بسم الله الرحمن الرحيم

ACCIDENT INVESTIGATION COORDINATING COMMITTEE

AIRCRAFT SERIOUS INCIDENT REPORT 2020/04

FINAL REPORT

INVESTIGATION OF THE SERIOUS INCIDENT INVOLVING TRANS MALDIVIAN AIRWAYS OPERATED VIKING AIR DHC-6-300, 8Q-TMR, FLOATPLANE AT SUN SIYAM IRUFUSHI RESORT WATER AERODROME, MALDIVES

on

22 October 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 this investigation is to prevent accidents and serious incidents. It is not the purpose of this investigation to apportion blame or liability as envisaged in Annex 13 to the Convention.

In investigating this Serious Incident, AICC was assisted by Maldives Civil Aviation Authority (MCAA), and Trans Maldivian Airways.

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

The report is released on 29 December 2021.

Mr. Abdul Razzak Idris
Chairperson
Accident Investigation Coordinating Committee

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

AICC : Accident Investigation Coordinating Committee

CVR : Cockpit Voice Recorder

DHC-6-300 : Viking Air Twin Otter 300 Series aircraft

EASA : European Union Aviation Safety Agency

ELT : Emergency Locator Transmitter

EMMA : Equalized Maintenance for Maximum Availability

FDR : Flight Data Recorder

FO : First Officer

IRU : Sun Siyam IruFushi Resort Water Aerodrome

lbs. : Pounds

LTC : Line Training Captain

LH : Left Hand

LOPA : Layout of Passenger Accommodation

LPC : License Proficiency Check

MCAA : Maldives Civil Aviation Authority

MCAR : Maldives Civil Aviation Regulations

MLE : IATA designated three letter code for Velana International Airport

MTOM : Maximum Take-Off Mass

Ng : Gas generator rotation speed - an indication of the power output of the engine

nm : nautical mile

OPC : Operator Proficiency Check

PF : Pilot Flying

PIC : Pilot-in-command

RH : Right Hand

STC : Supplemental Type Certificate

TAC : Total Air Cycles

TAT : Total Air Time

TBD : To be determined

TMA : Trans Maldivian Airways Pvt. Ltd.

Tq : Torque

UTC : Coordinated Universal Time

VFR : Visual Flight Rules

SYNOPSIS

On 22 October 2020, DHC6-300 aircraft, registration 8Q-TMR operated by Trans Maldivian Airways Pvt. Ltd., was on a scheduled flight, from Velana International Airport to Sun Siyam IruFushi Resort (Medhafushi Island at Noonu Atoll). Fourteen passengers, two pilots and one cabin crew were on board the aircraft.

The aircraft landed inside the Island lagoon at Sun Siyam IruFushi. After a normal touch down and upon selection of reverse, the pilots noticed that the aircraft started turning left - towards the anchored vessels. The PIC took over the controls of the aircraft and attempted to bring the situation under control but was unsuccessful before the left wing of the aircraft contacted one of the vessels anchored in the lagoon, pivoting the aircraft further to the left making the left propeller come in contact with the housing of the anchored vessel.

As a result, the aircraft sustained damages to its LH wing and LH propeller blades, and the vessel Sun Cruise 09 suffered damages; scratch marks were on the aft LH corner and hole cut in the aft RH corner of the vessel's accommodation. At the time of the collision no person was onboard the vessel.

After the collision, the PIC was able to move the aircraft back, away from the vessel and taxied to the fixed platform, using engine power. All passengers and crew disembarked safely. No injuries to crew or passengers were reported.

At the time of the incident the weather at the water aerodrome was reportedly calm and sunny, with westerly wind (a left cross wind) of around 07 knots, and good visibility.

The incident occurred at 11:08 hrs and the MCAA reported the incident to the Accident Investigation Coordinating Committee (AICC) at 12:34 hrs on the same day. AICC began its investigation on the same day by interviewing the crew members. One investigator from MCAA and two investigators from AICC traveled to the incident site on 24 October 2020, and continued the investigations.

1.0 FACTUAL INFORMATION

Legal Owner:	Seaplane Holding Cayman 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) DHC-6-300
Nationality:	8Q (Republic of Maldives)
Registration:	8Q-TMR
Aircraft Manufacturer:	de Havilland Canada (Type Certificate now owned by Viking Air Ltd.)
Manufacturers Serial No.:	270
Place of Incident / Accident:	Sun Siyam IruFushi Resort (Medhafushi Island, Noonu Atoll)
Latitude:	05° 44.488’ N
Longitude:	73° 19.305’ E
Date and Time:	22 October 2020 at 11:08 hrs.

1.1 History of Flight

1.1.1 Background

The aircraft was dispatched on 22 October 2020, on a multi-sector flight, (flight number FLT703694), MLE – Sun Siyam IruFushi (IRU) – Kuredhivaru (KRD) – MedhuFaru Lagoon (SJR) – MLE with 3 crew members (2 flight crew and 1 cabin crew) and a total of 14 passengers destined to Sun Siyam IruFushi resort. The aircraft was then scheduled to pick up passengers from the rest of destinations to MLE.

The aircraft was released at 19:05 hrs on 21 October 2020, following completion of a daily inspection. There was no record of any open deferred defects listed in the Aircraft Technical Log.

On the day of the incident the PIC reported to duty at 0530 hrs in the morning, after an overnight at outstation the previous night. The PIC was on second day of duty after a

three-day rest period. The FO reported to work, straight from home, at 0900 hrs and it was the third day of his duty. The crew carried out the pre-flight and walk-around checks, this being the first flight of the day on this aircraft. No abnormalities were reported by the crew.

As per the flight release document, the aircraft departed MLE with 574 lbs of baggage, 1415 lbs of fuel, and a passenger weight of 1,926 lbs, totalling a take-off mass of 12,490 lbs.

The airline's "flight release" document contains three parts - the 'Operational Flight Plan', 'Passenger & Cargo manifest' and the 'Flight release' – documenting weights for luggage and hand luggage. The operational flight plan is signed by both the Flight dispatcher and the PIC.

The FO computed a Mass & Balance for the flight by using information from the Flight Release documents, and the Centre of Gravity was recorded as 29% of MAC.

The aircraft departed MLE at 10:24 hrs on 22 October 2020 and landed at IRU at 11:08 hrs. The FO was the PF for the sector MLE - IRU. The aircraft was cruising at 1500 ft, when the aircraft hit a storm cell at the south edge of Lhaviyani atoll, and as advised by the PIC, the PF did a descent to 500 ft and continued the flight to IRU. According to the flight crew, no abnormalities were observed throughout the flight until reverse was selected after touch down at IRU.

The crew reported not receiving any weather update for Sun Siyam IruFushi. According to the crew the wind was blowing from a westerly direction at about 7 knots. The nearest automatic weather station was available at Shaviyani Atoll Funadhoo, which is 28 nm north of Medhafushi island. The following weather information was recorded in Funadhoo at 11:10 hrs on 22 October 2020.

Wind direction:	250°
Average wind:	3 knots
Max wind direction:	200°
Max wind speed:	5 knots
Accumulated rain:	Nil

While approaching IRU, the crew performed descent checks and PF briefed for a north-west bound landing inside the lagoon, and the PIC instructed to perform an overhead circuit to inspect the water conditions and landing line, hence PF conducted a right orbit around the island and then stated that the landing line appeared clear of obstacles and acceptable to him considering the wind and water condition. The go-around line was also briefed by the PF. The briefed VREF speed was 70 knots. The aircraft was then configured for landing by setting full flaps and propellers to maximum RPM. Crosswind technique was applied by banking the aircraft to the left to counter left crosswind of about 7 knots. The aircraft landed inside the island lagoon. After a normal touch down and upon selection of propeller reverse, the pilots noticed that the engines were producing asymmetric reverse power and the aircraft started veering left towards the anchored vessels. The PIC immediately held the controls over the PF's hand and applied maximum reverse, but the aircraft moved forward and collided with one of the anchored vessels. As a result of the collision, both the aircraft and the vessel sustained damages. The LH propeller and the LH wing were found damaged, while the vessel sustained scratch marks on the aft LH corner and a hole cut in the aft RH corner of the vessel's accommodation. At the time of the collision no person was onboard the vessel.

After the collision, PIC took full control of the aircraft and by applying reverse power, the aircraft was moved away from the anchored vessel and taxied to the fixed platform where a normal docking was carried out. Once the aircraft was secured at the platform both the engines were shut down, all passengers and crew disembarked safely followed by offloading the baggage. No injuries to crew or passengers were reported.

1.1.2 Aircraft

The aircraft (MSN: 270) was manufactured in January 1969 by de Havilland Canada. The aircraft was first registered in the Maldives on 30 May 2006 and is currently operated by Trans Maldivian Airways Pvt Ltd.

1.1.3 Flight crew

The flight was operated by three crew members. Detailed information on crew qualification, are included in section 1.5 of this report.

1.2 Injury to Persons

Injuries	Flight Crew	Cabin Crew	Passengers	Others
Fatal	0	0	0	Nil
Serious	0	0	0	Nil
Minor	0	0	0	Nil
Nil	2	1	14	Nil
Total	2	1	14	Nil

1.3 Damages to aircraft

Survey of the aircraft revealed the extent of the damages caused to the wing and propellers. The damages include but not limited to:

1. LH wing:
    a. Leading edge dented and skin torn at approximately 63 inches from outboard of STA 60;
    b. Wing fence damaged;
    c. On bottom wing skin 3 stringers bent inwards along with the skin;
    d. On top wing surface skin and 4 ribs damaged

2. LH propeller:
    a. Approximately 12 inches missing from each of the 4 propeller blade tips;
    b. Erosion strips de-bonded;
    c. Blades cracked.

1.4 Other damage

As a result of the collision, scratch marks were found on the aft left-hand corner of the vessel's housing, by the aircraft wing, and the left propeller cut the aft right corner of housing of the vessel. At the time of the incident no person was on board the vessel.

1.5 Personnel information

1.5.1 Pilot-In-Command

Age:	37 years
Nationality:	Maldives
Gender:	Male
Type of License:	Air Transport Pilot License
License issued on:	08.12.2019
License expires on:	07.12.2023
Type of medical:	Class one
Medical issued on:	15.03.2020
Medical expires on:	14.03.2020
Types flown:	DHC-6 (on Maldivian license)
Hrs. on type:	10,129.1 hrs.
Ratings:	DHC-6, Float Plane
Last Proficiency check:	08.07.2020 (OPC), 12.03.2020 (LPC)
Total hrs. as PIC:	7,848.5 hrs.
Total flight time:	13,019.2 hrs.
Last 90 days:	82 hrs.
Last 28 days:	31.7 hrs.
Last 24 hrs.:	4.6 hrs.
Previous rest period:	2nd duty day after 3 days rest
History for the work week (16 - 22 October 2020):	
16 October 21:	Performed flying duties (03 sectors)
17 October 21:	Performed flying duties (08 sectors)
18 – 20 October 21:	Weekly off-days
21 October 21:	Performed flying duties (04 sectors) Overnight at Vommuli (VOM)

22 October 21:	Breakfast at 0500 Reported to VOM Jetty at 0530 hrs Performed 02 sectors on 8Q-MAJ prior to accident flight (VOM-LUX-MLE) Arrived to base at 0711 hrs

1.5.2 Co-pilot

Age:	22 years
Nationality:	Maldivian
Gender:	Male
Type of License:	Commercial Pilot License
License issued on:	27.11.2019
License expires on:	26.11.2024
Type of medical:	Class one
Medical issued on:	12.08.2020
Medical expires on:	11.08.2021
Types flown:	DHC-6, Float Plane
Hrs. on type:	376 hrs.
Ratings:	DHC-6, Float Plane
Last Proficiency check:	05.08.2020 (OPC), 05.08.2020 (LPC)
Total flight time:	626.7 hrs
Last 90 days:	56.8 hrs
Last 28 days:	27.5 hrs
Last 24 hrs:	2.1 hrs
Previous rest period:	3rd duty day after 3 days rest (1st duty day on call)

History for the work week (16 - 22 October 2020):

16 October 21:	Performed flying duties (05 sectors)
17 – 19 October 21:	Weekly off-days
20 October 21:	Was scheduled as On Call
21 October 21:	Performed a training flight (01 sector) Slept around 2300 hrs
22 October 21:	Woke up at 0700 hrs (08 hrs of sleep) Breakfast at home Arrived to base at 0845 hrs

1.5.3 Cabin Crew

Age:	32 years
Nationality:	Maldivian
Gender:	Male
Type of License:	Cabin Crew License
License issued on:	04.08.2016
License expires on:	03.08.2021
Type of medical:	Cabin crew
Medical issued on:	11.07.2019
Medical expires on:	11.07.2021
Previous rest period:	2nd duty day after 3 days rest and 1-day emergency leave

History for the work week (16 - 22 October 2020):

16 October 21:	Performed flying duties (02 sectors)
17 – 19 October 21:	Weekly off-days
20 October 21:	Emergency leave
21 October 21:	Performed flying duties (02 sectors) Overnight at AKM
22 October 21:	Breakfast at AKM Performed 04 sectors on 8Q-MAI prior to accident flight (AKM-HRV-AKM-AKM-MLE) Arrived to base at 0830 hrs

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 four-bladed, reversible-pitch, full feathering propellers manufactured by MT Propeller, Germany. MT propellers are installed under an STC approved by MCAA. The aircraft is designed for seating two pilots, side by side with dual controls with Sandal flight instrumentation.

The aircraft was in float configuration with Wipaire 13000 floats installed. The aircraft had four exits in the cabin and two in the cockpit. In this configuration the right aft door is approved to be blocked.

Manufacturer:	de Havilland Canada
Registration:	8Q-TMR
Powerplants:	PT6A-27
Manufacturer's Serial Number (MSN):	270
Year of construction:	1969
Total Air Time and Landing at time of incident :	44,386.75 hrs. and 92,582 landings
Certificate of Airworthiness:	Normal category, issued on 11 July 2009
Airworthiness Review Certificate:	Issued on -3 April 2019 - extended until 2 April 2021
Last periodic inspection	EMMA No 4 on 20 October 2020
Last inspection carried out at TAT	44,384.27 hrs

1.6.2 Engines and Propellers

Right Engine (Gas Generator)	
Right engine manufacturer	PWC
Year of manufacture	1999
Model	PT6A-27
Serial number	PCE PG0122
Total Hrs. since new	15,311.71
Last overhaul date	23 January 2014
Hrs. since overhaul	4,943.01 hrs.
Last check carried out	EMMA #4 dated 20 October 2020
Hrs. since last check	2.48 hrs
Right Engine (Power Section)	
Right engine manufacturer	PWC

Year of manufacture	Unknown
Model	PT6A-27
Serial number	PS-52118-100
Last overhaul date	26 May 2014
Hrs. since overhaul:	4633.81
Last check carried out:	EMMA #4 dated 20 October 2020
Hrs. since last check:	2.48 hrs
Left Engine (Gas Generator)	
Left engine manufacturer:	PWC
Year of manufacture:	1978
Model:	PT6A-27
Serial number:	PCE-51671
Total hrs. since new:	20,229.81 hrs.
Last overhaul date:	19 Dec 2019
Hrs. since overhaul:	275.03
Last check carried out:	EMMA#4 dated 20 October 2020
Hrs. since last check:	2.48 hrs
Left Engine (Power Section)	
Left engine manufacturer:	PWC
Year of manufacture:	Unknown
Model:	PT6A-27
Serial number:	42006-100
Last overhaul date:	19 Dec 2019
Hrs. since overhaul:	275.03 hrs
Last check carried out:	EMMA#4 dated 20 October 2020
Hrs. since last check:	2.48 hrs
Right Propeller	
Manufacturer:	MT Propeller
Year of manufacture:	2019
Model:	MTV-16-1ECFR(P)CFR240-55A
Serial number:	190125
Last overhaul date:	N/A

Hrs. since last overhaul:	N/A
Last check carried out:	EMMA#4 dated 20 October 2020
Left Propeller	
Manufacturer:	MT Propeller
Year of manufacture:	2019
Model:	MTV-16-1ECFR(P)CFR240-55A
Serial number:	190124
Last overhaul date:	N/A
Hrs. since last overhaul:	N/A
Last check carried out:	EMMA#4 dated 20 October 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 normally carried by fifteen passengers. The aft baggage compartment is used only for loading smaller luggage.

1.6.4 Recent maintenance

The most recent maintenance inspections carried out include: Equalized Maintenance for Maximum Availability (EMMA) check number 04, complied with on 20 October 2020, at 44,384.27 TAT and 92,576 TAC.

During this EMMA inspection, inspection cards 4E, LH engine and 5E, RH engine was called for and completed satisfactorily. The EMMA card 58 and 68 (Mechanical) included engine / propeller maintenance tasks, which includes:

1. Auto feather system
2. Overspeed governor
3. Constant speed governor
4. Propeller assembly

Additionally, engine ground runs were carried out before and after the EMMA check – with several engine parameters recorded – including:

1. Propeller overspeed governor check
2. Acceleration check
3. Acceleration in reverse and asymmetry check
4. Max reverse check

1.6.5 Flight Controls

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

1.6.6 Powerplants

Refer to 1.6.2 under Engines and Propeller.

1.6.7 Fuel

Jet A-1 fuel was used on the aircraft. The aircraft was loaded with a total of 1415 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

The aircraft had no open defects recorded.

1.6.10 Aircraft load

The aircraft has a Maximum Take-off Mass (MTOM) of 12,500 pounds. When it was dispatched from MLE for sector MLE-IRU, the aircraft had a total MTOM of 12,490 lbs., as per the operational flight plan computed by the TMA Dispatch.

Flight Release (with passenger list) document completed and printed at 09:48 hrs on 22 October 2020 by TMA Flight Dispatchers (available in MLE) confirms that:

- Passenger weight (13+1 passengers) weighed a total of 1,926 lbs.
- Luggage (18 pieces) weighed 491 lbs.
- Hand luggage (8 pieces) weighed a total of 64 lbs.
- Total fuel at departure 1415 lbs.

This translates to a total payload of 2,484 lbs. carried onboard the aircraft, at departure from MLE. The landing weight of the aircraft was calculated at 12,050 lbs. after consideration for sector fuel burn.

The Mass and balance Report had a total baggage recorded as 574 lbs., whereas the flight release document records total baggage as 558 lbs. This is a discrepancy of 16 lbs., and this error does not exceed the MTOM limitations. In this case the landing weight of the aircraft was calculated at 12,060 lbs. after consideration for fuel burn. The aircraft CG was calculated at 29% MAC for take-off and 29% MAC for landing.

1.6.11 Load Sheet

The load sheet which served as the passenger manifest was retained with Dispatch prior to take-off, as required per the company Operations Manual.

1.7 Meteorological information

No weather data was available at Sun Siyam Iru Fushi Resort 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. No such visual aid was available at Sun Siyam IruFushi Resort water aerodrome at the time of the incident.

Meteorological information available from the automatic weather station at Shaviyani Atoll Funadhoo, which is 28 nm north of Medhafushi Island, at 11:10 hrs on 22 October 2020 was recorded as follows:

Wind direction:	200^{o} - 250^{o}
Average wind:	3 knots
Max wind speed:	5 knots
Accumulated rain:	Nil

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: Sun Siyam IruFushi Resort water aerodrome
Reference:

Floating –	N05°44.46012', E73°19.945'	
Attached –	N 05°44.488', E 73°19.067,	N 05°44.537', E 73°19.305
Facilities:	1 fixed platform, 2 floating platforms and 3 mooring buoys	

Location of the water aerodrome, including 4 proposed areas and lines of landing, at Sun Siyam IruFushi Resort is shown on the aerodrome chart, issue 4, revision 0, published by TMA, dated 10 June 2018.

VR-IRU **SUN SIYAM IRUFUSHI** **NOONU ATOLL**

Coordinates - **5°** 44.48' N **73'** 19.07' E MLE VOR - **356°** / **93** nm

DESCRIPTION	Normal operations inside/outside lagoon with transfers from fixed platforms.				
FACILITIES	2 Fixed Platform(s) / 1 Floating Platform(s) / 3 Mooring Buoy(s)				
CATEGORY	A	DINGHY	Yes	FUEL	Yes
COMM	Advisory 128.8				
ALTERNATES	VR-RND (fuel) 160°/3 nm, VR-SJR (fuel) 112°/6 nm, VR-KDU (fuel) 027°/9 nm				
CAUTION	Cross swell can be present inside lagoon at high tides, and hard to see during overhead inspection when considering inside lagoon ops. Inside lagoon operations can be conducted at all tides. Boat activity and boats moored in close proximity to operating area inside lagoon.				
REMARKS	Noise Abatement: Please take-off and land outside lagoon if water and weather conditions permit. Deep water inside lagoon free of coral heads. Beware of possible coral heads in the shallower water when back tracking for take-off at low tides.				
CHART TABLE	1) Position of floating platform in NE monsoon. 2) Position of floating platform in SW monsoon.				
RESORT INFO	7950158				
LOCAL ISLAND NAME	Medhafushi				

Figure 1: Sun Siyam IruFushi Resort Water Aerodrome Chart

Aerodrome License for Sun Siyam IruFushi Resort (Medhafushi Island), bearing license number AP/O/92, was issued to Trans Maldivian Airways Pvt Ltd., on 28 November 2010.

1.11 Flight Recorders

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder. Neither recorder was required by the relevant Regulations.

1.12 Wreckage and impact information

1.12.1 Incident site visit

Incident site was visited by investigators from both MCAA and AICC. During this visit the aircraft was visually checked for damages.

1.12.2 Wreckage Condition

For damage information refer to 1.3.

1.12.3 Salvage operations

No salvage operation was required

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 the three crew members.

1.14 Fire

There was no evidence of fire or fire alarms in flight or after the impact

1.15 Survival Aspect

Not Applicable.

1.16 Tests and research

For the purpose of ferrying the aircraft back to base the LH engine power section and the damaged LH propeller was replaced at IRU, but no rigging was performed. On the RH engine, no maintenance or repair was carried out.

The Captain who ferried the aircraft performed engine runs and testing at IRU prior to ferry flight and his observations were as follows:

- RH engine startup was within the starting parameters and observed normal
- Auto feather test was carried out and found to be satisfactory
- RH engine spooling on forward was observed normal
- RH engine spooling on reverse was observed slow
- Total of three high speed taxi runs followed by reversing to stop was made and it was noticed that the RH engine reverse was significantly slow in comparison to the LH engine. In the interview the captain who did the engine runs stated that based on his experience he found the RH engine too slow to respond.

It is noted that the aircraft flew 05 sectors on the day prior to the incident, and the operating pilots did not report any issues with the engine performance and lack of right-hand engine lagging power in reverse.

The aircraft was then ferried back to Operator's main base at VIA and rigging adjustments on LH engine was performed. A ground run was then carried out on 30th October 2020 which showed a Torque (Tq) value of 36 on "Max Reverse check".

Discussions were held with senior captain's and as per the pilots, if the Torque value obtained is 16 at the max reverse range, the pilot would have noticed the anomaly during taxiing and docking, and would have reported it.

Further testing (including engine runs, hi-speed taxiing) were performed by the same ferry Captain and the chief pilot, to assess the reverse performance of RH engine and to

identify whether there is a delay in activating reverse by recreating similar scenarios. The Operator's safety report states that during the test no significant difference in spooling on reverse and no notable difference in activating reverse on both engines was observed. However, during a later interview with the ferry captain, he stated that during the tests done after repair and rigging of the left engine, still the RH engine was slow to respond on selecting reverse.

In the last EMMA check max reverse check was carried out on both engines and the recorded values for RH engine was 16 and LH engine was 40. The maintenance crew when interviewed stated that the figure 16 entered was an error made during copying to the logbook. In the interviews the certifying staff stated that during engine ground runs appropriate forms or checklists were not used and instead notes are made on loose paper which are later used to refer to complete the appropriate forms / checklists, days later, in some cases.

The Engine ground run sheet was last amended on 5th March 2020 and the "Max reverse check" was introduced with the last amendment. Previously the reverse check was only performed at 80 Ng and the ideal reverse at that power setting is about 14-17 Tq, hence it may be possible that the engineer's mind may be accustomed to noting the Tq value in 80 Ng and missing to note the correct figure, as justified by the certifying staff when enquired on the abnormality.

1.17 Organizational and Management Information

TMA is a MCAA approved Air Operator Certificate holder. TMA provides domestic air services with a fleet of over 50 DHC-6 floatplanes. The company is authorized to conduct day VFR Operations.

The company holds Aircraft Maintenance Organization Approval reference MV.145.025 issued by the MCAA.

1.18 Additional Information

None

1.19 Useful or Effective Investigation Techniques

None

2.0 ANALYSIS

The aircraft had no known maintenance overruns or open deferred defects when released after Daily Maintenance check on 21 October 2020 evening, and no defects were noted by the operating crew at the time of pre-flight checks in the morning of next day, 22 October 2020. The analysis therefore focusses on crew qualification, performance, operating procedures and conditions.

Both crew members held valid licenses, medicals and had satisfactorily completed the required proficiency checks and were current to operate the type.

The PIC held a valid ATPL with a total of over 13,000 hrs including 7,848.5 hrs as PIC on DHC-6 floatplanes. The captain is a senior Line Training Captain (LTC) who is an experienced and qualified captain actively involved in training and checking activities (including LIFUS, route familiarization and line checks) for newly appointed and existing first officers and captains.

The FO held a CPL with a total of 626.7 hrs which includes 376 hours on type. According to him, he had previously landed inside the lagoon at IRU and did not land outside, hence he was comfortable to land inside considering the favourable water and wind conditions.

The PIC was unfamiliar with the FO's experience. No appropriate pre-flight crew briefing was done; as laid down in the Operations Manual (OM) Part B Chapter 2.2.5, to discuss about the flight, weather conditions, operational restrictions, passengers and other relevant factors.

The two flight crew members and the cabin crew adequately rested prior to the flight and there was no exceedance of duty time and sectors. Hence, it is unlikely that crew fatigue contributed to this incident.

TMA holds Water Aerodrome License number AP/O/92 issued to Sun Siyam IruFushi Water Aerodrome (IRU), by the MCAA, dated 28 November 2010.

The VFR approach charts issued by TMA for IRU dated 10 June 2018 shows 4 different possible landing lines: three outside the reef and one inside the lagoon.

The Caution column on the aerodrome chart states that “cross swell can be present inside lagoon at high tides, and hard to see during overhead inspection when considering inside lagoon ops. Inside lagoon operations can be conducted at all tides. Boat activity and boats moored in close proximity to operating area inside lagoon.”

In the remarks column it is stated “Noise Abatement: please take-off and land outside lagoon if water and weather conditions permit. Deep water inside lagoon free of coral heads. Beware of possible coral heads in the shallower water when back tracking for take-off at low tides.”

VR-IRU inside lagoon is considered as a challenging area for take-off and landing as the area is very confined and if the pilot made an error, it may be difficult to recover. According to the PIC, the reason why he allowed the FO to perform the landing was to provide FO with a practice opportunity to land cross wind on confined areas. However, considering the limited experience of FO, the judgement to let him take the risk of landing inside the lagoon while the weather and water condition allowed to land outside of lagoon, was not the most appropriate decision, considering the captain’s experience as a senior LTC.

The crew did not notice any discrepancies or abnormalities with the aircraft during the flight, till reverse was applied. As per the crew, when reverse was applied the aircraft behaved unexpectedly and there was a delay in activating the reverse and/or there may have been a difference in reverse power generated (asymmetrical reverse) on both sides.

There have been incidents involving aircraft in the operator’s fleet installed with the MT Propeller type, where the crew has complained of the performance of the type of propeller. These initial problems with the change of propeller type from 3 bladed Hartzell propellers were found to be related to engine rigging after the installation of the MT Propeller type.

One previous incident similar to this occurred on another aircraft of the same operator’s fleet during docking where the crew also complained of producing differential reverse thrust on the engines. At the time of that incident there was a strong left cross wind prevailing.

Veering to the left can be caused by:

1. Inadvertently applying left rudder after touchdown, however, rudder is not sufficiently effective to make a sharp turn on a decelerating floatplane;
2. Not releasing the rudder input on landing for the crab applied for the cross-wind correction;
3. Strong cross wind during landing;
4. Application of differential reverse power or a difference in spooling of the engines during the application of reverse power;
5. When propeller controls are incorrectly rigged, the possibility of forward thrust being produced on the engine can occur when reverse is selected. In this situation the Propeller RPM reaches more than the CSU pneumatic maximum set RPM (91%, ± 1%). If the propeller RPM reaches more than the CSU pneumatic maximum set RPM (91% +/-1%) in reverse, then CSU or OSG can enter in governing RPM and dump the servo oil from the propeller which cause the propeller to go to a forward angle.

The last scheduled inspection of the aircraft was EMMA number 04 carried out on 20 October 2020, at 44,384.27 TAT and 92,576 landings. During the EMMA, several airframe, engine, propeller and float related tasks were carried out. Additionally, engine ground runs were carried out before and after the EMMA check. No maintenance overruns were noted.

During the pre-EMMA check requiring engine performance check and operation of engine instruments, some recorded engine parameters were out of the limits, but no entries were made relating to any corrective actions taken, prior to releasing the aircraft back into service.

The Torque value entered in the Engine Ground Run sheets post EMMA for “Max Reverse check”, was found to be incorrect. This was confirmed by the maintenance staff involved.

After repairing the LH engine and replacing the LH propeller for ferrying the aircraft to base, the ferry Captain carried out engine runs and high speed taxiing. Following were his observations:

- RH engine start-up was within the starting parameters and normal;
- Auto feathering test was found satisfactory;
- RH engine spooling on forward was normal;

- RH engine spooling on reverse was slow;
- Total of three high speed taxiing, followed by reversing to stop the aircraft was made. RH engine reverse was significantly slow in comparison to the LH engine. Based on the ferry captain's experience he found the RH engine too slow to respond.

3.0 CONCLUSIONS

3.1 Findings

a. The flight crew members were licensed and appropriately qualified;
b. Flight crew fatigue was not a factor in the incident;
c. There were no maintenance overruns noted on the aircraft and the systems
d. There was no evidence of airframe failure or system malfunction prior to the incident;
e. No appropriate pre-flight crew briefings were made by the crew;
f. The PIC was unfamiliar with FO's experience;
g. Data entry in the engine run sheets of pre and post EMMA #4 dated 19th and 20th October 2020 was noted as 16 psi for RH engine;
h. The erroneous values recorded in the engine run sheets of EMMA #4 dated 19th and 20th October 2020 was not identified prior to issue of CRS;
i. There was no wind direction indicator at the water aerodrome;
j. A number of vessels were anchored on the port side of the landing line;
k. A left cross wind of about 7 knots was present at the time of the incident.

3.2 Causes / Contributing Factors

The AICC determines that the causes / contributing factors of this incident as:

a. The landing line is too close to the anchored boats;
b. Abnormal differential spooling of the engines during reverse;
c. The prevailing left cross wind.

3.3 Recommendation to all Operators:

a. Review the operational conditions inside island lagoons where permanent obstructions exist, especially when the proposed approach and landing line is close to these obstructions;

b. Ensure maintenance / certifying staff follow correct procedures in recording maintenance work including making log book entries.

c. Ensure that the aerodrome is maintained in compliance with regulations in force.

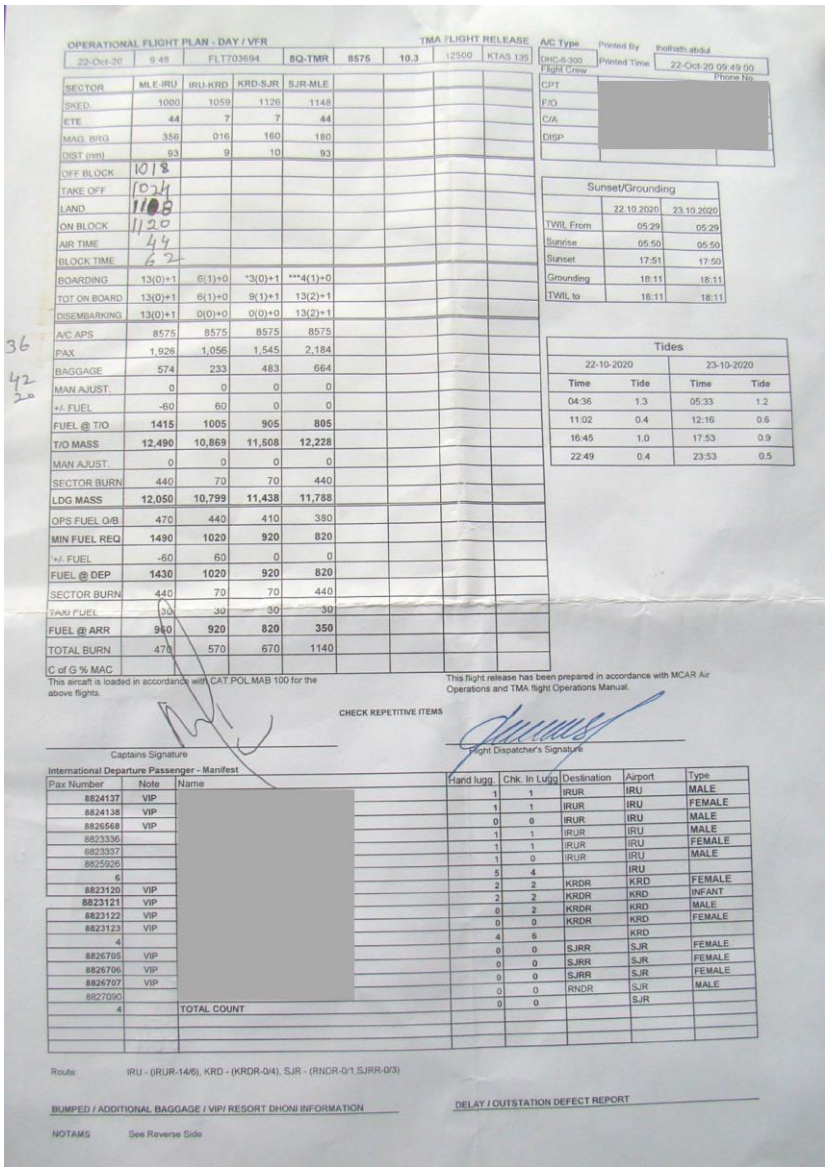
3.4 Recommendation to the Regulator:

None

4.0 APPENDICES

4.1. Flight Release Documents

a. Operational Flight Plan



OPERATIONAL FLIGHT PLAN - DAY / VFR — TMA FLIGHT RELEASE

22-Oct-20	9:48	FLT703694	8Q-TMR	8575	10.3	12500	KTAS 135

A/C Type: DHC-6-300 — Printed By: thothieth abdul — Printed Time: 22-Oct-20 09:49:00

Flight Crew: CPT [redacted] / F/O / C/A / DISP — Phone No

SECTOR	MLE-IRU	IRU-KRD	KRD-SJR	SJR-MLE
SKED	1000	1059	1126	1148
ETE	44	7	7	44
MAG. BRG	356	016	160	180
DIST (nm)	93	9	10	93
OFF BLOCK	1018			
TAKE OFF	1024			
LAND	1108			
ON BLOCK	1120			
AIR TIME	44			
BLOCK TIME	62			
BOARDING	13(0)+1	6(1)+0	*3(0)+1	***4(1)+0
TOT ON BOARD	13(0)+1	6(1)+0	9(1)+1	13(2)+1
DISEMBARKING	13(0)+1	0(0)+0	0(0)+0	13(2)+1
A/C APS	8575	8575	8575	8575
PAX	1,926	1,056	1,545	2,184
BAGGAGE	574	233	483	664
MAN AJUST.	0	0	0	0
+/- FUEL	-60	60	0	0
FUEL @ T/O	1415	1005	905	805
T/O MASS	12,490	10,869	11,508	12,228
MAN AJUST.	0	0	0	0
SECTOR BURN	440	70	70	440
LDG MASS	12,050	10,799	11,438	11,788
OPS FUEL O/B	470	440	410	380
MIN FUEL REQ	1490	1020	920	820
+/- FUEL	-60	60	0	0
FUEL @ DEP	1430	1020	920	820
SECTOR BURN	440	70	70	440
TAXI FUEL	30	30	30	30
FUEL @ ARR	960	920	820	350
TOTAL BURN	470	570	670	1140
C of G % MAC				

Sunset/Grounding

	22.10.2020	23.10.2020
TWIL From	05:29	05:29
Sunrise	05:50	05:50
Sunset	17:51	17:50
Grounding	18:11	18:11
TWIL to	18:11	18:11

Tides

22-10-2020		23-10-2020	
Time	Tide	Time	Tide
04:36	1.3	05:33	1.2
11:02	0.4	12:16	0.6
16:45	1.0	17:53	0.9
22:49	0.4	23:53	0.5

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

Captains Signature — Flight Dispatcher's Signature

International Departure Passenger - Manifest

Pax Number	Note	Name	Hand lugg.	Chk. In Lugg	Destination	Airport	Type
8824137	VIP	[redacted]	1	1	IRUR	IRU	MALE
8824138	VIP		1	1	IRUR	IRU	FEMALE
8826568	VIP		0	0	IRUR	IRU	MALE
8823336			1	1	IRUR	IRU	MALE
8823337			1	1	IRUR	IRU	FEMALE
8825926			1	0	IRUR	IRU	MALE
6			5	4		IRU	
8823120	VIP		2	2	KRDR	KRD	FEMALE
8823121	VIP		2	2	KRDR	KRD	INFANT
8823122	VIP		0	2	KRDR	KRD	MALE
8823123	VIP		0	0	KRDR	KRD	FEMALE
4			4	6		KRD	
8826705	VIP		0	0	SJRR	SJR	FEMALE
8826706	VIP		0	0	SJRR	SJR	FEMALE
8826707	VIP		0	0	SJRR	SJR	FEMALE
8827090			0	0	RNDR	SJR	MALE
4		TOTAL COUNT	0	0		SJR	

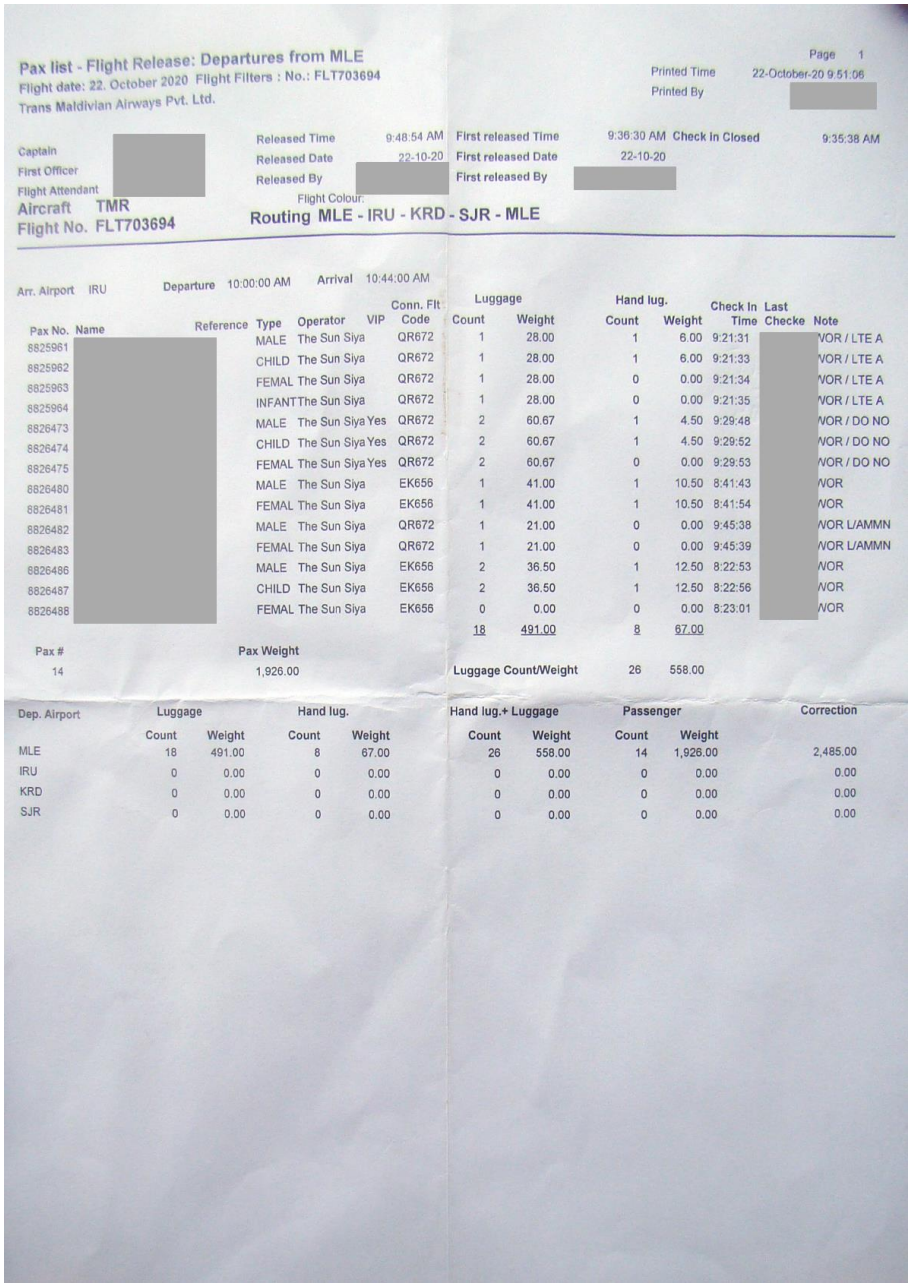
Route: IRU - (IRUR-14/6), KRD - (KRDR-0/4), SJR - (RNDR-0/1,SJRR-0/3)

BUMPED / ADDITIONAL BAGGAGE / VIP/ RESORT DHONI INFORMATION

DELAY / OUTSTATION DEFECT REPORT

NOTAMS See Reverse Side

b. Passenger List – Flight Release (Page 1 of 2)



Pax list - Flight Release: Departures from MLE
Flight date: 22. October 2020 Flight Filters : No.: FLT703694
Trans Maldivian Airways Pvt. Ltd.

Page 1
Printed Time 22-October-20 9:51:06
Printed By [redacted]

Captain [redacted]
First Officer
Flight Attendant
Aircraft TMR
Flight No. FLT703694

Released Time 9:48:54 AM
Released Date 22-10-20
Released By [redacted]
Flight Colour:

First released Time 9:36:30 AM Check in Closed 9:35:38 AM
First released Date 22-10-20
First released By [redacted]

Routing MLE - IRU - KRD - SJR - MLE

Arr. Airport IRU Departure 10:00:00 AM Arrival 10:44:00 AM

Pax No.	Name	Reference	Type	Operator	VIP	Conn. Flt Code	Luggage Count	Luggage Weight	Hand lug. Count	Hand lug. Weight	Check In Time	Last Checke	Note
8825961	[redacted]		MALE	The Sun Siya		QR672	1	28.00	1	6.00	9:21:31	[redacted]	WOR / LTE A
8825962			CHILD	The Sun Siya		QR672	1	28.00	1	6.00	9:21:33		WOR / LTE A
8825963			FEMAL	The Sun Siya		QR672	1	28.00	0	0.00	9:21:34		WOR / LTE A
8825964			INFANT	The Sun Siya		QR672	1	28.00	0	0.00	9:21:35		WOR / LTE A
8826473			MALE	The Sun Siya	Yes	QR672	2	60.67	1	4.50	9:29:48		WOR / DO NO
8826474			CHILD	The Sun Siya	Yes	QR672	2	60.67	1	4.50	9:29:52		WOR / DO NO
8826475			FEMAL	The Sun Siya	Yes	QR672	2	60.67	0	0.00	9:29:53		WOR / DO NO
8826480			MALE	The Sun Siya		EK656	1	41.00	1	10.50	8:41:43		WOR
8826481			FEMAL	The Sun Siya		EK656	1	41.00	1	10.50	8:41:54		WOR
8826482			MALE	The Sun Siya		QR672	1	21.00	0	0.00	9:45:38		WOR L/AMMN
8826483			FEMAL	The Sun Siya		QR672	1	21.00	0	0.00	9:45:39		WOR L/AMMN
8826486			MALE	The Sun Siya		EK656	2	36.50	1	12.50	8:22:53		WOR
8826487			CHILD	The Sun Siya		EK656	2	36.50	1	12.50	8:22:56		WOR
8826488			FEMAL	The Sun Siya		EK656	0	0.00	0	0.00	8:23:01		WOR
							18	491.00	8	67.00			

Pax # 14
Pax Weight 1,926.00

Luggage Count/Weight 26 558.00

Dep. Airport	Luggage Count	Luggage Weight	Hand lug. Count	Hand lug. Weight	Hand lug.+ Luggage Count	Hand lug.+ Luggage Weight	Passenger Count	Passenger Weight	Correction
MLE	18	491.00	8	67.00	26	558.00	14	1,926.00	2,485.00
IRU	0	0.00	0	0.00	0	0.00	0	0.00	0.00
KRD	0	0.00	0	0.00	0	0.00	0	0.00	0.00
SJR	0	0.00	0	0.00	0	0.00	0	0.00	0.00

c. Mass and Balance Report

Mass & Balance Report

Thursday, 22 October 2020 - 8Q-TMR - 10:16:24 - MLE to IRU

Trip Information

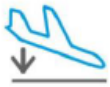
AIRCRAFT	
Registration No	8Q-TMR
APS Index	10.33
APS Weight	8,575.27 lbs
CREW	
Pilot-in-Command	[redacted]
ROUTE	
Departure	MLE Velana International Airport
Arrival	IRU The Sun Siyam Iru Fushi
Distance	93 nm
Bearing	352° N
TOTALS	
Total Pax Weight	1,926.00 lbs
Total Fuel	1,430.00 lbs
Total Baggage	574.00 lbs
Take-Off Weight	12,490.27 lbs
Sector Burn	430.00 lbs
Landing Weight	12,060.27 lbs

Details

FUEL TANKS	
FWD Tank	715.00 lbs
AFT Tank	715.00 lbs
MOMENTS	
APS Moment	1,804,106.70
Take Off Moment	2,629,432.70
Landing Moment	2,543,217.70
SECTIONS	
Section A	339.00 lbs
Section B	944.00 lbs
Section C	643.00 lbs
Section D	574.00 lbs
Section Tail	0.00 lbs

Take Off CG

29% MAC



Landing CG

29% MAC

TMAPP WB Report ID: 489336, Generated on: 23-Oct-2020 20:08:06

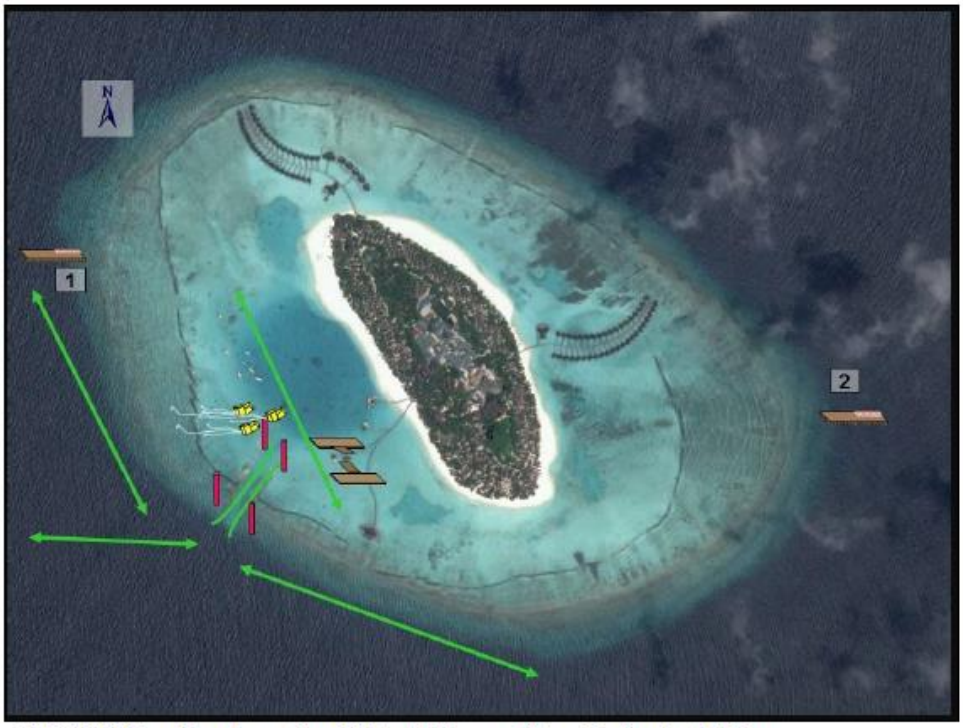
4.2 Sun Siyam IruFushi Water Aerodrome Chart

Trans Maldivian Airways
WATER AERODROME CHART

Issue: 4, **Rev:** 1
04 Nov 2020

VR-IRU / SUN SIYAM IRUFUSHI - NOONU ATOLL/

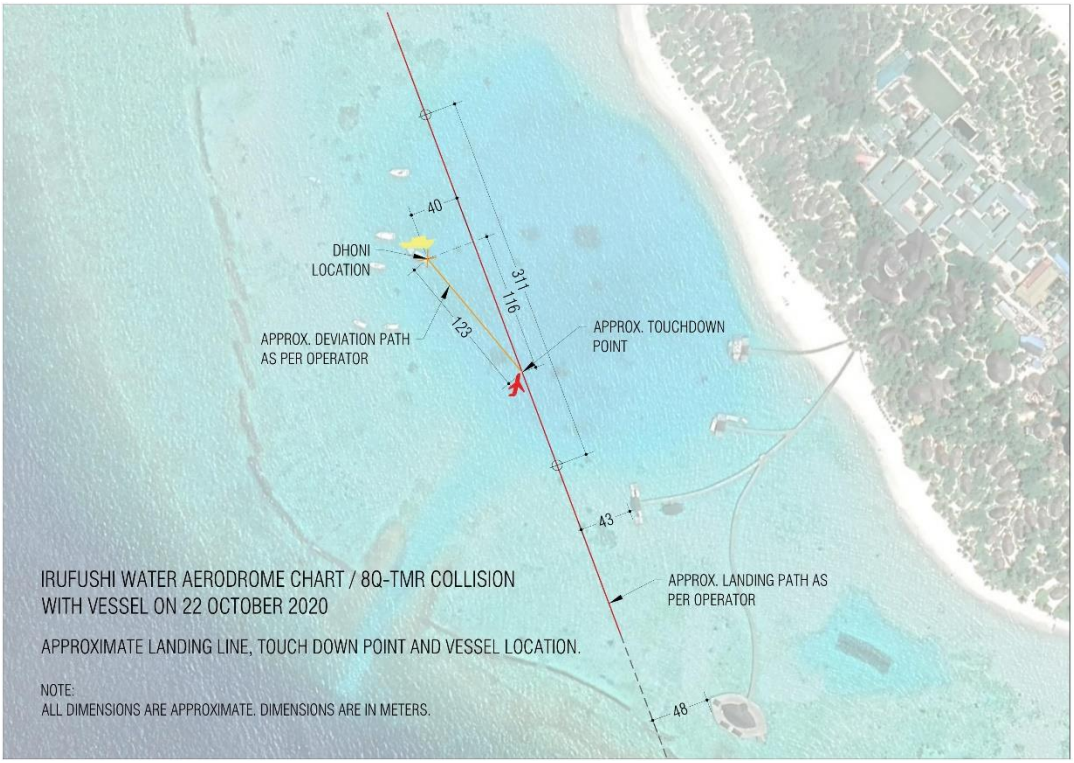
Coordinates: 5° 44.48' N 73' 19.07' E (MLE VOR - 356° / 93 nm)



DESCRIPTION	Normal operations inside/outside lagoon with transfers from fixed platforms.				
FACILITIES	2 Fixed Platform(s) / 1 Floating Platform(s) / 3 Mooring Buoy(s)				
CATEGORY	A	**DINGHY**	Yes	**FUEL**	Yes
COMM	Advisory 128.8				
ALTERNATES	VR-RND (fuel) 160°/3 nm, VR-SJR (fuel) 112°/6 nm, VR-KDU (fuel) 027°/9 nm				
CAUTION	Cross swell can be present inside lagoon at high tides, and hard to see during overhead inspection when considering inside lagoon ops. Inside lagoon operations can be conducted at all tides. Boat activity and boats moored in close proximity to operating area inside lagoon.				
REMARKS	Noise Abatement: Please take-off and land outside lagoon if water and weather conditions permit. Deep water inside lagoon free of coral heads. Beware of possible coral heads in the shallower water when back tracking for take-off at low tides. **T/O & Landing inside the lagoon shall be operated by the PIC only.**				
CHART TABLE	1) Position of floating platform in NE monsoon. 2) Position of floating platform in SW monsoon.				
RESORT INFO	7950158				
ISLAND NAME	Medhafushi				

Water Aerodrome Charts Page IRU -1

4.2 Sun Siyam IruFushi Water Aerodrome Chart showing 8Q-TMR Landing Path



4.3 Damages to aircraft and the vessel

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

Figure 3: LH Wing: Damage to LH Wing

Figure 4: Damage to LH wing

Figure 5: LH Wing: Damage to LH Wing

Figure 6: LH Wing: Damage and propeller damage

Figure 7: LH Wing: Damage to LH Wing

Figure 8: LH Propeller damaged

Figure 9: LH Propeller damaged

Figure 10: The vessel with which the aircraft collided

Figure 11: Damage on the vessel

Figure 12: Damage on the vessel

Figure 13: Damage on the vessel