perception at the time was that the aircraft was experiencing a strong gust from the right and had possibly become airborne again. He believed that the No. 4 engine nacelle strike might occurred while he was applying corrective inputs in response to the lifted right wing. There were no indications of the strike in the aircraft except for a "No. 4 REVERSER" EICAS message that appeared while taxiing clear of the runway. The aircraft exited via N9 and taxied to the parking gate.

It was in the post-flight that the crew discovered that there was damage to the No. 4 engine. Aside from the reverser advisory message, there were no other abnormal indications during taxi.

1.18.1.2 The First Officer

The first officer was the PM of the occurrence flight. The first officer stated that the flight was delayed in Hong Kong while the crew waited for the wind speed to decrease. The actual takeoff time was about one and a half hours later than scheduled. While en route to TPE, the crew maneuvered around the typhoon and then entered a brief holding prior to the first approach.

During the first and second approaches, the winds reported were out of limits, and the crew went around before attempting landings. The crew was then radar vectored for a holding and consulted with the company. The company advised that a diversion to Clark be considered in the event landing could not be accomplished, and the crew reviewed the routing to Clark during the hold. Later, the updated wind report was within limits, and therefore, the crew attempted a third approach.

The first officer stated that the third approach met their company's stable approach criteria and touched down normally. He described the main factor for a stabilized approach is the descent rate of 1,200 FPM or less, and the speed within plus five knots of the approach speed, which was 177 knots for the last approach.

The first officer stated that after touchdown, he saw the speedbrake deployed and made the standard call “speedbrakes up”. As he observed the reversers begin to indicate normal on the display, the aircraft encountered wind gusts on the runway, and the right wing was lifted. His attention then turned from the display to an outside scan. Since the reversers were already deployed, it is not an option for the crew to perform a go-around. As the pilot monitoring, the first officer recalled he gave a “reversers normal” call followed by a “right wing down” call to provide verbal guidance, and the captain corrected it.

The first officer stated that after the aircraft attitude returned to a normal trend, he shifted his scan back to the display and noticed that the No. 1 reverser was not indicating deployment. Almost simultaneously, the ACM called out “no reverse, engine one” and he observed the captain corrected the throttle position; therefore, he did not make an additional call for the reverser.

Although the crew suspected possible damage from the oscillations during rollout, there were no indications on the instruments except for the “NO. 4 REVERSER” caution, which came up as the aircraft exited the runway. Nevertheless, the damage could not be confirmed until the aircraft vacated the runway and parked.

After parking, the first officer remained in the cockpit while the jump seater conducted a walk-around, during which he saw people gathered around the No. 4 engine and confirmed the damage. As soon as the crew was aware of the damage, the first officer notified Taipei Tower on the tower frequency immediately.

According to the first officer, the company's crosswind limit is 30 knots, and during the approaches, he calculated the crosswind component with real-time wind checks from the tower to decide whether to continue at around 500 feet. The first officer recalled that it was initially 40 knots with the wind from 100 degrees. Later, the wind shifted to 090 degrees, which was more aligned with the runway,

and its speed decreased as well to be within the limits for the final approach. The first officer recalled that for the last approach, the steady wind was approximately 23 knots, with gusts in the low 30s.

The first officer recalled that the taxi route was N9, N, then Spot 515, which was a very short taxi.

The first officer stated that he was unsure about the dispatch policy under typhoon, but explained that the general policy is that if the weather is forecast to be within limits, the flight proceeds. He noted that the occurrence flight was delayed due to forecast winds, but subsequent updates indicated that the winds would be within operational limits by the time of arrival.

1.18.1.3 The Additional Crew Member

The ACM was scheduled to operate the flight from Taipei to Anchorage the following day. This sector was therefore a positioning flight for him. Given the weather conditions of the flight, after discussion, the captain agreed that the ACM would sit in the cockpit observer's seat to assist the crew.

Throughout the flight, the crew checked the weather regularly. Upon receiving the ATIS from TPE, the reported wind exceeded the limits with only a small margin. Therefore, the crew decided to shoot an approach and request an update on wind from the tower. After receiving the landing clearance, the crew checked the wind with the tower again and discontinued the approach at approximately 500 or 600 feet due to the wind being over limits. The go-around was uneventful.

The condition was similar for the second approach. When the crew received the landing clearance, the wind was within limits. However, a subsequent wind check on final was again outside limits and resulted in another go-around at approximately the same altitude as the first approach.

According to the ACM, at the beginning of the third approach, the wind reported by approach control did not exceed the limits and stayed within limits for the whole approach. The ACM monitored the descent rate and the airspeed closely from the observer's seat. It was a stabilized approach, and therefore there was no reason to go-around.

The landing was initially uneventful on touchdown, and the first officer made the “speedbrakes up” and “reversers normal” calls. Shortly after touchdown, the right wing started to come up. The first officer called out, and the captain corrected it. There was a bit of lateral roll because of the crosswind. He was surprised that it was the engine that made contact on the right side. The crew was unsure if something would have made contact or not from the cockpit. He also noted that he observed three green “REV” indications on the upper EICAS and noted that the No. 1 thrust reverser was not yet in reverse. He recalled that he called “no reverse, engine one” and the captain then selected reverse on No. 1 engine.

The ACM recalled the winds reported during the approaches were varying from 090 to 100, and maybe 080. For the last approach, the wind reported by the tower was 090 at 28 knots, gusting to 38 knots, with a crosswind component of about 24 knots.

The ACM stated that both he and the first officer did the crosswind component calculations. The company crosswind limit for dry runway is 30 knots, including gusts. Stable approach criteria require the aircraft to be flown on the proper glide path with a descent rate of 1,000 FPM or less at 1,000 feet AGL (up to 1,200 FPM if briefed), and airspeed within +20/-5 knots of the approach speed. At 500 feet AGL, the thrust lever position had to be correct and the airspeed within +5 knots.

The ACM stated that the crew used V_{APP} in accordance with Boeing

procedures. V_{APP} is calculated as V_{REF} plus 1/2 the steady headwind component and all of the gust factor, with a maximum addition of 20 knots. For the last approach, the approach speed was 177 knots.

The ACM did not notice any indication of the strike on the instruments. After the door opened, the captain asked him to see if there might have been some damage. It was when he saw people gathered near the right side of the aircraft that he noticed the damage. The ACM immediately advised the first officer to call the tower and report potential FOD.

The ACM explained that company policy does not prohibit attempting an approach if the wind in ATIS exceeds the limits, as the ATIS may be 30 minutes or an hour old. Usually, the crew waits until they receive a landing clearance and then checks with the tower for the most current wind. However, visibility has stricter limits. It is not legal to start an approach if it is below the minimum.

The ACM stated that in the U.S. the PIC shares joint responsibility for flight safety with the dispatcher and can delay or cancel a flight based on the weather forecast. In this case, the flight was initially delayed departing Hong Kong and further delayed due to slot restrictions. While in flight, the ACM also discussed with the dispatcher that Clark was a suitable alternate and the route would avoid the weather if diversion was necessary.

1.18.2 Manual Information

1.18.2.1 Aircraft Operational Procedures and Limitations

Manual information related to the B747-8F crosswind limitations, autoland limitations, stabilized approach criteria, approach speed, landing procedures and techniques, crosswind landing techniques, reverse thrust operation, and pitch and roll limit conditions was collected by the investigation team, subsequently verified by UPS, and will be used for further analysis.

1.18.2.2 Tower Controllers' Operations

According to the Air Traffic Management Procedures (ATMP)[23] jointly published by the Civil Aviation Administration and the Air Force Command Headquarters of Taiwan, the relevant operating procedures when tower controllers visually observe an abnormal aircraft landing (such as one accompanied by sparks) are described in Chapter 3 Aerodrome Traffic Control-Terminal, as follows:

3-1-5 Runway Incursion or Obstructed Runway

a. In the event the aerodrome controller, after a take-off clearance or a landing clearance has been issued, becomes aware of a runway incursion or the imminent occurrence thereof, or the existence of any obstruction on or in close proximity to the runway likely to impair the safety of an aircraft taking off or landing, appropriate action shall be taken as follows:

1. cancel the take-off clearance for a departing aircraft;

2. cancel the landing clearance for a landing aircraft and take any other necessary measures or instruct a landing aircraft to execute a go-around or missed approach as the case maybe;

3. in all cases inform the aircraft of the runway incursion or obstruction and its location in relation to the runway.

b. Pilots and air traffic controllers shall report any occurrence involving an obstruction on the runway or a runway incursion.

3-1-10 Observed Abnormalities

Whenever an abnormal configuration or condition of an aircraft, including conditions such as landing gear not extended or only partly extended, or unusual smoke emissions from any part of the aircraft, is observed by or

[23] 18th edition, effective date September 25, 2024.

reported to the aerodrome controller, advise the aircraft without delay.

3-3-1 Landing Area Condition

If you observe or are informed of any condition which affects the safe use of a landing area:

a. *Relay the information to the aerodrome authority/military operations office concerned.*

b. *Copy verbatim any information received and record the name of the person submitting it.*

c. *Confirm information obtained from other than authorized aerodrome or CAA personnel unless this function is the responsibility of the military operations office.*

d. *If you are unable to contact the aerodrome authority, issue a Notice to Airmen publicizing an unsafe condition and inform the management or operator as soon as practicable.*

e. *Runway Condition Report (RCR).*

   1. *Furnish RCR, as received from the aerodrome operator, to aircraft via the ATIS.*
   2. *When an update to the RCR is provided, verbally issue Runway Condition Code (RWYCC) to all aircraft until the ATIS broadcast can be updated.*
   3. *At aerodromes without ATIS, verbally issue Runway Condition Code (RWYCC) to all aircraft .*
   4. *Verbally issue RCR upon pilot request, workload permitting.*

f. *In the absence of RCR, issue to aircraft only factual information, as reported by the aerodrome authority, concerning the condition of the runway surface.*

g. *Whenever information is provided concerning runway surface conditions that may adversely affect aircraft braking action, the following terms shall be used, as necessary: DRY, WET, SLIPPERY WET, STANDING WATER.*

3-3-3 Timely Information

Issue aerodrome condition information necessary for an aircraft's safe operation in time for it to be useful to the pilot. Include the following, as appropriate:

a. *Construction work on or immediately adjacent to the maneuvering area.*

b. *Rough portions of the maneuvering area.*

c. *Braking conditions caused by ice, snow, slush or water.*

d. *Temporary hazards, including parked aircraft and birds on the ground or in the air.*

e. *Irregular operation of part or all of the aerodrome lighting system.*

f. *Volcanic ash on any aerodrome surface area and whether the ash is wet or dry (if known).*

g. *Other pertinent aerodrome conditions.*

1.18.3 Sequence of Events

The sequence of events of the occurrence flight is listed in Table 1.18-1.

Table 1.18-1 Sequence of events

Taipei Time	Event	Source
1750	Takeoff from VHHH Airport	FDR
1849:25	CVR recording started	CVR
1916:23	RCTP tower reported wind 100 degrees 21 knots gusting 45 knots for Runway 05L, cleared to land	CVR
1919:41	At 682 feet RA, RCTP tower reported wind 090 degrees at 29 knots gusting 45 knots for Runway 05L	CVR, FDR
1920:03	At 370 feet RA, wind speed increase was noted, and the PF initiated go-around for the first approach	CVR, FDR
1932:15	RCTP tower reported wind 090 degrees at 30 knots gusting 39 knots for Runway 05L, cleared to land	CVR
1934:44	At 527 feet RA, RCTP tower reported wind 100 degrees at 29 knots gusting 43 knots for Runway 05L	CVR, FDR
1934:52	At 428 feet RA, the PF initiated go-around for the second approach	CVR, FDR
1951:06	The crew informed RCTP approach of the decision for another approach	CVR
2003:55	RCTP tower reported wind 090 degrees at 26 knots gusting 38 knots for Runway 05L, cleared to land	CVR
2005:50	RCTP tower reported wind 090 degrees at 28 knots gusting 38 knots	CVR
2006:24	RCTP tower local controller cleared BR6032 to land on Runway 05L in a landing sequence number two	Radio Transcripts
2007:01	The PM called out “one thousand feet stable sinks eight hundred”	CVR
2007:04	The PF called out “runway in sight”	CVR
2007:37	The PM called out “five hundred feet stable sinks eight hundred”	CVR
2007:43	At 430 feet RA, autopilot disconnected	FDR
2008:05	At 185 feet RA, autothrottle disconnected	FDR
2008:14	Auto altitude callout “fifty”	CVR
2008:15	Auto altitude callout “forty”	CVR
2008:16	Auto altitude callout “thirty”	CVR

Taipei Time	Event	Source
2008:17	Auto altitude callout “twenty”; Thrust levers (ALL) were moved to idle position	CVR, FDR
2008:18	Auto altitude callout “ten”	CVR
2008:21.4	The occurrence aircraft touched down	CVR, FDR
200822.2	The PM called out “…speedbrakes up keep right wing down right wing down”	CVR
2008:23	The No. 1 forward thrust lever was advanced, while No. 2, No. 3, and No. 4 reverse thrust lever were pulled	FDR
200826.6	The PM called out again “right wing down”	CVR
2008:30	The occurrence aircraft reached an attitude of pitch angle 1.4 degrees and roll angle 9.2 degrees to the right; No.1 forward thrust lever was pulled to the idle position while No. 2, No. 3, and No. 4 reverse thrust lever to maximum reverse thrust	FDR
2008:30	The RCTP tower local controller and local monitor reported visually observing the aircraft during its landing. Upon main landing gear touchdown, the aircraft exhibited an unstable attitude characterized by lateral oscillations, appearing as though a go-around might be initiated. Shortly thereafter, sparks were observed emanating from the aft section of the aircraft, prompting an exclamation from the controllers regarding the presence of sparks. The aircraft’s attitude subsequently stabilized, and it vacated the runway	Controllers’ Statements
2008:37	The PM called out “reversers are normal”	CVR
2008:40	The ACM called out “no reverse number one”	CVR
2008:41	No. 1 reverse thrust lever was pulled	FDR
2009:21	RCTP tower local controller instructed 5X61 to contact ground controller	Radio Transcripts
2009:48	The ACM called out “engine four reverse” of the EICAS message	CVR
2009:58	The occurrence aircraft vacated Runway 05L	FDR
2012:00	BR6032 notified RCTP tower local controller that the aircraft was vacating runway and reported there was an aircraft part on the runway	Radio Transcripts

Taipei Time	Event	Source
2012:17	BR076 contacted RCTP tower local controller for an ILS approach on Runway 05L. The controller instructed BR076 to continue approach	Radio Transcripts
2012:22	RCTP tower notified the Airside Management Department that BR6032 had reported possible aircraft debris on Runway 05L after landing. Consequently, runway operations were temporarily suspended	Interphone Transcripts
2012:30	RCTP tower local controller instructed BR6032 to contact ground controller	Radio Transcripts
2012:57	RCTP tower local controller instructed BR076 to discontinue the approach due possible FOD on Runway 05L	Radio Transcripts
2019	RCTP Airside Management Department inspected Runway 05L	Tower Duty Log
2020:59	The flight crew of 5X61 notified the RCTP tower local controller that they had experienced a heavy engine nacelle strike during landing; a runway inspection was required	CVR, Radio Transcripts