



**FINAL REPORT
AIC 18-1001**

**Lynden Air Cargo and Air Niugini Limited
N403LC and P2-PXE
Lockheed Hercules L-382 and Boeing 737-800
Collision during taxiing
Parking Bay 23 and Bay 22, Jacksons International Airport
National Capital District
PAPUA NEW GUINEA
12 May 2018**

About the AIC

The Accident Investigation Commission (AIC) is an independent statutory agency within Papua New Guinea (PNG). The AIC is governed by a Commission and is entirely separate from the judiciary, transport regulators, policy makers and service providers. The AIC's function is to improve safety and public confidence in the aviation mode of transport through excellence in: independent investigation of aviation accidents and other safety occurrences within the aviation system; safety data recording and analysis; and fostering safety awareness, knowledge and action.

The AIC is responsible for investigating accidents and other transport safety matters involving civil aviation, in PNG, as well as participating in overseas investigations involving PNG registered aircraft. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The AIC performs its functions in accordance with the provisions of the *PNG Civil Aviation Act 2000 (As Amended)*, and the *Commissions of Inquiry Act 1951*, and in accordance with *Annex 13 to the Convention on International Civil Aviation*.

The object of a safety investigation is to identify and reduce safety-related risk. AIC investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not a function of the AIC to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the AIC endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why it happened, in a fair and unbiased manner.

About this report

Decisions regarding whether to conduct an investigation, and the scope of the investigation, were based on many factors, including the level of safety benefit likely to be obtained from the investigation. The accident occurred at 05:15 UTC and the AIC was notified by the holder of the *Air Operator Certificate* for the Hercules operation at 06:15 UTC. An on-site investigation was immediately commenced. As both aircraft sustained significant damage to the wings, the occurrence was classified as an accident.

This *Final Report* has been produced in accordance with the *PNG Civil Aviation Act 2000 (as amended)*, *ICAO Annex 13 to the Convention on International Civil Aviation*, and the *PNG Accident Investigation Commission's Policy and Procedures*. The report contains factual information, analysis of that information, and findings as to the contributing factors and causes of the accident.

Taxiing collision — Lockheed Hercules L-382 and Boeing 737-800

Occurrence Details

On 12 May 2018, a US registered Lockheed Hercules L-382 aircraft, registered N403LC, owned and operated by Lynden Air Cargo on the PNG Air *Air Operator's Certificate*, conducted a charter flight from Komo Aerodrome, Hela Province, to Jacksons International Airport¹, National Capital District. The crew consisted of a pilot in command (PIC), copilot, two flight engineers and a load master. None of the aircraft occupants or ground staff were injured.

The Hercules landed at Jacksons Airport on runway 14 Left at 05:10 UTC² (15:10 local) and rolled through to taxiway M. It then turned right onto taxiway M, crossed runway 14 Right and taxiway A, and continued taxiing to Bay 23. The adjacent bays, Bay 22 and Bay 24 were occupied by a Boeing 737-800, registered P2-PXE, operated by Air Niugini Limited and a Canadian registered Basler BT-67³ aircraft respectively. Both aircraft were stationary and unoccupied.

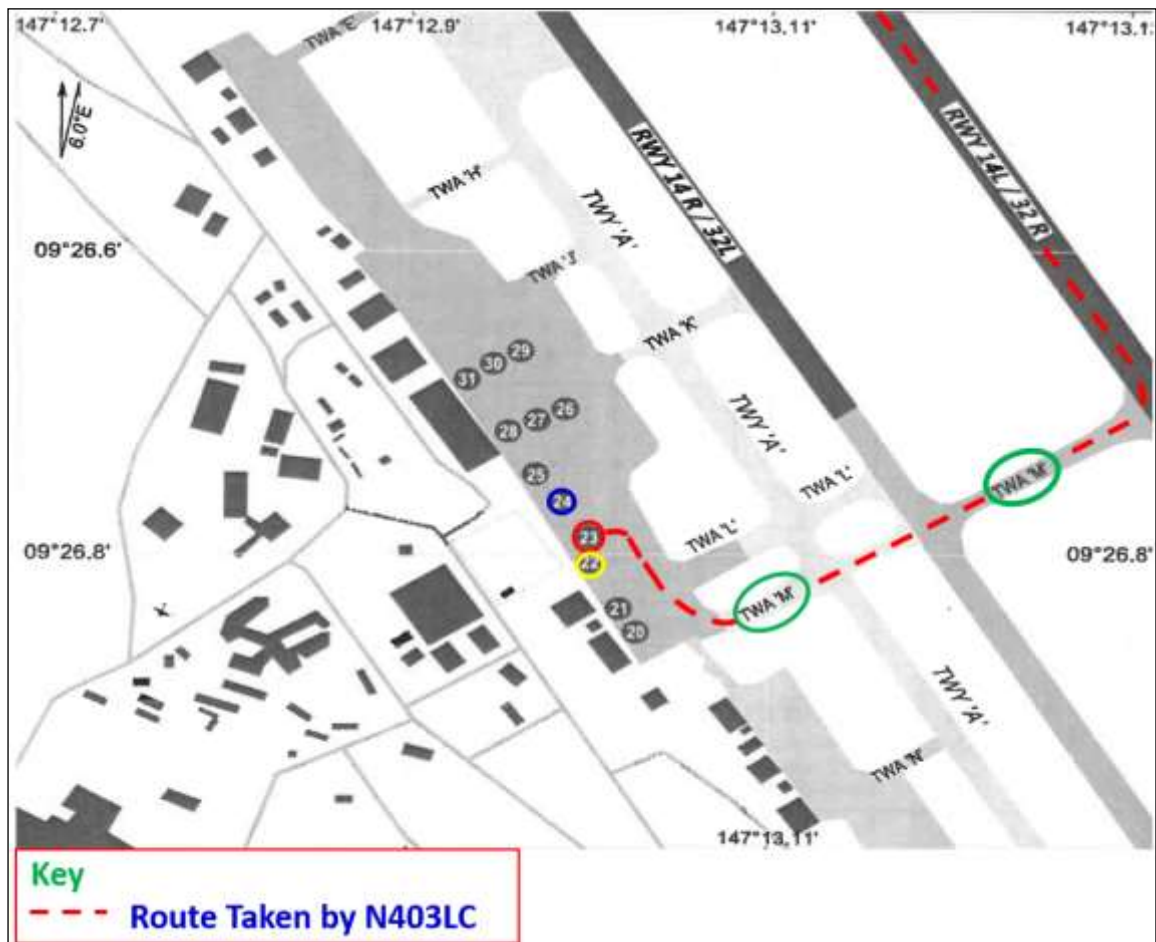


Figure 1: Jacksons International Airport- Aerodrome Diagram

1 Jacksons International Airport is the airport servicing the Capital of PNG, Port Moresby.

2 The 24-hour clock, in Coordinated Universal Time (UTC), is used in this report to describe the local time as specific events occurred. Local time in the area of the accident, Papua New Guinea Time (Pacific/Port Moresby Time) is UTC + 10 hours.

3 Basler BT-67: A modified Douglas DC3, fitted with two Pratt and Whitney Canada PT-67 engines.



Marshalling guidance was provided at Bay 23 by the Operator's ground personnel. At 05:15, as the Hercules PIC was manoeuvring the aircraft slightly to the left to prepare the aircraft to make a right turn and position its aft cargo ramp to face the airport access gate to the cargo yard, the radius of turn took it beyond the wingtip of the Boeing 737.

The PIC reported that he was being guided by a marshaller who was positioned in the left quadrant ahead of the aircraft. He said that he glanced left to check the wing clearance, taking his view from the marshaller. When he looked back at the marshaller he saw the marshaller signalling for him to stop the aircraft. He immediately braked and stopped the aircraft as it impacted the Boeing 737 winglet.

The investigation determined the speed of the Hercules was 3.3 knots (1.7 metres/second). (Figure 3)

The crew were appropriately licenced and qualified, and medically fit to conduct the flight. There was no evidence that incapacitation or physiological factors affected the performance of the flight crew or the marshaller.

The aircraft was certified as being airworthy when dispatched for the flight and there was no evidence of any defect or malfunction in the aircraft that could have contributed to the accident.

Aircraft parking bays

The Boeing 737 wingspan is 34.1 metres and the Hercules wingspan 40 metres. The Bay 22 centreline was not parallel to the Bay 23 centreline.

That provided less distance between the lines as aircraft moved further along the lines. Bay 23 was suitable for Boeing 747 aircraft with a wingspan of 64 metres. The distance between the parking Bay centrelines abeam the right wing-root of the parked Boeing 737 was 46.2 metres.

The investigation found that the centreline of the Boeing 737 fuselage adjacent to the wing root was 6.5 metres to the left of the Bay 22 centreline. The nosewheel of the Hercules was 15.7 metres left of the Bay 23 centreline.

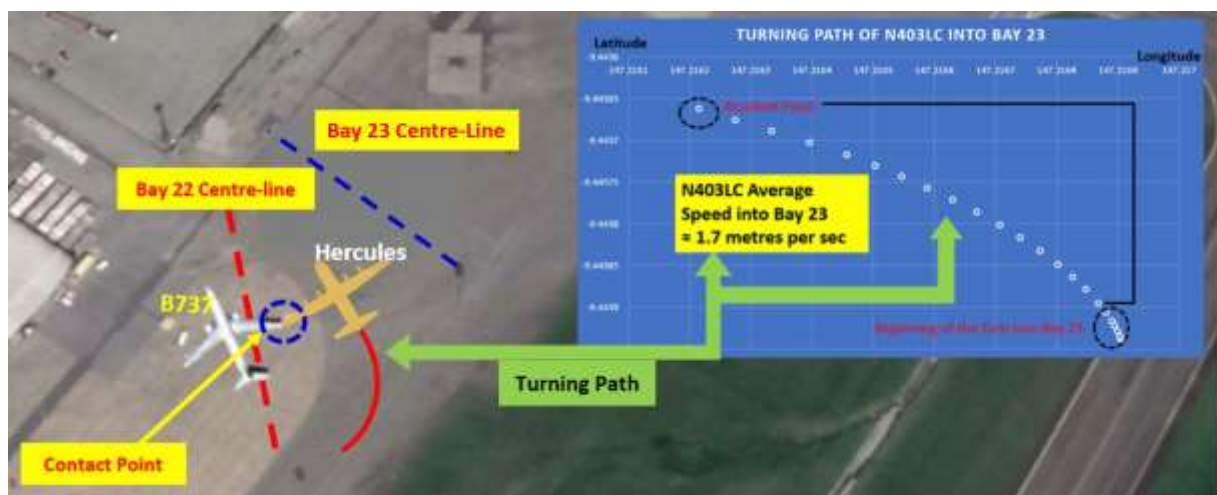


Figure 3: Depiction of aircraft on the parking bays

Witnesses reported that there was no wing walker providing wingtip guidance. The investigation found that while that was correct, there is no requirement in *PNG Civil Aviation Rules* for a wing walker. The aircraft was being appropriately marshalled by a marshaller at a point in full view of the PIC.



Figure 2: Aircraft on Bays at the Jacksons International Airport Cargo area

Damage to the aircraft

The leading edge of the left wing of the Hercules impacted the right winglet of the Boeing 737 causing significant damage to both aircraft. The Hercules leading edge penetrated the Boeing 737 blended winglet to a depth of 40.64 mm (16 inches).



Figure 4: Damage to both aircraft

The Hercules Operator's Maintenance Organisation provided details of the repairs to the Hercules wing. The log stated: *Aircraft structure that requires major repair*. The repairs included replacement of the upper forward wing tip fitting, rib and leading edge.

Flight recorders

The Lockheed Hercules was equipped with following recorders:

Cockpit Voice Recorder

Manufacturer: Honeywell
Type: Solid State (SSCVR)
Part number: 2100-1020-00
Serial number: 000677834

Flight Data Recorder

Manufacturer: Honeywell
Type: Solid State Universal (SSUFDR)
Part number: 980-4120-GQUS
Serial number: 7216

Both of the recorders were successfully downloaded at the AIC's Flight Recorder laboratory. The FDR raw data and the CVR audio data were analysed.

Due to electrical power being retained on the Hercules for more than an hour after the accident and prior to the AIC being notified, the CVR audio data for the time of the accident was overwritten and was not available for the AIC's investigation.

The Magnetic Heading, Longitudinal Acceleration and the Pitch raw data from the SSUFDR were used to reconstruct the turning path of the aircraft as it was manoeuvred onto Bay 23. Using available data including from the distance of the turning path and the recorded data timestamp, an average taxiing speed of the Hercules was established as shown in Figure 2.

Blended winglets⁴.

Boeing blended winglets on the Boeing 737-800 aircraft are an 8 ft (2.44 metre) carbon graphite "upward-swept extension to the airplane wings".

"The winglet and associated wing modifications were designed to meet Boeing and Federal Aviation Administration (FAA) criteria for damage tolerance and fatigue...

"For the Boeing 737-800 retrofit, the modification involves 35% of the outboard wing. The production airplane with full speed-brake capability involved wing panel changes that affect 60% of the span...

"Retrofit of the 737-800 commercial airplane includes a load alleviation system to obtain full use of the speed brakes to the in-flight detent position during typical airline operations...

"For airplanes in production, the wings are strengthened throughout the wingbox to accommodate the winglet loads with full use of the speed brakes to the in-flight detent position...

"In addition to the winglet-induced increase in air load, the weight of the winglet itself and its extreme outboard location also increase the loads for the outboard wing. The heavier the winglets are, the higher the dynamic loads..."

⁴ Boeing published a document titled *AERO 17 – Blended Winglets*. The section in this AIC report titled *Blended winglets* is quoted from the Boeing publication. Blended winglets are classified as wing-tip devices as distinct from traditional wingtips as contemplated in the *ICAO Annex 13* exceptions to the definition of an Accident.

AIC comment⁵

The damage to the B737's "upward-swept extension to the airplane wings" termed blended winglet was significant requiring replacement. The damage to the Hercules wing was listed by the Operator's Maintenance Organisation as structure requiring major repair. Therefore, it was categorized as an accident.

The accident occurred at 05:15 and the AIC was notified by the holder of the *Air Operator Certificate* for the Hercules operation at 06:15. The AIC was not notified by the Civil Aviation Safety Authority in accordance with *Section 62* of the *Civil Aviation Act 2000 (as amended)*.

The investigation obtained photographs from witnesses, and CCTV footage from the Air Niugini cargo building adjacent to the accident site. These were examined and used in correlation with FDR data and interviews, including those given by the crew of the Hercules and the marshaller.

The investigation found that the PIC did not taxi via the Bay 23 centreline, but was 15.7 metres to the left of the line. Bay 23 is designed for Boeing 747 parking which provides for a wingspan 24 metres longer than the Hercules. If the Hercules had been taxiing on the Bay 23 centreline and if the parked Boeing 737 was on the Bay 22 centreline there would still have been a safety margin of 8 metres between the wing tips.

The PIC's decision to taxi the Hercules left of the Bay 23 centreline was based on his decision to turn the aircraft through 180 degrees onto the bay in order to have its aft cargo ramp facing the gate to the cargo yard. In order to make such a manoeuvre the PIC considered it necessary to manoeuvre the aircraft left before making the 180-degree turn. He misjudged the turning radius and distance between the wingtips.

In taking his attention away from the marshaller, he deprived himself of the crucial guidance that could have prevented the accident.

⁵ *AIC comment* is a summation of the report providing a brief analysis of the evidence and findings as to the contributing factors and causes.

General Details

Date and time:	12 May 2018 – 05:15 UTC	
Occurrence category:	Accident	
Primary occurrence type:	Taxiing collision	
Location:	Bay 23, Jackson International Airport, NCD, PNG	
	Latitude: 09° 26' 46.28"S	Longitude: 147° 12' 59.7"E

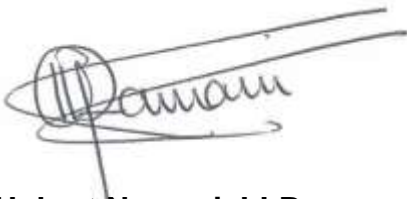
Aircraft details N403LC

Manufacturer and model:	Lockheed Martin L-382	
Registration:	N403LC	
Serial number:	4590	
Type of operation:	Charter	
Persons on board:	Crew: 5	Passengers: 0
Injuries:	Crew: 0	Passengers: 0
Damage	Substantial	

Aircraft details P2-PXE

Manufacturer and model:	Boeing 737-800	
Registration:	P2-PXE	
Serial number:	33024	
Type of operation:	N/A The aircraft was stationary and unoccupied.	
Persons on board:	Crew: N/A	Passengers: N/A
Injuries:	Crew: N/A	Passengers: N/A
Damage	Substantial	

Approved



Hubert Namani, LLB

Chief Commissioner

19 October 2018