بسم الله الرحمن الرحيم

ACCIDENT INVESTIGATION COORDINATING COMMITTEE

AIRCRAFT ACCIDENT REPORT 2020/01

FINAL REPORT ON INVESTIGATION OF THE ACCIDENT INVOLVING VIKING AIR DHC-6-300, 8Q-MBC AIRCRAFT AT KUREDHU WATER AERODROME, MALDIVES

on 24 February 2020

INTRODUCTION:

Maldives is a signatory to the 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 report is based upon the investigation carried out by the Accident Investigation Coordinating Committee (AICC) in accordance with Annex 13 to the Convention, the Civil Aviation Act 2/2001 and the Civil Aviation Regulations. The sole objective of the investigation of an accident or incident shall be the prevention of accidents and serious incidents and it shall not be the purpose of this activity to apportion blame or liability.

The AICC was assisted by MCAA and TMA.

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

The report is released on 19 May 2021.

Mr. Abdul Razzak Idris
Chairperson
Accident Investigation Coordinating Committee

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LIST OF ABBREVIATIONS:

AICC : Accident Investigation Coordinating Committee
AMP : Approved Maintenance Program
ASI : Air Speed Indicator
CVR : Cockpit Voice Recorder
EASA : European Union Aviation Safety Agency
ELT : Emergency Locator Transmitter
EMMA : Equalised Maintenance for Maximum Availability
FDR : Flight Data Recorder
FO : First Officer
KUR : Operator designated 3 letter code for Kuredu Water Aerodrome
lbs. : Pounds
LE : Leading Edge
LH : Left Hand
LOPA : Layout of Passenger Accommodations
LPC : Line Proficiency Check
LT : Local time
MCAA : Maldives Civil Aviation Authority
MCAR : Maldives Civil Aviation Regulations
MLE : IATA designated 3 letter code for Velana International Airport
OPC : Operator's Proficiency Check
PF : Pilot Flying
PIC : Pilot-in-command
PIREP : Pilot Reports
PNF : Pilot Not Flying
PWC : Pratt & Whitney Canada
RH : Right Hand
SOP : Standard Operating Procedure
TAC : Total Air Cycles
TAT : Total Air Time
TMA : Trans Maldivian Airways Pvt. Ltd.
UTC : Universal Coordinated Time
VFR : Visual Flight Rules
VIA : Velana International Airport

SYNOPSIS:

On 24 February 2020, DHC6-300 aircraft, registration 8Q-MBC owned and operated by TMA, was on a charter flight from VIA to Kuredhu Island Resort. The flight was conducted in accordance with the Visual Flight Rules (VFR). There were fifteen passengers, two pilots and one cabin crew onboard the aircraft. The accident occurred during landing on the water aerodrome at Kuredhu Island Resort.

At the time of the accident the water aerodrome was experiencing squally winds and rough seas under sunny conditions, common during the north east monsoon that is typical to the time of the year.

The aircraft, while landing on one of the designated (but unmarked) water runways, touched down and bounced. After the bounce, the aircraft banked to the left dipping the left wing-tip into the water and the aircraft veered to the left. The right wing of the aircraft then abruptly dropped with the aircraft nose digging into the water. The PIC attempted to initiate a go around after the bounce without success.

During the accident the fuselage, wings, engines and propellers of the aircraft sustained substantial damage. Both the floats remained intact and the aircraft was upright after the accident. The aircraft taxied to the mooring buoy using the left engine power and assistance by a dinghy.

All passengers and crew were able to evacuate safely. However, as a direct consequence of the accident, two of the operating crew and one passenger suffered minor injuries.

The accident occurred at 11:35 hours. MCAA reported the accident to the Accident Investigation Coordinating Committee (AICC) at 12:02 hours on the same day. One investigator from MCAA representing AICC arrived at the accident scene, approximately at 13:00 hours. The investigation commenced, forthwith. Two other investigators, (one each from MCAA and AICC) arrived at the accident site at around 17:15 hours on the same day and continued their investigation efforts gathering data, interviewing crew, passengers, and available witnesses.

1. FACTUAL INFORMATION

Aircraft Owner:	Trans Maldivian Airways Pvt. Ltd.
Registered owner:	Trans Maldivian Airways Pvt. Ltd.
Operator:	Trans Maldivian Airways Pvt. Ltd. (Air Operator Certificate No.005)
Aircraft Type:	Viking Air (de Havilland Canada) DHC-6-300
Nationality:	8Q (Republic of Maldives)
Registration:	8Q-MBC
Aircraft Manufacturer:	de Havilland Canada (Type Certificate now owned by Viking Air Ltd.)
Manufacturers Serial No.:	256
Place of Accident:	Kuredhu Island Resort Latitude: 05° 32.90N Longitude: 73° 27.89E
Date and Time:	24 February 2020 at 11:35 hours

1.1 History of Flight

1.1.1 Background

On the day of the accident both the pilots reported for duty at 06:00 hours at TMA base. Both the PIC and the FO were on 05:10 hrs bus from HulhuMale'. For both the PIC and the FO, it was their first day back on duty after a three day rest period. It was the first time ever that both the pilots were paired to fly together. Neither appropriate introductions of the flight crew were made, nor crew briefing took place before their first flight.

The aircraft was released for flight by the maintenance team on the previous night and there were no record of any deferred defects.

The crew began the day by preparing the aircraft for flight; carried out the pre-flight and walk-around checks. No abnormalities were recorded or reported by the crew.

The first flight of the day was Male'-Lily Beach-Male' and the second flight was Male'-InnaHuraa-Atmosphere-Male'. The accident flight was the third flight - the sixth leg of the day. All the flights of the day were uneventful up to the accident flight. The crew reported

not receiving any weather update for Kuredhu water aerodrome, but was aware of other flights operating to Kuredhu.

The company issued a "flight release" for both sectors MLE / KUR and KUR / MLE for flight number FLT692600 – issued at 10:14 hours on the same day. The airline "flight release" document contains three parts - the operational flight plan, passenger manifest and the luggage list – documenting weights for cabin luggage and hand luggage. The operational flight plan was signed by both; the Flight dispatcher and the PIC. A Mass & Balance report for the flight was also issued, at 10:44 hours before the flight departure. This Mass and Balance report is computed by the PIC, using a tablet in the cockpit and is prepared using the data stated in the flight release document. There is no provision for PIC's signature on the Mass & Balance report, and is available on a tablet. At main base the Mass and Balance data is uploaded on company network in real time as the tablet is connected to Operator's network using Wi-Fi data network, and at other stations it is connected to company network using mobile data. If mobile data is not available at a point of departure, the mass and balance data does not get uploaded in the company network until mobile data becomes available.

The roundtrip flight, Male'-Kuredhu-Male' was released with 3 crew members (2 flight crew and 1 cabin crew) and 15 passengers from Male' to Kuredhu. As per the flight release document, the aircraft was loaded with 434 lbs of baggage and 785 lbs of fuel, with a take-off mass of 12,495.58 lbs.

The FO was PF for this (Male'-Kuredhu) sector of the flight. All phases, taxi-out, take-off, cruise and the approach to Kuredhu, of the flight was normal and uneventful. Cruising altitude was 6500 feet. The winds were easterly, and the sea conditions were found to be rough which is typical to the time of the year, during North -East monsoon.

Descent began 15 mins prior to landing at Kuredhu, and the FO gave the briefing and descent checks were carried out. The FO requested the PIC to 'standby for the line' (direction for landing). When Kuredhu was visible, the FO informed the PIC that this will be "Right base for north east bound landing". The FO reported seeing white caps on the waves and the waters were choppy but was confident of landing in such rough waters, as having done landings in similar conditions even the week before. The FO communicated the line to the PIC and stated "in case of go-around we will climb to 500 feet as per the SOP".
The PIC advised the FO to keep the aircraft slightly to the left, closer to the reef, just on the lighter blue area, as it was believed that this area was relatively calmer. The FO reported that

around 400 feet FO called out for full flap and max rpm, and repeated for a second time "that in case of ground we will climb to 500 feet as per the SOP". FO stated that there was no obstruction in the selected landing strip. During approach, at about 100 to 150 feet the PIC noticed the speed was low and instructed the FO to correct the speed. The FO responded by correcting the speed. While interviewing during the investigation, the FO stated noticing an altimeter difference of 20 to 40 feet between the altimeters. The FO also stated noticing a difference of 2 to 3 knots on the ASI's.

The PIC confirmed landing the aircraft just outside the lagoon and the wind was about 10 degrees to the right of the aircraft direction. Landing inside the lagoon appeared to be more risky to the PIC, due to number of obstructions including boats and buoys, and the landing outside the lagoon was believed to be safer. The crew did not circle around the island to check for a calm area despite the prevailing rough sea conditions.

The aircraft, while landing touched down and bounced, which appeared to be manageable, according to the flight crew. Once the aircraft bounced, the PIC attempted to initiate a go-around by adding power but the speed bled off. Consequently the left wing dropped and the aircraft banked to the left, with the wing tip dipping into the water and the aircraft veering to the left. The FO tried to level off the aircraft but reported controls extremely heavy. The right wing of the aircraft then abruptly dropped digging into the water with a nose-down attitude.

Immediately after the dip, the PIC attempted to shut down the right engine as the fire bell was continuously ringing, but could not move the fuel levers as it was jammed, and subsequently activated the fire extinguisher bottles as a precautionary measure, and then switched off the fuel shutoff valves and also shut-off the right engine boost pump. The PIC instructed the FO to visually check for a fire in right engine, to which the FO confirmed there was no visible fire, but smoke emanating due to engine exhaust.

The FO recalled continuously checking outside for the float damages as usually float damages are associated with heavy landings. The FO, after seeking approval from the PIC, started to follow the evacuation procedure and with the assistance of the cabin crew instructed and assisted the passengers to remove the seat belts. Next, passengers were instructed to remove the life jackets from under the seat and all passengers were made to wear the life jackets but was instructed not to inflate the life jackets. The passengers were told to wait for the boat.

FO reported calling the TMA dispatch three or four times and reported an accident and requested for help. A recreational personal watercraft (jet ski) arrived but the watercraft operator declined to tow the aircraft as the watercraft would not have the capacity to tow the aircraft.

As the left engine was still running, the PIC attempted to maintain directional control of the aircraft using the left engine power lever. After about 15 minutes the resort dinghy arrived and assisted the aircraft to taxi to the buoy.

Once the aircraft was secured the left engine was shut down, the passengers disembarked and baggage was offloaded and taken to the resort, before the crew went to the resort.

1.1.2 Aircraft:

The aircraft (MSN 256) manufactured by de Havilland Canada (presently supported by Viking Air Ltd) was rolled out from the production line in September 1969. It had previously been operated under different registrations with a few other operators until registered in the Maldives in 2010 under registration 8Q-MBC, for operation with Maldivian Air Taxi, a company later bought over by TMA.

1.1.3 Flight crew:

The flight was operated by three crew members. All had valid licences granted by MCAA. Review of the records confirm that the medicals, seaplane ratings, and proficiency checks of the pilots were current, as of the date on which the accident occurred. Both pilots held Commercial Pilot Licences. Details including hours accrued on type are specified in para 1.5 of this report.

1.2 Injury to persons:

Injuries	Flight Crew	Cabin Crew	Passengers	Total affected in the aircraft	Others
Fatal	0	0	0	0	0
Serious	0	0	0	0	0
Minor	2	0	1	3	0
Nil	0	1	14	15	0
Total	2	1	15	18	0

1.3 Damages to aircraft:

Survey of the wreckage by accident investigators identified the extent of the damages caused to the airframe, wing, engines and propellers. The damages include but not limited to:

1. Right Hand Wing:
    a. Various damages were observed on wing in the area between ribs 25 to rib 28
    b. The leading edge bottom skin of ribs 26, 27 and 28 found buckled upwards
    c. Wing tip torn in several places
    d. Wing fin dislocated with the leading edge shifted inboard
    e. The inboard trailing flap skin were found buckled upward
2. Left Hand Wing:
    a. Wing tip found damaged
    b. Wing tip Leading Edge (LE) buckled and bent downwards and aft
    c. LH aileron (outer most) found twisted and bent upward
3. Right Hand engine:
    a. Right Hand engine found fully detached from the mount/nacelle, hanging only by the fuel hoses and fuel control rods connected to it
    b. One of the vibration isolators (inboard) found sheared off
    c. Nacelle structure to which the vibration isolators (outboard and top) were ripped off
    d. RH engine propeller blades (all three of them) were found bent aft. Red paint scratch marks found on one of the blades
    e. Nicks observed on all three blades
    f. Bottom engine cowling skin ruptured at several places, and attachment rivets were found sheared off
4. Floats:
    a. LH float tip was found damaged
5. Airframe:
    a. LH Hydraulic bay panel was found twisted and forward top corner bent outwards
    b. RH hydraulic bay panel was found twisted and bent outward from bottom aft corner
    c. Control columns movement partially restricted
    d. RH fuel control jammed

Figure 1: Aircraft engine detached

Figure 2: RH engine inboard vibration isolator mount

1.4 Other damage:

There were no damages to any other property or objects.

1.5 Personnel information:

1.5.1 Pilot-In-Command

Age:	31 years
Nationality:	Indian
Gender:	Male
Type of License:	Commercial Pilot Licence
License issued on:	26.05.2019
License expires on:	25.05.2024
Type of medical:	Class 1
Medical issued on:	17.02.2019
Medical expires on:	16.03.2020
Types flown:	DHC-6 (on Maldivian licence)
Hours on type:	2,774.5 hours
Ratings:	DHC-6, Float Plane
Last Proficiency check:	22.01.2020 (OPC), 29.07.2019 (LPC)
Total hours as PIC:	2,849 hours
Total flight time:	4,436.3 hours

1.5.2 Co-pilot

Age:	31 years
Nationality:	Maldivian
Gender:	Male
Type of License:	Commercial Pilot Licence
License issued on:	18.05.2018
License expires on:	17.05.2023
Type of medical:	Class 1
Medical issued on:	28.02.2019
Medical expires on:	16.03.2020
Types flown:	DHC-6
Hours on type:	768 hours
Ratings:	DHC-6, Float Plane
Last Proficiency check:	19.11.2019 (OPC), 15.05.2019 (LPC)
Total flight time:	1,007 hours

1.5.3 Cabin Crew

Age:	23 years
Nationality:	Maldivian
Gender:	Male
Type of License:	Cabin Crew Licence
License issued on:	21.07.2019
License expires on:	20.07.2024
Type of medical:	Cabin crew
Medical issued on:	30.05.2019
Medical expires on:	30.05.2021

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 Ltd (de Havilland Canada)
Registration	8Q-MBC
Powerplants	PT6A-27
Manufacturer's Serial Number (MSN)	256
Year of construction	1969
Total Air Time and Landing at time of accident	50,640.48 hours and 88,358 landings
Certificate of Airworthiness	Normal category, issued on 20 Jan. 2010
Airworthiness Review Certificate	Issued on 20 January 2019 - later extended until 19 January 2021
Last periodic inspection	EMMA No 17 on 29 January 2020
Last inspection carried out at TAT	50,533.17 hours

1.6.2 Engines and Propellers:

Right Engine (Gas Generator)	
Right engine manufacturer	PWC
Year of manufacture	UNKNOWN
Model	PT6A-27
Serial number	PCE-52061
Total Hours since new	15,567.70
Last overhaul date	30-Jan-20
Hours since overhaul	55.85
Last check carried out	Fuel Nozzle Replacement & Borescope Inspection on 18 February 2020
Hours since last check	30.79
Right Engine (Power Section)	
Right engine manufacturer	PWC
Year of manufacture	UNKNOWN
Model	PT6A-27PS
Serial number	25279-100
Last overhaul date	30-Jan-20
Hours since overhaul	55.85
Last check carried out	Overhauled on 30 January 2020
Hours since last check:	55.85
Left Engine (Gas Generator)	
Left engine manufacturer	PWC

Year of manufacture	UNKNOWN
Model	PT6A-27
Serial number	PC-E41260
Total Hours since new	21,449.17
Last overhaul date	26-Jun-17
Hours since overhaul	3,498.15
Last check carried out	EMMA#17 dated 29 January 2020
Hours since last check	107.31
Left Engine (Power Section)	
Left engine manufacturer	PWC
Year of manufacture	UNKNOWN
Model	PT6A-27PS
Serial number	41260-100
Last overhaul date	26-Jun-17
Hours since overhaul	3,498.15
Last check carried out	EMMA#17 dated 29 January 2020
Hours since last check	107.31
Right Propeller	
Manufacturer	HARTZELL
Year of manufacture	UNKNOWN
Model	HC-B3TN-3DY
Serial number	BUA21393
Last overhaul date	26 July 2019
Hours since last overhaul	746.29
Last check carried out	EMMA#17 dated 29 January 2020
Left Propeller	
Manufacturer	HARTZELL
Year of manufacture	UNKNOWN
Model	HC-B3TN-3DY
Serial number	BUA24398
Last overhaul date	18 December 2019
Hours since last overhaul	159.2
Last check carried out	EMMA#17 dated 29 January 2020

1.6.3 Cabin Layout and Configuration:

Cabin was configured under a LOPA approved by an EASA approved Design Organization to carry fifteen passengers plus one cabin crew in a standard floatplane configuration in which the seat normally installed in the sixth-row position is removed for carriage of passenger luggage in the cabin rather than carrying them in the dedicated cargo compartments. The reason being that the forward cargo compartment is not accessible for loading the luggage while the aft cargo compartment is not large enough to accommodate all the luggage's normally carried by fifteen passengers. The aft baggage compartment is only used for loading smaller luggage. The aircraft was in float configuration with Wipaire 13000 floats installed. The aircraft had four exits in the cabin and two exits in the cockpit. In this configuration the right passenger door is approved to be blocked.

1.6.4 Recent maintenance

The most recent maintenance inspections carried out include 'Equalized Maintenance for Maximum Availability' (EMMA) number 17 complied with, on 29 January 2020, at 50,533.17 TAT and 88,093 TAC.

1.6.5 Flight Controls

Only those inspections called for in the EMMA were carried out on the flight controls. Neither maintenance nor operating crew reported abnormalities on the flight controls.

1.6.6 Powerplants

The maintenance records confirm that the engine installed on right hand position was replaced on 12 February 2020, as troubleshooting action on a pilot report (Pirep) which stated that the reverse spooling takes more than 8 seconds. As a concurrent requirement, propeller dynamic balancing was carried out on 16th February 2020. No spooling defects were reported thereafter.

1.6.7 Fuel

Jet A-1 fuel was used on the aircraft. The aircraft had a total of 785 lbs. of fuel at departure from MLE, as per the Mass & Balance Report filed with TMA by the dispatchers.

1.6.8 Accessories

None

1.6.9 Defects

From the documents surveyed, the aircraft had no open defects.

1.6.10 Load Sheet

The load sheet also served as the passenger manifest. A copy of the loadsheet was retained with the dispatcher prior to taking-off, as required per Company Operations Manual. No discrepancies were evident in loading the aircraft from the results of the investigation carried out.

1.7 Meteorological information:

No wind direction indicator was available at Kuredhu water aerodrome. CAA Air Safety Circular ASC14-2 Amendment 1, Procedure and requirements for licensing water aerodromes and floating platforms, dated 04 February 2009, requires one wind direction indicator to be mounted on the movement area.

Nearest location from where recorded meteorological information was available was the automatic weather station at Lhaviyani Olhuvelifushi island, located 34km south-east of Kuredhu water aerodrome. The data available at 1100 hours was:

Pressure: 1011 hectopascals

Rain fall: 0

Wind velocity (average): 080° at 15 mph (13.03 knots)

Wind velocity (maximum): 070° at 26 mph (22.59 knots)

1.8 Aids to navigation

The aircraft was operating under VFR where no navigational aids were required.

1.9 Communications

There were no communication problems or system anomalies throughout the flight from taxi to take-off to cruise to landing.

1.10 Aerodrome information

Destination Aerodrome:	Kuredhu Island Resort, Lhaviyani Atoll
Reference	5° 32.90'N 73° 27.89'E
Facilities:	2 fixed platforms and 4 mooring buoys

Location of the water aerodrome, including 4 water runways available at Kuredhu is shown on the aerodrome chart, published by TMA.

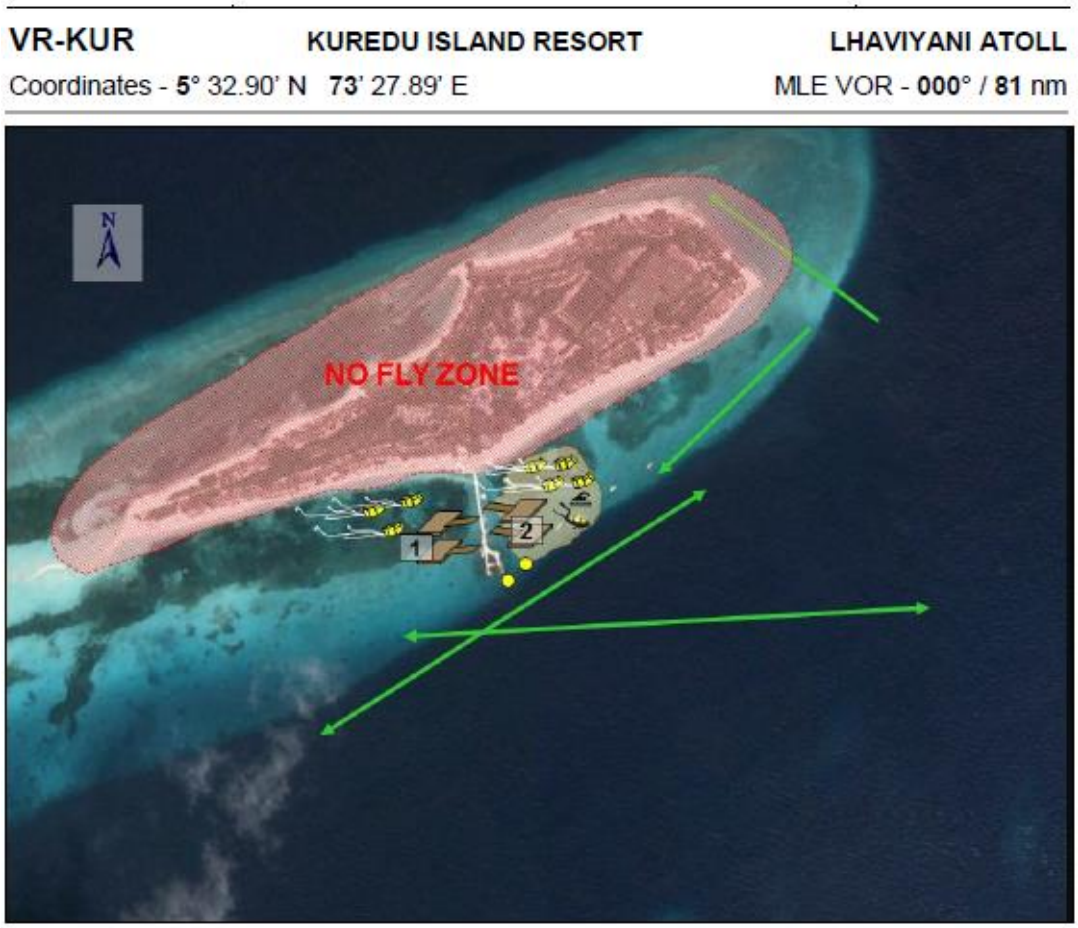


Figure 3: Kuredhu water aerodrome landing areas

Aerodrome License bearing license number AP/PR/23 (for Private use) was initially issued on 31 January 1996, to Kuredhu Holdings Limited by the then Department of Civil Aviation.

1.11 Flight Recorders:

Flight recorders are not a requirement for DHC-6 series 100/200/300 (legacy) aircraft under the MCAR's. No flight data recorder (FDR) or cockpit voice recorder (CVR) was installed on the aircraft as MCAR's permit operation of the DHC-6 series 100/200/300 (legacy) aircraft without them.

1.12 Wreckage and impact information:

1.12.1 Accident site visit

Accident site was visited by investigators from both MCAA and AICC. The accident occurred on water. There were no debris or aircraft parts scattered in the area.

1.12.2 Wreckage Condition:

For information refer to 1.3.

1.12.3 Salvage operations:

The wreckage was loaded on to a flat top barge, using a crane and was transported and offloaded at VIA. Secondary damage to the wreckage was very minimal.

1.13 Medical and pathological information

Both flight crew members and the cabin crew were subjected to drug tests and the results were reported negative for all crew.

1.14 Fire

At the time of impacting the water, crew reported that a fire alarm sounded from the RH engine. The FO visually checked the RH engine area for any fires and none could be observed. The PIC operated the fire shutoff handle and the indicator cartridge suggests the fire bottle was discharged.

Subsequent visual inspections carried out by the crew and by the investigators did not reveal any signs of a fire.

1.15 Survival Aspect

Having the aircraft stabilized the FO proceeded to the cabin and worked along with the cabin crew to check on the welfare of the passengers. They ensured that the passengers had donned their life jackets, while they themselves put on their own life jackets. The PIC called dispatch and advised the Dispatchers on the situation and requested them to call Kuredhu to provide them with a dingy so that mooring of the aircraft at the buoy can be accomplished. A dinghy was deployed from the resort that assisted the crew taxi the aircraft to the buoy and secure the aircraft. All passengers were then evacuated, safely. All seats and seatbelts were intact. All passengers were given lifejackets before evacuation from the aircraft.

There were no evidences of an activated ELT.

1.16 Tests and research:

There were no tests or research carried out.

1.17 Organizational and Management Information:

TMA is a MCAA approved Air Operator Certificate holder and provides domestic air services with an aircraft fleet of over 57 DHC-6 aircraft on floats. The company is authorized to conduct day VFR operations.

Regular inspections and periodical flight checks were conducted on the operation and crew respectively by MCAA to verify compliance and competency. The company also holds Aircraft Maintenance Organization Approval (MCAR-145).

1.18 Additional Information:

None

1.19 Useful or Effective Investigation Techniques

None

2. ANALYSIS:

The aircraft departed MLE with 12,496 lbs MTWA which is slightly below the 12,500 lbs. Maximum Take-off Mass authorized. The CG of the aircraft was within limits. The aircraft was flown by the FO (PF). The aircraft had taken off from MLE without incident around 1050 hours and obtained clearance to climb up to 6500 feet until Kuredhu. Approximately, fifteen minutes prior to reaching the destination, the pilots commenced descent into Kuredhu water aerodrome.

Weather conditions en-route were isolated small build ups and picking up wind. Conditions at Kuredhu water aerodrome was unknown. The PF had decided to join a right base to a North-East bound landing. It was at this point PIC realized that the conditions being rough and had considered in his mind about landing in the inside lagoon area of Kuredhu (See figure 3), but noticing the presence of boats and what looked like a small dredger in the area, the PIC decided against it. With respect to that, PIC also noticed that the landing line was a bit far out to the sea and hence made a correction to the left so as to land closer to the reef. Around 100-150ft, the PIC as the PNF had noticed the speed was lower than usual and had advised the PF to check, which he immediately corrected. A few seconds later, the PF positioned the aircraft for touchdown. Just as the floats touched a wave, the aircraft bounced with a nose high attitude. PIC called for power and the PF acknowledged and attempted, to the best of his abilities to stabilize the aircraft, but lost control. PIC attempted for a go-around, but by then the aircraft left wing dropped dipping into the water.

PIC stated that immediately after left wing dug in the water, the right wing dropped with the nose of aircraft digging into the water, but came clear of the water. He then heard the right engine fire bell. The FO looked outside and confirmed that the right engine was detached and hanging but was unsure of any signs of fire.

The PIC attempted to shut down the right engine, but the fuel lever was stuck and applied rest of the shutdown procedure and pressed the right fire discharge button. PIC attempted to maintain directional control of the aircraft with the working operational left engine, until the dinghy arrived and assisted to tow the aircraft to the buoy. After the aircraft was secured on the buoy the PIC shut down the left engine and switched off the masters. The crew then assisted the passengers to disembark and offloaded the luggage. The crew remained on the aircraft to secure it.

As per the crew and eye witnesses and video filmed by a passenger, the aircraft bounced on landing, then the left wing dropped first and caused the aircraft to turn sharply to the left. With the forward momentum and the bank correction applied to the right, the right wing and engine were hit hard by a large swell while the propeller was still rotating at above idle speed. The centrifugal force of the propeller caused the blades to rupture through the engine nacelle, the whole engine was twisted, engine mounts fractured, nacelle longerons broken and detached from the wing.

Survey of the aircraft carried out by PIC, post-accident confirmed both wingtips, flaps and ailerons were damaged. Right engine was detached while hydraulic power pack access door was ripped open. No damage to floats was evident.

Figure 4: Aircraft tied to buoy after the accident

PIC was able to put the rudder lock but could not install those for the control column as it was stuck, fully turned to the right.

Examination of the RH propeller indicated that the blades were at a low pitch angle at the time of impact. It was revealed that right engine inboard mount was fractured while the outboard and top engine mounts were left intact but had torn out with the nacelle structure.

MCAA Approved Maintenance Program (AMP) for maintaining DHC-6 aircraft required a visual inspection of the engine vibration isolator assemblies every 125 hours. The AMP also requires carrying out eddy current inspections on the engine mounts every 1000 hours or 3000 landings whichever occurs earlier. All three mounts have a discard life of 3000 hours. The inspections are complied with, as tabulated below.

Description	Part number	Serial Number	TSN	TSO	CSN	CSO	AD Compliance Last Date
MOUNT - INBD	7351256-2	9340	1,874.52	932.98	4,553	2,210	15-05-2019
MOUNT - OTBD	7351256-2	9405	1,898.37	932.98	4,622	2,210	15-05-2019
MOUNT - TOP	7351256-2	10197	107.31	265	0	0	NEW

Review of the records confirm that all AMP requirements have been met on the engine vibration isolator mounts installed, and none of the three had reached the discard life. Hence, it may not be a contributing factor for premature failure of the inboard mount.

Damage to the right and left wing tips and the leading edges indicated that they both impacted water prior to aircraft coming to rest. Further inspection of the airframe components including the flap system and the control and trim systems did not reveal any pre-impact anomalies.

3. CONCLUSIONS:

3.1 Findings:

- No crew briefing were done before the first flight
- During approach, at about 100 to 150 feet the PIC noticed the speed was low and instructed the FO to correct the speed. FO acted accordingly. At the time of landing, winds were easterly, and the sea conditions were rough which is typical to the time of the year (North-East Monsoon). The line taken for the approach was easterly direction just outside the reef edge where sudden high waves break
- The aircraft landed on a wave and bounced at touchdown. Left wing dig into water and then the right wing dipped into water with the nose of aircraft digging in
- Right engine was detached (hanging) and the wings and airframe were damaged at various locations
- The data card (SD) installed in the Garmin 950 Avionics Suite on this aircraft that capture technical and operational parameters was found missing
- Actions of the crew at touchdown indicated cross control took place

3.2 Causes:

Power was added on approach at around 100 to 150 ft. The aircraft bounced on touchdown which indicates probable skipping of the aircraft due to higher speed and with the prevailing sea conditions encountered a sudden big wave.

4. RECOMMENDATIONS:

4.1 For Operator:

- Review the crew pairing /briefing policies/procedures established at TMA given the condition that the majority of the accidents occurred in the recent past had resulted from poor coordination between the PF and PNF which can be deemed a contributory factor in each case
- Grading of aerodromes by the Operators shall be included in the flight operations manual
- Wave pattern reading or assessment for different monsoons shall be included in flight crew trainings
- To introduce a policy and procedure on management of data cards (SD) installed on the Displays on all aircraft fitted with G950 avionics suite
- The Operator shall have a system in place to ensure that the standards and operational requirements for water aerodromes meet the Air Safety Circular ASC 14-2, 'Procedures and requirements for licensing water aerodromes and floating platforms'. The ASC requires the water aerodromes to meet standards prior to conducting flight. These requirements include, but not limited to, making available resort agents, transfer dhoni and all equipment including RFF's, as well as boats on standby for any required assistance during or after landing, communication between crew and resort agents, provision of a wind direction indicator; Resort agent trainings including firefighting training, preparation of an Emergency response plan, completion of operational exercises every quarter.

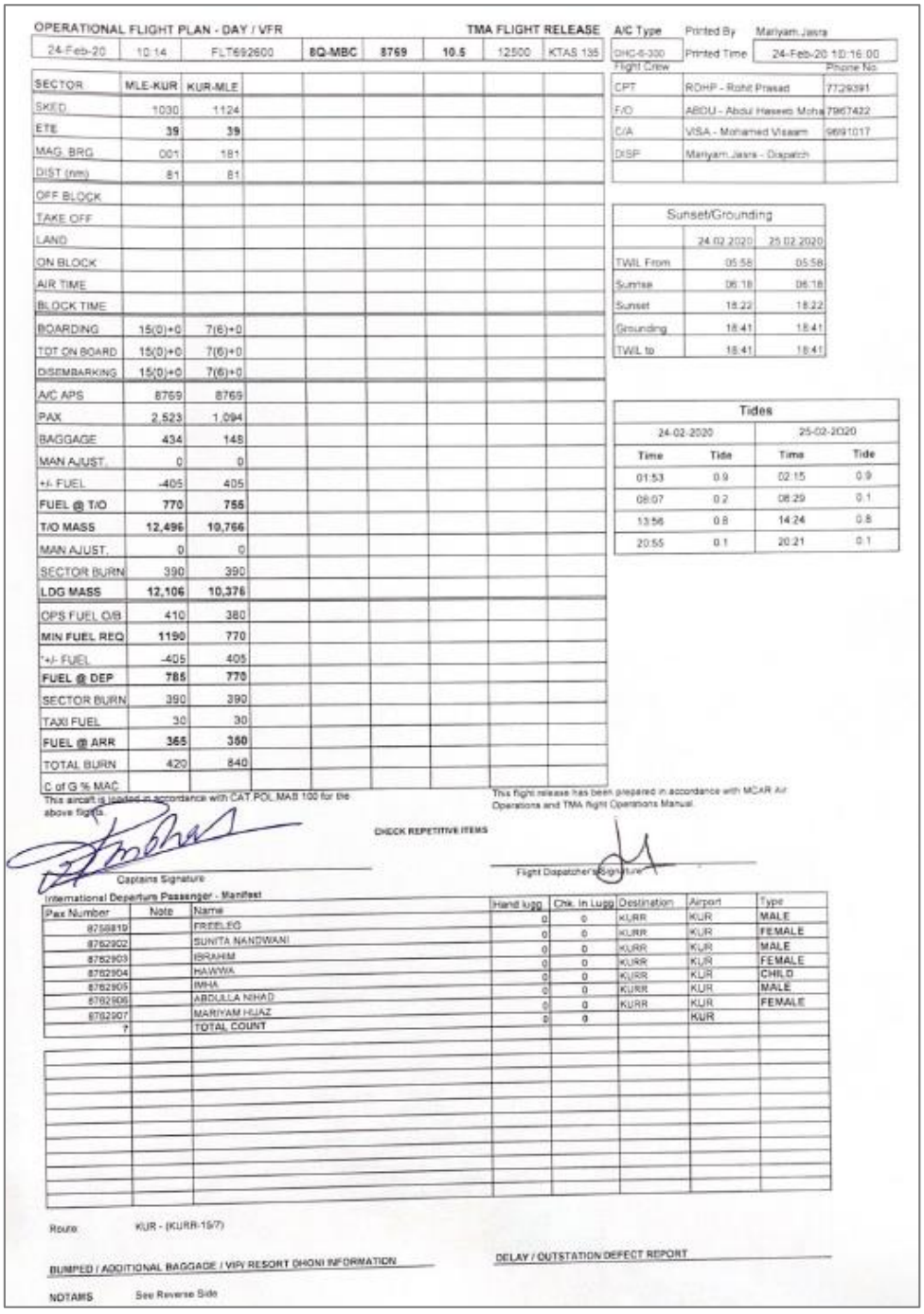
4.2 For Regulator:

- Establish procedures to ensure data card (SD) installed all aircraft embodied with G950 Avionics suit remain in their respective slots at all times and as data saved in them can contribute immensely to identifying the actual cause of the accident.
- Review the criteria for fitting flight recorders, CVR in particular, on transport category aircraft certified to carry more than 9 passengers. It should be noted that the AICC in its recommendations following several previous accident investigations made this recommendation. These include recommendations made following accidents that occurred on 17 May 2004, 2 June 2009 and 2 July 2015.
- The MCAA to review and revise, if necessary, the current Air Safety Circular ASC 14-2, 'Procedures and requirements for licensing water aerodromes and floating platforms' considering the industry experiences and any applicable technological advances, to reflect an updated set of requirements for safe operation of water aerodromes.

5.0 APPENDICES:

5.1. Flight release documents

a. Operational flight plan



OPERATIONAL FLIGHT PLAN - DAY / VFR — TMA FLIGHT RELEASE

24-Feb-20	10:14	FLT692600	8Q-MBC	8769	10.5	12500	KTAS 135

A/C Type: DHC-6-300 — Printed By: Mariyam Jasra — Printed Time: 24-Feb-20 10:16:00

Flight Crew

		Phone No.
CPT	RDHP - Rohit Prasad	7729391
F/O	ABDU - Abdul Haseeb Moha	7967422
C/A	VISA - Mohamed Visaam	9691017
DISP	Mariyam Jasra - Dispatch	

SECTOR	MLE-KUR	KUR-MLE
SKED	1030	1124
ETE	39	39
MAG. BRG	001	181
DIST (nm)	81	81
OFF BLOCK		
TAKE OFF		
LAND		
ON BLOCK		
AIR TIME		
BLOCK TIME		
BOARDING	15(0)+0	7(6)+0
TOT ON BOARD	15(0)+0	7(6)+0
DISEMBARKING	15(0)+0	7(6)+0
A/C APS	8769	8769
PAX	2,523	1,094
BAGGAGE	434	148
MAN AJUST.	0	0
+/- FUEL	-405	405
FUEL @ T/O	**770**	**755**
T/O MASS	**12,496**	**10,756**
MAN AJUST.	0	0
SECTOR BURN	390	390
LDG MASS	**12,106**	**10,376**
OPS FUEL O/B	410	380
MIN FUEL REQ	**1190**	**770**
+/- FUEL	-405	405
FUEL @ DEP	**785**	**770**
SECTOR BURN	390	390
TAXI FUEL	30	30
FUEL @ ARR	**365**	**350**
TOTAL BURN	420	840
C of G % MAC		

Sunset/Grounding

	24.02.2020	25.02.2020
TWIL From	05:58	05:58
Sunrise	06:18	06:18
Sunset	18:22	18:22
Grounding	18:41	18:41
TWIL to	18:41	18:41

Tides

24-02-2020		25-02-2020	
Time	Tide	Time	Tide
01:53	0.9	02:15	0.9
08:07	0.2	08:29	0.1
13:56	0.8	14:24	0.8
20:55	0.1	20:21	0.1

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

Captains Signature

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

CHECK REPETITIVE ITEMS

Flight Dispatcher's Signature

International Departure Passenger - Manifest

Pax Number	Note	Name	Hand lugg	Chk. In Lugg	Destination	Airport	Type
8758819		FREELEG	0	0	KURR	KUR	MALE
8782902		SUNITA NANDWANI	0	0	KURR	KUR	FEMALE
8782903		IBRAHIM	0	0	KURR	KUR	MALE
8782904		HAWWA	0	0	KURR	KUR	FEMALE
8782905		IMHA	0	0	KURR	KUR	CHILD
8782906		ABDULLA NIHAD	0	0	KURR	KUR	MALE
8782907		MARIYAM HIJAZ	0	0	KURR	KUR	FEMALE
7		TOTAL COUNT	0	0		KUR	

Route: KUR - (KURR-15/7)

BUMPED / ADDITIONAL BAGGAGE / VIP/ RESORT DHONI INFORMATION

DELAY / OUTSTATION DEFECT REPORT

NOTAMS: See Reverse Side

b. Mass and balance report 8Q-MBC 24 Feb 2020

Mass & Balance Report

Monday, 24 February 2020 - 8Q-MBC - 10:44:23 - MLE to KUR

Trip Information

AIRCRAFT	
Registration No	8Q-MBC
APS Index	10.50
APS Weight	8,768.58 lbs
CREW	
Pilot-in-Command	ROHP Rohith Prasad
ROUTE	
Departure	MLE Velana International Airport
Arrival	KUR Kuredhu
Distance	80 nm
Bearing	357° N
TOTALS	
Total Pax Weight	2,523.00 lbs
Total Fuel	785.00 lbs
Total Baggage	434.00 lbs
Take-Off Weight	12,495.58 lbs
Sector Burn	380.00 lbs
Landing Weight	12,115.58 lbs

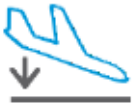
Details

FUEL TANKS	
FWD Tank	392.00 lbs
AFT Tank	393.00 lbs
MOMENTS	
APS Moment	1,846,401.80
Take Off Moment	2,625,698.38
Landing Moment	2,549,508.38
SECTIONS	
Section A	528.00 lbs
Section B	978.00 lbs
Section C	1,017.00 lbs
Section D	434.00 lbs
Section Tail	0.00 lbs

Take Off CG

28% MAC

Landing CG



28% MAC

TMAPP WB Report ID: 473150, Generated on: 27-Feb-2020 16:24:26

5.2 Weather report from nearest earth station (Hourly Average Maxiumum Windspeed recorded at Olhuvelfushi automatic weather station)

بسم الله الرحمن الرحيم

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Maldives Meteorological Service

Hourly Average and Maximum Wind
Automatic Weather Station, Lh. Olhuvelifushi
24 February 2020

	Average Wind		Maximum Wind	
	Direction	Speed	Direction	Speed
24-02-2020 00:00	80	10	90	16
24-02-2020 01:00	90	08	80	14
24-02-2020 02:00	90	07	90	14
24-02-2020 03:00	100	06	80	13
24-02-2020 04:00	110	06	150	13
24-02-2020 05:00	100	06	100	13
24-02-2020 06:00	100	07	110	15
24-02-2020 07:00	100	07	90	16
24-02-2020 08:00	100	07	90	13
24-02-2020 09:00	90	09	80	20
24-02-2020 10:00	90	13	80	21
24-02-2020 11:00	80	15	70	26
24-02-2020 12:00	80	15	90	22
24-02-2020 13:00	80	13	90	20
24-02-2020 14:00	80	13	60	20
24-02-2020 15:00	80	13	90	21
24-02-2020 16:00	90	12	90	20
24-02-2020 17:00	90	09	100	19
24-02-2020 18:00	90	10	80	17
24-02-2020 19:00	90	10	100	16
24-02-2020 20:00	90	09	90	15
24-02-2020 21:00	80	09	90	16
24-02-2020 22:00	80	11	80	17
24-02-2020 23:00	80	09	90	15

Time is in local time
Wind direction is in degrees
Wind speed is in miles per hour

CLIMATE SECTION
Maldives Meteorological Service
p: +960 3323084
w: www.meteorology.gov.mv
e: nmc@met.gov.mv
a: Hulhule, 22000,Republic of Maldives

5.3 Aerodrome Information

a. Kuredhoo Aerodrome licence

Licence No. AP/PR/23

1. Name of Aerodrome KUREDU

2. Position of Aerodrome NO53289 E732792 (See map in Schedule)

3. Name and Address of License KUREDU HOLDINGS LIMITED

KUREDU HOLDINGS LIMITED
CHAMPA BUILDING,
MALE'
REPUBLIC OF MALDIVES

The Department of Civil Aviation (in this licence referred to as 'The Department') in exercise of its powers ~~under Law No. 3/68 Javiyani~~ hereby licenses the above-named aerodrome as an aerodrome to be used as a place of take-off and landing of aircraft engaged in flights for the purpose of the public transport of passengers or for the purpose of instruction in flying, subject to the following conditions:

1. The aerodrome is licensed for use only by the licensee ~~and by persons specifically authorised by him.~~
2. No aircraft shall take-off or land at the aerodrome unless such fire-fighting and rescue services and such medical services and equipment as are required in respect of such an aircraft in the ICAO Document Annex 14 are provided there. Such services and equipment shall at all times when the aerodrome is available for the take-off or landing or aircraft be kept fit and ready for immediate turnout.
3. Changes in the physical characteristics of the aerodrome including the erection of new buildings and alterations to existing buildings or to visual aids shall not be made without prior approval of the Department.
4. The licensee shall, by the quickest means available, notify the Department of any material change in the surface of the landing area, or in the obstruction characteristics of the approach, take-off or circuit in relation to the aerodrome.
5. The aerodrome is not licensed for the take-off or landing of aircraft during the night.
6. Any public right of way crossing or bordering the landing area shall be adequately signposted with notices warning the public of danger from aircraft.

This licence shall remain in force until it is varied, suspended or revoked.

Date 31 January 1996

FOR THE DEPARTMENT OF CIVIL AVIATION

b. Kuredhu Water Aerodrome Charts, Issue 4 Rev 0, dated 10 June 2018

Trans Maldivian Airways — Issue: 4, Rev: 0

WATER AERODROME CHART — 10 Jun 2018

VR-KUR **KUREDU ISLAND RESORT** **LHAVIYANI ATOLL**

Coordinates - **5°** 32.90' N **73'** 27.89' E MLE VOR - **000°** / **81** nm

DESCRIPTION	Normal operations in open water with transfers from fixed platform.				
FACILITIES	2 Fixed Platform(s) / 0 Floating Platform(s) / 4 Mooring Buoy(s)				
CATEGORY	A	**DINGHY**	Yes	**FUEL**	Yes
COMM	Advisory 128.8				
ALTERNATES	VR-KOM 220°/4 nm, VR-KNU 116°/3 nm, VR-MDI (fuel) 134°/7 nm				
CAUTION	Mandatory fly-over if planning to operate inside lagoon. Swimmer and water sports activity often present inside lagoon.				
REMARKS	KUR is a charter flight. Accept all passengers manifested by KUR even if not indicated on the flight release. Depending on conditions, preferred TO/LDG area is outside the lagoon. Reef provides little to no protection from swell, however resort concrete jetty can provide protection from wind and swell when operating inside the lagoon. Shutdown on fixed platform prohibited unless circumstances necessitate and conditions are favourable.				
CHART TABLE	1) Position of fixed platform and buoys in NE monsoon. 2) Position of fixed platform and buoys in SW monsoon.				
RESORT INFO	7924367				
LOCAL ISLAND NAME	Kuredhdhu				

Water Aerodrome Charts — Page KUR -1

5.5 Damages to aircraft

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

Figure 5: Damage to LH Wing - from rib 25 to rib 28, and wing tip were damaged

Figure 6: Damage to LH wing - leading edges of rib 26, 27 and 28 buckled

Figure 7: Damage to LH wing - dented

Figure 8: Wing fin dislocated and the leading edges bent inboard

Figure 9: RH Wing - trailing flap skin buckled inward

Figure 10: Right Hand engine – completely detached from the mount/nacelle

Figure 11: Right Hand engine – One engine vibration isolator (Inboard) was sheared,

Figure 12: Right Hand engine – One engine vibration isolator (Inboard) was sheared,

Figure 13: Right Hand engine – One engine vibration isolator (Inboard) was sheared,

Figure 14: Right Hand engine – both the outboard and top engine vibration isolator (mounts) attaching structures ripped off

Figure 15: Right Hand engine – both the outboard and top engine vibration isolator (mounts) attaching structures ripped off

Figure 16: RH propeller blades bent (backward)

Figure 17: RH propeller blade - red paint scratch marks found possibly due to hitting the engine bottom cowl

Figure 18: RH propeller – nicks observed on all three blades

Figure 19: RH engine bottom cowl - skin ruptured at several places

Figure 20: RH engine bottom cowl – prop blade struck through

Figure 21: RH engine bottom cowl - attachment rivets were found sheared

Figure 22: RH cowling – Rivets sheared

Figure 23: LH Hydraulic bay panel found twisted and bent

Figure 24: RH hydraulic bay panel found twisted and bent outward

Figure 25: LH aileron (outer most) was twisted and bent upward