بسم الله الرحمن الرحيم

Accident Investigation Coordinating Committee

Aircraft Accident Report 2015/04

Final Report on the Accident to
Viking Air DHC-6-300, 8Q-MAN
Near Kuredu Resort, Maldives
02 July 2015

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.

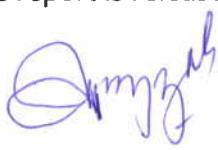
This investigation has been conducted in accordance with Annex 13 to the Chicago Convention, the Civil Aviation Act 2/2012 and the Civil Aviation Regulations. The sole objective of this investigation and the Final Report is to prevent accidents and incidents. It is not the purpose of this investigation 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 28 December 2016.



Mr. Abdul Razzak Idris
Chairperson
Accident Investigation Coordinating Committee

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Aircraft Accident Report No: 2015/04

Registered Owner	Trans Maldivian Airways Pvt. Ltd.
Operator	Trans Maldivian Airways Pvt. Ltd.
Aircraft Type	Viking Air (De Havilland) DHC-6-300 (Float plane)
Nationality	Maldivian
Registration	8Q-MAN
Manufacturer's Serial Number	435
Place of Accident	Approximately 3 km southeast of Kuredu Latitude: 05° 31.115' N Longitude: 73° 28.971' E
Date and Time	2 July 2015 at 1733 hrs

Synopsis

Flight FLT371301, a Viking Air (De Havilland) DHC-6-300 aircraft with registration mark 8Q-MAN, crashed into the sea approximately 3 km southeast of Kuredu (KUR) at 1733 hrs on 2 July 2015. The aircraft was flying under visual flight rules (VFR) on a charter flight, carrying 11 passengers from Komandoo (KOM) to Kuredu (KUR).

According to the operating crew, the aircraft was on final approach, northwest bound, to land at KUR. At approximately 400 feet, on selection of flaps to the fully down position, the aircraft pitched up and the aircraft was vibrating. The pilot flying (PF) could not control the aircraft and asked the PIC to take over the controls. The aircraft was in a nose-high attitude when the PIC took over the controls. The stall warning light illuminated. The PIC applied full left rudder, moved the control column forward and put the power levers to idle to recover the aircraft. The aircraft, however, did not respond to these actions. Flaps were then moved to the fully up position. The PIC was gaining some control at this stage but the aircraft continued turning right, losing height and impacted the sea before he could regain full control of the aircraft.

On initial impact the left float detached. The aircraft then bounced and landed on the right float causing the right float to also detach from the aircraft. The right float was, however, trapped between the airframe and the engine for several minutes. With both floats detached from the aircraft and the right float still trapped between the airframe and engine, the aircraft stayed afloat until all passengers and crew evacuated. At the same time the aircraft started tilting left causing water to rush inside and started sinking.

All 11 passengers and three crew were able to evacuate the aircraft without injury, before the aircraft completely sank.

The accident was notified to the Aircraft Accident Investigation Committee (AICC) at 1750 hrs. Investigation began on the same day. Inspectors arrived at the scene at 2300 hrs, about five and a half hours after the accident occurred.

The investigation identified the following causal factors:

a. The aircraft was operated outside of the centre of gravity limitations on the sector in which the accident occurred.

b. The load distribution errors went undetected because the mass and balance calculations were not carried out in accordance with the approved procedures, prior to the accident flight.

c. The co-pilot (PF) was not alerted to the impending stall as she neither saw the stall warning light nor heard the aural stall warning.

d. The PIC was not able to gain control of aircraft as developing stall was not recognised and incorrect recovery procedures were applied.

12 recommendations were made during the course of the investigation.

1 Factual information

1.1 History of the flight

1.1.1 Background

The aircraft 8Q-MAN made 8 sectors (3.75 hours of flight time) on the day before the accident and on the day of accident, 4 sectors (1.62 hours of flight time) were flown prior to the accident flight. No defects were reported on these flights and the aircraft had no outstanding deferred defects.

On the day before the accident, the co-pilot reported for duty at her home base in Male' at 0800 hrs. That day, she completed the sequence of flights assigned to her uneventfully and her duty ended at 1825 hrs.

The Pilot-in-Command of the flight was off duty on the day before the date of accident.

On the day of the accident both pilots reported for duty at 0845 hrs. This was the first working day for the PIC after two days of rest (according to the flight rotation) and second working day for the co-pilot after one month of annual leave.

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 compartment status form". Company procedures require this at the start of each day and at the end of each day. The co-pilot pumped the right float while the cabin crew pumped the left float. They concur the number of pump strokes were within the limits specified in the company procedures. The crew carried out the pre-flight checks and a walk-around prior to the first flight of the day. No abnormalities were recorded or reported by the pilots.

The company usually schedules a sequence of flight sectors together and issues a combined "flight release" for these flight sectors. Two such sequences of flights were scheduled for the crew and the aircraft on the day of the accident. The airline "flight release" document contains three parts. These are the operational flight plan, passenger list and the luggage list.

The first sequence of flights for the day was Male'–Angaga–Conrad–Male'. The first sector in this sequence was at 0924 hrs, flying from Male' (MLE) to Angaga (ANG). The second sector was from Angaga (ANG) to Conrad (CON) where the aircraft was parked at the buoy for a 'day shutdown' of 5 hours. The third sector was from Conrad (CON) back to Male' (MLE). The PIC asked for the floats to be pumped while preparing for departure at Conrad and the crew pumped water out of the floats and the number of strokes was again reported to be within the company limits. The aircraft departed from Conrad at approximately 1522 hrs and arrived Male' at 1600 hrs.

When it arrived at Male', the aircraft was already confirmed for the next sequence of two flight sectors, i.e. Male'–Komandoo–Kuredu. Passengers disembarked, the aircraft was unloaded and preparations for the next flights began.

1.1.2 Conduct of loading

All handling is done by the Operator itself and all loading is done by its staff. The aircraft was loaded for both flight legs as this was one sequence of flights.

The "flight release" indicates 779 lb of luggage was loaded out of which 166 lb were destined to Komandoo and 613 lb destined to Kuredu.

The aircraft was loaded by the time the co-pilot arrived. The co-pilot stated that the loading staff informed her that 297 lb of luggage were loaded to the aft baggage compartment. The co-pilot further stated this information was relayed to the PIC and was acknowledged by him. The PIC, however, could not recall making this acknowledgement

Baggage in the passenger compartment, as usual practice, was secured using a belt. There is no mechanism to secure baggage in the aft compartment as this compartment is usually used to store handbags. A bulkhead separates the aft baggage compartment from the passenger compartment.

1.1.3 Preparations for flight

The PIC obtained the "flight release" from Flight Dispatch in preparation for the second sequence of flights for the day Male-Komandoo-Kuredu.

The aircraft was then refuelled with 435 lb of Jet A1 at Male' to make up the 835 lb of fuel required in the "flight release".

The flight was "released" with 3 crew members (2 flight crew and 1 cabin crew) and 15 passengers (4 passengers to Komandoo and 11 passengers to Kuredu).

The "flight release" indicated, the aircraft was loaded with 779 lb of luggage and 835 lb of fuel, with a take-off mass of 12,484 lb, at the time of departure from Male'.

A pre-flight inspection was carried out prior to the first flight of the day but a pre-flight inspection was not done prior to the flight departure from Male'-Komandoo as it is the approved procedure of the company to do the pre-flight inspection only at the start of the day or if there is a change of crew.

The crew members reported flight preparation as normal.

1.1.4 The accident flight

The aircraft departed Male' at 1625 hrs and the PIC was PF for the first sector. Taxi-out, take-off, cruise and the landing at Komandoo were normal according to the PIC and no anomalies were reported. The aircraft landed at Komandoo at 1710 hrs.

Four passengers disembarked at Komandoo and 166 lb of luggage (3 suitcases from the cabin and 1 hand luggage from the aft baggage compartment) were offloaded from the aircraft. The passengers that disembarked at Komandoo were seated in the first and the second row of double seats.

The second sector of the sequence was Komandoo-Kuredu with an approximate flight duration of five minutes. The aircraft departed Komandoo at approximately 1725 hrs and the co-pilot was PF on this sector.

The new take-off mass of the aircraft for departure at Komandoo, in accordance with the flight release, was 11,240 lb. 11 passengers (5 female, 4 male and 2 child), 613 lb of luggage and 435 lb of fuel remaining on board. All passengers on the Komandoo–Kuredu sector concur that no seat changes were made at Komandoo. However, the occurrence report by the PIC, states a 'couple of passengers were moved forward to maintain CG within limits'.

The take-off at Komandoo was normal as per the crew members. Once airborne, the co-pilot briefed the PIC on the approach and landing area selection. The co-pilot stated that she was taking a North West bound line with Kuredu on the right side of the aircraft. The decent checks were completed shortly after and the aircraft joined the pattern on left downwind. The co-pilot initially requested for 10 degrees of flap followed by 20 degrees of flap on base (i.e. when the aircraft is 90 degrees to the intended runway), with speeds reducing to 75-80 knots. The crew did not recall any anomalies throughout this portion of the flight.

In preparation for the landing, on final approach (i.e. when the aircraft was aligned with the intended runway), the co-pilot requested the flaps at the fully down position and propeller levers forward. Immediately after the selection of flaps, the nose of the aircraft started to rise and the aircraft started to vibrate. The co-pilot stated that she was no longer able to control the aircraft at this stage and transferred the controls to the PIC. When the PIC took over the controls, the aircraft was passing at approximately 300 ft, in

a pitch up attitude. The PIC stated he saw the stall warning light on and the aircraft was in a right bank going into a spin at this stage.

The PIC then applied full left rudder, moved the control column forward and put the power levers to idle. The nose of the aircraft however continued to rise. The PIC, then moved the flaps to the fully up position. The PIC reported gaining a small degree of control at this stage but the aircraft impacted the sea before he could regain full control of the aircraft.

On initial impact the left float detached. The aircraft then bounced and landed on the right float causing the right float to also detach from the aircraft. The right float was, however, trapped between the airframe and the engine for several minutes.

Once the aircraft settled down, PIC gave the command for evacuation. The co-pilot and the cabin crew coordinated the evacuation and all the passengers and crew were able to escape through the left passenger door before the aircraft submerged completely. The PIC was the last to leave the aircraft, after making sure that all passengers and other crew had evacuated the aircraft and that everybody had life jackets.

With both floats detached from the aircraft and the right float still trapped, the aircraft stayed afloat until all passengers and crew escaped. At the same time, the aircraft started tilting left causing water to rush inside and started sinking.

None of the passengers or crew sustained any injuries.

A boat standing at Kuredu jetty diverted to the accident site by some on lookers (among whom was an air crew of the flight that landed at Kuredu few minutes before 8Q-MAN was to land) arrived at the scene followed by another boat that was passing by. All passengers and crew were picked up on the boats and safely taken to Kuredu Resort.

The aircraft continued sinking, banking left, flipped over then sank to the bottom of the sea. The wreckage was found the next day approximately 3 km southeast of Kuredu Resort at a depth of 36.5 m.

1.1.5 Witness evidence

The crash was seen by four people at the Kuredu jetty and the crew of a nearby fishing boat. They reported “unusual” and “abrupt” manoeuvres before the aircraft crashed.

The four witnesses at the jetty (a TMA pilot, a TMA cabin crew, captain of a ferry speedboat and a passenger of the speedboat) immediately took-off on the speedboat to the rescue of any survivors.

The captain of the speedboat reported they were able to make it to the accident site in less than 5 minutes and was quite relieved to see the passengers had evacuated the aircraft and were in life jackets, floating in the sea near the aircraft that was sinking. They started rescuing the passengers and were shortly joined by the fishing boat that was passing by.

The captain and the passenger of the speedboat reported taking pictures and videos of the site. These were however deleted at the request of the TMA pilot that accompanied them on the speedboat.

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.

1.3.1 Damages to the airframe

The radome and the nose cone were severely buckled inwards due to impact and all the avionics shelves in the nose avionics rack were damaged and detached. The windshield was cracked. Aircraft structure forward of station 60.00 was severely damaged.

RH wing strut was bent and the RH forward wing root fairing was cracked. The trailing edge of the RH trailing flap was bent upwards. The trailing edge of the LH trailing flap was torn and bent between station 97.00 and 172.00. LH Wing leading edge outboard of station 297.00 was crushed from aft to approximately half chord

LH forward float attachment fitting was sheared off by impact. LH float fairings were all cracked and torn. The LH float pylon was broken into pieces leaving only the leading edge.

LH horizontal stabilizer was ripped off at approximately horizontal stabilizer station 30.00. LH elevator was ripped off at approximately horizontal stabilizer station 60.00. The LH horizontal stabilizer and the LH elevator were ripped off by the LH float that was flung back on aircraft impact on water.

RH elevator leading edge at the vortex generator area was dented.

Forward edge of the aft cargo door skin was torn along the full height of the door. The skin along the top edge of the door was torn all the way back to the aft hinge.

RH fuselage skin forward of station 111 below the lower hinge of the flight compartment RH door and LH fuselage skin from station 73.00 to 60.00 was crumpled. Top of the fuselage was damage around station 239.00.

1.3.2 Damages to the float

Both floats were substantially damaged. These include deformed stringers, torn pylon/strut attachment fittings, gunwall and bulkheads. Large sections of the float skin were ripped in many areas.

1.3.3 Damages to the engines and propellers

There was no evidence to suggest catastrophic failure of any engine component. The engines were damaged beyond economic repair due to severe corrosion attributed to exposure to salt water subsequent to the accident. Refer to PTB report AIR 54-15.

Both propellers were scrapped due to the propeller strike.

1.4 Other damage

The sea at the accident site was contaminated with Jet A1 fuel.

1.5 Personnel information

1.5.1 Commander

Age:	39	
Licence:	Airline Transport Pilot Licence (Aeroplanes)	
Aircraft Ratings:	DHC-6	
Last proficiency check:	13 March 2015	
Last instrument rating renewal:	13 March 2015	
Last line check:	29 March 2015	
Last medical:	Class 1 (19 May 2015)	
Flying experience:	Total all types:	5,075 hours
	On Type:	4,200 hours
	Last 90 days:	187.7 hours
	Last 28 days:	88.3 hours
	Last 24 hours:	2.2 hours
Previous rest period:	2 days 6 hours	

1.5.1 Co-pilot

Age:	32	
Licence:	Validation (Swedish CPL (Aeroplanes))	
Aircraft Ratings:	Swedish CPL – DA42, DA40, DA20m, C172 Maldivian validation – DHC-6	
Last proficiency check:	15 May 2015	
Last instrument rating renewal:	Not relevant	
Last line check:	16 August 2014	
Last medical:	Class 1 (2 January 2015)	
Flying experience:	Total all types:	988 hours
	On Type:	705 hours
	Last 90 days:	110.7 hours
	Last 28 days:	6.1 hours
	Last 24 hours:	6.1 hours
Previous rest period:	14 hours	

1.5.1 Cabin crew

Age:	21
Licence:	Cabin Crew Licence
Last recurrent training:	Line check on 24 December 2014
Last medical:	Class 3 (30 October 2013)
Previous rest period:	On medical leave from 20 June 2015. Resumed work on 2 July 2015.

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 full flight instrumentation.

Manufacturer:	Viking Air (De Havilland)
Registration:	8Q-MAN
Powerplants:	2 x Pratt & Whitney PT6A-27 turboprop engines
Manufacturer's serial number:	435
Year of construction:	1975
Airframe hours at time of accident:	24,123.2
Certificate of Airworthiness:	Normal category issued on 9 November 2009
Airworthiness Review Certificate:	13 May 2015

1.6.2 Cabin layout and configuration

The aircraft was in float configuration with Wipaire 13000S floats. The cabin was configured for 15 passengers. Passenger seats were arranged in 5 rows of 3, with single seats to the left and double seats to the right and a central walkway. A seat for the cabin crew was placed at the rear adjacent to the left passenger door. Baggage is placed near the right passenger door or the aft baggage compartment. The aircraft has four exits in the cabin and two exits in the cockpit. The right passenger door is usually blocked with baggage.

The left passenger door was used for evacuation on the accident flight.

1.6.3 Recent maintenance

The last scheduled maintenance check was Equal Maintenance for Maximum Availability (EMMA) number 14 carried on 26 June 2015 (at 24,103.6 TAT and 44,276 TAC). A scheduled left hand propeller replacement was carried out on 22 June 2015. Three unscheduled defects were reported in the 30 days prior to the accident. These were a leak from the RH fuel line, a cracked ignition adapter and a collapsed passenger seat, all of which were

rectified on the date of discovery. The last engine wash was done on 30 June 2015. The last aircraft maintenance release was after the daily check on 01 July 2015.

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

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.

While the aircraft was lying on the seabed, Maldives National Defence Force (MNDF) divers (under the direction of engineers) inspected and in some cases physically moved the flight controls to detect any failures in the flight controls. Their investigations did not reveal any failures in the flight controls.

The flight controls were again inspected by CAA Inspectors after the aircraft was recovered from the seabed. All controls were found functional. In particular, the flap control system was found working; no obvious faults were observed in the flap-elevator interconnect tab; no obvious damage was found in the elevator control cable circuit; and the elevator control rod in the tail fin was observed to respond to control column inputs as expected.

1.6.5 Stall warning system

The aircraft stall warning system comprises of two lift-detecting vanes and switches in the left wing leading edge, and in circuit with a warning light and audible alarm horn. The two vanes are set at slightly different levels in the wing leading edge to ensure effectiveness of the stall warning system at all flap settings. The lower vane is operative over the full flap range of 0 degrees to 37.5 degrees, but the upper vane is effective only with the flaps fully extended. The warning system activates between 4 to 9 knots above the stall speed.

At an aircraft weight of 10,927 lb, with 37.5 degrees of flap deployed and the wings level, the stall speed is 54 knots.

On the accident flight, the PIC recalled seeing the stall warning light but neither pilot recalled hearing an aural warning.

The audible warning (or Mod 6/1277) is required to be installed on all aircraft beginning manufacturer serial number 311 and the aircraft documents confirm mod 6/1277 was incorporated at production.

Post-accident examination of the aircraft revealed that the aural warning horn of the stall warning system was deactivated. It was understood later that it was deactivated primarily due to false activations of the stall warning system distracting the flight crew during the landing and take-off phases, which is inherent in the Wipaire 13000 floats installation.

This modification, which alters the Type Certificate of the aircraft, was not approved by the relevant Certifying Authorities. However, the CAA was made aware, in writing, of the deactivated condition since September 2014, and updated through regular updates.

1.6.6 Powerplants

The aircraft was powered by two Pratt & Whitney Canada PT6A-27 turboprop engines. Each engine is fitted with a Hartzel Propeller Inc. HC-B3TN-3DY three-blade, constant speed propeller which incorporates full feathering and reversing capabilities.

The pilots did not report any anomalies related to the engines or propellers and the post-accident observation of the damages to the propellers indicate the engines were operating at the time of impact.

The engines were sent to Pacific Turbine Brisbane (MV.145.038), a maintenance organisation approved under MCAR-145, for further analysis and testing. Their technical investigation of both engines did not reveal evidence of any component failures except for extreme corrosion attributed to exposure to salt water subsequent to the accident.

1.6.7 Mass and balance

Limitations

Maximum Take-Off Weight	12,500 lb
Maximum Landing Weight	12,500 lb
Unladen CG Station	214.70 inches of datum
Unladen CG position	36% of MAC
Unladen Index	13.74
CG Limits	Forward 207.74 inches (25% of MAC)
	Aft 213.20 inches (32% of MAC)
Estimated landing weight	10,927 lb

Weighing

The aircraft was last weighed on 24 February 2015 by the TMA maintenance organisation (MV.145.025) as per the mass and balance report MAN/2015/WB/002. The mass and balance report includes calculations related to conversion into float configuration and the mass and balance in Index format. The Basic Index at the time of weighing was 13.74. This mass and balance report (number MAN/2015/WB/002) was part of the aircraft documents.

Grouping and Aircraft Prepared for Service (APS) weight

TMA allocates its aircraft to specific aircraft group weights in accordance with MCAR-OPS 1.605 and standard operating procedure C-007. This activity is carried out by TMA CAMO (MV.MG.003). They also calculate the APS weight, i.e. the weight that corresponds to the sum of the basic empty weight, the weight of the crew members and their baggage.

Aircraft weights and index are included in the Aircraft Loading Manual (ALM), Electronic Flight Bag and the Operational Flight Plan. The following information were available on the accident flight.

Reference	Basic Index	APS Index
Mass and Balance Report	13.74	-
Electronic Flight Bag	12.3	9.6
ALM	11.43	
Operational Flight plan	-	11.0

Aircraft Loading

Aircraft loading and weight & balance is done according to the ALM. This manual contains the information required in Operations Manual Part B, Volume 1, Chapter 6 and 7. The ALM indicates two methods for calculating the centre of gravity, i.e. the "pre-determined method" and the "calculator method". Both methods are different to the method provided in the AFM. The two methods are:

Pre-determined method uses a series of pre calculated passenger and loading configurations that ensures that the CG is within limits if loaded according to the applicable placard. This method, even though approved in the ALM, was not in use. It was discontinued after the merger between MAT and T.M.A.

Calculator method uses a manual wheel calculator to determine if the CG is within limits. The calculator is produced by CAVU international and approved for use by CAA via the ALM.

During normal operations weight sheet is done by the dispatchers and handed over to the flight crew at the dispatch office. The ground staff then loads the aircraft and the CG check is done by the flight crew. At outstations, the weight sheet is done by resort staff, and the loading is done by the crew.

TMA uses a free seating policy for their passengers, and it is the responsibility of the flight crew to ensure, by the use of the two above methods, whether the CG is within limits.

Mass and Balance Documentation

The TMA mass and balance documentation includes the operation flight plan (which lists the sectors, flight crew, weight & balance information, sunset times, tides, release statement for loading etc.), passenger list and the luggage list. A copy is attached in Appendix 5.1.

Ground copy of the signed "release" statement is not available.

1.7 Meteorological information

Meteorological information covering the Kuredu area was not available.

1.8 Aids to navigation

The aircraft was operating under visual flight rules. 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 did not report a communication problem.

1.10 Aerodrome and approved facilities

Kuredu water aerodrome and platform is located at 053289N, 732792E. The floating platform was approved on 31 January 1996. The last inspection date was 18 August 2004.

It has two fixed platforms and six mooring buoys. The platform emergency equipment includes a first aid kit, 2 life buoys and an emergency box.

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 the AICC in its recommendations after the 8Q-TMC accident of 17 May 2004 asked 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 8Q-MAG accident of 2 June 2009 asked the CAA to mandate CVRs on all aircraft used in commercial air transport.

1.12 Wreckage and impact information

1.12.1 Accident site

The wreckage was approximately 3 km southeast of Kuredu Resort at a depth of 36.5 m. The aircraft was found lying upside down. Aircraft parts such as steps, a part of the left horizontal stabilizer was found near the aircraft. A few passenger bags, mobile phones, boarding passes were also recovered from the area.

Figure 1: Aircraft wreckage

1.12.2 Examination of baggage

Examination of baggage revealed it was consistent with the luggage list. Four large bags were recovered from the aft baggage compartment.

1.12.3 Underwater salvage operations

The underwater salvage operation was conducted by the Maldives National Defence Force (MNDF). The main obstacle identified by the dive team include lack of equipment appropriate to the dive depth and the fact a lot of time was wasted for decompression. The MNDF report highlighted the need for:

- Nitrox and Trimix diving equipment and training on these equipment.
- Lifting balloons appropriate to the weights associated with such salvage operations.
- General familiarisation on 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

There was no evidence of fire throughout the flight or on impact.

1.15 Survival aspects

1.15.1 Emergency Locator Transmitter (ELT)

8Q-MAN 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 09 June 2013 and the battery expiry is 31 March 2016.

1.15.2 Life jackets

The aircraft had crewmember life vest at every crew seat location and passenger life vest under every passenger seat. The accident aircraft has the statements, “Life Vest Under Your Seat” on the bulkhead separating the cockpit and cabin.

Some passengers reported difficulties in removing the life vest during the evacuation. This was also true in the 8Q-MAT accident of 9 February 2012 where almost all passengers reported they were unable to remove the life vest from the pouch under the seat. The CAA, on 3 September 2014, did carry out an evacuation demonstration to determine if participants were able to remove the vest from the pouch within a reasonable time. This demonstration revealed the participants were able to remove the vest within a reasonable time.

The passengers also had difficulties in removing the life vest from the plastic protective covering. They were assisted by the cabin crew who used his teeth to open the plastic covering. It should be noted this covering has an opening string.

The Operator uses different life jacket stowage designs. It was, however, not possible to determine the exact manufacturer design and attachment method since the aircraft manuals do not contain such design data. Aircraft manual PSM 1-63-2 states "as a customer option, a stowage for a life jacket is fitted under each seat". A customer option SOO 6309 exists for the DHC-6-400 life jacket stowage.

1.15.3 Evacuation

Immediately after the impact and after the aircraft came to a stop, passengers were asked to get life vests from under the seat and evacuate quickly. The left hand main door was opened by the cabin crew and this was used by the passengers and crew for evacuation. The crew provided life jackets to passengers who did not have them.

There was considerable panic within the passengers and some had not inflated the life vests. Cabin crew reported he did not remember giving instructions to all the passengers on use of life jackets during the evacuation but assisted some passengers in inflating life vests while they were in water.

The co-pilot reported a woman and a child, both of whom were without life jackets, holding on to the engine cowl. The cabin crew ordered them to move away from the sinking aircraft but she was unable to do so while holding the child and had to be assisted by the co-pilot. The co-pilot swam to them and took the child from the woman allowing her to swim away. Both the woman and the child had to be supported by the co-pilot as neither had a life vest causing the co-pilot to be dragged down. The co-pilot requested help from the cabin crew who swam to them and assisted the woman to get a life jacket on.

1.16 Tests and research

The engines were damaged but were sent to Pacific Turbines Brisbane (MV.145.038) to verify if there was an engine failure before the accident that may have caused the accident. There was no evidence to suggest catastrophic failure of any engine component. Refer to PTB report AIR 54-15.

1.17 Organisational and management information

1.17.1 Company structure

Trans Maldivian 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) and a maintenance organisation approval (MV.145.025) issued by the CAA.

1.17.2 Operations Manual

The Operations Manual (OM) was compiled with the expressed 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

Relevant chapters include OM Part A Chapter 8.1.8 and Part B Chapter 6.

1.17.3 Aircraft Loading Manual (ALM)

The ALM describes the loading system used by TMA, including the calculations, “See Gee” calculator, standard weights, mass and balance documentation, seat allocation and baggage loading.

1.17.4 Training scheme

Training of flight crew, cabin crew and flight planning staff are covered in Operations Manual Part D. Training of loading staff is conducted separately by the Ground Operations department in accordance with the Ground Operations Manual.

1.17.5 Crew training

Operations Manual Part D 2.1.1.12 states mass and balance shall be taught to the flight crew. Further the syllabus for flight crew training in 2.2.17 specifies mass and balance training should be imparted in flight training, difference training and checked on line checks. Cabin crew training requirements in 2.3.1.1 does not state any training on mass and balance.

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

1.17.6 Loader training

Ground Operations Manual states in 4.4.4 that loaders should be taught principles of loading. The training syllabus in 2.5.1 for dockhands/loaders does not contain a mass and balance training.

1.17.7 Training for flight planning staff

Operations Manual Part D 2.5.2.1.0 requires mass and balance training to be given to flight planning staff.

1.18 Additional information

During the investigation it was found that there were two other mass and balance related occurrence reports recorded by the operator in the months of July and August 2015. Investigation reports of both these incidents were requested by the investigation team, but these were not available as it was decided by the Company that those incidents did not require a formal safety investigation.

1.19 Useful or effective investigation techniques

[Not applicable]

2. Analysis

2.1 General

The take-off from Komandoo was normal without any problems and the pilots did not report any difficulties en-route to Kuredu. There was no evidence within the wreckage (or in subsequent tests) of any significant aircraft defect. Meteorological information covering Kuredu area was not available despite requirements under MCAR-OPS 1 to have weather information at intended landing sites. The company's Operations Manual permits Dispatch to inform crew about destination conditions prior to a flight. No adverse weather conditions were reported.

Crew reports indicate that the aircraft started to pitch up at an approximate altitude between 400 – 300 feet, immediately after the flap controls were moved to the fully down position (37.5°).

Initial investigation was focused on any mechanical failures that could have prevented the normal operation of the aircraft. The investigation identified no failures that could have prevented the normal operation of the aircraft. The investigation team also examined the floats but did not find any pre-existing defects that could have caused leaks. The investigation then moved on to the analysis of the aircraft's mass and balance as a significant amount of baggage was found in the aft cargo compartment. Calculation of the aircraft's mass and balance, based on the distribution of passengers and baggage, showed that the weight was within the approved limits but the centre of gravity position was significantly aft of the approved limits before the aircraft left Komandoo. Consequently, there can be no doubt that this accident was triggered by operating the aircraft outside the Centre of Gravity limitations. The error went undetected at the time of departure from Komandoo because the crew did not ensure the aircraft Centre of Gravity was within limits.

2.2 Scope of the analysis

This analysis is focused on an overview of the aerodynamic reasons for loss of control and the reasons why the crew were unable to regain control when the aircraft went into a stall. This is followed by a review on why the mass and balance error was not detected by the pilots. It also concludes with a review of the organisational and training factors that could have contributed to the events which led to the accident.

2.3 Aerodynamics

2.3.1 Mass and balance

The DHC-6-300 aircraft is certified to a maximum take-off weight of 12,500 lb. The aircraft was loaded to 12,484 lb for the MLE-KOM flight. The take-off mass at Komandoo was 11,240 lb which includes 613 lb of luggage and 420 lb of fuel, and this was within the approved weight limits.

Reconstruction of the distribution of crew, passengers and baggage for the KOM-KUR flight based on the "flight release", crew reports, witness statements and actual baggage

recovered from the wreckage is shown below. The weights in each individual section are round up to the nearest whole number.

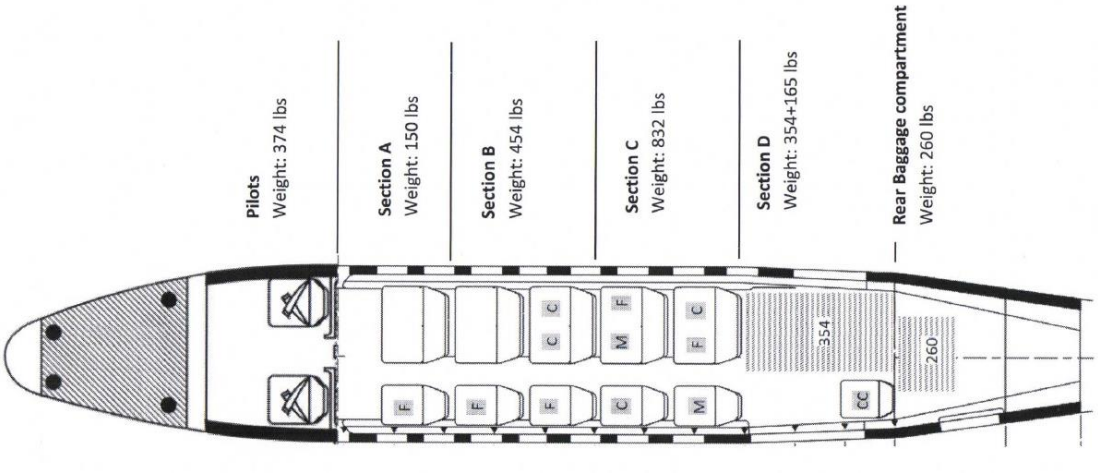

Figure 2: Distribution of crew, passengers and baggage (KOM-KUR flight)

Calculations based on Figure 2 (and the index data in section 1.6.7) indicate the aircraft centre of gravity at Komandoo was significantly aft of the approved limit using any of the indices available to the crew. The CG index at Komandoo should have been less than 13.6.

Centre of Gravity at:	Using maintenance data	Using the electronic flight bag	Using "flight release" data
Komandoo	16.6	15.4	17.7

Table 2: Centre of gravity at Komandoo

2.3.2 Ground handling of cargo

All ground handling of TMA aircraft are done by its staff. Loading at Male' (base) is done by dedicated staff and at all other stations by the air crew. The aircraft, for the MLE-KOM sector, was loaded at Male' by the dedicated loading staff. Offloading of baggage at Komandoo was carried out by the crew.

It should be noted Figure 2 indicates 297 lb of baggage was loaded into the rear compartment even though the Aircraft Loading Manual section 2.2 requires all heavy bags to be loaded in to cabin baggage area.

This in itself is not sufficient to cause a balance problem as it can be compensated by appropriate seating of the passengers. This is demonstrated by the MLE-KOM sector where the centre of gravity was within the approved limits. This was not so for the KOM-KUR flight as the passengers seated in the forward seats disembarked. The flight crew did not detect that, with the baggage unloaded from the front baggage compartment, the seating arrangement, if not changed, would cause the centre of gravity to move. There is

no evidence to suggest the flight crew calculated the mass and balance prior to take off as passenger redistribution was not done.

2.3.3 Flight preparation instructions

TMA Operations Manual Part A section 8.1.8.3 states that for flights departing from MLE an electronic copy of the "flight release" will be kept on ground and for all other flights a signed duplicate carbon copy of the passenger and cargo manifest forms must be left at the departure point.

It should be noted (a) that MCAR-OPS 1.140 requires the signed mass and balance data to be retained on ground and (b) a duplicate carbon copy of the passenger and cargo manifest was not retained at the point of departure. This is permitted in the company's Operations Manual, which states that a passenger and cargo manifest need not be generated if there are no departing passengers or cargo from an outstation.

2.3.4 Aircraft Floats:

The two floats of the aircraft were the first parts recovered from the crash site as they were still floating. These were inspected on the following day and Investigators found water in the aft compartment of both floats. It was not possible to determine if this water had been ingested during the accident or was present prior to the accident.

Company procedures require water to be pumped out of the float at the start and end of each day, however, since this sequence of flights started in the afternoon it was not possible to determine if the float had any water during the KOM-KUR flight.

The CG position would have been moved back further, if the water was there before the accident occurred contributing to uncontrollable pitch up attitude on deployment of the full flaps.

2.3.5 Flight crew handling of aft CG flights and characteristics of aft CG flights

Operator's standard procedure was to take-off with flaps at 20 degrees and elevator trim set within the take-off band. This ensures no abnormal forces act on the control column when the aircraft centre of gravity is within the approved limits. This also allows the pilot to compensate aft centre of gravity take-offs with the trim.

The aircraft speed is reduced for landing and the flaps are moved to the fully down position to create the necessary lift. The elevator loses effectiveness at this reduced speed and greater deflection is required to maintain lift and the nose down moment. The elevator may lose authority at an extreme aft centre of gravity position as its deflection (and hence lift) is physically constrained. Once the aircraft enters a condition where the elevator cannot produce the necessary nose down moment, the aircraft will pitch up and the wings would stall. The aircraft would also stall at a higher speed than the speeds given in the AFM as the result of the CG being aft of the aft limit.

It is possible to recover the aircraft at this point by doing a go-around. A go-around will simultaneously increase the thrust (which produces a nose down pitch moment as the

DHC-6-300 is a high wing aircraft with the thrust line above the centre of gravity) and increase the speed (which produces greater lift at the elevator and hence a greater nose down moment).

A reduction in power, on the other hand, would aggravate the stall condition.

2.3.6 Flight Controls

The investigation deemed that the flight controls were functional and had no contribution to the accident.

2.3.7 Recovery attempt

The flight characteristics described by the flight crew from the time the co-pilot stated she was unable to control the aircraft, to the time the aircraft crashed, bear the hallmarks of a stall. The pilot flying was, however, unable to determine the aircraft was going into a stall and handed over the controls to the PIC. The PIC interpreted the flight characteristics as those of a spin and applied the spin recovery procedures.

The PIC applied full left rudder, moved the control column forward and put the power levers to idle. These proved ineffective as the loss of engine power would reduce thrust and speed aggravating the stall condition. The nose of the aircraft thus continued to rise. The PIC, then moved the flaps to the fully up position where a measure of control was gained.

2.3.8 Stall warning modification

The DHC-6-300 is fitted with a stall warning light and aural horn, which activate 4 – 9 knots above the stall speed.

The stall warning light is on the left hand side and the PIC confirmed seeing the light illuminated when the co-pilot asked him to take over the controls. The co-pilot, on the right seat, did not report seeing the light. Neither pilot heard any aural warnings as the stall warning horn was removed from the aircraft.

Without these warnings; the buffeting of the control column was construed by the PF as "aircraft vibrating" uncontrollably. Had the aural warning been functional, the PF would have been alerted of the impending stall for recovery action in time.

Removal of the stall warning horn was done by the Operator as stall warning activates frequently during take-off and landing causing a nuisance to the pilots.

It is not clear why the PIC did not react to the stall warning light that illuminated and the unusually nose up attitude of the aircraft and subsequent buffeting before the PF asked him to take over the controls. It is common that the stall warning (light and horn) activates at both the take-off roll and touch down during the landing phase. The flight crew are accustomed to this but should have recognised the warning light illuminating while still in flight. However, had the aural warning been active this would have made the crew become alerted to take corrective action in time.

This change is done on the majority of the TMA fleet and is not supported by design information. A CAA audit of TMA CAMO in March 2014 revealed a number of unapproved changes on the TMA aircraft fleet. TMA was requested to do a fleet campaign and 98 unapproved changes were identified many of which were applied across the fleet.

The removal of stall warning horn is one of these unapproved changes and remain uncorrected. At the time of the accident 61 of the original 98 unapproved changes were rectified.

2.4 Training of DHC-6 crews

The operator is approved to conduct DHC-6 type conversion and recurrent training courses by the CAA through Operations Manual Part D. The type conversion consists of a ground training component (of approximately 2-3 days) and a flight training component (of approximately 1-5 hours).

The training syllabus requires all flight crew to undergo ground training on mass and balance; stall warning system; and procedures for normal and abnormal conditions among other things. The syllabus of the flight training also includes aspects of mass and balance; and approach to stall. The Operator Proficiency Check (OPC) also requires approach to stall with two different stalls for the initial OPC and one stall for the recurrent OPC. Section 3.3 of OM Part D requires recovery action to be taken on the first symptoms of the stall (stall warning light/horn or buffet).

It should be noted pilots are trained on the basis of a stall warning light/horn and buffet even though the aural warning horn is deactivated on majority of the Operator's fleet.

Captains undergo a separate 2 day, 13 hour course on the specific duties and responsibilities of the commander.

The PIC last completed his aircraft flight training on 12 March 2015. This included training on mass and balance and approach to stall under ‘clean’ (0 degrees) and ‘full’ (37.5 degrees) flap settings.

PIC’s last operator proficiency check (OPC) was done on 13 March 2015. This skill test included a review of mass and balance and approach to stall at 20 degrees flap setting. The OPC found him to be competent for PIC duties.

The co-pilot last completed her aircraft flight training on 13 May 2015. This included training on mass and balance and approach to stall under ‘clean’ (0 degrees), take-off (20 degrees) and ‘full’ (37.5 degrees) flap settings.

Co-pilot’s last operator proficiency check (OPC) was done on 15 May 2015. This skill test included a review of mass and balance and approach to stall at 0, 20 and 37.5 degrees. The OPC found her to be competent for co-pilot duties.

2.5 [Reserved]

2.6 Survival Aspects

2.6.1 Distress Signal

Air Safety Circular AW-12 requires all aircraft to be fitted with an ELT that meets or exceeds FAA TSO C91a and complies with European Directive 62.

The aircraft had an Artex model C406-1 ELT (that meets both the EU ETSO 2C126 the FAA TSO C126 requirements) mounted to the left of the fuselage, immediately behind the rear cabin bulkhead. The ELT was fixed horizontally with the primary G-switch oriented to the direction of flight. The G-switch activates automatically at speeds exceeding 2.3 g.

A distress signal was, however, not received from the aircraft on impact. A feature common to all the DHC-6 accidents in the Maldives most of which have occurred over water.

The ELT was sent to Australian Avionics Pty Ltd (CASA approval number 3280) for investigation, however it was not possible to determine if the ELT activated or not on impact. The G-switch was found seized but this was attributed corrosion due to salt water ingress. The report also states the "ELT is not designed to operate underwater or activate on contact with water. ELT will only activate with a nose first collision".

Australian Transport Safety Bureau (ATSB) research investigation AR-2012-128 on the effectiveness of ELTs in aviation accidents found lack of water proofing, disconnection of the co-axial antenna cable from the unit during impact, damage to the antennae during impact and aircraft coming to rest inverted after impact, among other things, as factors that could affect ELT performance. Damage to the antenna cable and aircraft resting inverted were common to this specific accident.

It is also noted (although unrelated to this accident), the FAA now requires TSO 126b certified ELTs after NTSB recommendation A-10-170 on inadequate mounting and retention requirements of hook and loop fasteners under TSO C91a.

2.6.2 Evacuation

Evacuation began immediately after the aircraft settled as there was rapid water ingress. All the passengers and crew evacuated through the left main door. The right main door was blocked as this is the area where baggage is kept. The cabin crew reported the baggage was secure during the evacuation. A bag was however was seen to escape the aircraft as it became fully submerged.

Three main issues were noted from the interviews of the crew and passengers. These were:

a. Several passengers could not remove the life jacket from its storage location under the seat.

b. Teeth was used to extract life jackets from the outer protective plastic bag.
c. Many passengers did not inflate the life vest on evacuation.

Passengers are briefed on evacuation procedures through audio visual presentation prior to boarding and a passenger briefing card in the front seat pocket. These include instructions on the use of life jackets in an emergency evacuation. The audio visual presentation loops and specific attention of the passengers are not drawn to it prior to boarding.

Guidance to the crew on emergency evacuation procedures is provided in OM Part B Chapter 11.2. These also include brief positive messages such as "Take life vest from under your seat".

Difficulties in life jacket removal was also true in the 8Q-MAT accident of 9 February 2012 where almost all passengers reported they were unable to remove the life vest from the pouch under the seat. The CAA, on 3 September 2014, did carry out an evacuation demonstration to determine if participants were able to remove the vest from the pouch within a reasonable time. This demonstration revealed the participants were able to remove the vest within a reasonable time.

It should be noted CS 23.1415(a) states emergency floatation and signalling equipment required by the operating rules must be installed so that it is readily available to the crew and passengers.

Further review of the seats and the life vest pouches revealed, as the DHC-6 aircraft seats do not have an associated component maintenance manual, the company uses FAA AC 43.13-1B to repair and maintain these seats. Specific repair designs have not been produced by the company and it is not clear if the CS 23.1415(a) requirements are being met.

2.6.3 Emergency Response

The crash was seen by four people at Kuredu jetty (which included a TMA pilot and cabin crew) and immediately took on a launch to rescue any survivors. The passengers were rescued before any planned emergency response can take effect.

ASC 14-2 paragraph 11 requires a standby boat at least 200 m away from the floating platform when the aircraft is ready to land. Further paragraph 15 requires a trained firefighting and rescue agent to be in attendance on the boat at any landing. This standby boat was not at the platform at the time of the accident.

3. Conclusions

3.1 Findings

a. The crew were properly licenced and qualified to operate the flight.

b. The aircraft had a Certificate of Airworthiness and a current Airworthiness Review Certificate.

c. There were significant discrepancies between the various aircraft mass and balance documents available to the pilot for calculating mass and balance.

d. The aircraft aft baggage compartment was not loaded in accordance with the Operator's approved procedures.

e. The PIC did not verify whether the actual loading was carried out in accordance with the "flight release".

f. There was no evidence the CG index was calculated prior to departure from Komandoo.

g. The aircraft's centre of gravity was significantly aft of the approved limit at the time of departure from Komandoo.

h. The pilots did not experience any unusual handling difficulties until the approach phase, and the full flaps were deployed, when the aircraft pitched up uncontrollably.

i. The imminent stall warning signs (stall warning light/buffet) were not recognised by the flight crew

j. The removal of aircraft stall warning horn was not in accordance with the regulation.

k. The regulator was made aware of the removed stall warning horn since 2014.

l. During take-off and landings, the stall warning comes on frequently on aircraft fitted with Wipaire 13000 floats under Transport Canada Supplementary Type Certificate Number SA93-103.

m. The aircraft was found to have been embodied with several unapproved modifications.

n. The aircraft ELT did not activate on impact.

3.2. Causes

The investigation identified the following causes;

a. The aircraft was operated outside the centre of gravity limitations on the sector in which the accident occurred.

b. The load distribution errors went undetected because the mass and balance calculations were not carried out in accordance with the approved procedures, prior to the accident flight.

c. The co-pilot (PF) was not alerted to the impending stall as she neither saw the stall warning light illuminated nor heard the aural stall warning.

d. The PIC was not able to gain control of aircraft as developing stall was not recognised and incorrect recovery procedures were applied.

4. Safety Recommendations

4.1 Recommendations to the CAA

a. Determine if the emergency locator transmitter requirements specified in Air Safety Circular AW-12 are adequate to meet an expeditious emergency response. Based on the results of this determination revise, as necessary, the regulatory requirements on emergency locator transmitters.

b. Evaluate and enhance its oversight techniques to more effectively identify and address unapproved changes to the aircraft type design.

c. Review the flight operations and training manuals of Trans Maldivian Airways to ensure that the requirements of the current operational regulations are met and practiced.

d. Determine the actual life jacket and stowage requirements for DHC-6 aircraft and ensure, during aircraft continuing airworthiness monitoring (ACAM) surveys, whether the aircraft meet these requirements.

e. Review and consider recommendation 4.3 in the accident report of 8Q-MAG (Twin Otter) crash of 2 June 2009 on mandating installation of cockpit voice recorders on all aircraft used for commercial air transport operations.

f. Inspect all water aerodromes in a timely manner to ensure they meet the regulatory standards.

g. Ensure all Operators comply with search and rescue requirements, including the requirement to have a standby boat at the time of an aircraft arrival or departure.

4.2 Recommendations to the Operator

a. Review and update the Operations Manual, Training Manual and the Loading Manual to reflect the current regulations in force and expand these documents to include detailed descriptions of mass and balance and upset recovery procedures.

b. Train crew on mass and balance; stall recognition and stall recovery procedures.

c. Ensure crew carry out aircraft load distribution and CG calculation prior to each departure and especially at transit points.

d. Reinstate stall warning systems on all affected aircraft to meet the aircraft certification standards.

e. Ensure all unapproved changes to the aircraft type design are either removed or get them approved in accordance with the civil aviation regulations.

f. Ensure passengers receive a demonstration of the safety procedures including use and location of life jackets including how to remove the life jacket from its packaging.

g. Revise the mass and balance documentation system to ensure flight crew receive a cohesive set of mass and balance information.

h. Implement the Loading Manual immediately and train all flight preparation staff (including but not limited to dispatchers, loaders, resort agents and reservation staff) on the requirements specified in the Manual.

i. Ensure a signed copy of the mass and balance statement is retained on ground at each departure point.

j. Ensure a standby boat is present at all landing sites at the time of an aircraft arrival or departure.

4.3 Recommendations to the Supplemental Type Certificate holder (Wipaire, Inc.)

a. Determine if aircraft incorporated with Transport Canada supplemental type certificate number SA93-103 (Wipaire 13000 floats) meet the requirements specified in Transport Canada Civil Aviation Regulations Part V Chapter 523 paragraph 207 (stall warning). Based on the results of this determination revise, as necessary, the supplemental type certificate.

4.4 Recommendations to the Search and Rescue Provider (MNDF)

a. Equip and train its staff to ensure under water search and rescue operations can be carried out at depths no less than 60 m, as presently MNDF is equipped and trained to carry out search and rescue operations at a maximum depth of 40 m.

5. Appendices

5.1 Flight Release

a. Operational Flight Plan

OPERATIONAL FLIGHT PLAN - DAY / VFR — TMA FLIGHT RELEASE

02-Jul-15	19:36	FLT371301		8Q-MAN	8508	11.0	12500	KTAS 135

SECTOR	MLE-KOM	KOM-KUR	S/D Night	KUR-MLE				
SKED.	1615	1707		600				
ETE	37	4		39				
MAG. BRG	360	038		181				
DIST (nm)	79	4		81				
OFF BLOCK								
TAKE OFF								
LAND								
ON BLOCK								
AIR TIME								
BLOCK TIME								
BOARDING	15(3)+0	0(0)+0		0(0)+0				
TOT ON BOARD	15(3)+0	11(1)+0		0(0)+0				
DISEMBARKING	4(2)+0	11(1)+0		0(0)+0				
A/C APS	8508	8508		8508				
PAX	2,377	1,699		0				
BAGGAGE	779	613		0				
MAN AJUST.	0	0		0				
+/- FUEL	-435	0		0				
FUEL @ T/O	820	420		350				
T/O MASS	12,484	11,240		8,858				
MAN AJUST.	0	0		0				
SECTOR BURN	370	40		390				
LDG MASS	12,114	11,200		8,468				
OPS FUEL O/B	470	440		380				
MIN FUEL REQ	1270	870		770				
'+/- FUEL	-435	0		0				
FUEL @ DEP	835	435		365				
SECTOR BURN	370	40		390				
TAXI FUEL	30	30		30				
FUEL @ ARR	435	365		-55				
TOTAL BURN	400	470		890				
C of G INDEX								

Flight Crew		Phone No.
CPT	RDZO - Ravindra De Zoysa	7461574
F/O	JOKA - Josephine Kaagegaa	7448628
C/A	AAGA - Ahadh Abdul Gadir A	7697111
DISP	Maaha - Dayres	

Sunset/Grounding		
	02.07.2015	03.07.2015
TWIL From	5:37	5:37
Sunrise	5:59	5:59
Sunset	18:21	18:21
Grounding	18:43	18:43
TWIL to	18:43	18:43

Tides			
7/2/2015		7/3/2015	
Time	Tide	Time	Tide
6:48	0.1	7:25	0.0
13:37	1.0	14:10	1.0
19:55	0.3	20:27	0.2

This aircaft is loaded in accordance with MCAR Ops 1.605 for the above flights.

This flight release has been prepared in accordance with MCAR Ops- 1 and the 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
0		TOTAL COUNT	0	0		KOM
0		TOTAL COUNT	0	0		KUR

Route: KOM - (KOMR-3/0), KUR - (KURR-12/0)

BUMPED / ADDITIONAL BAGGAGE / VIP/ RESORT DHONI INFORMATION

DELAY / OUTSTATION DEFECT REPORT

NOTAMS See Reverse Side

b. Passenger List

Pax list - Flight Release: Departures from MLE
Flight date: July 2, 2015 Flight Filters : No.: FLT371301
Maldivian Air Taxi

July 2, 2015
Page 1
MAAHA

Captain	RDZO(C)	Released Time	7:36:36 PM	First released Time	4:03:38 PM	Check in Closed	3:51:46 PM
First Officer	JOKA(F)	Released Date	07/02/15	First released Date	07/02/15		
Flight Attendant	AAGA(CA)	Released By	MAAHA	First released By	MAAHA		

Aircraft MAN Flight Colour:
Flight No. FLT371301 **Routing MLE - KOM - KUR**

Arr. Airport KOM Departure 4:15:00 PM Arrival 4:52:00 PM

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
5451559	PEARCE, PHILIP		MALE	KUREDU ISL		EK652	1	41.00	1	5.50	3:35:29	Nizam	
5451560	HANDSCOMBE, SARAH		FEMAL	KUREDU ISL		EK652	1	41.00	1	5.50	3:35:32	Nizam	
5457406	AHMED MOHAMED		MALE	KUREDU ISL		MLE	0	0.00	1	10.00	3:12:31	fathimat	TMA CAPTAI

Arr. Airport KOM Departure 4:15:00 PM Arrival 4:52:00 PM

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
5457520	HALEEMA	CONFIRME	FEMAL	KUREDU ISL		MLE	1	16.50	0	0.00	3:08:50	jiedi.do	
							3	98.50	3	21.00			

Pax #	Pax Weight			
4	678.00	Luggage Count/Weight	6	119.50

Arr. Airport KUR Departure 4:15:00 PM Arrival 5:11:00 PM

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
5451544	FUHRY, ALEXANDER		MALE	KUREDU ISL		EK652	1	42.45	1	8.98	3:37:20	ahmed.	
5451545	FUHRY, ANDREMAURIC		MALE	KUREDU ISL		EK652	1	42.45	1	8.98	3:38:13	ahmed.	
5451546	FUHRY, KARIN		FEMAL	KUREDU ISL		EK652	0	0.00	1	8.98	3:37:29	ahmed.	
5451547	FUHRY, RENEANGELO		MALE	KUREDU ISL		EK652	0	0.00	1	8.98	3:37:42	ahmed.	
5456138	FREY, DIANA		MALE	KUREDU ISL		EK652	1	42.00	1	5.50	3:44:00	Nizam	
5456139	FREY, SVENJA SABRIN		FEMAL	KUREDU ISL		EK652	1	42.00	1	5.50	3:44:04	Nizam	
5456251	STRATMEIER ALEXAND		FEMAL	KUREDU ISL		EK652	2	61.20	1	14.67	3:42:00	jiedi.do	
5456252	STRATMEIER NASTASS		CHILD	KUREDU ISL		EK652	2	61.20	1	14.67	3:44:21	jiedi.do	
5456253	STRATMEIER NICOLAI		CHILD	KUREDU ISL		EK652	1	30.60	1	14.67	3:42:10	jiedi.do	
5456254	STRATMEIER RAINER-J		MALE	KUREDU ISL		EK652	0	0.00	0	0.00	3:42:26	jiedi.do	
5457247	LIZ		FEMAL	KUREDU ISL		MLE	2	22.60	1	5.00	2:50:39	jiedi.do	
							11	344.50	10	95.90			

Pax #	Pax Weight			
11	1,699.00	Luggage Count/Weight	21	440.40

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	14	443.00	13	116.90	27	559.90	15	2,377.00	2,937.00
KOM	11	344.50	10	95.90	21	440.40	11	1,699.00	2,140.00

c. Luggage List

Luggage list - Flight Release: Departures from MLE

July 2, 2015
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MAAHA

Flight date: July 2, 2015 Flight Filters : No.: FLT371301
Maldivian Air Taxi

Captain	RDZO(C)	Released time	7:36:36 PM	First released Time	4:03:38 PM	Check in Closed	3:51:46 PM
First Officer	JOKA(F)	Released Date	07/02/15	First released Date	07/02/15		
Flight Attendant	AAGA(CA)	Released By	MAAHA	First released By	MAAHA		

Aircraft MAN
Flight No. FLT371301 **Routing MLE - KOM - KUR**

Luggage:

No.	Passeng No.	Passenger name	Check In Time	Luggage Weight	Barcode	Dep. Destination	Arr. Destination	CO mail name	Cargo	Cargo customer
1	0		9:18:06 AM	46.08	0002529595106	MLE	KOM	lost and found to KOM	Yes	1000
2	5451559	PEARCE, PHILIP	3:35:42 PM	42.00	00025303591	MLEB	KOMR		No	
3	5451559	PEARCE, PHILIP	3:35:59 PM	40.00	00025303592	MLEB	KOMR		No	
4	5451549	SIEBERS, SEBAS	3:00:47 PM	42.00	00025302811	MLEB	KURR		No	
5	5451549	SIEBERS, SEBAS	3:00:59 PM	40.00	00025302812	MLEB	KURR		No	
6	5451544	FUHRY, ALEXAN	3:40:53 PM	43.00	00025303616	MLEB	KURR		No	
7	5451544	FUHRY, ALEXAN	3:42:23 PM	41.90	00025303618	MLEB	KURR		No	
8	5456138	FREY, DIANA	3:44:25 PM	42.00	00025303761	MLEB	KURR		No	
9	5456138	FREY, DIANA	3:44:40 PM	42.00	00025303762	MLEB	KURR		No	
10	5456249	STELLING, CHRIS	3:34:55 PM	44.00	00025303551	MLEB	KURR		No	
11	5456249	STELLING, CHRIS	3:35:09 PM	44.00	00025303552	MLEB	KURR		No	
12	5456251	STRATMEIER AL	3:44:42 PM	63.00	00025303712	MLEB	KURR		No	
13	5456251	STRATMEIER AL	3:47:59 PM	27.00	00025303717	MLEB	KURR		No	
14	5456251	STRATMEIER AL	3:49:01 PM	17.00	000253037110	MLEB	KURR		No	
15	5456251	STRATMEIER AL	3:49:12 PM	28.00	000253037111	MLEB	KURR		No	
16	5456251	STRATMEIER AL	3:49:29 PM	18.00	000253037112	MLEB	KURR		No	
17	5457520	HALEEMA	3:09:06 PM	16.50	00025303011	MLEB	KURR		No	
18	5457247	LIZ	2:50:55 PM	11.00	00025302391	MLEB	KURR		No	
19	5457247	LIZ	2:51:09 PM	11.60	00025302392	MLEB	KURR		No	
		Total Luggage Weight		659.08	19					

Hand-luggage:

No.	Passeng No.	Passenger name	Check In Time	Luggage weight	Barcode	Dep. Destination	Arr. Destination
1	5451559	PEARCE, PHILIP	3:37:28 PM	5.00	00025303593	MLEB	KOMR
2	5451559	PEARCE, PHILIP	3:37:30 PM	6.00	00025303594	MLEB	KOMR
3	5457406	AHMED MOHAME	3:12:35 PM	10.00	00025303031	MLEB	KOMR
4	5451544	FUHRY, ALEXAN	3:39:10 PM	8.50	00025303611	MLEB	KURR
5	5451544	FUHRY, ALEXAN	3:39:45 PM	8.00	00025303612	MLEB	KURR
6	5451544	FUHRY, ALEXAN	3:40:00 PM	10.00	00025303613	MLEB	KURR
7	5451544	FUHRY, ALEXAN	3:40:15 PM	9.40	00025303614	MLEB	KURR
8	5456138	FREY, DIANA	3:44:56 PM	5.00	00025303763	MLEB	KURR
9	5456138	FREY, DIANA	3:44:58 PM	6.00	00025303764	MLEB	KURR
10	5456251	STRATMEIER AL	3:47:33 PM	10.70	00025303716	MLEB	KURR
11	5456251	STRATMEIER AL	3:48:37 PM	16.80	00025303718	MLEB	KURR
12	5456251	STRATMEIER AL	3:48:49 PM	16.50	00025303719	MLEB	KURR
13	5457247	LIZ	2:51:30 PM	5.00	00025302393	MLEB	KURR
		Total Luggage Weight		116.90	13		

5.2 List of Abbreviations

AICC	: Accident Investigation Coordinating Committee
ATC	: Air Traffic Controller
CG	: Centre of Gravity
C of A	: Certificate of Airworthiness
COM	: Communication
C of R	: Certificate of Registration
CRM	: Crew Resource Management
CVR	: Cockpit Voice Recorder
DHC-6-300	: Viking Air Twin Otter 300 Series
F/O	: First Officer
HF	: High Frequency
ICAO	: International Civil Aviation Organization
IFR	: Instrument Flight Rules
KOM	: Komandoo Resort
km	: Kilometer
KUR	: Kuredu Resort
lb	: Pounds
LH	: Left hand
LMC	: Last Minute Change
LT	: Local time
CAA	: Maldives Civil Aviation Authority
MCAR	: Maldivian Civil Aviation Regulation
MEL	: Minimum Equipment List
MLE	: Male’
MNDF	: Maldives National Defence Force
MTOW	: Maximum take-off weight
NM	: Nautical Mile
OM	: Operations Manual
OPC	: Operational Proficiency Check
PF	: Pilot Flying
PIC	: Pilot in command
PROP	: Propeller
RH	: Right hand
RWY	: Runway
SIC	: Second in command
SOP	: Standard Operating Procedures
TBA	: To be assessed
TBD	: To be determined
TMA	: Trans Maldivian Airways Pvt. Ltd.
UTC	: Universal Coordinated Time
VFR	: Visual Flight Rules
VMC	: Visual Meteorological Conditions