

Republic of the Philippines DEPARTMENT OF TRANSPORTATION CIVIL AVIATION AUTHORITY OF THE PHILIPPINES MIA Road, Pasay City 1300

AIRCRAFT ACCIDENT INVESTIGATION AND INQUIRY BOARD

FINAL REPORT

<u>RP-C4202</u> AVION DE TRANSPORT REGIONAL <u>ATR 42-500</u>

OPERATOR: AIRSWIFT TRANSPORT, INC.

TYPE OF OPERATION: SCHEDULED COMMERCIAL

DATE OF OCCURRENCE: JANUARY 09, 2023

PLACE OF OCCURRENCE: LIO AIRPORT, RUNWAY 15, EL NIDO, PALAWAN, PHILIPPINES

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FOREWORD

This report was produced by the Aircraft Accident Investigation and Inquiry Board (AAIIB), Civil Aviation Authority of the Philippines, MIA Road, Pasay City, Philippines.

The report is based upon the investigation carried out by the AAIIB in accordance with Annex 13 to the Convention on International Civil Aviation, Republic Act 9497 Section 42 and Philippine Civil Aviation Regulation Part 13.

Readers are advised that the AAIIB investigates for the sole purpose of enhancing aviation safety. Consequently, AAIIB reports are confined to matters of safety significance and may be misleading if used for any other purpose. It should be noted that the information in AAIIB reports and recommendations is provided to promote aviation safety and in no case is it intended to imply blame or liability.

Furthermore, No part of AAIIB report or reports relating to any accident or investigation shall be admitted as evidence or used in any suit or action for damages arising out of any matter mentioned in such report or reports.



Republic of the Philippines DEPARTMENT OF TRANSPORTATION CIVIL AVIATION AUTHORITY OF THE PHILIPPINES MIA Road, Pasay City 1300 www.caap.gov.ph

FINAL REPORT

TITLE: An incident involving an ATR 42-500 type of aircraft with Registry Number RP-C4202 operated by AirSWIFT Transport, Inc., that had encountered a damaged aircraft main landing gear tires and wheel hubs during landing roll at Lio Airport, Runway 15, El Nido, Palawan, Philippines, on January 09, 2023, at around 1248H.

Notification of Occurrence to National Authority

The incident was reported to the CAAP AAIIB by the operator of the aircraft on January 09, 2023.

Identification of the Investigation Authority

The Aircraft Accident Investigation and Inquiry Board (AAIIB), the mandated accident investigation organization within the Civil Aviation Authority of the Philippines (CAAP) as the state of Occurrence/Registry/Operator conducted the investigation.

Organization of the Investigation

In accordance with the provisions of Philippine Civil Aviation Regulation (PCAR) Part 13, an Investigator-In-Charge was appointed.

In addition, the following were appointed as Accredited Representatives based on Annex 13 provisions:

- Bureau of Enquiry and Analysis of France: As the State of the Manufacturer and Design
- Transport Safety Investigation Bureau of Singapore: As the State that participated in the investigation.

Authority Releasing the Report

The Final Investigation Report was released by the Aircraft Accident Investigation and Inquiry Board (AAIIB) and published on the CAAP website on <u>12 September 2023.</u>

Synopsis:

At around 1248H of January 09, 2023, an ATR 42-500 aircraft with Registry Number RP-C4202, operated by Airswift Transport Inc., encountered damage to its main landing gear tires and wheel hubs during its landing roll on Runway 15 of Lio Airport. On board were two (2) pilots, one (1) cabin crew, and forty-eight (48) passengers. No injuries were reported among the crew or passengers. Additionally, the aircraft sustained substantial damage to its landing gear. During the investigation, it was determined that the probable cause of the incident was the inadvertent engagement of the emergency parking brake lever before landing and the flight crew's failure to cross-check critical instrument indications.

LIST OF ACRONYMS AND ABBREVIATIONS

AAIIB	:	Aircraft Accident Investigation and Inquiry Board
ADD	:	Acceptable Deferred Defect
ATC	:	Air Traffic Control
ATPL	:	Air Transport Pilot License
ATR	:	Avions de Transport Regional
CAAP	:	Civil Aviation Authority of the Philippines
CAVOK	:	Ceiling And Visibility OK
CFI	:	Carry Forward Items
CPL	:	Commercial Pilot License
CRM	:	Crew Resource Management
CVR	:	Cockpit Voice Recorder
DFDR	:	Digital Flight Data Recorder
EWD	:	Engine and Warning Display
FCOM	:	Flight Crew Operations Manual
F/O	:	First Officer
IESI	:	Integrated Electronic Standby Indicator
MEL	:	Minimum Equipment List
NAIA	:	Ninoy Aquino International Airport
OFSAM	:	Office of the Flight Surgeon and Aviation Medicine
OM-A	:	Operations Manual – Part A
PAPI	:	Precision Approach Path Indicator
PCAR	:	Philippine Civil Aviation Regulation
PF	:	Pilot Flying
PIC	:	Pilot-In-Command
TSIB	:	Transport Safety Investigation Bureau
VFR	:	Visual Flight Rules
VMC	:	Visual Meteorological Condition
WOW	:	Weight-On-Wheels



Republic of the Philippines CIVIL AVIATION AUTHORITY OF THE PHILIPPINES



1. FACTUAL INFORMATION

Aircraft Registration No.	:	RP-C4202
Aircraft Type/Model	:	Avion De Transport Regional ATR 42-500
Operator	:	AirSWIFT Transport, Inc.
Address of Operator	:	5001-5006 5th Floor, Ayala Malls Manila Bay, Diosdado Macapagal Blvd., corner ASEANA Ave., Paranaque City, Philippines
Place of Occurrence	:	Lio Airport, Runway 15, El Nido, Palawan, Philippines
Date/Time of Occurrence	:	January 09, 2023/1248H
Type of Operation	:	Scheduled Commercial
Phase of Flight	:	Landing
Type of Occurrence	:	Main landing gear wheels and brakes

1.1 History of Flight

On or about 1248H of 09 January 2023, an ATR 42-500 type of aircraft with Registry Number RP-C4202, encountered damaged main landing gear tires and wheel hubs during landing roll at Lio Airport (El Nido) Runway 15. On-board the aircraft were two (2) pilots, one (1) cabin crew and forty-eight (48) passengers.

The flight departed Manila for El Nido at around 1145H. The flight was uneventful from takeoff until its final approach. Upon touchdown, the pilot noticed that the aircraft was decelerating faster than the usual and while on landing roll, the pilot of the other aircraft holding at west taxiway was heard on the radio requesting for a fire truck from Lio Airport Tower. Vibration was then felt on the cockpit as the aircraft continue its roll. As the aircraft comes to a complete stop, the crew performed precautionary engine shutdown procedures and pulled the fire handles in case there is a confirmed engine fire. Following the information from Tower and ground personnel that there was no evidence of fire, the Pilot-In-Command (PIC) then ordered a normal deplaning of passengers while the aircraft is still on the runway. The crew and all passengers completed the disembarkation from the aircraft without any reported injuries.

1.2 Injuries to Person (s)

Injuries	Crew	Passengers	Others	TOTAL
Missing/Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	3	48	0	51

1.3 Damage to Aircraft

The aircraft sustained substantial damage on its main landing gears.

1.4 Personnel Information

1.4.1 Pilot-In-Command (PIC)

Gender	:	Male
Date of Birth	:	March 31, 1990
Nationality	:	Filipino
License	:	ATPL 103662
Valid up to	:	October 31, 2027
Medical Certificate	:	Class 1 valid until March 07, 2023
Date of last medical	:	August 12, 2022
Total Flying Time	:	6,106 + 54 Hours as of 08 January 2023
Total Flying Time On Type	:	3,881 + 11 Hours as of 08 January 2023

1.4.2 First Officer (F/O)

Gender	:	Male
Date of Birth	:	December 24, 1994
Nationality	:	Filipino
License	:	CPL 014742
Valid up to	:	March 31, 2027
Medical Certificate	:	Class 1 valid until December 06, 2023
Date of last medical	:	November 22, 2022
Total Flying Time	:	2,245 + 33 Hours as of 08 January 2023
Total Flying Time On Type	:	1,039 + 29 Hours as of 08 January 2023

1.5 Aircraft Information

The ATR 42 is a twin-engine turboprop, short-haul regional aircraft developed and produced in France and Italy by the aircraft manufacturer ATR (Avions de transport régional), a joint venture formed by French aerospace company Aérospatiale (now Airbus) and Italian aviation conglomerate Aeritalia (now Leonardo S.p.A.). The number "42" in its name is derived from the aircraft's standard seating configuration in a passenger-carrying configuration, which could seat 42 passengers in a single-class arrangement.

1.5.1 Aircraft Data

Registration Mark	:	RP-C4202
Manufacturer	:	Avions de transport régional (ATR)
Type/Model	:	ATR 42-500
Serial Number	:	1205
Date of Manufactured	:	January 08, 2016
Aircraft Total Time	:	9,458 + 15 Hours as of 08 January 2023
Certificate of Airworthiness	:	Valid until February 28, 2023
Certificate of Registration	:	Valid until February 28, 2026
Gross Weight	:	18,600 Kilograms (Kgs.)

1.5.2 Engine Data

The PW127M engine is part of the PW100 family series of 1,800 to 5,000 shaft horsepower (1,300 to 3,700 kW) turboprops manufactured by Pratt & Whitney Canada. Originally called the PT7, the PW100 uses a relatively unusual three-shaft engine configuration. In the PW100, a centrifugal low-pressure (LP) impeller (except for the PW150, which uses a 3-stage axial LP compressor), driven by a single-stage LP turbine, supercharges a contra-rotating centrifugal high-pressure (HP) impeller, driven by a single-stage HP turbine. Power is delivered to the offset propeller reduction gearbox through a third shaft connected to a two-stage free (power) turbine. The gearbox has two stages, yielding a reduction ratio between 15.4 and 17.16. The first stage uses double helical gears, followed by a second stage with straight spur gears.

Manufacturer	:	Pratt and Whitney Canada
Type/Model	:	Turboprop/PW127M
Engine Serial Number	:	PCE-ED1220 (ENG 1)/
		PCE-ED1146 (ENG 2)
Time Between Overhaul	:	On-Condition
Time Since New	:	8,405 + 20 Hours (ENG 1)
		9,458 + 25 Hours (ENG 2)

1.5.3 Propeller Data

Manufacturer	:	Hamilton Sundstrand
Type/Model	:	Reverse-Pitch/568F-1
Propeller Serial Number	:	FR20150726 (LH)/FR20150727 (RH)
Time Between Overhaul	:	10,500 FH
Time Since New	:	9,017 + 13 hours (LH)
		9.453 + 5 hours (RH)

1.6 Meteorological Information

Visual Meteorological Conditions (VMC) prevailed at the time of the incident:

Date/Time	Wind Direction	Wind Speed	Visibility	Sky Condition	Temperature	Dew Point	QNH
09 Jan 2023/1200H	-	Calm	CAVOK		28°C	23°C	1014

1.7 Aids to Navigation

The flight was carried out under Visual Flight Rules (VFR). Likewise, the airport is equipped with PAPI and runway edge lights.

1.8 Communications

The aircraft is equipped with a standard radio transceiver. Communications were carried out between the pilot, Lio Airport Tower and other traffic within the area.

1.9 Flight Recorders

The aircraft is equipped with Digital Flight Data Recorder (DFDR) and Cockpit Voice Recorder (CVR) as required by the Philippine Civil Aviation Regulations (PCAR).

The recorded parameters and data were intact and allowed an accurate reconstruction of the incident dynamics. The data were analyzed and validated with the assistance of Singapore TSIB using the appropriate interpretation tools.

1.9.1 DFDR

Manufacturer	: L-3 Aviation Recorders
Model	: L3 FA2100
Part No.	: 2100-4245-60
Serial No.	: 000879367

The recording quality of the DFDR data was of good quality. The DFDR contained 23,1452 seconds of synchronized subframes data that includes the recorded data of the incident flight. It has also 801 parameters in the data frame file. The "DFDR recorded parameters decoding law" (Service Letter No. ATR42-31-5011 Rev. 09) was provided by the operator to convert the DFDR data to engineering units based on data frame version V4.

On the Flight Data readout, the incident flight departed Ninoy Aquino International Airport (NAIA) on runway 13 and tracked in the south west direction towards Lio Airport. At 04:28:03 hour, the aircraft was cruising at 22,051 feet just over the northern tip of Busuanga Island (see Figure 1) when the brake pressures for all four (4) wheels increased to 2,040 psi (see Figure 2). The emergency/parking brake handle position is not a recorded parameter in the DFDR. During this period, the following were observed:

- A. No inputs recorded to the brake pedals at the Captain and First Officer's position;
- B. Changes to the hydraulic systems around this period were:
 - a. Blue hydraulic system: 2,969 psi \rightarrow 2,886 psi
 - b. Green hydraulic system: 2,916 psi \rightarrow 2,896 psi



Figure 1 - Flight path and approximate location when brake pressures increased



Figure 2 – Hydraulic Pressure around the time the Brake Pressures increased

The brake pressures of the four (4) wheels remained at nominal pressure of approximately 2,000 psi until the aircraft landed. At 04:47:28 hours, the first Weight-on-Wheels (WOW) Ground signal for the main gear was recorded, indicating the first instance where the main landing gear made contact with the runway surface. A second later, the All-Gear WOW Ground signal was recorded, indicating all three (3) landing gears were compressed and all wheels were in contact with the runway surface. At the point of touchdown, following parameters were recorded:

- A. Magnetic heading was 156.1 degrees;
- B. Indicated airspeed is at 108 knots;

- C. Pitch angle is at 0.34 degrees;
- D. Range of X-axis acceleration recorded in the integrated electronic standby indicator (IESI) was between -0.079G to -0.644G;
- E. Range of Y-axis acceleration recorded in the IESI was between -0.028G to 0.095G;
- F. Range of Z-axis acceleration recorded in the IESI was between -0.208G to -0.016G.

After the initial touchdown, the recorded brake pressure and hydraulic pressures over the next thirty (30) seconds are tabulated in the table below:

Time (UTC)	Brake Pressure 1 (psi)	Brake Pressure 2 (psi)	Brake Pressure 3 (psi)	Brake Pressure 4 (psi)	Blue Hydraulic Pressure (psi)	Green Hydraulic Pressure (psi)	Captain and First Officer Brake Pedals
04:47:28	2063	2062	2062	2056	2969	2940	Normal (Not Active)
04:47:42 to 04:47:45	2046> 56	2048	2048	2045 67	2911	2969	Normal (Not Active)
04:47:46 to 04:47:50	40	44 → 1583 → 94	22	50	2999	2965	Normal (Not Active)
04:47:50 to 04:47:52	13	94> 2051	13	23	2930	2984	Normal (Not Active)
04:47:52 to 04:47:54	11	2051	11	16	2989> 2388	2974	Normal (Not Active)
04:47:55 to 04:48:08	0	0	0	0	2168 98	2896	Normal (Not Active)



Figure 3 – Brake and Hydraulic Pressure between 04:47:28 to 04:48:08

The last recorded valid position of the aircraft was at latitude 11.1996161286 N and latitude 119.418083829805 E. The DFDR stopped recording after 05:16:33 for the event flight. Electrical power was introduced to the DFDR at 06:41:15 and the last recorded data in the FDR was at 06:41:36.

1.9.2 CVR

Manufacturer	: L-3 Aviation Recorders
Model	: L3 FA2100
Part No.	: 2100-1220-02
Serial No.	: 001060056

The recovered CVR data contained four (4) audio tracks of two (2) hours recording. The CVR for the event flight stopped recording at approximately 04:58:02 UTC.

Upon conducting a thorough listening of the recovered file, it was observed that there were no significant or noteworthy events documented throughout the recording that relates to any maintenance or operational limitations of the aircraft during the flight. Operationally, the interaction and communications between the two (2) pilots appeared to be all in order. However, if there is anything that seems to be out of place is the non-observance of the flight deck crew on the sterile cockpit procedures (AirSWIFT OM-A 8.30.140.30.40) of the company and the performance of the checklist.

The sterile cockpit is an essential safety practice implemented in aviation to ensure that critical phases of the flight are conducted with minimal distractions and maximum focus on flight operations. This procedure is based on the understanding that distractions and non-essential conversations in the cockpit can divert the pilot's attention from crucial tasks such as monitoring of instruments, communicating with ATC and executing flight procedures. During the sterile cockpit periods, pilots are expected to limit their discussions strictly to matters directly related to the safe operation of the aircraft. Further, the sterile cockpit concept has been proven to be an effective measure in enhancing flight safety since it promotes a disciplined and focused cockpit environment, allowing pilots to allocate their attention and mental resources to the crucial tasks required during critical phases of flight.

On the flight last 09 January 2023, several non-operationally related communications were noted between the two (2) pilots on which this occurred during the approach and while performing their landing checklist. In addition, it was observed that not all items on the checklist were strictly carried out by both flight crew. During their interview, they stated that since most of the checklist actions are part of their normal routine, they sometime tend to miss out some items listed on the checklist.

In one of the checklists, the "Before Landing" checklist (Figure 4) requires that the "Flaps" and "TLU LO Speed" shall be checked. On the aircraft instrument particularly on the EWD, the location of the "Flaps" settings indication is just below the indication for the "PRKG BRK ON" while the "TLU LO Speed" is above of the latter (see Figure 5).

BEFORE LANDING		
CABIN CREWADVISED LDG GEAR3 GREENS FLAPSCHECK PWR MGTTC		
TLU LO SPEEDCHECK ICING AOA LIGHTAS RQRE EXT LIGHTSON		

Figure 4 – Before Landing Normal Checklist



Figure 5 – PRKG BRK ON as indicated in the EWD

In the accomplishment of this specific checklist, there was no mention on the CVR or in the interview of both flight crew if they have noted that the "PRKG BRK ON" indication was observed prior to their landing.

Furthermore, at the time when the aircraft was in flight and the brake pressure was applied, the crew had just established radio contact with El Nido air traffic control. The communication between the controller and crew was about the weather conditions at the El Nido Airport.

Though the CVR recording did not completely indicate that both flight crew have not noted anything unusual in the EWD, the likelihood that they might have captured this indication is possible if they only strictly followed each item on the checklist, performed the appropriate cross checking and being focused on the critical phase of the flight.

1.10 Wreckage and Impact Information

The aircraft came to rest at coordinates 11° 11' 58.5" N, 119° 25' 05.1" E which is approximately located 790 meters from the threshold of runway 15 and 591 meters from its touched down point.

Post incident inspection of the runway revealed the presence of skid marks from the four (4) main landing gear tires beginning from the tires initial contact with the runway surface till the aircraft final stopping position. Likewise, the four (4) main landing gear tires were noted to be busted and its main wheel hubs incurred scraping damage.



Figure 6 - RP-C4202 at the incident site



Figure 7 – RP-C4202 damaged main landing gear tires



Figure 8 – Tire marks from touched down to the final stopping point of RP-C4202

1.11 Medical and Pathological Information

The PIC and F/O completed the mandatory drug and alcohol testing the day after the incident at the Makati Medical Center hospital. The result was then later endorsed to CAAP OFSAM for the required post-accident medical examination. Both pilots were later issued with a medical clearance by the mentioned CAAP office.

1.12 Fire

There was no post-crash fire observed during on-site investigation

1.13 Survival Aspects

The incident was survivable since the aircraft was generally intact and only the main landing gears incurred substantial damages. The aircraft final position was also within the runway paved surface thus the crews and passengers were able to vacate the aircraft unharmed and without any issues. Further, the cabin crew were able to manage the normal and safe deplaning of passengers with the assistance from the responding ground personnel. Also, the Airport Rescue and Firefighting unit were able to respond immediately after receiving the alert from the Airport Control Tower.

1.14 Organizational and Management Information

Founded in 2002 as Island Transvoyager (ITI), the company had three Dornier-228 aircraft. All of these were retired by early 2013 and was replaced by ATR 42-500's. Ayala Land Inc. acquired ownership of ITI in 2012 and it was rebranded as AirSWIFT last October 2015. Currently, the airline has daily flights from El Nido to Manila and Cebu. It also operates Lio Airport, a private airport at El Nido, Palawan which serves as its hub. AirSWIFT is one of the two known charter airlines in Philippines which own and operate a private airport.

2.0 ANALYSIS

2.1 Flight Crew

2.1.1 Qualifications

A review was made on the flight deck crew's documents/records and was able to establish the following:

- A. The PIC was with AirSWIFT since 22 September 2014 and been performing the duty of an ATR 42/72 Captain since 08 February 2019. He had logged a total career time of 6,106:54 hours and 3,881:11 hours for the involved aircraft type.
- B. As for the F/O, he has been with the company as First Officer for the ATR 42/72 fleet since 27 January 2018. He had logged a total career time of 2,245:33 hours and 1,039:29 hours for the involved aircraft type.
- C. In addition, both pilots possess current licenses with ratings on ATR 42 and valid medical certificates issued by the CAAP.

2.1.2 Trainings

Listed below are trainings attended by the involved pilots:

TD A INING	EXPIRATION	
IRAIMING	Pilot-In-Command	First Officer
Recurrent	15 October 2023	15 October 2023
Proficiency Check	16 April 2023	16 April 2023
Recency (90 days)	22 February 2023	24 February 2023
Dangerous Goods	28 July 2023	28 July 2023
Aviation Security	03 February 2024	07 March 2023
Safety Management System	14 February 2024	06 April 2023
Crew Resource Management	30 June 2023	10 March 2023

Based on the above, the flight crew were able to complete the required training based on the published manuals of the airline. With this, it can be confirmed that the concerned were qualified and current upon assumption of their flight duties last 09 January 2023.

2.1.3 Fatigue and Crew Resource Management

Interview of both pilots to include review of their actual duty schedule did not disclose any issue on their physical capability to man their flight last 09 January 2023. The occurrence flight was the first flight for both crew that day and based on records, there was no report of any exceedance related to their duty time limitation the week the incident happened.

As for the Crew Resource Management (CRM) between the two (2) pilots, it was stated during their interview that they were able to establish a good working and communication relationship throughout the flight. However, review of the CVR recording revealed several instances that did not align with good CRM practices.

There were multiple non-operational related discussions that took place among the flight crew leading to inefficiencies in completing and cross-checking the items on the checklist. The probability of the crew noticing the "PRK BRK ON" indication on the EWD is higher if they only adhered strictly to each item on the checklist.

2.2 Aircraft Status

2.2.1 Pre-flight Inspection

On the day of the incident, flight ATX 132/RP-C4202 undergone the standard Base Transit Check prior to its turn-around and was released by an AirSWIFT on-duty Aircraft Lead Line Mechanic. The involved mechanic is a holder of a CAAP issued AMT license no. 134815 and valid until 05 May 2026. He is also authorized to perform Maintenance Check, Maintenance Release and Release to Service of AirSWIFT's ATR 42 and 72 aircraft based on the company issued Certifying Staff Authorization no. ATXQA-CS-008. The said authorization is valid until 16 April 2023.

In addition, the involved aircraft has NIL remarks upon its arrival from its previous assigned flight.

2.2.2 Maintenance Records

Review of available maintenance records disclosed that there were no existing ADD (Acceptable Deferred Defect), CFI (Carry Forward Items) and MEL (Minimum Equipment List) items that has correlation to the incident. In addition, record shows the following information related to the aircraft main landing gears and brakes:

Main Landing Gear Tires	Installation Date
No. 1/SN 1462/PN 3-1518-2	03 November 2022
No. 2/SN 1453/PN 3-1518-2	16 December 2022
No. 3/SN 1573/PN 3-1518-2	09 November 2022
No. 4/SN 1477/PN 3-1518-2	23 November 2022

Main Landing Gear Brakes	Installation Date
No. 1/SN 1114/PN 2-1549-3	12 August 2022
No. 2/SN 1270/PN 2-1549-3	17 November 2022
No. 3/SN 0877/PN 2-1549-3	14 August 2021
No. 4/SN 1150/PN 2-1549-3	01 June 2022

2.2.3 Post incident maintenance actions/ inspections

After the incident, AirSWIFT maintenance personnel on-duty at Lio airport conducted the initial inspection of the aircraft and found the following:

A. G meter has a reading of 1.16 which is within the aircraft limits; B. No reported "Hot Brakes" fault;

- C. No other "Fault" code retrieved;
- D. No evidence of structural and burned damage on the fuselage;
- E. All four (4) wheel tires are busted;
- F. Main wheel brakes nos. 1 and 2 were damaged and with external hydraulic leak;
- G. Main wheel brakes nos. 3 and 4 were intact and with no visible damage and hydraulic leak;
- H. No findings on the main landing gear struts and nosewheel tires.

2.3 Flight Handling

On the interview of both pilots, the flight was operated normally from the time it departed Manila and there was no issue noted on the handling of the aircraft particularly on its landing gears or brakes from push back till its take-off roll.

During landing at Lio airport, the Captain was the Pilot Flying (PF) which is in line with AirSWIFT's procedure. The airport has been classified as a "Captain's runway" due to aircraft performance limitations and only the PIC is authorized to perform take-off and landing.

On landing roll, both crews stated that they were surprised to have encountered the issue on the aircraft landing gears. Based on their statement, there have been no prior indication or warning on the cockpit instrument that the landing will lead to this incident. On-site examination of the runway as well as with aircraft wheel hubs and tires gives the following initial impressions:

- A. The scraping damage on the wheel hubs and the features of the busted tires indicates that the wheel was not able to roll after touchdown (Figure 9);
- B. Evidence of rubber deposits were noted from the initial touchdown point of the aircraft.



Figure 9 – Damaged tires and wheel hubs

With this, a review was initiated on the aircraft landing gear, hydraulic and brake operations in order to determine how the system works and its interrelation between each system.

The four (4) main gear wheels are equipped with multidisc brakes, each operated by hydraulically powered pistons. Two modes are available:

- A. Normal: The flight crew controls the brakes via the brake pedals (supplied by the green system).
- B. Emergency and braking: The flight crew controls the brake via the emergency and parking brake handle (supplied by the blue system).

The Emergency-Parking Brake Handle controls emergency and parking braking mode through the emergency and parking metering valve. Spring-loaded to the OFF position.

EMER: A metered pressure is applied to the brakes.

PARKING: Full pressure is applied to the brakes.

Further, the ATR 42-500/600 aircraft is equipped with two independent hydraulic circuits namely the "green" circuit and the "blue" circuit. The "green" circuit provides landing gear operation (extension and retraction) and also ensures the (usual) normal braking of the four (4) wheels of the main landing gears. On the other hand, the "blue" circuit provides emergency braking and parking braking through a specific hydraulic accumulator (see Figure 10).





Aside from the landing gear operation (extension and retraction) and normal braking, the "green" circuit is also used for the antiskid system. In the antiskid system, the wheel speed sensors are mounted on each landing gear wheel and measure the rotational speed of the wheel. The control units receive the wheel speed data and use it to determine the maximum safe braking force that can be applied without causing the wheels to lock up and skid. The hydraulic valves regulate the hydraulic pressure applied to the brakes to prevent the wheels from locking up.

On the other hand, under the "blue" circuit is the parking brake. It is used to supplement the main brakes. It works by mechanically applying pressure to the brake pads, causing them to clamp down on the brake discs and prevent the wheels from turning. It has three (3) positions which includes BRK OFF, EMERGENCY and PARKING.

Operation of the parking and emergency braking is done by actuating the Emergency Parking Brake lever (Figure 11). In this case, the antiskid system becomes inoperative with all its protection channels. In Figure 5, it can be seen that when operating the emergency/parking brake lever, the hydraulic pressure in the blue circuit goes directly to the four (4) wheels of the main landing gears, through the shuttle valves, bypassing the antiskid valves. With this, the braking pressure is controlled by its positioning, so that when positioning it up, to half of the available movement, the braking pressure will be gradually applied up to 500 psi. Conversely, engaging the emergency/parking brake lever on the PARKING position, the braking pressure will increase up to 2,000 psi. Operating the emergency/parking brake lever (removal from "BRK OFF" position) will indicate an amber warning of "PRKG BRK ON" in the EWD.





Parking Brake in ON Position

Figure 11 – Emergency Parking Brake Lever Operations

Lastly, after take-off, when the landing gear control lever is set to the "UP" position (retracted), the wheels of the main landing gear are automatically braked, and after the landing gear is locked in the "UP" position, the brake pressure is also released automatically, so that there is no hydraulic pressure in the braking system during the flight.

With the above logic and without any findings of system malfunction on the aircraft prior and after the incident, it can be said that only by engaging the Emergency Parking Brake lever will result to the brakes to be engaged and prevent the rolling of the tires during landing.

2.4 Test and Research

2.4.1 Brake Assembly Inspection

Last 16-17 February 2023, the AAIIB Investigators proceeded to TP Aerospace Asia Pte Ltd facility in Singapore to supervise the functional test of the aircraft main wheels brake assembly. A copy of the Shop Finding Report dated 13 March 2023 was provided with the following summary of findings:

- A. During physical and hydraulic functional test, there was no abnormality found on main wheel brakes nos. 3 and 4. All have been found to be properly rotating and functioning. Detailed inspection further revealed that the pressure plate, stator plate, and torque tube assembly are out of GoodRich CMM 32-46-86 limit and required replacement.
- B. For main wheel brakes no. 1 and 2, the planned hydraulic functional check was not performed since the brakes assembly are already damaged as a result of the incident. On the detailed inspection, the Piston Housing Assembly P/N: 266-248-1, pressure plate, stator plate, and torque tube assembly are out of GoodRich CMM 32-46-86 limit and required replacement.

Reference: TP Aerospace Shop Finding Report dated 13 March 2023 with control nos. SIN-23-046, SIN-23-047, SIN-23-049 and SIN-23-050.

With the above shop findings, it can be concluded that the installed brake assemblies were operationally functioning during the time of the incident.



Figure 12 – Brake assembly inspection at TP Aerospace Singapore



Figure 13 – RP-C4202 main wheel brakes assembly

2.4.2 Similar Incidents

There were previous incidents similar to this occurrence and had the same outcome. These incidents happened at Otopeni and Hyderabad airports.

Both incidents had the following observations:

- A. All four (4) main wheel landing gear tires were damaged during the landing roll.
- B. Parking brakes for both incidents were positioned to Emergency and slightly above the Emergency position.

2.5 Summary

In summary of the gathered information, analysis of the recorders data and results of the test conducted, it can be said that the aircraft landed with its emergency parking brake lever being engaged manually to PARKING position while on flight resulting for the wheels to lock-up during landing roll.

3.0 CONCLUSION

3.1. Findings

- **3.1.1** The involved flight deck crew are holders of valid pilot licenses and medical certificates issued by CAAP and with valid and current trainings as required by the Operator.
- **3.1.2** The aircraft has a valid Certificates of Airworthiness and Registration.
- **3.1.3** The aircraft was released for flight without any recorded maintenance issue to include systems related to the landing gear, brake and hydraulic systems.
- **3.1.4** DFDR data shows that the hydraulic brake pressure increases to around 2,000 2,040 psi during cruise approximately 19 minutes prior to touchdown and only decreased 14 seconds after touchdown. The increase in the hydraulic pressure indicates that the emergency/parking brake lever has been set to PARKING position while on flight.
- **3.1.5** Review of the aircraft CVR disclosed non-adherence to the sterile cockpit requirements and proper accomplishment of checklists.
- **3.1.6** Post maintenance check shows no issues or abnormalities in the landing gear, brake and hydraulic systems.
- **3.1.7** The aircraft has been flying since RTS and did not encounter any maintenance issue particularly on its braking system.

3.2 Probable Cause

3.2.1 Primary Cause Factor

- **a.** The emergency parking brake lever was manually engaged to PARKING position prior to landing.
- **b.** The flight crew failed to cross-check critical instrument indications in the EWD because they were in a hurry completing the checklist.

3.2.2 Contributory Factors

a. Non-adherence to the sterile cockpit requirements of both flight crew resulting to lack of focus during the critical phase of the flight;

4. SAFETY RECOMMENDATIONS

For **CAAP-FSIS** to ensure that the Operator:

a. To reiterate to all concerned strict adherence to the sterile cockpit requirements and the diligent accomplishment of every flight checklist.

5. SAFETY ACTIONS

- **5.1** Following this occurrence, AirSWIFT initiated the following safety corrective actions on the issue regarding emergency/parking brake engagement inflight:
 - **a.** Counselling of the involved flight crew;
 - **b.** The involved flight deck crew undergone a check ride from AirSWIFT Chief Pilot. Emphasis was made on the proper observance of all flight procedures, use of checklist and correct use of brakes during landing;
 - **c.** Revision of the Landing Checklist to include "Parking brake message ... OFF" was made last 16 January 2023;
 - **d.** Pilot meeting was conducted emphasizing the following:
 - Monitoring of parking brake status during flight.
 - Proper use of checklist.
 - Review of the landing gear, hydraulic and brake systems.

(Reference: AirSWIFT VP-Flight Operations letter (DO 2023-025) to AirSWIFT President and CEO dated 10 March 2023).

e. Coordination was made by AirSWIFT with ATR regarding "Parking Brake Engagement during Flight – Alert/Warning" wherein ATR recommended reinforcing flight crew training on the matter.

(Reference: Email thread between AirSWIFT and ATR dated 07 March 2023 and 13 March 2023)

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