بسم الله الرحمن الرحيم

Accident Investigation Coordinating Committee

Aircraft Accident Report 2017/01

Final Report on the Accident to
Viking Air DHC-6-300, 8Q-TMV
Velana International Airport, Maldives
27 May 2017

Introduction

Maldives is a signatory to Convention on International Civil Aviation (Chicago 1944) which established the principles and arrangements for the safe and orderly development of international air transport. Article 26 of the Convention obligates Signatories to investigate accidents to civil aircraft occurring in their State.

This investigation has been conducted in accordance with Annex 13 to the Chicago Convention, the Civil Aviation Act 2/2012 and the Civil Aviation Regulations. The sole objective of this investigation and the Final Report is to prevent accidents and incidents. It is not the purpose of this investigation to apportion blame or liability.

The AICC was assisted by the Maldives Civil Aviation Authority (CAA), Trans Maldivian Airways, the Maldives National Defence Force and the Maldives Police Service.

The recommendations in this report are addressed to the CAA, unless otherwise stated.

All times in this report are in local time unless stated otherwise. Time difference between local and UTC is +5 hrs.

The report is released on 26 September 2018.

Mr. Abdul Razzak Idris
Chairperson
Accident Investigation Coordinating Committee

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Aircraft Accident Report No: 2017/01

Owner	Beau Del Leasing Inc
Registered Owner	Trans Maldivian Airways Pvt. Ltd.
Operator	Trans Maldivian Airways Pvt. Ltd.
Aircraft Type	Viking Air (De Havilland) DHC-6-300
Nationality	Maldivian
Registration	8Q-TMV
Manufacturer's Serial Number	625
Place of Accident	North Right Water Aerodrome in Velana International Airport Latitude: 041153N Longitude: 0733210E
Date and Time	27 May 2017 at 0835 hrs

Synopsis

On 27th May 2017, DHC-6 aircraft, registration number 8Q-TMV owned by BEAU DEL LEASING INC and operated by Trans Maldivian Airways was on a chartered flight from Rangali Island resort, Conrad Maldives to Velana International Airport. The flight was conducted in accordance with the visual flight rules (VFR). There were nine passengers, two pilots and one cabin crew on board the aircraft. The accident occurred during landing on the water aerodrome at Velana International Airport.

The aircraft, while landing on the North Right Water Runway, touched down on the left float and bounced. After the second bounce, while the aircraft was still airborne, it banked to the right dipping the right wing tip in the water. The aircraft then abruptly veered to the right and crashed.

The passengers and crew were able to evacuate before the aircraft submerged completely. No passenger or crew sustained any injuries and they were rescued and safely taken to Hulhumale' Hospital.

The accident site was secured by MNDF Coast Guard personnel and accident investigation was initiated immediately. The aircraft wreckage was salvaged and brought to a secured place for further investigation on the same day.

1 Factual information

1.1 History of the flight

1.1.1 Background

On the previous day (in the evening) the aircraft underwent non-routine maintenance and was released for flight. There were no deferred defects. Prior to the accident, the aircraft had flown a thirty eight minutes (block time) uneventful sector.

On the day of the accident both the pilots reported for duty at 0700 hours at TMA base. It was the first time that both the pilots flew together. No appropriate introductions of the crew were made before the flight (crew briefings).

The company usually schedules a sequence of flight sectors back to back and issues a combined "flight release" for these flight sectors. On the day of the accident five such sequences of flights were scheduled for the crew on the same aircraft. The airline "flight release" document contains three parts. These are the operational flight plan, passenger manifest and the baggage manifest.

The crew began the day by preparing the aircraft for flight. Water was pumped out of the floats and the number of strokes required to empty the floats were recorded in the "float status report form". Company procedures require to check the float serviceability status at the start and end of each day. The co-pilot pumped the right float while the cabin crew pumped the left float. According to the crew, the number of pump strokes to empty the water from the floats were within the limits specified in the company procedures. The crew carried out the pre-flight and walk-around checks prior to the first flight of the day. No abnormalities were recorded or reported by the crew.

The roundtrip flight, Male'-Rangali-Male' was released with 3 crew members (2 flight crew and 1 cabin crew) and 11 passengers from Male' to Rangali. As per the flight release document, the aircraft was loaded with 304 lbs of baggage and 990 lbs of fuel, with a take-off mass of 11,741 lbs.

The PIC was PF for the first sector of the flight. Taxi-out, take-off, cruise and the landing at Rangali were normal, according to the crew. The aircraft landed at Rangali at 0754 hours.

The aircraft took off from Rangali for the second sector of the flight with same crew members (2 flight crew and 1 cabin crew) and 9 passengers. As per the flight release (manifest), the aircraft was loaded with 111 lbs of baggage and 670 lbs of fuel, with a take-off mass of 11,117 lbs. The flight duration of this sector was approximately 30 minutes. The PIC taxied the aircraft through the coral area of Rangali lagoon. When cleared of the coral area, the PIC handed over control of the aircraft to the co-pilot.

According to the flight crew, no abnormalities were observed throughout the flight. From the take-off at Rangali to approach for landing at Velana International Airport, and until the first touch down the flight was uneventful. The approach to land was normal.

While landing left float touched the water first, then the aircraft bounced and ballooned; then landed on the left float for a second time, and bounced again. Then the aircraft was banking excessively to the right digging the right wing tip in the water, making the aircraft veer to the right. Then the aircraft crashed on water banking to the left with left float digging into water.

Figure 1: Aircraft position when the investigation team arrived to the site

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	-	-	-
Minor/None	3	11	-

1.3 Damage to aircraft

The aircraft was substantially damaged.

The investigation identified the following damages to the aircraft;

- Damage to outer skin of rear baggage compartment door. Large dents on the entire surface.
- Large dent and puncture on step strut attachment point on fuselage aft of rear baggage compartment door.
- Step strut attachment point broken off leaving a hole. Cracks propagating from the damaged area.
- 7" Puncture of fuselage skin above port side cabin window 6.
- Step strut attachment point sheared off leaving hole of approximately 3" diameter on the fuselage skin below port side Pilot door.
- Sliding window on the port side deformed and pulled out of groove.
- Multiple cracks, fractures and major dents on the door. Door latch broken. Fuselage skin under door damaged and ripped off.
- Nose cone crushed inward due to impact when aircraft was being lowered to M5 dock.
- Water damage to all flight deck avionic equipment and furnishings.
- Fuselage skin crumpled and deformed on top and side of fuselage where ropes went around it to hoist the fuselage out of water. Rivets sheared and mating flanges exposed.
- Frame 239 cracked.
- Fuselage top skin and stringers bent and crumpled above 'A Frame'.

- Rudder was found to be cracked and split in half.
- Damage to R/H wing from STA 376.20 to 272.00 including damage to aileron.
- Damage from STA 376.20 to 322.00 L/H Wing.
- Cracks on outboard longeron of R/H and L/H engine.
- Impact damage of L/H and R/H propellers. Both engines were submerged in water.
- Deformation of floats and spreader bars of both L/H and R/H floats. R/H float sheared off on impact. L/H float obtained substantial damage on impact.

Refer Annex A of the report to view the damages to the aircraft.

1.4 Other damage

None

1.5 Personnel information

1.5.1 Commander

Age:	60	
Licence:	Airline Transport Pilot Licence (Aeroplanes)	
Aircraft Ratings:	DHC-6 (on Maldivian licence)	
Last proficiency check:	28 February 2017	
Last instrument rating renewal:	28 February 2017	
Last line check:	16 March 2017	
Last medical:	Class 1 (08 March 2017)	
Flying experience:	Total all types:	15,991 hours
	On Type:	12,834 hours
	Last 90 days:	180 hours 53 minutes
	Last 28 days:	41 hours 46 minutes
	Last 24 hours:	5 hours 8 minutes
Previous rest period:	13 hours	

1.5.1 Co-pilot

Age:	28
Licence:	Commercial Pilot License (Aeroplanes)
Aircraft Ratings:	DHC-6
Last proficiency check:	25 January 2017

Last instrument rating renewal:	No IR	
Last line check:	14 April 2017	
Last medical:	Class 1 (30 October 2016)	
Flying experience:	Total all types:	537.6 hours
	On Type:	342.1 hours
	Last 90 days:	229 hours 29 minutes
	Last 28 days:	82 hours 39 minutes
	Last 24 hours:	7 hours
Previous rest period:	11 hours 35 minutes	

1.5.1 Cabin crew

Age:	23
Licence:	Cabin Crew Licence
Last recurrent training:	Line check
Last medical:	Class 3 (19 November 2015)
Previous rest period:	12 hours 15 minutes

1.6 Aircraft information

1.6.1 General information

The DHC-6-300 "Twin Otter" is an unpressurised, all-metal, high wing aircraft powered by two Pratt & Whitney PT6A-27 engines driving Hartzell three-blade, reversible-pitch, full feathering propellers. The aircraft is designed for seating two pilots, side by side with dual controls and standard flight instrumentation.

Manufacturer:	Viking Air (De Havilland)
Registration:	8Q-TMV
Powerplants:	2 x Pratt & Whitney PT6A-27 turboprop engines
Manufacturer's serial number:	625
Year of construction:	1979
Airframe hours at time of accident:	57,523.79 hrs
Certificate of Airworthiness:	Normal category, issued on 24 December 2009
Airworthiness Review Certificate:	Issued on 11 April 2017

1.6.2 Cabin layout and configuration

The aircraft was in float configuration with Wipaire 13000 floats installed. The aircraft cabin was configured for 15 passengers plus one cabin attendant with baggage placed near the right rear passenger door. The aft baggage compartment is used for loading smaller luggage. The aircraft had four exits in the cabin and two exits in the cockpit. The right passenger door is not used as an emergency exit; usually blocked with baggage.

1.6.3 Recent maintenance

The last scheduled maintenance Check was Equalised Maintenance for Maximum Availability (EMMA) number 29 carried out on 06 May 2017 (at 57,449.93 TAT and 96,376 TAC). A scheduled Reverse Current Relay (RCR) replacement was carried out on 21 May 2017 and a scheduled Push-To-Talk (PTT) switch(R/H) replacement was carried out on 17 May 2017. On the 26 May 2017 (in the evening) the aircraft underwent non-routine maintenance which was to replace a fuel flow indicator to clear a deferred defect and was released for flight.

There were 11 unscheduled defects reported in the 30 days prior to the accident. The details are as follows;

1. R/H Radio auto transmitting & heavy static (PIREP - cleared on 28/04/2017)
2. Very stiff aileron to the left on landing (PIREP - cleared on 01/05/2017)
3. L/H heavy aileron on the control (PIREP - cleared on 02/05/2017)
4. Aileron movement to the left side still very heavy & stiff. Slight right turning tendency felt on approaches (PIREP - cleared on 03/05/2017)
5. Airstair door aft bottom cable broken strands (MAREP - cleared on 11/05/2017)
6. Stall bar on R/H wing is missing (PIREP - cleared on 13/05/2017)
7. L/H engine T5 going above limitations (PIREP - cleared on 17/05/2017)
8. L/H engine T5 indicator found cracked at connection point (MAREP - cleared on 17/05/2017)
9. Wind shield wiper starboard side (R/H) side INOP (PIREP - cleared on 18/05/2017)

10. Controls are on a right bank in straight and level flight (PIREP - cleared on 24/05/2017)
11. R/H fuel flow INOP (PIREP – deferred on 25/05/2017 and cleared on 26/05/2017)

The last engine wash was done on 26 May 2017, while the last aircraft maintenance release carried out on the same day.

The aircraft had no outstanding deferred defects at the time of accident nor were any reported defects.

1.6.4 Flight controls

The flight controls consist of conventional, manually actuated primary flight controls operated through cables, pulleys, and mechanical linkages. Rudder and elevator trim are manually controlled and mechanically actuated; aileron trim is electrically actuated. Secondary flight controls consist of hydraulically actuated wing flaps.

The flight controls were inspected after the aircraft was recovered from the seabed and no issues were identified in the flight control system.

1.6.5 Powerplants

The aircraft was powered by two Pratt & Whitney Canada PT6A-27 turboprop engines. Each engine is fitted with a Hartzell (HC-B3TN-3DY), three-bladed, constant speed, full feathering and reversible propeller.

The pilots did not report any anomalies related to the engines or propellers.

1.7 Meteorological information

Meteorological information Male' (VRMM) issued on 27th May 2017 at 0800 LT and 0900 LT.

Type and Area	Date & Time in UTC	Weather	Remarks
METAR VRMM	270300Z	25011KT 9999 FEW018 FEW019CB BKN270 30/60 Q1010 CB S NOSIG	Nil
METAR VRMM	270400Z	25012KT 9999 FEW018 BKN270 30/26 Q1010 NOSIG	Nil

1.8 Aids to navigation

The aircraft was operating under Visual Flight Rules. Aids to navigation was not a factor in this accident.

1.9 Communications

The aircraft was equipped with two VHF sets both of which were serviceable at the time of departure. The pilots were communicating with the ATC during approaching and landing.

1.10 Aerodrome and approved facilities

Velana International Airport has three water runways. They are water runway North Right/South Left, runway North Left/South Right and runway East/West.

The aircraft landed on the North Right water runway of Velana International Airport.

1.11 Flight Recorders

The aircraft was not equipped with a flight data recorder (FDR) or cockpit voice recorder (CVR), nor were these required to be fitted under current Civil Aviation Regulations. It should be noted that the AICC in its recommendations made after an accident that occurred on 17 May 2004, recommended the CAA to re-examine the criteria of carriage

for flight recorders on transport category aircraft certified to carry more than 9 passengers with a view to requiring all aircraft to carry at least a CVR.

Further, the AICC in its recommendations after the accident that occurred on 2 June 2009 recommended CAA to mandate installation of CVRs on all aircraft used for commercial air transportation.

AICC in its recommendations after the accident that occurred on 2 July 2015 recommended CAA to review and consider implementing the previous recommendations made with regard to mandating installation of CVR's.

1.12 Wreckage and impact information

1.12.1 Accident site

The wreckage was at a depth of approximately 10-11metres on the seabed at North Right water runway, Velana International Airport.

1.12.2 Examination of baggage

Examination of baggage revealed that one piece of baggage of a passenger was missing. Further search for the missing piece was carried out by MNDF, however the baggage was not recovered.

1.12.3 Salvage operations

The salvage operation of the wreckage was jointly carried out by MNDF and TMA personnel, overseen by the investigators. The main challenge in the salvage operation experienced by the team was the murkiness of the water caused by the ongoing dredging works. This could have contributed to non-recovery of one of the steps which was detached from the aircraft.

1.13 Medical and pathological information

The crew did not have any pre-existing medical conditions that may have contributed to the accident. Medical examinations were performed on all crew members and there was no evidence of alcohol, drugs or any toxic substance that may have contributed to the accident.

1.14 Fire

No fire involved.

1.15 Survival aspects

1.15.1 Emergency Locator Transmitter (ELT)

8Q-TMV was equipped with an Artex model C406-1 ELT (capable of transmitting on 121.5/243 and 406 MHz) fixed in the aft baggage compartment. The ELT was connected by cable to an external roof-mounted antenna and to a remote cockpit switch.

No distress signals were received from the accident aircraft. The ELT was found attached to the aircraft within the wreckage. The ELT was last serviced on 8 March 2017 and the battery expiry is 1 April 2019.

1.15.2 Life jackets

The aircraft had crewmember life vest at every crew seat location and passenger life vest under every passenger seat.

It was reported that only one of the passengers was wearing the life jacket who happened to be someone that did not know how to swim. This passenger was apparently assisted by the cabin crew in wearing the life jacket.

Unlike a previous accident involving a similar seaplane, in this particular accident, there was no passenger who complained that they had any difficulties in removing the life vest from the plastic protective covering.

1.15.3 Evacuation

Immediately after the impact, Cabin crew, PIC and the FO collectively initiated evacuation. Right emergency door of the aircraft was used for the evacuation.

1.16 Tests and research

No tests or researches were carried out as there were no technical defects identified during the course of the accident investigation.

1.17 Organisational and management information

1.17.1 Company structure

Trans Maldivian Airways is a commercial air transport operator (with operator certificate number MV.AOC.005) formed in October 1993. It operated as Maldivian Air Taxi until February 2013 when the name was changed to Trans Maldivian Airways following the merger of Maldivian Air Taxi and T.M.A. Ltd. The company currently operates a fleet of 46 DHC-6 aircraft providing charter services to resort islands.

The company also hold a maintenance management organisation approval (MV.MG.003), a maintenance organisation approval (MV.145.025) and Approved Training Organisation (ATO number: 005) issued by the MCAA.

1.17.2 Operations Manual

The Operations Manual (OM) was compiled with the express intention of complying with Maldivian Civil Aviation Regulations and the Air Operator Certificate (AOC). The OM was divided into several sections as follows:

Part A	General
Part B	Aircraft Operating Matters
Part C	Route and Aerodrome
Part D	Training

1.17.5 Crew training

Operations Manual Part D covers DHC-6 type conversion and recurrent training courses.

First Officer

As per the training records from the operator, FO started flying on 10th January 2017 and completed on 24th January 2017 with a total of 12.06 hours/10 Training flights. As per the instructors (TRI) review he completed the training with standard performance and repeated 1 training lesson to practice take-off, approach and landing. His progress was noted as 'acceptable'. He completed LPC on 25th January 2017 covering all the required checks. As per TRE's review he was safe and effective, average for initial type rating. Supervised line flying of the FO commenced on 30th January 2017 to 14th April 2017 and did a total of 183.67 hours and 351 sectors. According to the Operations Manual part D, a minimum of 100 hours and 100 sectors and more than 3 recommendations from Line Training PICs are required before a line check. LTCs' commented 'slow progress' at the beginning, however 'progress good' was noted in the later part of the Line Training. All three recommendations from Training PICs for a line check was received by 10th April 2017. He completed the line check on 14th April 2017 and the review given by the Examiner stated as "good solid performance". As per the instructors', Examiners' and Line Training PICs' comments given on the training forms indicated him to be an average initial type rating candidate.

PIC

As per the training records the PIC's last line check was done on 28th February 2017 which expires on 31st March 2018. In line check, he completed 1.25 hrs. As per the Examiner's comment given on the training forms, "no major errors". The block time of Line Training was 16.6 hrs/ 39 sectors.

1.18 Additional information

National Transportation Safety Board Accident Report AAR-91/01

The following is an excerpt of an investigation report (AAR-91/01) from the National Transportation Safety Board (NTSB) following a similar DHC-6-300 accident which occurred in 1989:

"Grand Canyon Airlines' Pilot Operating Manual (POM) for the DHC-6...contains a caution statement that; in a go-around with flaps extended, the nose will point below the actual flight path. Pilots reported that applying power at low airspeeds when the flaps were fully deployed would result in the airplane pitching up. The pilots further reported that positive pressure against the control yoke was needed to stop or prevent this pitching tendency. While some pilots reported that occasionally it was necessary to use both hands on the control yoke to prevent the airplane from pitching up, no one reported that the control forces exceeded the Federal Aviation Administration (FAA) maximum limitation of 50 pounds.

The NTSB investigation sought to determine the factors that might have caused the pilots to lose control of the airplane during the go-around. During the dynamic situation while the airplane was right wing down and heading for the side of the runway, the pilot's reaction might have been to raise the nose and add power for an anticipated go-around.

At airspeeds near stall, the downwash on the horizontal stabilizer tends to raise the nose of the airplane, requiring the control yoke to be pushed forward to maintain a normal pitch attitude for the same trim setting. If the pilot pulled back on the control yoke while adding power, this could have resulted in the airplane lifting off in a nose high, power-on stall or near-stall condition. In addition, the visual reference may have been misleading. According to the operations manual for the DHC-6, with 40° (full flap is frequently referred to as 40°, but is actually 37.5°) of flaps, the airplane's deck angle is below the flight path angle during a go-around. Therefore, an increase in pitch to a typical nose-up reference attitude while the flaps were at 40° would increase the possibility of aerodynamic stall and subsequent loss of lift.[1]"

This is also supported by 'Aviation Investigation Report A11W0144' of Transport Safety Board of Canada.

1.19 Useful or effective investigation techniques

Desktop research was carried out on similar accidents occurred across the globe involving DHC 6 aircraft to understand the causes that lead to the accident on 8Q-TMV.

[1] *National Transportation Safety Board, Grand Canyon Airlines flight Canyon 5, De Havilland Twin Otter, DHC-6-300, N75GC, Grand Canyon National Park Airport, Tusayan, Arizona, September 27, 1989, (Washington, D.C.: National Transportation Safety Board, 1991), page 13.*

2. Analysis

2.1 General

This analysis is focused on the crew coordination and handling of aircraft during the landing and attempted go-around.

The flight from CON-MLE was normal until the first touchdown at MLE. No abnormalities during the flight were reported. Examinations and tests carried out on the wreckage revealed no evidence of any technical defects which could have contributed to the accident.

It is noted that there were four defects recorded in the previous 30 days regarding heavy aileron forces in the left wing down direction. This could have contributed to the aircraft rolling to the right. However, these defects had been reportedly fixed at least three times prior to the accident. When the flight controls were inspected after the aircraft was recovered from the seabed and no issues were identified in the flight control system.

During interview the crew indicated as the aircraft approached touch down it looked and felt as though the aircraft was going to touchdown on the left float, (upwind) for the consideration of the current wind. Unexpectedly the aircraft bounced off the right float with a very high pitch attitude. With this attitude the aircraft veered to the right, and they did not recall any aural warnings.

According to the PIC; immediately the aircraft bounced after the first impact with the water. PIC told the co-pilot he was taking control and called for a go-around, requesting ten degrees flap, and added full power. PIC tried to lower the nose and get the wings level with the objective to regain airspeed and directional control to fly the aircraft out of the situation. PIC was unaware that the aircraft right wing tip dipped in the water as the aircraft veered to the right after the unexpected bounce.

According to the co-pilot; when the aircraft impacted water, the PIC called for change of control and the control was handed over. The co-pilot neither heard the PIC's call for 10 degrees flap, nor took any actions to change the flap settings. During the investigation, it

was confirmed that the flaps were at full down position. Proper procedures for the go around were not followed which is indicative of CRM breakdown.

However, an enhanced video recording of the approach and landing of the aircraft revealed that the aircraft touched water on the left float and bounced twice. The aircraft then was seen making a steep turn to the right with a nose up attitude and the right wing tip was seen contacting water. Next it was seen suddenly banking to the left and dropping nose down into the water.

After the initial bounce, the aircraft would have been in a slow flight condition. The aircraft yawed to the right, nose pitched up and the right wing tip dipped in the water. Combined controls were used to counter the nose up attitude and initiate a go-around.

Studies of similar accidents involving same type of aircraft elsewhere in the world have shown that if a go-around was initiated when the aircraft is in a high pitch attitude and adding full power results in the aircraft lifting off the water in a very nose-high, right-wing-low attitude. With full flaps selected and both wings in a stalled or semi stalled condition, the aircraft would not accelerate or climb. This results in the wings stalling and a loss of control.

The investigation revealed that similar conditions lead to the accident occurred on this aircraft. The aircraft was in a pitch up condition when the PIC took over the controls and added full power initiating go around while the flaps were still in full down position.
This resulted in the aircraft going into a stall condition with a pitch up and right wing low attitude causing the right wing dig into water. The PIC's action to counter the situation resulted the aircraft rolling to the left with the left float digging into the water and crashing.
The Aircraft Flight manual (AFM) states, "WARNING - With Flaps fully extended at 37.5, any pitch attitude in the go-around manoeuvre greater than 0 degrees (level flight attitude) may cause a rapid decrease in airspeed and possible stall". [2]

[2] *Supporting information can be found in the DHC 6-300 AFM (page 4 -46)*

2.2 Aerodynamics

There were no aerodynamics issues identified in the accident.

2.3 Flight crew

There was no evidence of adverse medical conditions that affected the flight crew. Drug tests indicated that neither the PIC nor the FO were under the influence of, or impaired by, drugs or alcohol at the time of accident.

2.4 Weather

Weather was not a contributing factor in this accident.

2.5 Crew training

The operator is approved to conduct DHC-6 type conversion and recurrent training courses by the MCAA through Operations Manual Part D. The flight crew had completed the required training as per the Operator's OM.

2.6 Survival Aspects

2.6.1 Evacuation

All passengers and crew were evacuated safely without injuries. Some passengers escaped through starboard emergency exit, while the rest escaped through the rear starboard door although the latter is not a designated exit. The flight crew escaped through the right cockpit exit.

No passengers or crew reported any difficulties in evacuation.

2.6.2 Emergency Response

As soon as all the passengers were evacuated, the flight crew and passengers were rescued by a small boat used by a dredger located close to the accident site and later transferred to an Airport rescue boat.

3. Conclusions

3.1 Findings

a. The airplane was certified, equipped, and maintained in accordance with MCARs and approved procedures.

b. There was no known pre-existing damage to the airplane, its systems, or Powerplants.

c. The flight crew were properly certified and qualified for their duties.

d. Weather was not a factor in the accident.

e. During landing, subsequent to the second bounce, a go-around was attempted.

f. Full power was applied with the intention of performing a go-around while the aircraft was:

- At low speed
- At a nose high attitude
- With flaps fully extended.

g. When the go-around was attempted, the right wing had stalled and dipped in water.

h. No appropriate briefings as stated in OM, part-B were conducted although the two crew flew together for the first time. This led to CRM (communication) breakdown.

3.2. Causes

The investigation identified the following causes;

a. Improper recovery techniques from a bounced landing; application of go-around procedures whilst the aircraft was at low speed with flaps fully extended.

b. Breakdown of crew coordination during the attempted go-around.

4. Safety Recommendations

4.1 Recommendations to the MCAA

Subsequent to the findings of the investigation of this accident, the AICC makes the following recommendations to the MCAA:

Determine whether the airline procedures;

a. Allowing the aeroplane to operate with full flaps are consistent with a safely initiated and implemented go-around manoeuvre in a DHC-6-300 aircraft from a stall or near-stall condition.
b. Contain a bounced landing and recovery procedure on DHC-6-300 aircraft operated on floats.
c. Include specific procedures and trainings covering the aircraft upset recovery in all phases of flight.

4.2 Recommendations to the Operator

Subsequent to the findings of the investigation of this accident, the AICC makes the following recommendations to the Operator:

a. If not already implemented, to add specific procedures covering the aircraft upset recovery in all phases of flight.
b. Coordinate with Type Certificate Holder to establish specific procedures pertaining to bounced landing recovery on DHC-6-300 aircraft operated on floats.
c. To revise the crew pairing procedures to make the crew and dispatchers aware about the experience of other crew members.

4.3 Recommendations to the Type Certificate and Supplementary Type Certificate holders

Subsequent to the findings of the investigation of this accident, the AICC makes the following recommendations to the Type Certificate holder:

a. To establish procedures pertinent to bounced landing and recovery on DHC-6-300 aircraft operated on floats.

5. Appendices

5.1 Flight Release

a. Operational Flight Plan

OPERATIONAL FLIGHT PLAN - DAY / VFR — TMA FLIGHT RELEASE

Printed By: hawwa aroosha
Printed Time: 27-May-17 07:06:00

27-May-17	7:02	FLT484433	8Q-TMV	8650	12.0	12500	KTAS 135

SECTOR	MLE-CON	CON-MLE
SKED	715	759
ETE	29	29
MAG. BRG	239	059
DIST (nm)	60	60
OFF BLOCK		
TAKE OFF		
LAND		
ON BLOCK		
AIR TIME		
BLOCK TIME		
BOARDING	10(1)+0	12(0)+0
TOT ON BOARD	10(1)+0	12(0)+0
DISEMBARKING	10(1)+0	12(0)+0
A/C APS	8650	8650
PAX	1,812	2,268
BAGGAGE	304	792
MAN AJUST.	0	0
+/- FUEL	0	0
FUEL @ T/O	**975**	**655**
T/O MASS	**11,741**	**12,365**
MAN AJUST.	0	0
SECTOR BURN	290	290
LDG MASS	**11,451**	**12,075**
OPS FUEL O/B	410	380
MIN FUEL REQ	**990**	**670**
+/- FUEL	0	0
FUEL @ DEP	**990**	**670**
SECTOR BURN	290	290
TAXI FUEL	30	30
FUEL @ ARR	**670**	**350**
TOTAL BURN	320	640
C of G % MAC		

Sunset/Grounding		
	27.05.2017	28.05.2017
TWIL From	05:30	05:30
Sunrise	05:52	05:53
Sunset	18:13	18:13
Grounding	18:35	18:35
TWIL to	18:35	18:35

Tides			
27-05-2017		28-05-2017	
Time	Tide	Time	Tide
01:14	0.8	01:55	0.8
07:29	0.0	08:06	0.0
14:17	1.0	14:53	1.0
20:28	0.2	21:06	0.3

This aircraft is loaded in accordance with CAT POL MAB 100 for the above flights.

This flight release has been prepared in accordance with MCAR Air Operations and TMA flight Operations Manual.

CHECK REPETITIVE ITEMS

Captain's Signature

Flight Dispatcher's Signature

International Departure Passenger - Manifest

Pax Number	Note	Name	Hand lugg.	Chk. In Lugg.	Destination	Airport	Type
6761475			0	0	CONR	CON	MALE
6761476			0	0	CONR	CON	MALE
6761477			0	0	CONR	CON	MALE
6761478			0	0	CONR	CON	MALE
6761479			0	0	CONR	CON	MALE
6761480			0	0	CONR	CON	MALE
6761481			0	0	CONR	CON	MALE
6761482			0	0	CONR	CON	MALE
6761483			0	0	CONR	CON	MALE
6761484			0	0	CONR	CON	MALE
6761485			0	0	CONR	CON	MALE
6761486			0	0	CONR	CON	MALE
12			0	0		CON	

Route: CON - (CONR-14/12)

BUMPED / ADDITIONAL BAGGAGE / VIP/ RESORT PHONE INFORMATION

DELAY / OUTSTATION DEFECT REPORT

NOTAMS: See Reverse Side

b. Passenger List

TRANS MALDIVIAN AIRWAYS
PASSENGER & CARGO MANIFEST

PRINT - Please print 2 copies for the captain

A/C Reg.: TMV	Date: Saturday, May 27, 2017	Checkin Close Time: 07:58:00
Dep. Station: CON	Flt. No.: FLT484433	Sequence of Close: 1 of 1
Arr. Flight No.:	Arr. Station:	Resort Name: CONR
	Dep. Flight No.:	Prepared By: Sana - HR

Passengers:

Resort	Passenger No.	Name	VIP	Type	Conn. Flt.	Tour Opr.	Pcs.	Lug. Wgt.	Pax Wgt.	Checked In
CONR	6761475			MALE	MLED	CONRAD	0	0	189	✓
CONR	6761476			MALE	MLED	CONRAD	3	33	189	✓
CONR	6761477			MALE	MLED	CONRAD	1	36	189	✓
CONR	6761479			MALE	MLED	CONRAD	2	27	189	✓
CONR	6761480			MALE	MLED	CONRAD	1	15	189	✓
CONR	6761481			MALE	MLED	CONRAD	0	0	189	✓
CONR	6761483			MALE	MLED	CONRAD	0	0	189	✓
CONR	6761484			MALE	MLED	CONRAD	0	0	189	✓
CONR	6761486			MALE	MLED	CONRAD	0	0	189	✓

Weight of checked in pax only

Checked in Count	Lug. Weight	Pax Weight
9	111.00	1701.00

Cargo :

Last Minute Changes(manual input):

Name	VIP	Type	Conn. Flt.	Tour Opr.	Pcs.	Lug. Wgt.	Pax Wgt.

Wgt 1701

Aircraft weight and balance is within limits for take-off, enroute and landing of the above flight

Captains Signature

Fuel		670
T.O.W.		11112
Corr		
ACT. T.O.W.		11112
Burn off		270
Landing WGT		10842

* All Weights in lbs.

Close Window

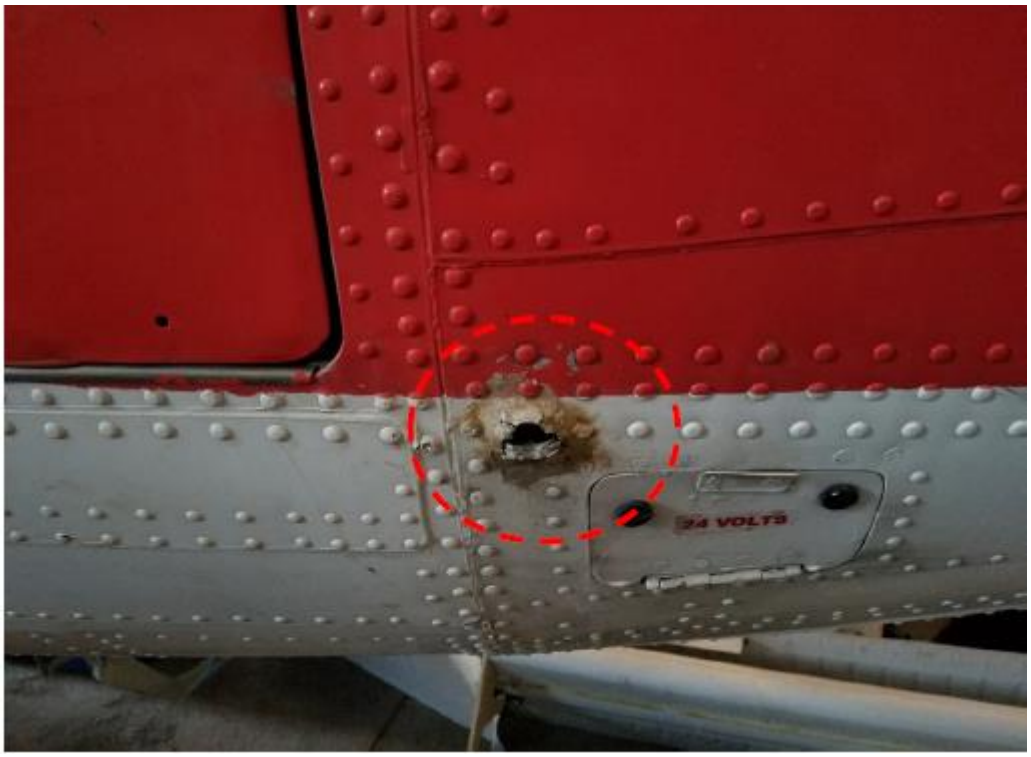
5.2 Damages to the aircraft

The below photos show the damages to the aircraft caused due to the accident.

1: Damage to outer skin of rear baggage compartment door. Large dents on the entire surface.

2: Large dent and puncture on step strut attachment point on fuselage aft of rear baggage compartment door.

3: Step strut attachment point broken off leaving a hole. Cracks propagating from the damaged area



5: 7" Puncture of fuselage skin above port side cabin window 6.

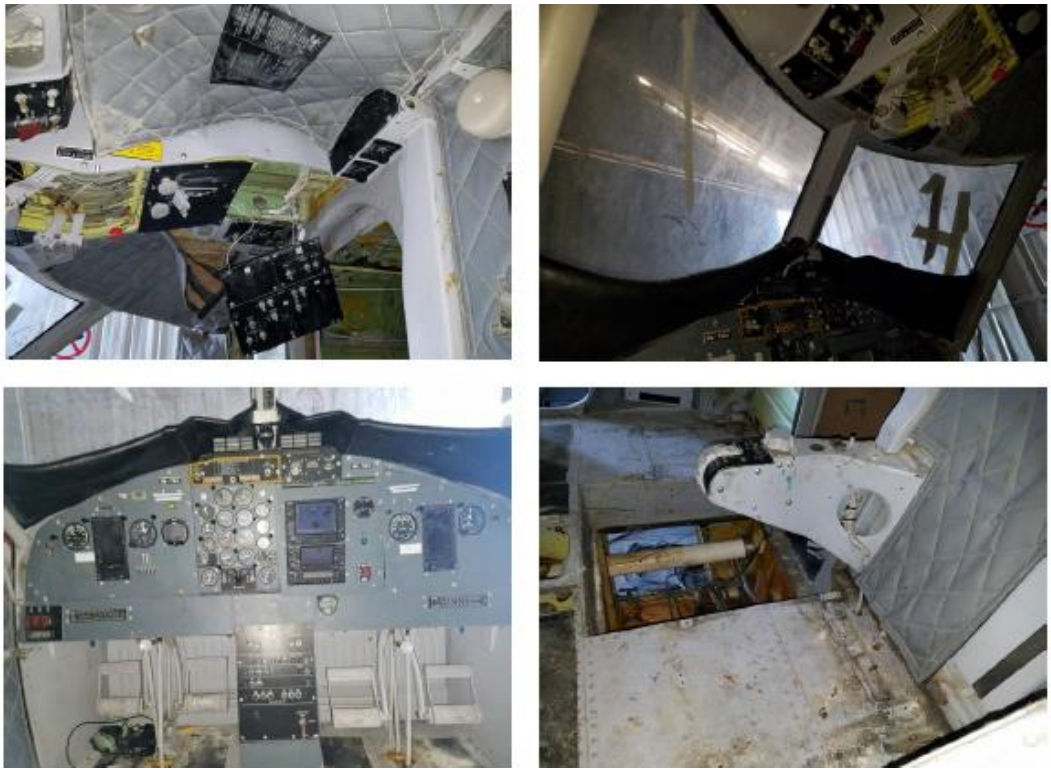
4: Sliding window on the port side deformed and pulled out of groove

6: Step strut attachment point sheared off leaving hole of approximately 3" diameter on the fuselage skin below port side Pilot door

7: Multiple cracks, fractures and major dents on the door. Door latch broken. Fuselage skin under door damaged and ripped off

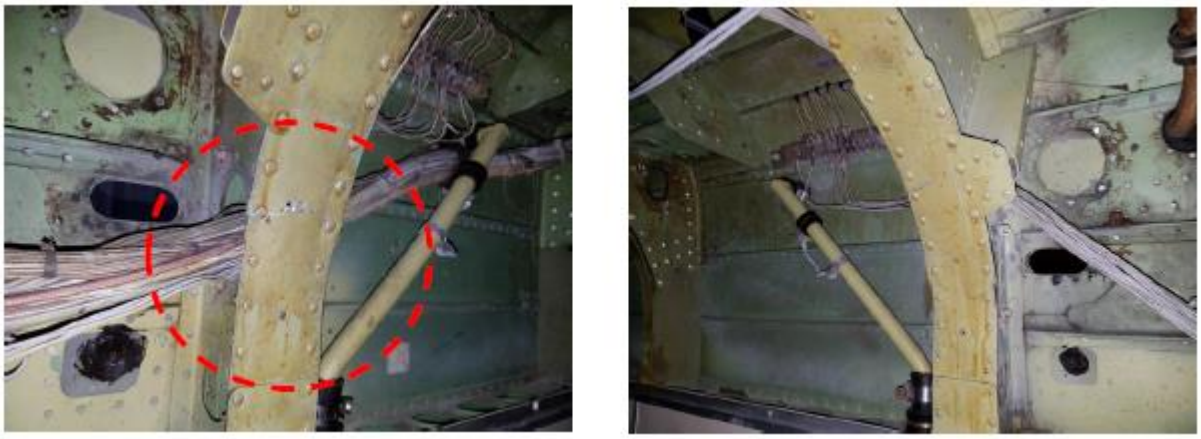
8: Nose cone crushed inward due to impact when aircraft was being lowered to M5 dock

10: Water damage to all flight deck avionic equipment and furnishings

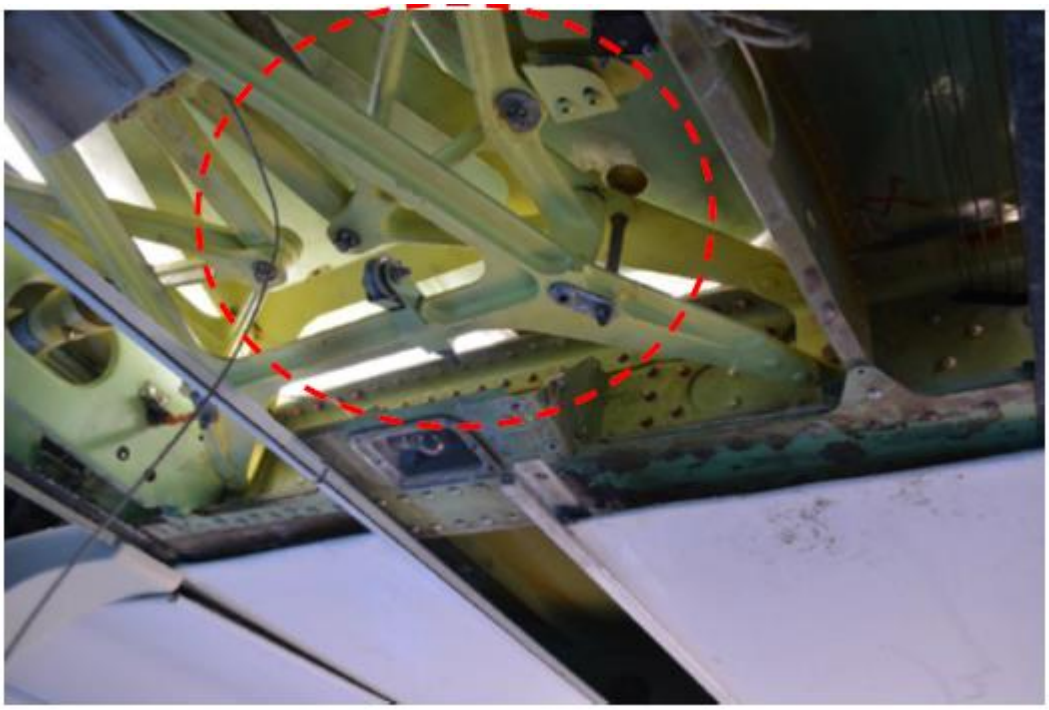


9: Fuselage skin crumpled and deformed on top and side of fuselage where ropes went around it to hoist the fuselage out of water. Rivets sheared and mating flanges exposed

11: Frame 239 cracked



12: Fuselage top skin and stringers bent and crumpled above 'A Frame'



13: Rudder was found to be cracked and split in half

13: Damage to R/H wing from STA 376.20 to 272.00 including damage to aileron

15: Damage from STA 376.20 to 322.00 L/H Wing

16: Cracks on outboard longeron of R/H and L/H engine

14: Impact damage of L/H and R/H propellers. Both engines were submerged in water

18: Deformation of floats and spreader bars of both L/H and R/H floats. R/H float sheared off on impact. L/H float obtained substantial damage on impact

5.3 List of Abbreviations

AICC	: Accident Investigation Coordinating Committee
ATC	: Air Traffic Controller
AOC	: Air Operator Certificate
COM	: Communication
CON	: Conrad Maldives Rangali Island
CVR	: Cockpit Voice Recorder
DHC-6-300	: Viking Air Twin Otter 300 Series
EMMA	: Equalised Maintenance for Maximum Availability
ELT	: Emergency Locator Transmitter
FAA	: Federal Aviation Administration
FDR	: Flight Data Recorder
FO	: First Officer
ICAO	: International Civil Aviation Organization
lb	: Pounds
LH	: Left hand
LT	: Local time
MCAA	: Maldives Civil Aviation Authority
MCAR	: Maldivian Civil Aviation Regulation
METAR	: Meteorological Aviation Report
MLE	: Male’
MNDF	: Maldives National Defence Force
NM	: Nautical Mile
NTSB	: National Transportation Safety Board
OM	: Operations Manual
PF	: Pilot Flying
PIC	: Pilot in command
PTT	: Push-To-Talk
POM	: Pilot Operating Manual
RCV	: Reverse Current Relay
RH	: Right hand
RWY	: Runway
TMA	: Trans Maldivian Airways Pvt. Ltd.
TRI	: Type Rating Instructors
UTC	: Universal Coordinated Time
VFR	: Visual Flight Rules
VRMM	: Velana International Airport
VMC	: Visual Meteorological Conditions