AIRCRAFT ACCIDENT

FINAL REPORT

A 06/19

Air Accident Investigation Bureau (AAIB)

Ministry of Transport Malaysia

Accident Involving Light Sport Amphibious Aircraft

Super Petrel LS Registration 9M-ETC

at Marina Island Lumut Perak

on the 17 August 2019

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AIR ACCIDENT INVESTIGATION BUREAU (AAIB)
MALAYSIA

ACCIDENT REPORT NO. : A 06/19

OPERATOR	**:**	**PRIVATE**
AIRCRAFT TYPE	**:**	**SCODA AERONAUTICA, SUPER PETREL LS**
NATIONALITY	**:**	**MALAYSIA**
REGISTRATION	**:**	**9M-ETC**
PLACE OF OCCURRENCE	**:**	**MARINA ISLANDS LUMUT, PERAK**
DATE AND TIME	**:**	**17 AUGUST 2019 AT 1005LT**

The sole objective of the investigation is the prevention of accidents and incidents. In accordance with Annex 13 to the Convention on International Civil Aviation, it is not the purpose of this investigation to apportion blame or liability.

All times in this report are Local Time (LT) unless stated otherwise. LT is UTC +8 hours.

INTRODUCTION

The Air Accident Investigation Bureau of Malaysia

The Air Accident Investigation Bureau (AAIB) is the air accident and serious incident investigation authority in Malaysia and is responsible to the Minister of Transport. Its mission is to promote aviation safety through the conduct of independent and objective investigations into air accidents and serious incidents.

The AAIB conducts the investigations in accordance with Annex 13 to the Chicago Convention and Civil Aviation Regulations of Malaysia 2016.

It is inappropriate that AAIB reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

In accordance with ICAO Annex 13 paragraph 4.1, notification of the accident was sent on 19 September 2019 to Civil Aviation Authority of Malaysia as State of Registry/Occurrence, Brazil AIG CENIPA as State of Design and the Operator. A copy of the Preliminary Report was subsequently submitted to the above organization on 23 September 2019.

In accordance with ICAO Annex 13 paragraph 6.3, a copy of the Draft Final Report was sent on 18 June 2020 to Civil Aviation Authority of Malaysia as State of Registry/Occurrence, Brazil AIG CENIPA and SCODA Aeronautica Brazil as State of Design and the Operator inviting their significant and substantiated comments on the report.

Unless otherwise indicated, recommendations in this report are addressed to the investigating or regulatory authorities of the State having responsibility for the matters with which the recommendations are concerned. It is for those authorities to decide what action is taken.

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GLOSSARY OF ABBREVIATIONS

A

AAIB	Air Accident Investigation Bureau
AIC	Aeronautical Information Circulars
AIG	Aircraft Investigation Group
AMSL	Above Mean Sea Level
ARFOR	Area Forecast
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATD	Actual Time of Departure
ATZ	Aerodrome Traffic Zone

C

CAAM	Civil Aviation Authority Malaysia
Cb	Cumulonimbus Clouds
CENIPA	Aeronautical Accident Investigation and Prevention Centre
C of G	Centre of Gravity
cm	centimetres
Cu	Cumulus Clouds

E

EAAM	Experimental Aircraft Association Malaysia
etc	et cetera or ‘other similar things’

F

FAA	Federal Aviation Administration
FESEM-EDX	Field Emission Scanning Electron Microscope - Energy Dispersive X-Ray
FEW	few
FH	Flight Hours
ft	feet

G

G/g	acceleration of gravity
GPS	Global Positioning System

H

HP	Horse Power
hrs	hours

I

IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
ie	id est or ‘that is’
IMC	Instrument Meteorological Conditions
in	inches

K

kg	kilogram
kts	knots

L

lbs	pounds
LS	Light Sport

M

m	metres
mph	miles per hour
MTOW	Maximum Take-Off Weight

N

nm	nautical miles

P

PCB	Printed Circuit Board
PPL	Private Pilot’s Licence

R

RPM	Revolutions per Minute

S

SATCO	Senior Air Traffic Controller
STRIDE	Science & Technology Research Institute for Defence

T

TAFOR	Terminal Aerodrome Forecast
TOD	Top of Descend

U

U.S	United States

V

VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

SYNOPSIS

On 17 August 2019 at approximately 0835hrs, a light sport bi-plane amphibious aircraft Super Petrel bearing registration 9M-ETC took-off from Subang Airport (WMSA) for a leisure flight to Marina Island, Lumut, Perak and back to Subang later in the day.

Upon arriving at Lumut, while turning on to final approach, the aircraft encountered some turbulence with aircraft speed at 70mph. Power was applied to maintain a safe turn. This resulted in a slightly higher altitude and a later touch down point than was intended.

During the landing, the first touch on the water was smooth and stable. Subsequently, on the second touch, there was a rapid deceleration of the aircraft and water was gushing into the cockpit resulting in cockpit flooding. The aircraft came to a halt with the engine operating at full throttle. After a few minutes the engine with pusher-propeller, still running at full speed, toppled the aircraft upside down. The engine stopped when it was immersed in the water.

The occupants escaped the aircraft safely with both suffering minor injuries upon evacuating the aircraft whilst in the water. The wreckage was immediately removed and towed by a boat to the marina.

In accordance to ICAO Annex 13, notification of the accident was sent to Brazil AIG (CENIPA) as state of design. CENIPA appointed Mr Daniel Barbosa Amancio as Brazil's Accredited Representative and Mr Rodrigo Scoda as advisor from SCODA Aeronautica. A Preliminary Report was subsequently submitted to CENIPA on 23 September 2019.

AAIB Malaysia appointed Dr Marwan Maurizio Chedid as a technical advisor to assist in the investigation. He is a member of the Experimental Aircraft Association Malaysia (EAAM) who are acting as an Interested Party in this investigation.

1.0 FACTUAL INFORMATION

1.1 History of the Flight

On Friday 16 August 2019 at 1830hrs, a flight plan was filed by email to Subang Tower for a planned departure at 0800hrs on Saturday 17 August 2019 morning for light sport bi-plane amphibious aircraft Super Petrel (9M-ETC) to Marina Island, Lumut and back to Subang in the afternoon. The Lumut Naval Base was advised by WhatsApp text message of expected arrival at 0930hrs and expected return to Subang at 1330hrs.

Figure 1: Light Sport Bi-Plane Amphibious Aircraft Super Petrel

After a pre-flight check and at 0758hrs on 17 August 2019, the pilot telephoned Subang Tower to confirm the received of flight plan and advised that he would be calling them on the ground frequency in about 15 minutes. At 0815hrs, when requesting Subang Ground (121.9) for start-up and air traffic clearance, the pilot was advised that the airfield status was IMC.

Both the pilot and passenger disembarked and waited until 0855hrs when the pilot phoned the tower again for an update on weather conditions. Subang advised that conditions were now VMC. 9M-ETC departed shortly afterwards and were airborne by about 0910hrs. Conditions were calm en-route to Lumut with the haze top at 1500ft and no visible wave action on the coast despite a forecast 12kts southerly wind.

At Bagan Datoh, 9M-ETC was transferred from Lumpur Information to Ipoh Tower for clearance to descend for Lumut. Arriving at Lumut, tidal current could be observed on the ships offloading at Lumut Port but no swell. On arriving at Marina Island at about 1005hrs, the pilot noticed the boat ramp was clear and the sea was calm. A ferry had departed from its dedicated terminal a few minutes before and was on its way to Pangkor Island. The pilot performed a circuit at 200ft around Marina Island to alert Marina staff of their arrival and followed the normal landing pattern as agreed with Lumut Naval Base to avoid flying over any part of the base. The pilot advised Ipoh Tower that landing will be in 1 minute (Figure 2).

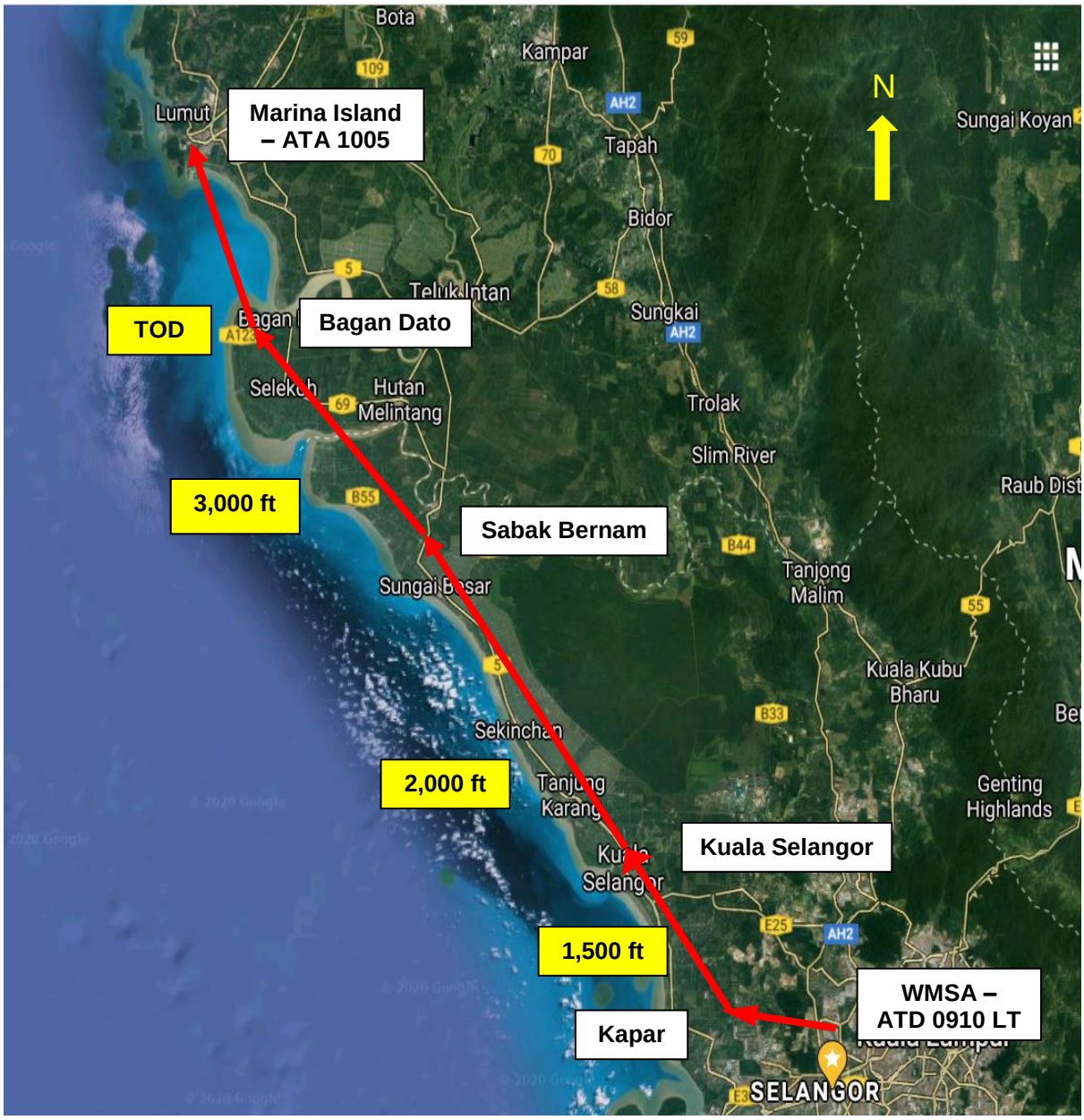


Figure 2: Fight Route Subang (WMSA) to Marina Island, Lumut

Turning on to final approach, the aircraft encountered some turbulence with aircraft speed at 70mph and power was applied to maintain a safe turn. This resulted in a slightly higher altitude and a later touch down point than was intended. The aircraft had an initial touch on the water at about 60mph and was able to see the water had a slight chop of about 6 inches but was well within the range of water conditions of normal operations. The flags on the shore indicated that there was a light headwind with crosswind component.

After the initial touch, the pilot held the aircraft off the water to bleed remaining speed. The track of the aircraft over the water was maintained straight and no floating obstacles or large waves were seen. After the second touch on the water, it hit a slight water chop and there was some heavy vibration couple with a very sudden rapid deceleration of the aircraft. The aircraft subsequently veered right 90^0 from the direction of landing with rapid flooding of the cockpit.

When the aircraft came to a halt, the cockpit was submerged in water with the tail section pointing vertically up and the engine operating at full throttle above water level. The ignition was turned off by the pilot (while cockpit was under water) but the engine did not stop. The water was about 4ft deep and was soft muddy at the bottom.

Both pilot and passenger evacuated the aircraft and remained clear of the aircraft out of concern of fire from the fuel spillage. After a few minutes the engine with pusher-propeller, still running at full speed, toppled the aircraft upside down which then stopped the engine when it fell into the water.

The wreckage was about 200m to 250m from Marina with the tide pushing it further away. The pilot decided to towed the aircraft by boat upside-down with a long rope to the marina where it was lifted out of the water by a crane hooked to the tail and placed under cover in the boat yard. Significant damaged to the cockpit and front fuselage area was sustained when lowering the aircraft to the ground with the crane.

After the aircraft was placed under a roof in the boat yard, the engine cowling was removed. The spark plugs were then removed and the propeller then turned to

remove salt water from the engine. Oil was then put in the cylinders to protect the engine until it can be overhauled.

Both the pilot's and passenger's telephones were lost in the incident. The aircraft logbook, certificate of registration and permit to fly were also lost in the accident. A co-owner of the aircraft, was contacted about 1130 hours, approximately 90 minutes after the accident and asked to advise Ipoh Tower. The delay was a result of the pilot no longer had a record of Ipoh Tower's telephone number.

The police arrived at the Marina at about 1400hrs after being alerted to the event on Facebook. They inspected the aircraft and advise the pilot to lodge a police report on the accident.

Figure 3: Aircraft veered 90^0 right from direction of landing and came to a halt with the nose section submerged in water and tail section vertically up.

Figure 4: Water splash as tail section toppled into water after being forced by the pusher-propeller engine full power.

Figure 5: Aircraft in upside-down position with nose section and engine submerged in water.

Figure 6: A boat arrived immediately to assist the crew.

1.2 Injuries to Persons

Injuries	Pilot	Passenger
Fatal	Nil	Nil
Serious	Nil	Nil
Minor	1	1
None	Nil	Nil

Figure 7: Injuries to Person

1.3 Damage to Aircraft

The aircraft broke at mid-section just in front of the bulkhead dividing the cockpit and tail section. The starboard side of the cockpit and hull sustained heavy damage with the right window and door missing. The port side of the cockpit and hull was fairly intact with a broken gap through the fuselage and hull just front of the bulkhead. The left window and door were still attached in position.

The left pilot seat was relatively intact while the right passenger seat broke and collapsed to the cockpit floor. Significant damage to the windscreen and nose section were sustained when the crane lowered the aircraft onto the ramp area during salvage operations.

Figure 8: Aircraft wreckage was towed upside-down from the crash site to the marina ramp by a boat.

Figure 9: Significant damage to the cockpit and nose section when the aircraft wreckage was lifted and lowered to the upright position by a crane.

Figure 10: Aircraft wreckage in upright position with fuselage broken into two pieces. Cockpit area and nose section heavily damage during lowering process by the crane onto the ramp.

Figure 11: Port Side - Aircraft broke into two through the fuselage and hull just in front of the bulkhead dividing the cockpit and tail section. Window and door are still attached and in relative position. Pilot seat relatively intact.

Figure 12: Starboard Side - Fuselage and hull sustained heavy damage with a big tear in front of the bulkhead. Right window and door broke off. Passenger seat broke and collapsed to cockpit floor.

Figure 13: Nose - Damage to the windscreen and nose section during wreckage salvage operations.

1.4 Other Damage

There was no other damage.

1.5 Personnel Information – Pilot in Command (PIC)

Status	Commander
Nationality	Malaysian
Age	59 years old
Gender	Male
License Type	PPL
License Validity	08 March 2018 (Expired)
Medical Examination	31 August 2019
Aircraft Rating	Single engine <5,700kg
Instructor Rating	Nil
Certificate of Test	10 September 2019
Flying Hours	Total hours: 461 hours
	Total on Type: Approx. 200 hours

Figure 14: Personal Information – Pilot in Command (PIC)

1.6 Aircraft Information

1.6.1 General

Super Petrel LS is a light amphibious biplane aircraft with semi-cantilever wings and equilibrium floats attached to its lower wings. The ailerons are located in the upper wings and the tail is conventional, with the horizontal stabilizer built half way up the tail fin. The engine is a pusher configuration attached to the upper wing pylon. A fiberglass cowling encloses the engine. The Super Petrel LS aircraft is manufactured by Scoda Aeronáutica LTDA which is located at Sao Paulo, Brazil.

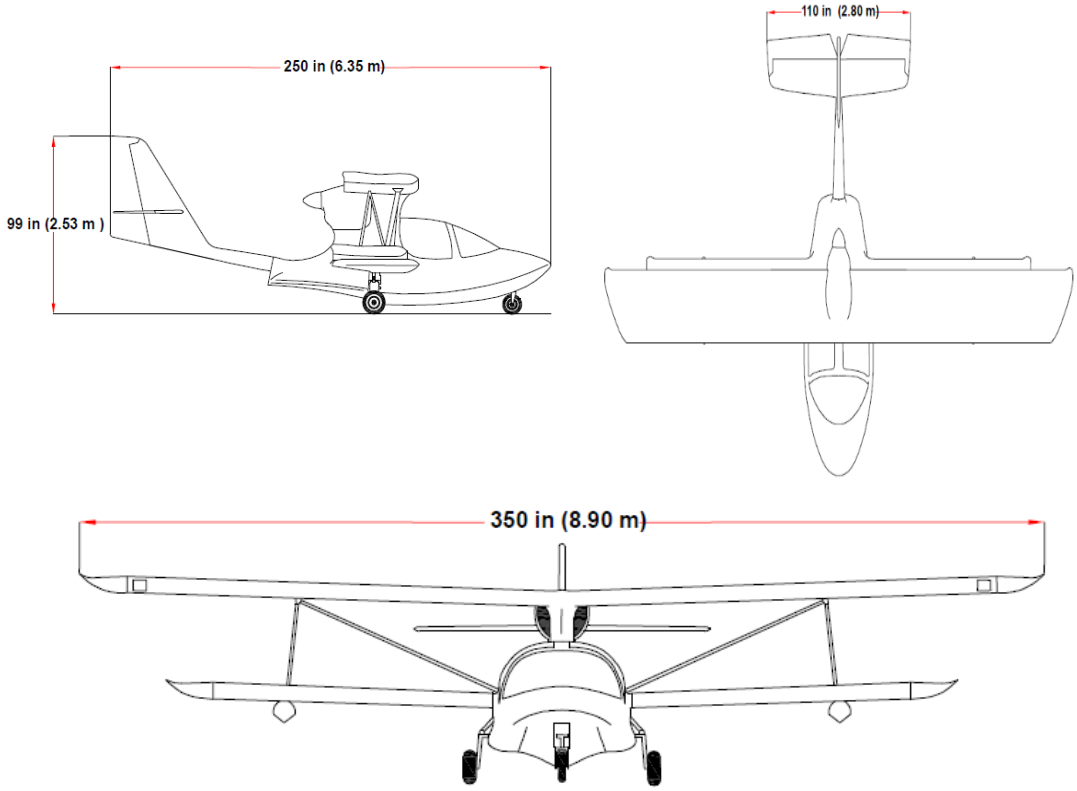


Figure 15: Three View of Aircraft

1.6.2 Fuselage

Two parts comprise the fuselage. The main fuselage and tail. The main fuselage is moulded in fiberglass, carbon and Kevlar and reinforced by fiberglass/PVC foam bulkheads.

The tail is moulded in carbon fibre and has internal PVC foam reinforcements. The detachable horizontal stabilizer is moulded in carbon and Kevlar fibre and has internal PVC foam reinforcements as the control surfaces.

1.6.3 Wings

The upper wings structure has a carbon fibre “C” channel spar, forming a “D” box when bonded to the fibre glass/PVC foam leading edge. The wing tips are made of carbon fibre and the wings are covered with fabric.

The lower wings are built in the same way; the difference is that fibre glass tanks are located in the leading edge. The floats are attached to the lower wing’s structure. The struts are made of 6061-T6 aluminium profile.

1.6.4 Aircraft Data

Aircraft	Super Petrel LS
Manufacturer	Scoda Aeronautica Brazil
Owner	Private
Registration	9M-ETC
Serial No.	S0340
Year of Manufacture	2015
Certificate of Registration No.	M.1988 issued by Civil Aviation Authority Malaysia (CAAM) on 12 Feb 2016.
Permit to Fly	MP.124 issued by CAAM on 12 Feb 2019 valid till 11 Feb 20.
Total Flight Hours	514.91 hours

Figure 16: Aircraft Data

1.6.5 Engine Data

Manufacturer	Rotax BRP-Powertrain GmbH & CO KG. A-4623 Gunskirchen, Austria.
Model	ULS 2

Type	912
Serial	6783866
Total Flight Hours	514.91 hours

Figure 17: Engine Data

1.6.6 Propeller Data

Propeller	3 Blade Propellers with Ground Adjustable Pitch
Manufacturer	Duc Helices
Propeller Model	Hydro Inconel Flash-2 Propeller
HUB Model	MFSH-3
Blade Model	FSH2-G-I
Total Flight Hours	514.91

Figure 18: Propeller Data

1.6.7 Aircraft Performance Specifications

WEIGHT		
Gross Weight (MTOW)	1320lbs / 600kg	
Maximum Zero Wing Fuel Weight	1177lbs / 535kg	
Empty Weight	784lbs / 356kg	
SPEED		
	IAS	
	mph	**knots**
Never Exceed	130	113
Normal Operating	112	97
Maximum Cruise	112	97
Maximum Landing Gear Operating	80	70
Manoeuvring Speed at Gross Weight	80	70
Manoeuvring Speed at Minimum Weight	76	66
Stalling Speed MTOW	40	35
OTHERS		
Load Factors	+4 / -2 g	

Minimum Depth for Secure Operations in Water	30in / 76cm
Maximum Water Wave Length	10in / 25cm
Service Ceiling	10,000ft / 3,000m
Maximum Power (5 minutes)	100HP at 5,800 RPM
Maximum Continuous Power	93 HP at 5,500RPM

Figure 19: Aircraft Performance Specifications

1.6.8 Preventive Maintenance

All maintenance work (Preventive and Corrective) on the aircraft to meet airworthiness requirements were performed by an Approved Engineer as stated in the CAAM Aircraft Permit to Fly. 9M-ETC has flown a total of 514.91 flight hours (FH) as of the day of the accident. The routine maintenance program feature checks at every 50, 100 and 200 hours. Inspection of the Aircraft Technical Log revealed all preventive maintenance checks were performed as schedule satisfactory. The maintenance status follows:

INSPECTION	LAST PERFORMED	NEXT TO BE AT	REMAINING
50 hours	28 November 2018 at 453.20 hours	550 hours	35.09 FH
100 hours	06 June 2019 at 506.51 hours	600 hours	85.09 FH
200 hours	29 March 2018 at 399.71 hours	600 hours	85.09 FH

Figure 20: Preventive Maintenance Status

During the 100 hours' inspection on the 06 June 2019, two small cracks were found under the passenger seat frame (Figure 21) and were patched repaired satisfactory in accordance with Repair Scheme Super Petrel LS Chapter 3 Airframe Damage, paragraph 3.2.5 Damage Rear Rib of Seat Pan.

The repair work was carried out by the approved engineer and was recorded in the 100 Hours Inspection Form.

Figure 21: Crack under passenger seat frame.

1.6.9 Corrective Maintenance

For year of 2019, till the accident date, the aircraft was airworthy, in condition for safe operation. The last corrective maintenance on the airplane was performed on 24 November 2018. The defects reported and rectified are as follows:

NO	DEFECTS	RECTIFICATION
1	Noise from engine	Crack on muffler welded
2	Nose tyre broke	Replaced nose tyre
3	Nose gear door broken	Replaced nose gear door
4	Brake disc stuck on both sides	Replace brake discs and pads
5	Unequal wear of left tyre	Flipped left tyre
6	Bearings of all wheels stuck	Replaced all bearings

Figure 22: Corrective Maintenance Status

1.6.10 Aircraft Certificate of Registration and Permit to Fly

The aircraft is categorised as Kitplane by CAAM. The Certificate of Registration was registered under the pilot's name on 12 February 2016 and was issued with a Permit to Fly annually without a Certificate of Airworthiness being in force. The Permit to Fly for this aircraft is valid from 12 February 2019 till 11 February 2020.

1.6.11 Aircraft Weight and Balance

The actual take-off weight at Subang (WMSA) was 593.1kg (MOTW = 600kg) with full fuel onboard. The C of G value calculated for the take-off was forward 27.9cm (range from aft 19cm to forward 30cm). Base on rough estimate, a one-hour flight time to Lumut will consumed about 18.5 litres (approximately 16kg) of fuel. Therefore, the estimated aircraft's landing weight at Marina Island will be approximately 577kg with a C of G value still fairly forward ie nose heavy.

1.6.12 Flight Operations

The aircraft flight hours for year 2018 and 2019 are as follows:

YEAR	MONTH	FLIGHT HOURS
2018	JANUARY TO DECEMBER	**90.61**
2019	JANUARY	2.8
	FEBRUARY	6.4
	MARCH	11.8
	APRIL	2.7
	MAY	14.9
	JUN	6.1
	JULY	NIL
	AUGUST	5.2
	TOTAL 2019	**49.9**

Figure 23: Aircraft Flight Hours

The aircraft previous flight before the accident was as follows:

DATE	ROUTE
11 August 2019	Subang (WMSA) - Rawa, Mersing (over fly) - Lanjut, Rompin (night stop).
12 August 2019	Lanjut, Rompin - Subang (WMSA).

Figure 24: Previous Flight Route Before Accident

1.7 Meteorological Information

ARFOR 50nm of Lumut Heliport which is about 4nm from Marina Island valid from 17 August 2019 at 0800 hours for 9hrs indicated cloudy over coastal area with winds at variable direction at 7kts and FEW Cb clouds at 1,700ft and FEW Cu at 2,000ft.

The TAFOR for Pangkor Airport which is about 5nm from Marina Island valid from 16 August 2019 at 1400hrs for 24hrs indicated light and variable wind at 3kts, visibility 9km and FEW clouds at 2,000ft.

Tide times for Lumut at the time of the aircraft arrival at Marina Island at 1005hrs indicated tide was progressing to low tide with lowest tide at time 1113hrs with a tide of 3.4ft.

1.8 Aids to Navigation

The aircraft is approved for VFR flight only and is equipped with a Garmin aera model 795 for navigation purposes. It presents a GPS-derived analogue flight instrumentation, position, navigation, and hazard avoidance information to the pilot using a 7-inch WVGA high brightness display with capacitive Touch Screen.

1.9 Communications

Marina Island is situated in Lumut ATZ in Training Area WMR 416C with vertical limits from sea level to 3,000ft AMSL. The airspace is restricted and is under the

controlling authority of Lumut Aerodrome Control. Its operating hours are from Monday to Friday, 0800hrs to 1700hrs and Saturday from 0800hrs to 1245hrs. Lumut was closed on the day of the accident and the aircraft was under Ipoh Tower control. Nevertheless, the aircraft pilot did send a text message to the SATCO of Lumut Naval Base to notify him of his planned flight to Marina Island on the day of the accident.

1.10 Aerodrome Information

There is no aerodrome in Marina Island. Marina Island is an artificial island catering for leisure boat and yacht activities. There is no published water landing area at any part of Marina Island. The nearest aerodrome in the vicinity of Marina Island are as below:

a. Pangkor Airport (WMPA) - unattended aerodrome situated about 5nm to the northwest of Marina Island. It has a unidirectional runway (take-off runway 04 and landing runway 22) with a length of 792m X 30m.

b. Lumut Heliport (WMLH) – Helicopter Base for Royal Malaysian Navy helicopter operations only and is situated about 4nm northeast of Marina Island.

c. Sitiawan Airstrip (WMBA) – unattended airstrip situated about 7nm to the east of Marina Island. The length of the airstrip is 549m X 69m.

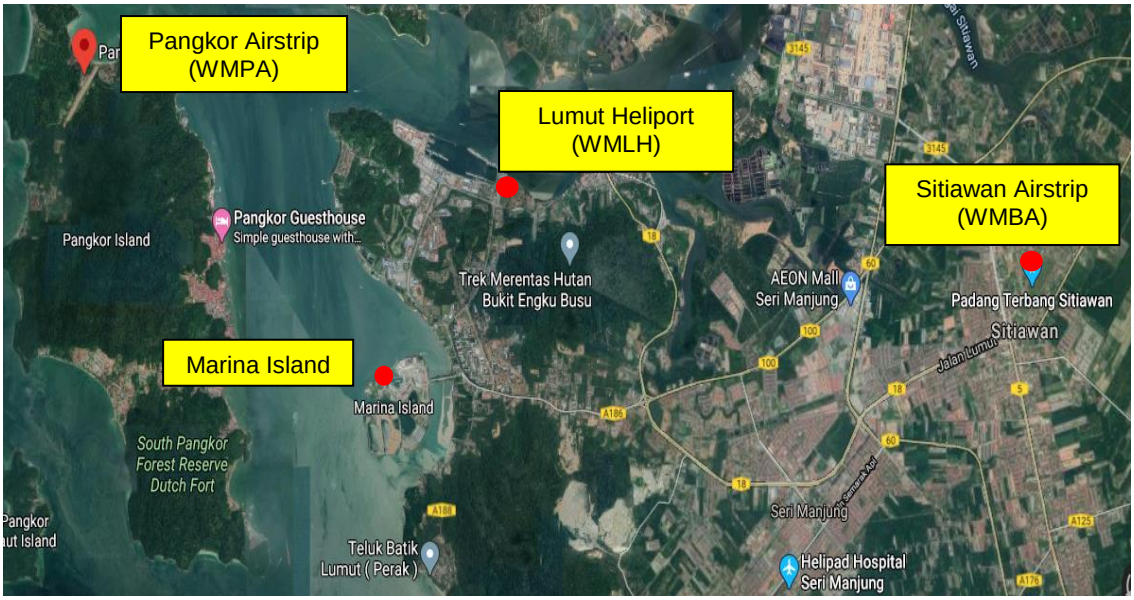


Figure 25: Nearest Aerodrome in the Vicinity of Marina Island

1.11 Flight Recorders

No flight recorders were installed in the aircraft.

1.12 Wreckage and Impact Information

The aircraft accident area is approximately 200m to 250m from the marina and toppled upside down in about 4ft of water. It was immediately towed by a boat to the marina ramp upside down and a crane was used to lift the aircraft out of the water. The aircraft was placed under cover in a boat yard approximately 70m to 80m from the ramp.

Figure 26: Approximate flight path into Marina Island and location of crashed site (not according to scale)

1.13 Medical and Pathological Information

The pilot sustained a minor cut to his head while the passenger sustained minor abrasions and cuts on his right shoulder and arm. No post-accident medical examination was carried out on both pilot and passenger as they did not want to seek medical treatment.

1.14 Fire

No fire to the aircraft reported before, during and after the incident.

1.15 Survival Aspects

The pilot and passenger swam out and away from the wreckage. Both of them were able to stand in the shallow water. They were immediately rescued by a boat from the Marina Jetty.

1.16 Tests and Research

Not applicable.

1.17 Organizational and Management Information

1.17.1 Aircraft Operator and Pilot Experience

The aircraft is co-owned privately by the pilot together with his business partner. Nevertheless, the aircraft, 9M-ETC is registered to the pilot. The pilot regularly flies the aircraft for leisure purposes especially on weekends around Peninsula Malaysia.

The pilot is considered to be a fairly experienced pilot for a PPL holder. He was awarded his Australia PPL in 19 September 1994 and passed the private practical test Airplane Single Engine sea rating in 5 October 1994. He was awarded his Malaysia PPL in 23 September 2016 and was rated on the Super Petrel LS aircraft on 9 March 2017. He has since clocked about 200hrs on this aircraft and flown to many water landing areas as mention in paragraph 1.17.5 since year 2016.

The pilot's flight check qualification was endorsed in his Australia Log Book and also in his Malaysia PPL. The pilot has accumulated a total of 461hrs on all types. The pilot is also rated on other aircraft types as follows:

NO	AIRCRAFT	RATED
1	Super Petrel LS	Malaysia
2	Cesnna 172	Malaysia & Australia
3	Cessna 152	Australia
4	Cessna 182 Skylane	Australia
5	Piper PA – 24 Comanche	Australia
6	Piper PA – 28 Cherokee	Australia

Figure 27: Other Types of Aircraft Rated

1.17.2 Aircraft Approved Engineer

The approved aircraft engineer and factory authorised ground and flight instructor for Super Petrel LS aircraft in Malaysia is as stated in the CAAM Permit to Fly. The approved aircraft engineer had carried out Schedule Maintenance Inspection (SMI) for this aircraft for the last 2 years. All maintenance on the aircraft were carried out as schedule satisfactory. He is a qualified pilot and also owns a Super Petrel LS aircraft.

1.17.3 Water Landing in Marina Island, Lumut

The aircraft first flight to Marina Island was on the 16 March 2019. Previous flights to Lumut were into Pangkor Airport (WMPA) which is an unattended aerodrome. There was no published procedure for approach and landing into Marina Island. All approach and landing into Marina Island are VFR and at pilot's discretion. After the first flight, a total of 7 more flights were flown into Marina Island by the pilot.

1.17.4 Encroachment into Lumut Naval Base Restricted Area

During the first flight to Marina Island on16 March 2019, the pilot overflew Lumut Naval Base thus encroached into Lumut Naval Base Restricted Area while positioning the aircraft for approach to land at Marina Island. A report was submitted by Lumut Naval Base SATCO on the encroachment.The flight path of the aircraft is as shown:

Figure 28: Flight Path Encroaching into Lumut Naval Base Restricted Area (not according to scale)

Subsequently after discussion between the pilot and SATCO of Lumut Naval Base, the SATCO agreed to the new flight path into Marina Island as proposed by the pilot without encroaching into Lumut Naval Base Restricted Area. This new flight path was not officially published and is just a verbal understanding between the pilot and Lumut Aerodrome Control. The agreed new flight path of the aircraft is as shown:

Figure 29: Agreed New Flight Path without Encroaching into Lumut Naval Base Restricted Area (not according to scale)

1.17.5 Pilot's Operation into Water Landing Locations in Peninsula Malaysia

Since the operation of the aircraft in year 2016, the pilot had flown and carried out water landing at various locations in Peninsula Malaysia. These water landing areas includes sea, lakes, dams and abandon mining lakes. The various locations of all the water landing areas in Peninsula Malaysia are marked on the map as shown below:

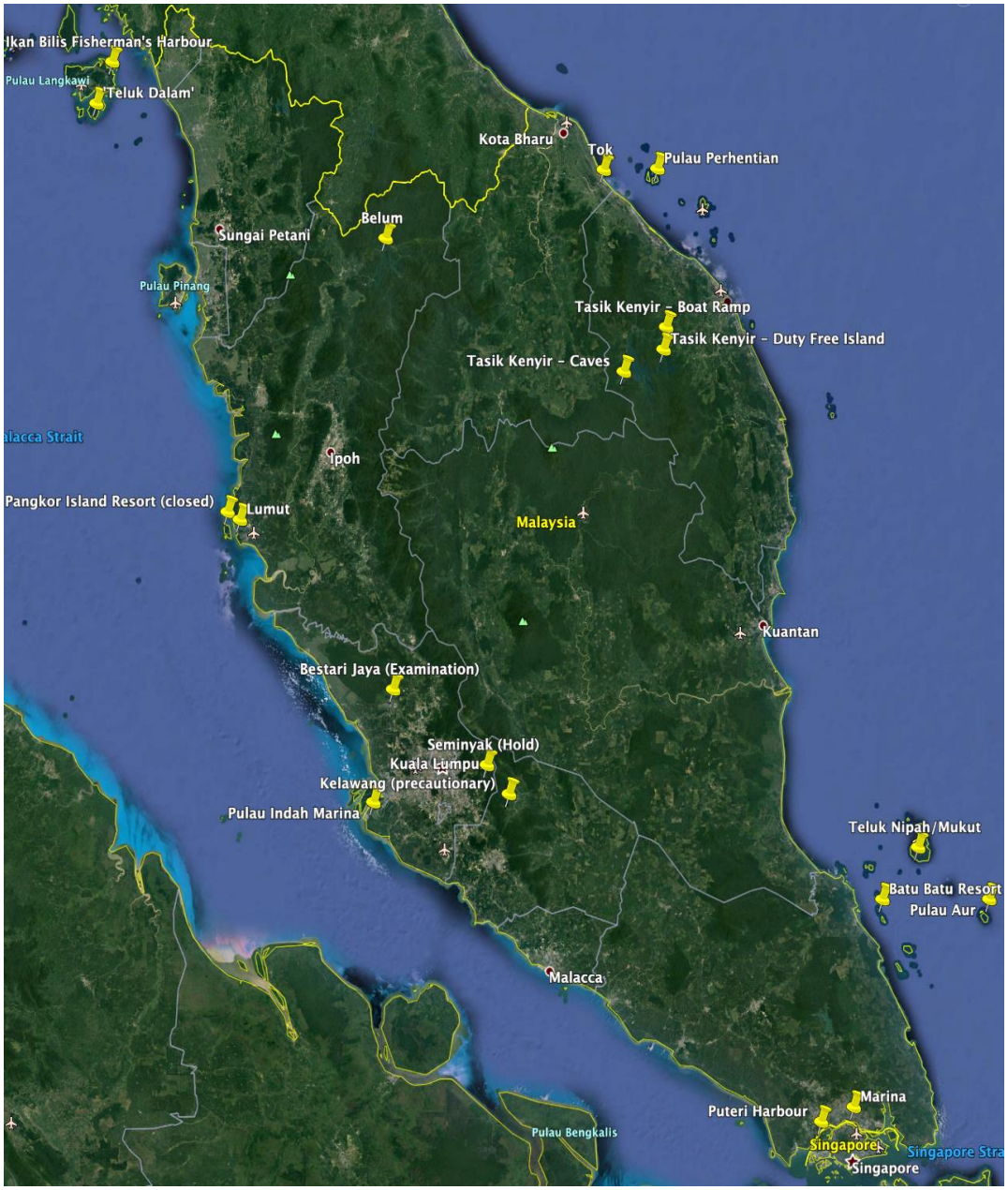


Figure 30: Pilot's Operation into Water Landing Locations in Peninsula Malaysia

1.17.6 Flight Approval by CAAM to Water Landing Areas

From the interview with the pilot, there was only one request for flight plan information from CAAM on all the flights he has flown to various water landing areas. This was for the flight to Teluk Dalam, Pulau Dayang Bunting, Langkawi on 30 April 2017 due to the close proximity of the water landing area to the approach path of Langkawi International Airport (WMKL). The pilot submitted a detailed report on the plan flight to CAAM and obtained approval for the flight.

For the flight to Marina Island, there was only a verbal agreement between the pilot and SATCO Lumut Naval Base on the approach and landing flight path after the encroachment incident into Lumut Restricted Airspace on the pilot's first flight to Marina Island as stated in paragraph 1.17.4.

For all other water landing areas at various location stated in paragraph 1.17.5, there were no request of flight plan information by CAAM when flight plan was submitted by the pilot.

1.17.7 Police Report

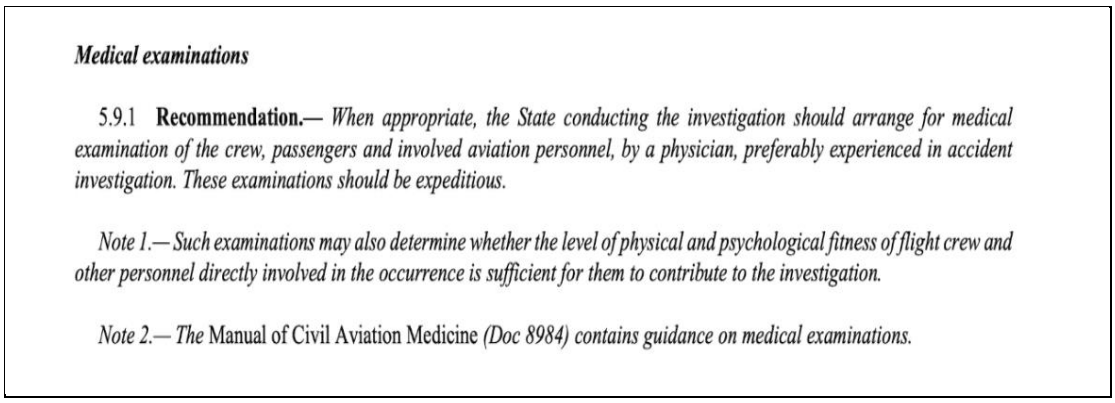
The news of the aircraft accident was read by a policeman in Facebook 'I love Manjung' while on patrol duties in Manjung. The policeman proceeded to Marina Island to investigate the reported news to confirm the accident. Both the pilot and passenger were interviewed by the policeman and the police investigating officer. The pilot decided, as no major injuries and no damage to properties, not to make a police report on the accident despite being advised to do so by the on-scene policemen. Nevertheless, the policeman lodged a police report on the accident at the Manjung Police Headquarters.

1.17.8 Post-Accident Medical Examinations

Post-accident medical examinations on the pilot was not carried out. ICAO Aircraft Accident and Incident Investigation Annex 13 Chapter 5

paragraph 5.9.1 requires a medical examination of the crew involved to be conducted expeditiously. Since this is a private owned aircraft and flight, it is the pilot's responsibility to ensure a Urine and Blood Test for substance abuse be conducted immediately after the incident. Any further or more detailed examination shall only be conducted when required by the investigation authority.

The on-scene policeman offered both the pilot and passenger assistance to seek medical treatment on their minor injuries but both refused the offer.



Medical examinations

5.9.1 **Recommendation.—** *When appropriate, the State conducting the investigation should arrange for medical examination of the crew, passengers and involved aviation personnel, by a physician, preferably experienced in accident investigation. These examinations should be expeditious.*

Note 1.— Such examinations may also determine whether the level of physical and psychological fitness of flight crew and other personnel directly involved in the occurrence is sufficient for them to contribute to the investigation.

Note 2.— The Manual of Civil Aviation Medicine *(Doc 8984) contains guidance on medical examinations.*

Figure 31: ICAO Aircraft Accident and Incident Investigation Annex 13 Chapter 5 – Medical Examinations

1.17.9 Wreckage Salvage

The decision to immediately remove and salvage the aircraft wreckage was made by the pilot to prevent the wreckage from sinking and being drifted out to deeper water due to the current.

During the salvage operations, substantial damaged had occurred to the aircraft especially the nose and front fuselage section. Nevertheless, the investigation team managed to obtain a number of videos and photographs of the whole salvage operations from the pilot and witnesses on-scene.

Although the salvage operations were made without obtaining approval from AAIB, nevertheless expeditious actions had ensured the wreckage did not obstruct the marina water way, and most importantly, the availability of the

wreckage close to intact for accident investigation purposes. Logistic and financial consideration was also a factor in the decision as greater effort would have been needed to recover the wreckage if it had drifted and sink in deeper waters later.

1.18 Additional Information

1.18.1 Interview and Statements

The AAIB investigation team conducted separate interview sessions with the Pilot, Passenger, Duty Air Traffic Controller, Police Personnel and other public witnesses to the accident. The interview sessions were all recorded under the express knowledge of all the parties. All of the above personnel had also submitted a written statement.

1.18.2 Video Conference between AAIB and SCODA

A video conference was held between AAIB investigation team and the aircraft manufacturer, SCODA with the presence of the pilot and approved engineer to explain and clarify circumstances leading to the accident. SCODA took the opportunity to review their Incident Accident Internal Protocol List.

1.18.3 Kitplane Airworthiness and Operation in Malaysia

The operation of this light sport amphibious aircraft is categorised by CAAM Malaysia as Kitplane and operates with a Permit to Fly. Kitplane operation requirements are governed by CAAM under AIC 05/1997 published on 22 April 1997.

The initial airworthiness of this category of light sport aircraft has its own type design and manufacturing acceptance or approval process. In fact, CAAM will either accept aircraft already approved by U.S FAA or any other internationally recognised Civil Aviation Authority or will require a dedicated approval process. In this specific case, the Super Petrel LS aircraft has

been approved by U.S FAA and the Malaysia Approval of Builder approved by CAAM in accordance with AIC 05/1997 and Permit to Fly.

Kitplane operations under Permit to Fly are mostly private owned and for leisure purposes. Although most of the Kitplane owners are members of the EAAM, who was instrumental in introducing the used of non-certified Permit to Fly aircraft for private operations, EAA does not have control or jurisdiction over private owners' operations of their aircraft. Therefore, private owners are solely responsible for the aircraft administration, licensing, operations, airworthiness and training.

The observations made on this accident in compliance to the above operation requirement by CAAM are as follows:

a. **Air Traffic Control (ATC)/Operation** – Light sport amphibious aircraft operates to vast and remote location as described in paragraph 1.17.5. These flight operations include water landing areas that are situated closed to ATZ, restricted areas and prohibited areas example dams, private beaches and marina, lakes and abandon mining pools etc. It poses a challenge for ATC to monitor and control these flights which might inadvertently contravene air traffic rules as in example described in paragraph 1.17.4.

Furthermore, ATC communication may have difficulty to immediately relay safety sensitive information or information pertaining to their flight due to the remoteness of the location which most of the time is outside the ATC radio coverage. It is observed that in this accident, ATC was only informed of the accident about 2 hours after the aircraft had crashed as the aircraft was under Ipoh ATC control with Lumut ATC closed on the day of the accident.

b. **Third Party Insurance** – The owner (pilot) did not seek third party insurance coverage as AIC 05/1997 does not require third party insurance to be mandatory. It is very fortunate that no injuries or

damage to third party properties occurred in this accident. Legal and compensation issues will arise when a third party sustained injuries or damaged to properties due to the accident.

c. **Accident/Incident Reporting** – Pilot was advised by Witness 3, who is the President of EAAM to report the accident to AAIB and CAAM. As private owners of this category of aircraft, they are not very familiar with accident or incident reporting procedures to relevant authorities, actions to be taken with regards to the safeguarding the wreckage, and accident investigation procedures. The pilot did not lodge a police report as there were no major injuries to persons or damage to third party properties. The pilot did not want to seek medical treatment for his injuries and no medical report to rule out substance abuse was made available to the investigation team.

d. **Maintenance** – Although the aircraft logbook, certificate of registration and permit to fly were lost during the accident, duplicate documents and records were made available to the investigation team. All documents and records were current and well maintained till the date of accident.

1.19 Useful or Effective Investigation Techniques

The AAIB team inspected the condition of wreckage placed at the boat yard after recovery from the crash site upon arrival at Marina Island. In general, the aircraft partially broke into two just ahead of the bulkhead with the cockpit and nose section badly damaged. There are some pieces of aircraft wreckage from the hull section and cockpit area which had broken off and needed to be identified of their exact relative location. The wreckage also needed to be placed in its correct position as the cockpit frame and nose section have broken, and some wreckage pieces are not in their relative position or missing.

To assist in the investigation to determine the cause of the accident, wreckage reconstruction was used as tool in this investigation to assemble the various pieces of

the aircraft wreckage to their relative position before failure and recreating the initial undamaged configuration. After cost-benefit analysis, it was decided to proceed the wreckage reconstruction away from the accident site. Moreover, the new location also allowed a more favourable access to the AAIB investigation team. Due to the missing parts, a simplified wreckage layout was obtained at the new site.

Before transportation, the licence engineer removed the large parts of the aircraft, ie both the wings (engine and propeller have been removed earlier for preservation) which are not crucial evidence in this investigation and for ease of transportation. The wreckage was transported by road from Marina Island Lumut, Perak to a boat shed at a private property owned by the pilot's company in Cheeding, Banting, Selangor.

Figure 32: Loading of wreckage at Marina Island under AAIB Team supervision

Figure 33: Unloading of wreckage at Cheeding under AAIB Team supervision

Figure 34: Wreckage in boat shed at Cheeding ready for reconstruction.

2.0 ANALYSIS

2.1 The Problem

The pilot stated that on the first touch onto the water, aircraft was stable with no floating obstacles or large waves seen. On the second touch the aircraft hit a slight water chop of about 6 inches and heavy vibrations were felt with a very sudden rapid deceleration of the aircraft. The aircraft subsequently veered to the right 90^0 from the direction of landing with rapid flooding of the cockpit. The nose and cockpit submerged into the water immediately with aircraft engine operating at full throttle. The engine stopped when it was immersed in the water.

2.2 Aircraft Reconstruction

Reconstruction of the aircraft was carried with the assistance from Science & Technology Research Institute for Defence (STRIDE), Ministry of Defence Malaysia, the aircraft approved engineer and AAIB technical advisor[1]. Particular attention was

[1] Dr Marwan Maurizio Chedid was appointed as a technical advisor to AAIB for this accident investigation. He is a member of the Experimental Aircraft Association (EAA), Malaysia who are acting as an Interested Party in this investigation.
Dr Maurizio graduated with Master of Science from School of Engineering, Cranfield University UK and PhD in Aerospace, Cranfield University UK. Dr Maurizio has also completed a course in Fundamentals and Applied Aircraft Accident Investigation at Cranfield University UK and have been involved in a few accident investigations as technical adviser.

given to the hull and fuselage section as it broke during water landing. Aircraft was laid to its port side for better viewing of the hull, especially the starboard side which incurred heavy damage.

Three main pieces were gathered and put to their relative position for further investigation. Many pieces had broken off and were missing during the accident leaving a big gaping hole at the right hull section.

Figure 35: Three main pieces reconstructed to its relative position at the hull section

Figure 36: Missing pieces leaving a big gaping hole at the right hull section

2.3 The Analysis

Considering the definition of the problem and evidence made available during reconstruction of the aircraft, the analysis will cover the following:

a. Damage Hull Analysis.

b. FESEM-EDX Mapping Analysis.

c. Comparison Severity of Impart Damage Marks between Left and Right Side of Aircraft.

d. Other Impact Marks on the Right Side of the Aircraft.

e. Pilot's Approach and Landing.

f. Patched Repair at Passenger Seat Frame.

g. Operation and Regulatory Requirements.

` **2.3.1 Damage Hull Analysis**

After the reconstruction of the aircraft and visual inspection, three main pieces from the bottom hull section consist of left hull, right hull and right hull (aft) were sent to the STRIDE laboratory for detail analysis.

Examination on the left hull and the right hull (aft) shows clear dented marks and branching cracks (Figure 37).

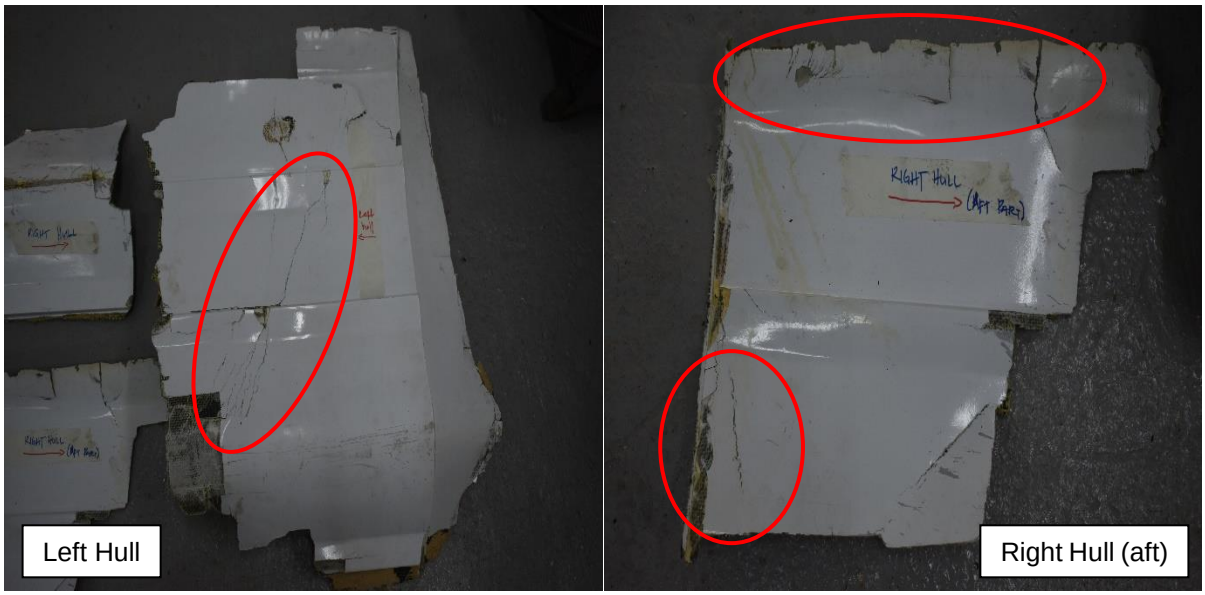


Figure 37: Left Hull and Right Hull (aft) with dented marks and branching cracks

Examination on the right hull shows there are brown trailing impact marks which could be seen clearly on the centre axis of the bottom hull (Figure 38).

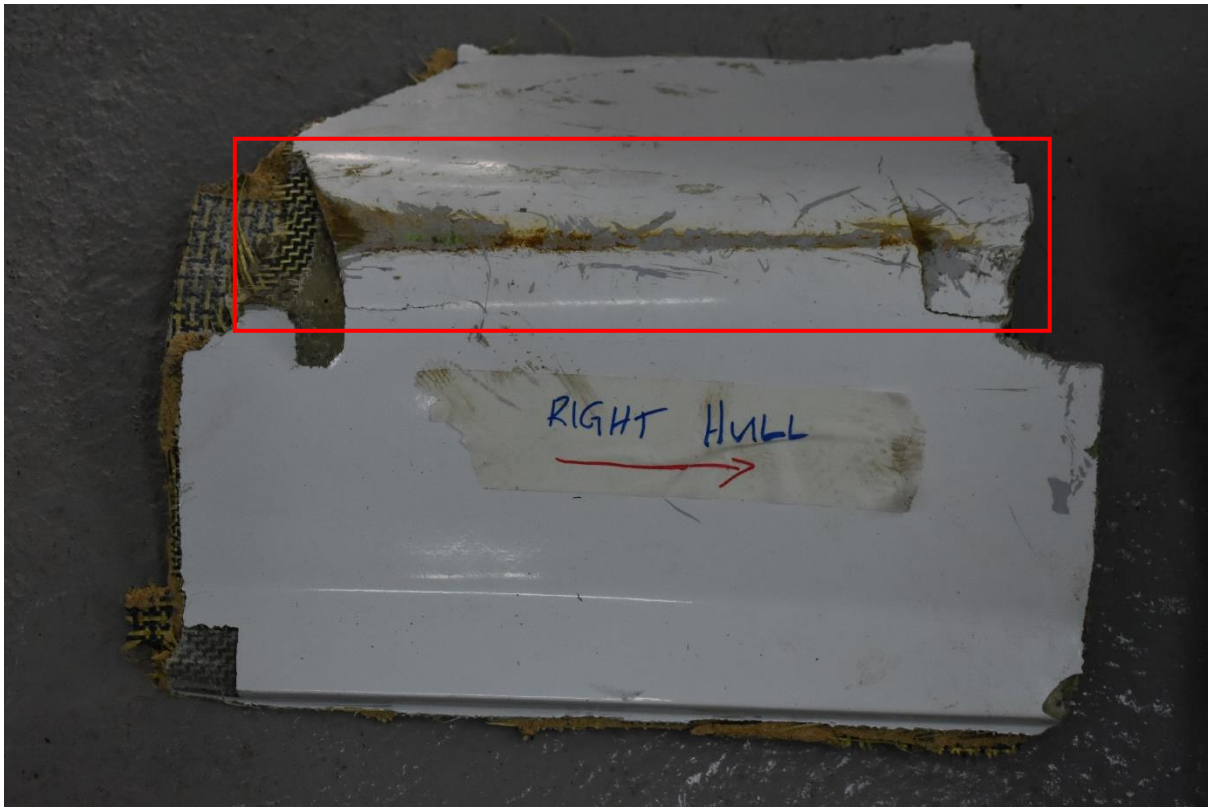


Figure 38: Right Hull with brown trailing impact marks

Examination on the inner side of the left hull discovered that some of the composite layers had delaminated and peeled off due to impact forces reacting on the adjacent broken hull (Figure 39).

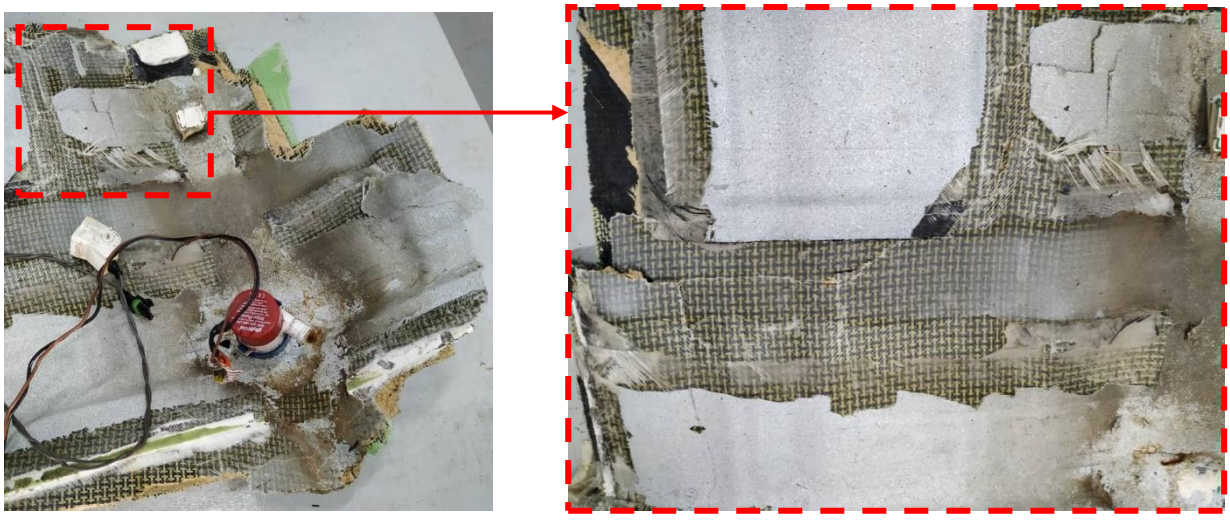


Figure 39: Delaminated & peeled off inner layer of the left hull

Closed-up examination of the fractured surface of the hull did not find any abnormalities or premature crack. Fractured surface of the hull showed the impact was in the shear and tension mode (Figure 40).

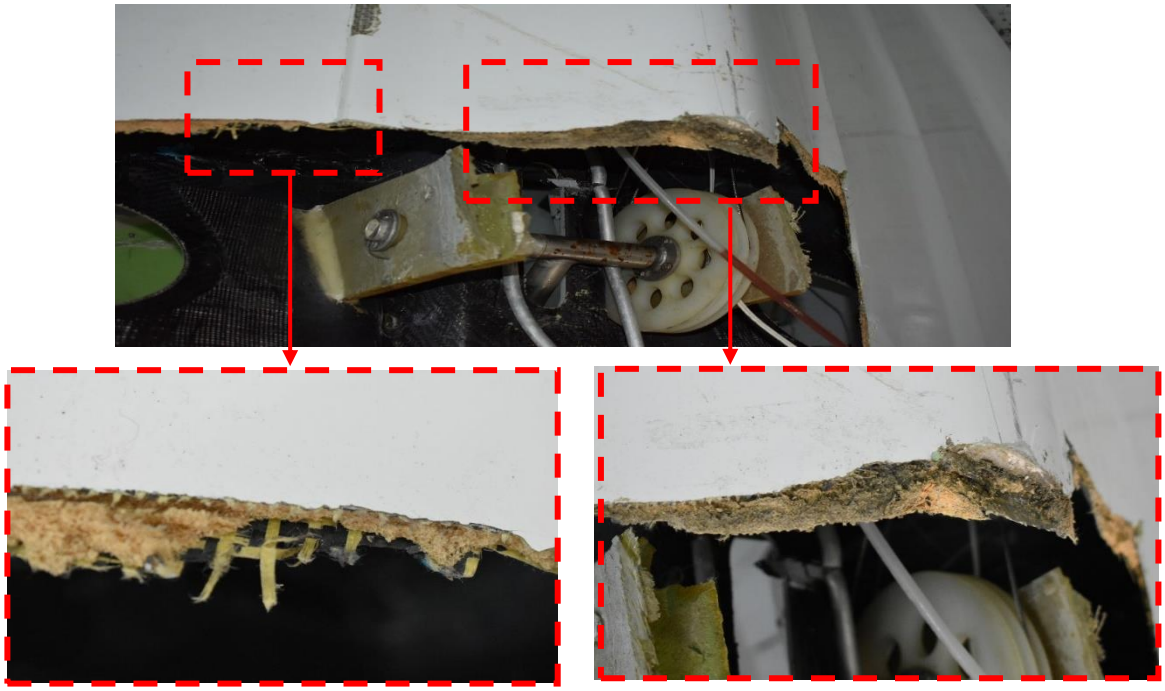


Figure 40: Fractured surface of the hull shows the impact was in the shear and tension mode

Other impart damage marks observed were at the centre bottom aft hull between the tail and cockpit section (Figure 41). The impact mark is consistent with the hull hitting a hard and sharp object.

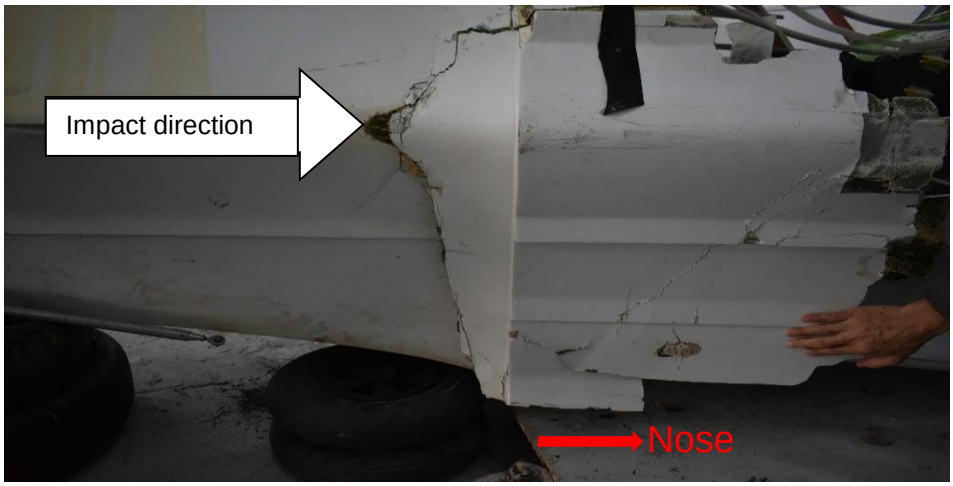


Figure 41: Impact mark on the centre bottom aft hull

2.3.2 FESEM-EDX Mapping Analysis

A Field Emission Scanning Electron Microscope coupled with Energy Dispersive X-Ray (FESEM-EDX) was used to analyse four (4) selected locations of the impact area (brown trailing mark) indicated as number 1 to number 4 (Figure 42). This method is used to trace the type of material present as appeared in the brown trailing mark.

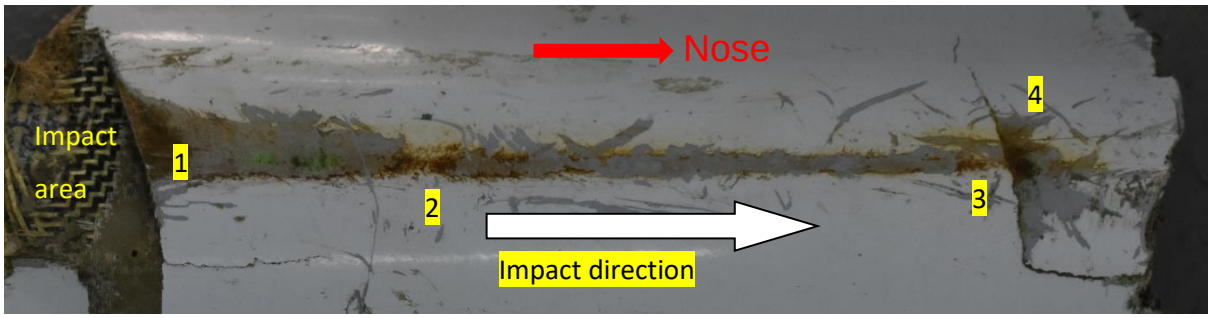


Figure 42: Four (4) selected locations of the impact area (brown trailing mark) marked as number 1 to number 4 for FESEM-EDX mapping analysis

The result obtained in the FESEM-EDX mapping analysis revealed numbers of metal elements embedded on that surface as presented below:

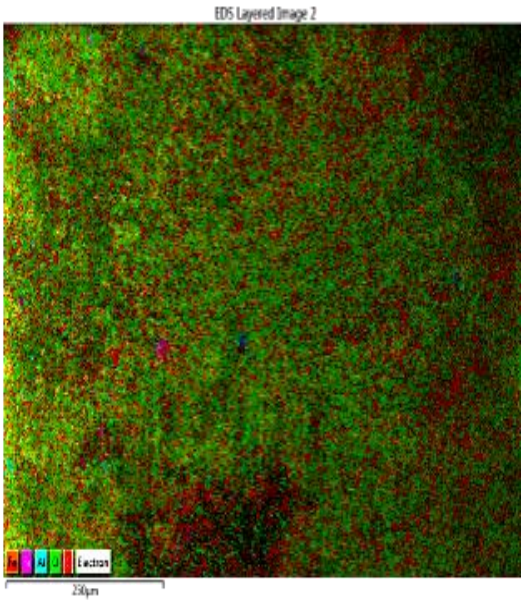
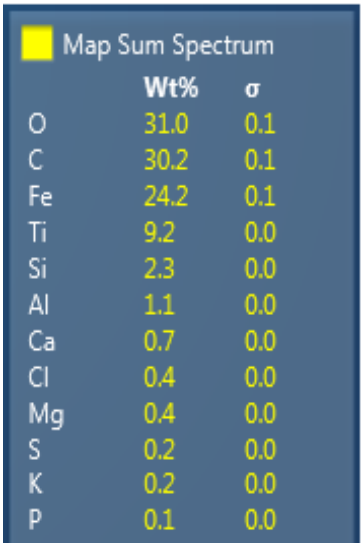
Mapping Image (Location No 1)	Detected Element (Wt%)
	

Figure 43: Mapping Image (Location No 1)

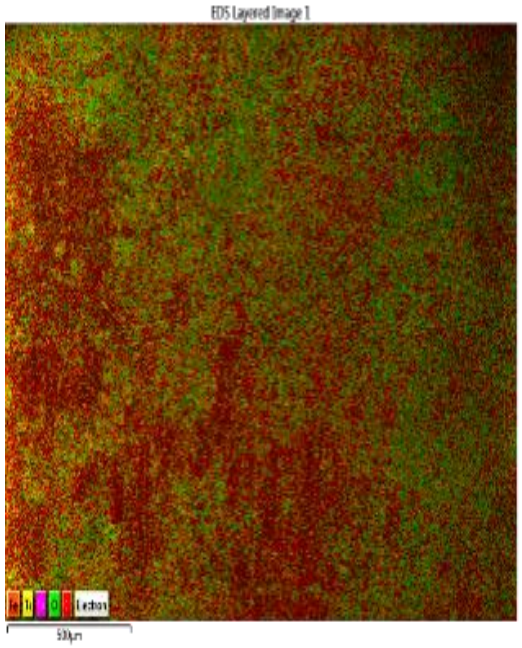
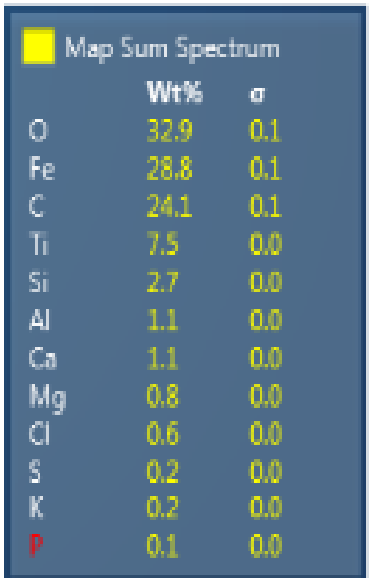
Mapping Image (Location No 2)	Detected Element (Wt%)
	

Figure 44: Mapping Image (Location No 2)

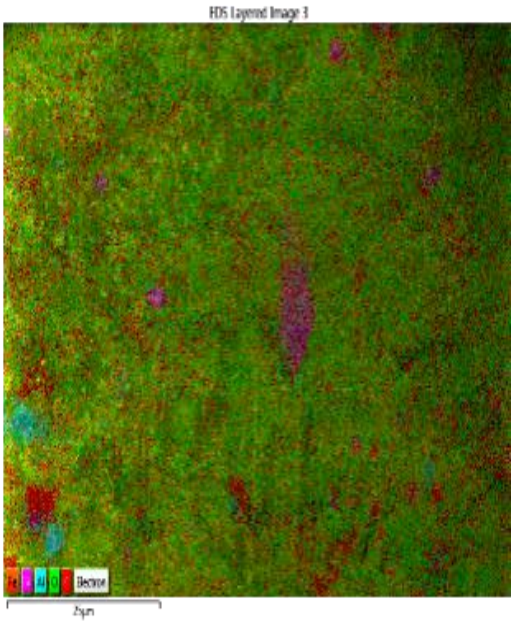
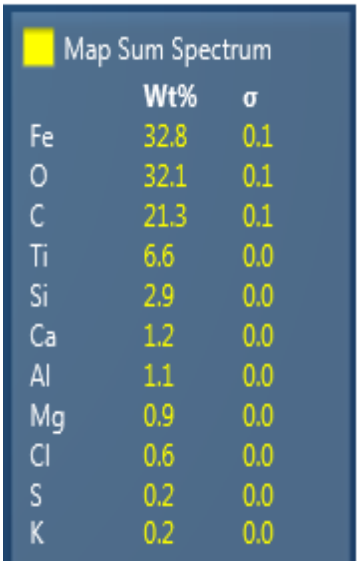
Mapping Image (Location No 3)	Detected Element (Wt%)
	

Figure 45: Mapping Image (Location No 3)

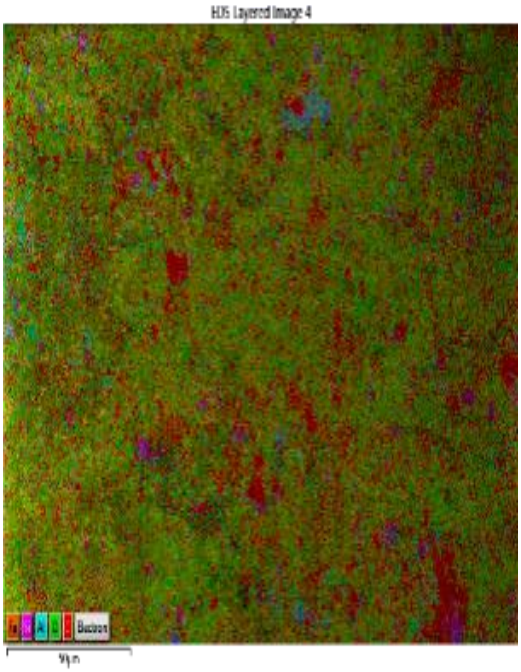
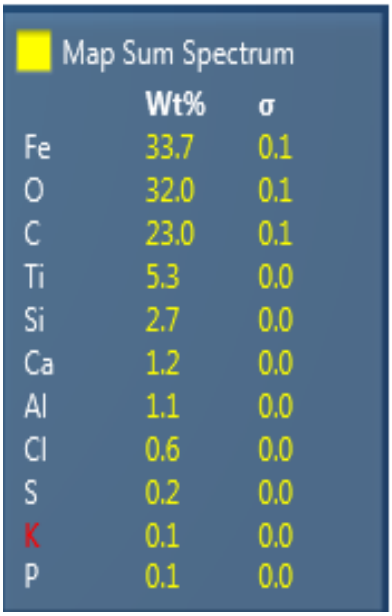
Mapping Image (Location No 4)	Detected Element (Wt%)
	

Figure 46: Mapping Image (Location No 4)

FESEM-EDX mapping analysis on the discolouration impact mark had traced several numbers of metal elements such as aluminium (AI), magnesium (Mg) and iron (Fe) as the major element that overlap with the oxygen (O) to form a brown corrosion product (FeO_2) indicating the oxidation process had occurred on that particular surface. The FeO_2 and other metals elements detected indicated the aircraft hull had made contact with an unknown object in the accident.

Based on the visual and FESEM-EDX mapping analysis, it was believed that the aircraft hull had collided with an unknown floating hard object during water landing.

2.3.3 Comparison Severity of Impart Damage Marks between Port and Starboard Side of Aircraft

From inspection of the aircraft, it was found that the starboard side of the aircraft impact damage marks are more severe as seen below:

2.3.3.1 Main Landing Gear Wheel Area

Figure 47: Nil damage marks

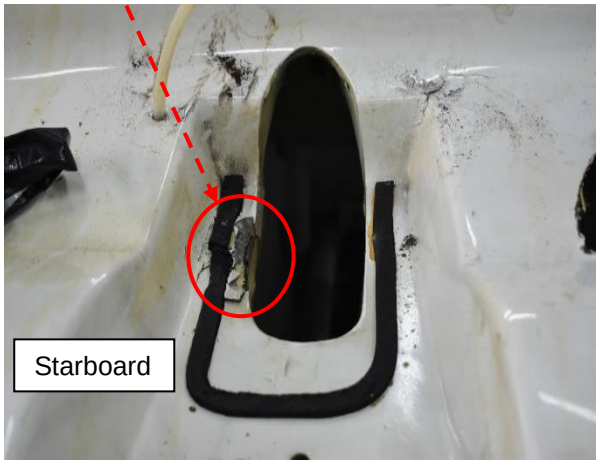


Figure 48: Dent at side housing frame caused by landing gear shock absorber strike when starboard wing impacted water

2.3.3.2 Pilot and Passenger Seat Belt Harness Frame

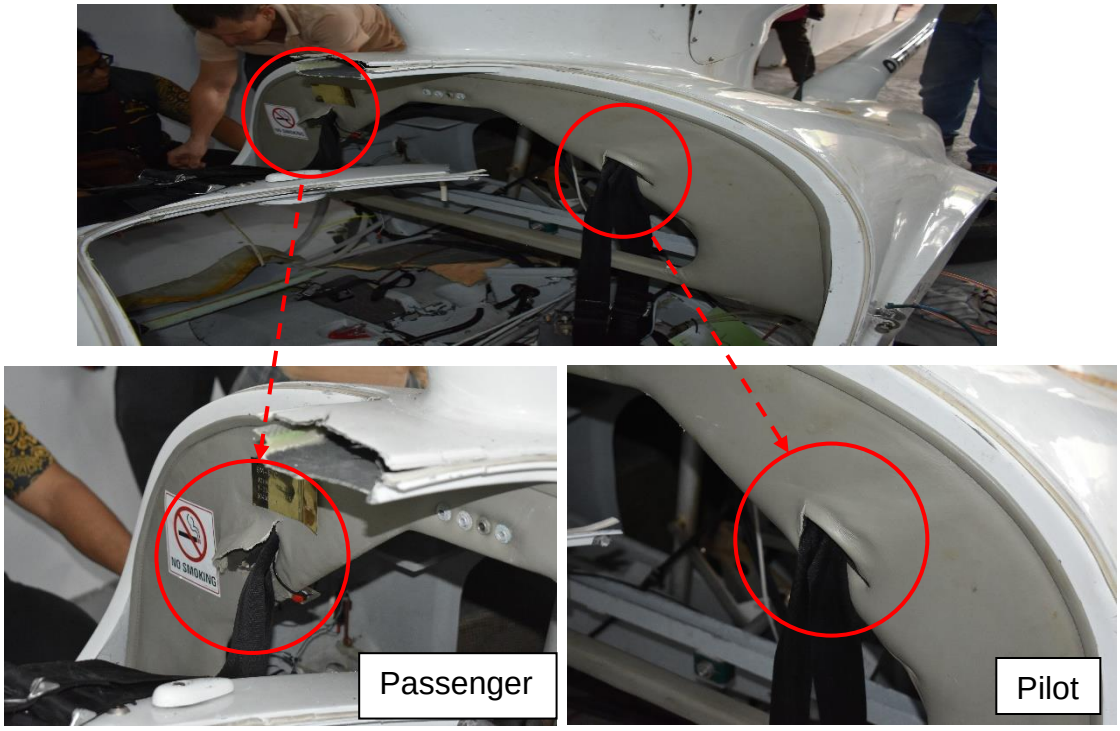


Figure 49: Passenger seat belt harness frame crack due to rapid deceleration G forces during impact	Figure 50: Pilot seat belt harness frame in good condition

2.3.3.3 Pilot and Passenger Seat

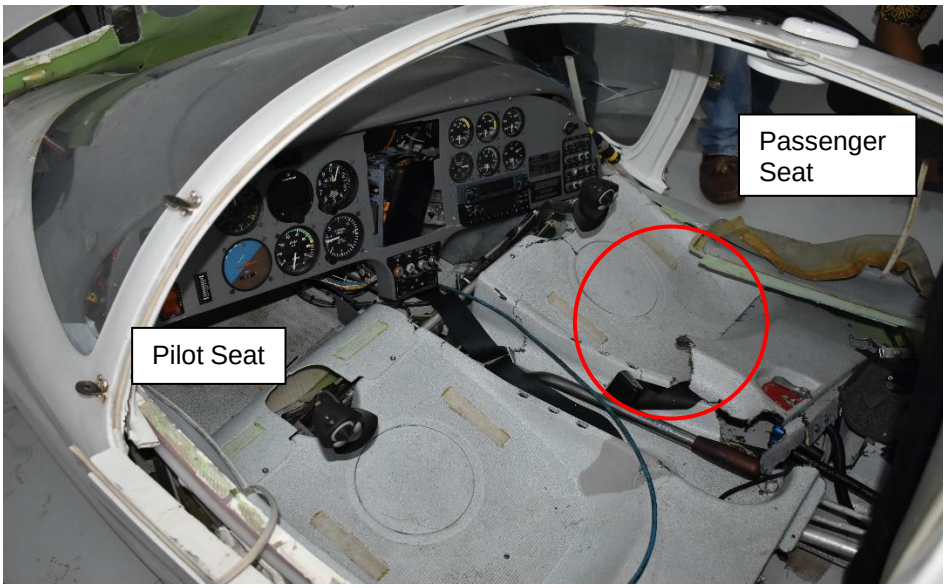


Figure 51: Pilot seat still intact while passenger seat broke and collapsed downward due to broken right hull during impact

2.3.3.4 Left and Right Aircraft Window

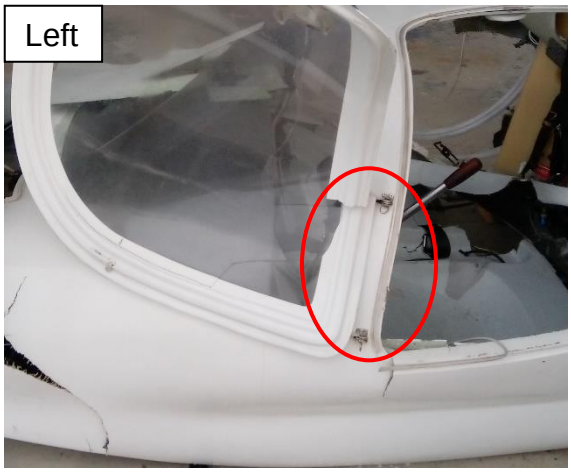


Figure 52: Left window and door hinge still intact

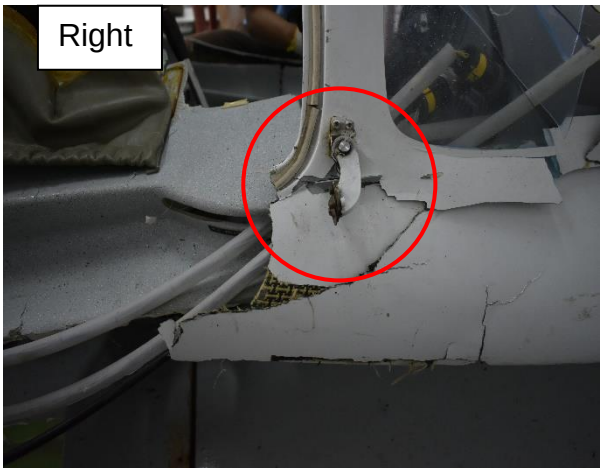


Figure 53: Right window missing and door hinge broke during impact

2.3.4 Other Impact Marks on the Starboard Side of the Aircraft

Other impact marks on the starboard side of the aircraft are as seen below:

Figure 54: Aircraft registration metal plate on the right tail fuselage section dislodged most probably caused by either boat towing or crank lifting process during salvage operations

Figure 55: Torn skin underside of the upper right wing aileron fairing most probably caused by an object impact when right wing dropped and impacted the water

Figure 56: Bulged surface underside of lower right wing most probably caused by water impact at speed when right wing dropped into water creating a dragging force and veering the aircraft to the right

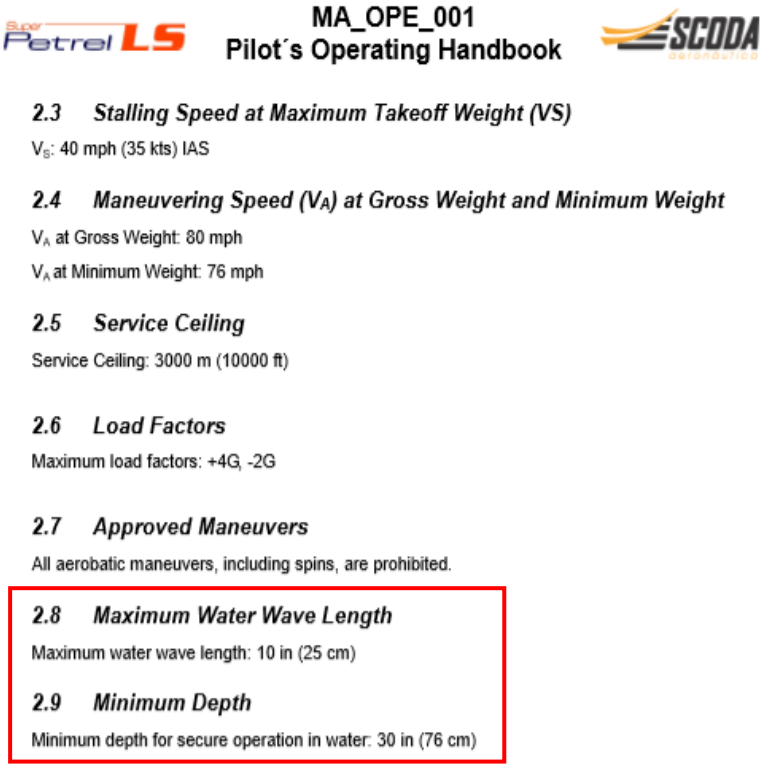
2.3.5 Pilot's Approach and Landing

From the pilot and passenger's statement and interview, the wind condition was light and variable, good sea state condition with about 6 inches of chop on the water surface. The pilot encountered some turbulence turning for final approach which caused the aircraft final approach to be higher than normal for the intended touchdown point. Nevertheless, the wind was light and variable on the final approach.

Both the pilot and passenger stated that the aircraft gently skim the water and was stable during the first touch. The aircraft hit a 6-inch water chop on the second touch and vibrate severely with rapid deceleration felt. Subsequently the aircraft crashed into the water about 4ft deep. The photograph taken below immediately after the accident from the shore indicate the water was very calm at low tide with slight chop which is stated in the pilot's statement on the sea state at the time of the accident.

Figure 57: Good sea state at low tide with slight water chop. A boat approaching the aircraft wreckage in the background immediately after the accident

From the pilot and passenger's statement, the sea state is well within the operating limits as stated in the Super Petrel LS Pilot's Operating Handbook and Flight Training Supplement for Maximum Water Wave Length and Minimum Water Depth.



MA_OPE_001
Pilot´s Operating Handbook

2.3 *Stalling Speed at Maximum Takeoff Weight (VS)*

V_S: 40 mph (35 kts) IAS

2.4 *Maneuvering Speed (V_A) at Gross Weight and Minimum Weight*

V_A at Gross Weight: 80 mph

V_A at Minimum Weight: 76 mph

2.5 *Service Ceiling*

Service Ceiling: 3000 m (10000 ft)

2.6 *Load Factors*

Maximum load factors: +4G, -2G

2.7 *Approved Maneuvers*

All aerobatic maneuvers, including spins, are prohibited.

2.8 *Maximum Water Wave Length*

Maximum water wave length: 10 in (25 cm)

2.9 *Minimum Depth*

Minimum depth for secure operation in water: 30 in (76 cm)

Figure 58: Super Petrel LS Pilot's Operating Handbook and Flight Training Supplement

The onboard GPS was sent to the laboratory to recover the flight data information stored. Due to impact and corrosion damage to the Printed Circuit Board (PCB), the laboratory personnel were unable to retrieve any data from the GPS to provide valuable information on the aircraft performance during the pilot's approach and landing.

Based on the reported wind, sea state and impact marks on the hull and fuselage, the evidence available do not support a hard landing by the pilot.

Figure 59: Condition of the GPS after recovery from the wreckage

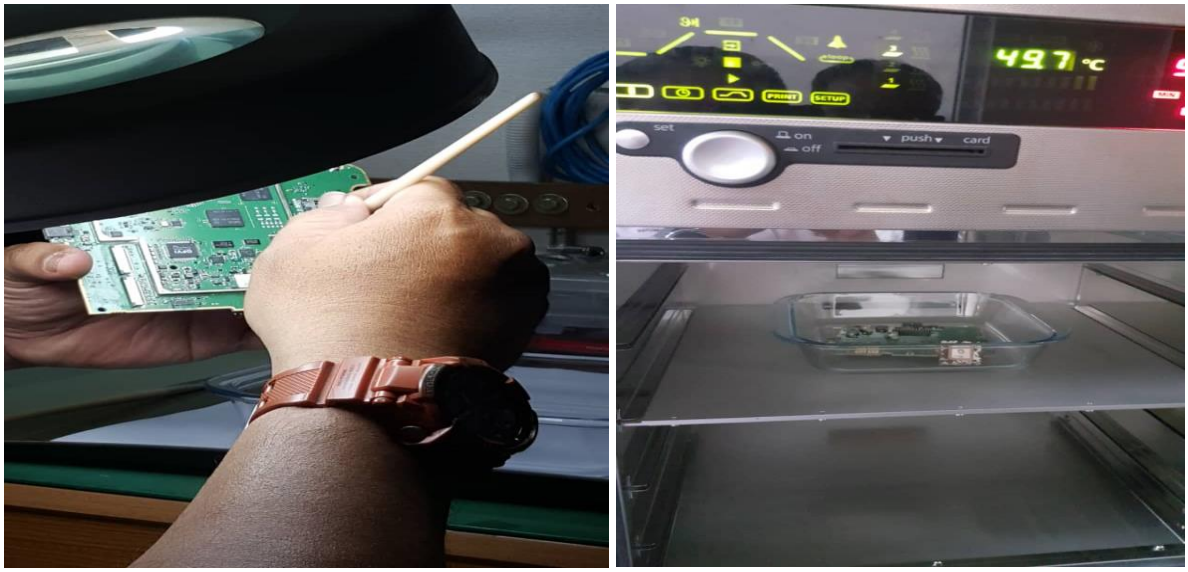


Figure 60: Cleaning and drying process of the GPS PCB at the laboratory

2.3.6 Patched Repair at Passenger Seat Frame

The two small cracks found under the passenger seat frame during 100 Hours Inspection (Figure 61) were patched and repaired satisfactory in accordance with Repair Scheme Super Petrel LS Chapter 3 Airframe Damage, paragraph 3.2.5 Damage Rear Rib of Seat Pan. The passenger seat frame was still intact after the accident although the passenger seat had collapsed during the accident due to the weight of the passenger and likely generated by an identified hard metal object whose marks and material particulars were found on the hull analysed broken parts via dedicated laboratory analysis.

The patch scheme of repair after the accident is still intact, as shown in Figure 62.

Figure 61: Cracks at passenger seat frame before accident

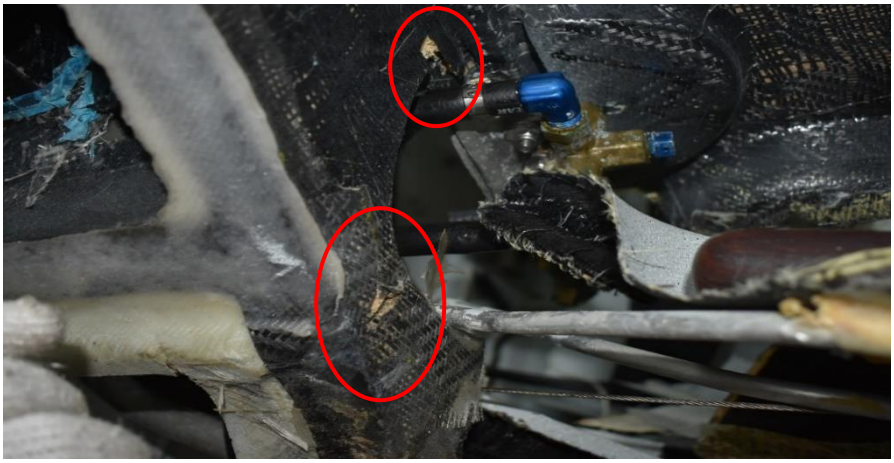


Figure 62: Patched repaired cracks at passenger seat frame still intact after accident (reverse side)

2.3.7 Operation and Regulatory Requirements

Light amphibious aircraft which is categorised as Kitplane generally conducted their water landing operations in remote locations around Peninsula Malaysia. The operating conditions are demanding in that landing and take-off surfaces are not specifically prepared and marked while adverse weather conditions can pose a challenge to the requirement of VFR flights.

Majority of light amphibious aircraft are private owned. It requires a high degree of independence from the pilot in which the pilot takes full responsibility

for himself, passenger, the aircraft, property of land owners in the area of landing, and the aircraft flight operation planning.

There is most probably no air traffic control tower available or communication may be difficult to immediately relay safety-sensitive information or information pertaining to their flight due to the remoteness of the location. These operating conditions pose a challenge for the regulator specifically ATC. Therefore, detailed description of flight plan as described in paragraph 1.17.6 to landing areas that are not familiar to ATC during submission of flight plan will assist the authorities to better monitor and control these flights to improve flight safety.

3.0 CONCLUSIONS

Visual examination of the wreckage showed that the fuselage and hull of the aircraft had broken into two sections. From the analysis above, the right side of the aircraft sustained more severe impact damages than the opposite side. Investigation evidence shows that during the second touch of the water landing, the aircraft most probably impacted a floating hard object when it hit a slight chop which caused some heavy vibration. The resultant impact at speed broke the right side of the hull and allowed water from below to flood the cockpit area. With forward momentum and engine suddenly running at full throttle, the right side of the hull and fuselage structure were torn apart by the dragging force of the water. This resulted in a very rapid deceleration G forces felt by the pilot and specifically the passenger of the aircraft. The drag due to the damage on the right hull structure caused the aircraft right wing to drop and hit the water resulting in the aircraft body to veer 90^0 to the right.

The weight of the flooded cockpit and the aircraft engine operating at full throttle further pitch the aircraft nose deeper into the water with the tail pointing vertically up. The aircraft tail was later toppled into the water under the push-propeller thrust and the aircraft came to a final resting position upside down in the water. The engine stopped when it was immersed in the water.

The investigation found evidence of a floating hard object of metal composition to have impacted the right side of the aircraft hull section. The investigation could not conclusively determine the exact impact point on the hull section as some section of the hull were missing. Investigation also cannot positively identify other information on the hard object that impacted the hull as only its metallic nature was determined via laboratory analysis.

Although, pilots fly low to make a visual inspection for any floating objects or obstructions on the intended water landing path and avoid floating objects, it is difficult to see these floating objects during touch down at the speed the aircraft is flying. Therefore, pilot must always be extra vigilant of this inherent hazard of water landing.

The investigation also revealed the need for the regulatory authorities to improve the managing and controlling mechanism of Kitplane operation. Allowing private owners who are not very knowledgeable and familiar with the landing environment to fly to any water landing areas in Peninsula Malaysia is a flight safety risk to be considered and mitigated.

3.1 Findings

3.1.1 The aircraft was maintained and documented in accordance to Super Petrel LS Maintenance Manual and was airworthy for the flight as required by CAAM Permit to Fly.

3.1.2 The Pilot’s licence was not valid at the time of the incident. The Pilot’s certificate of test for Super Petrel LS was conducted on 09 March 2017 and had expired on 08 March 2018. The Pilot’s medical certificate was valid at the time of the incident.

3.1.3 The aircraft water landing touchdown was stable and weather was good. The sea state was suitable for water landing at the time of incident in accordance with Super Petrel LS Pilot’s Operating Handbook and Flight Training Supplement for Maximum Water Wave Length and Minimum Water Depth. Hard landing is not a cause to this accident.

3.1.4 The mass and centre of gravity of the aircraft were within the approved limits.

3.1.5 The patched repair on the aircraft passenger seat frame was carried out in accordance to Repair Scheme Super Petrel LS Chapter 3 Airframe Damage, paragraph 3.2.5 Damage Rear Rib of Seat Pan. The patched repair did not contribute to the accident.

3.1.6 The propulsion system was serviceable and was operating upon impact.

3.1.7 The investigation did not reveal any catastrophic failure before impact.

3.1.8 Lack of proper procedures and regulatory operation requirements to monitor and control light amphibious aircraft landing at various water landing locations in Malaysia.

3.1.9 No post-accident medical examination was conduct on the pilot as required in accordance to the ICAO Aircraft Accident and Incident Investigation Annex 13 Chapter 5 - Medical Examinations.

3.1.10 Police report was lodged by the on-scene policeman who was responsible to investigate the accident instead of the pilot.

3.1.11 Aircraft hull and fuselage damage was most probably caused by impact of an unknown floating hard object.

3.2 Causes

The accident was most probably caused by an unknown hard floating object impacting the right side of the aircraft hull during landing which broke and tore it.

4.0 SAFETY RECOMMENDATIONS

4.1 CAAM is to carry out the following safety recommendations:

4.1.1 To review the Kitplane flight operation and licensing requirements in AIC 05/1997 as follows:

a. To formulate procedures for Water Landing Operations as such:

i. To engage with Aeronautical Information Services to state in Aeronautical Information Publication Malaysia for pilot/operator to provide to Air Traffic Control details of landing/take-off location coordinates in the flight plan.

ii. To ensure pilots communicate to Air Traffic Control the safe landing/take-off operations completion as required by the Director General Civil Aviation Malaysia Directive – Rules of the Air Chapter 3 paragraph 3.3.5.3 and 3.3.5.4.

iii. To engage with Aeronautical Information Services to state in Aeronautical Information Publication Malaysia for pilot/operator to provide to Air Traffic Control with their secondary telephone contact for emergency notification and rescue.

b. To mandate the requirement for water landing proficiency check by the regulating authorities.

c. To mandate the requirement to seek third party insurance to prevent uncontrolled legal liability implications.

4.1.2 To mandate the requirement for crews involved in accident and incident to undertake immediate post-accident/incident medical test on Urine and Blood for substance abuse.

4.1.3 To mandate the requirement for operator or crew to make a police report on all aircraft accident and incident to regulate potential legal disputes.

4.1.4 To formulate a general procedure which requires the operator to obtain approval from the proprietor (location of intended landing) and obtain the necessary approval from the relevant authorities, if transiting through any restricted areas.

5.0 COMMENTS TO THE REPORT AS REQUIRED BY ICAO ANNEX 13 PARAGRAPH 6.3

As required by ICAO Annex 13, paragraph 6.3, the draft Final Report was sent to State of Registry (CAAM), State of Design (CENIPA and Scoda) and the Operator (John Russell) inviting their significant and substantiated comments on the Report. The following is the status of the comments received: -

Organisations	**Status of Significant and Substantiated Comments**
Civil Aviation Authority of Malaysia	Accepted and incorporated comments
AIG, CENIPA of Brazil	Accepted and with no comments
Scoda Aeronautica of Brazil	Accepted and with no significant comments
John Beauchamp Russell (Operator)	Accepted and with no significant comments