Australian Government
Australian Transport Safety Bureau

Collision with water involving de Havilland Canada DHC-2 Mk 1 (Beaver), VH-NOO

Jerusalem Bay (Hawkesbury River), New South Wales, on 31 December 2017

ATSB Transport Safety Report
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Addendum

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The occurrence

Flight from Rose Bay to Cottage Point

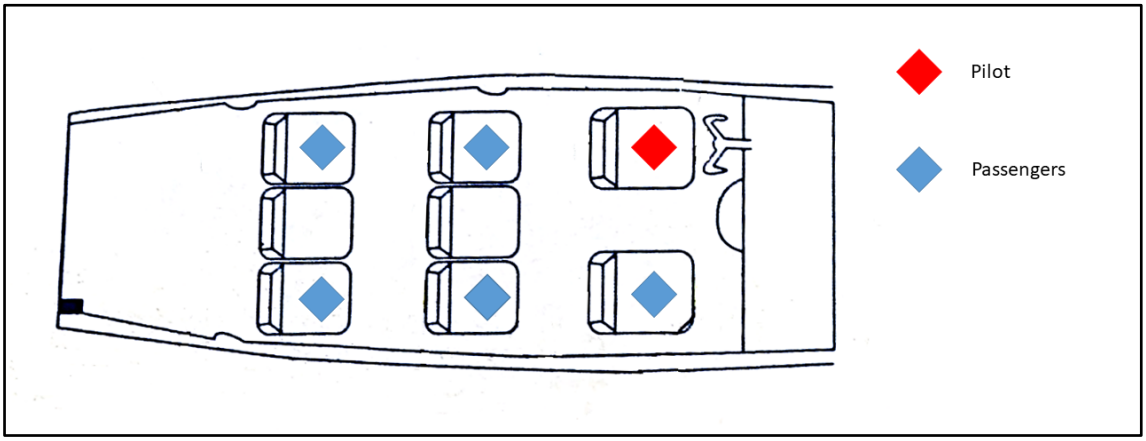
On 31 December 2017, at about 1115 Eastern Daylight-saving Time,[1] five passengers arrived via water-taxi at the Sydney Seaplanes Terminal, Rose Bay, New South Wales (NSW) for a charter fly-and-dine experience to Cottage Point. Prior to departing, the passengers received a pre-flight safety briefing.

Shortly after 1130, the pilot and five passengers departed Rose Bay for the flight to Cottage Point via the northern beaches coastal route in a de Havilland Canada DHC-2 Beaver floatplane, registered VH-NOO and operated by Sydney Seaplanes. The flight arrived at Cottage Point just before midday and the passengers disembarked. The pilot then conducted another four flights to/from Cottage Point in VH-NOO before returning to pick up the passengers.

Return flight to Rose Bay

As scheduled, at about 1500, the pilot and passengers boarded the aircraft for the return flight to Rose Bay.[2] The passengers had booked a water-taxi to transport them from Rose Bay at 1545 to their hotel. The passenger occupying the front right seat next to the pilot was taking photographs through the front and right side windows during the flight (refer to section titled *Passenger camera*).

Figure 1: Pilot and passenger locations on return flight to Rose Bay



Source: VH-NOO safety card, modified by ATSB

The passenger photographs showed that, at about 1505, the aircraft commenced taxiing toward the designated take-off area in Cowan Creek as per the operator's authorised landing area (ALA) procedure (refer to section titled *Cottage Point departure*) (Figure 2). At about 1512, the aircraft had become airborne and was at an altitude of about 43 ft[3] above the water, approaching Cowan Point.

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1 Eastern Daylight-saving Time (EDT): Coordinated Universal Time (UTC) + 11 hours.

2 The operator's other DHC-2 aircraft was scheduled to depart at the same time. However, at the request of the passengers, that flight departed Cottage Point for Rose Bay about 10 minutes prior to VH-NOO.

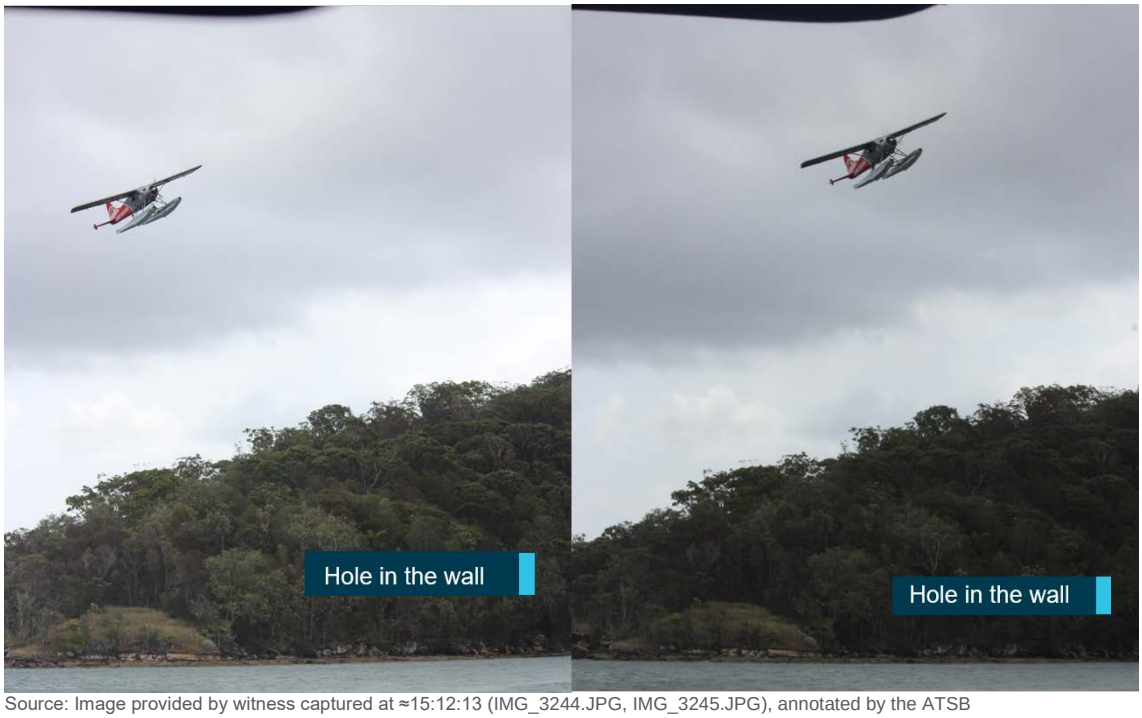
3 Aircraft altitude estimated from comparison images from NSW Police Force Forensic imaging, refer to section titled *Passenger camera*.

Figure 2: Passenger photograph taken through the front windscreen while taxiing to the designated take-off area (left) and shortly after becoming airborne (right)

Note: Image from CF card, Canon EOS 40D camera captured at ≈15:04:44 (000391.JPG[4] and ≈15:11:50 (000404.JPG).
Source: ATSB

The aircraft climbed straight ahead for about 2 km before commencing a right turn into Cowan Creek, heading towards the main Hawkesbury River, at a bank angle estimated to be about 20°. A witness on the river who was travelling across Cowan Creek towards Hallets Beach provided the ATSB with photographs (Figure 3) of the aircraft turning near the Hole in the Wall (Figure 4).

Figure 3: Witness photographs showing the aircraft turning near the Hole in the Wall



Source: Image provided by witness captured at ≈15:12:13 (IMG_3244.JPG, IMG_3245.JPG), annotated by the ATSB

The right turn was observed to continue above Little Shark Rock Point and Cowan Creek (Figure 4). The last photograph taken by the passenger was near Little Shark Rock Point, with the aircraft heading in a southerly direction towards Cowan Bay (refer to Figure 12 in section titled *Passenger camera*). At that time, the aircraft was estimated to be at an altitude of 175 ft.

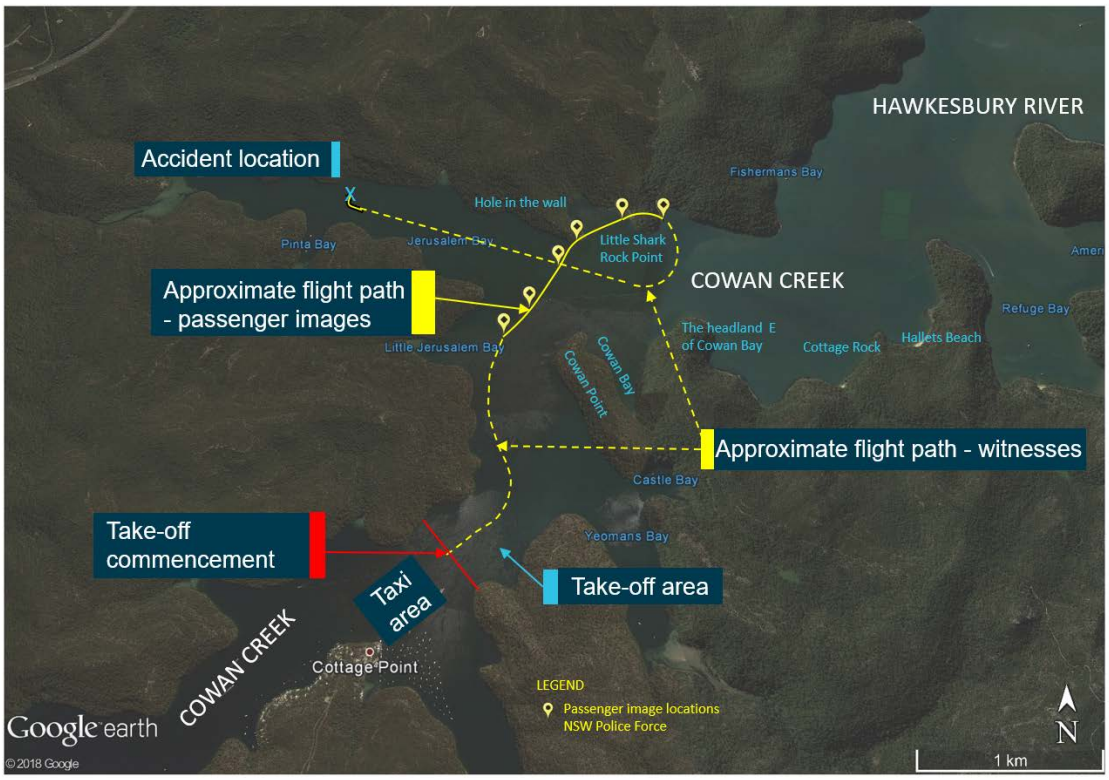
The aircraft was observed by several witnesses to then head directly towards Jerusalem Bay at an altitude below the height of the surrounding terrain (Figure 4 and Figure 5). Several witnesses

[4] On forensic download of all images from CF card by ATSB, the images were automatically renamed chronologically from 00001.JPG to 000412.JPG.

reported hearing the aircraft's engine and stated that the sound was constant and appeared normal.

Shortly after entering Jerusalem Bay, numerous witnesses reported seeing the aircraft suddenly enter a steep[5] right turn and the aircraft's nose suddenly drop before the aircraft collided with the water in a near vertical position. The aircraft came to rest inverted and with the cabin submerged. Witnesses reported the entire tail section and parts of both floats were initially above the waterline. The aircraft took over 10 minutes to completely submerge. A number of witnesses who heard or observed the impact responded to render assistance. All six occupants received fatal injuries.

Figure 4: Cottage Point area, established flight path and accident location

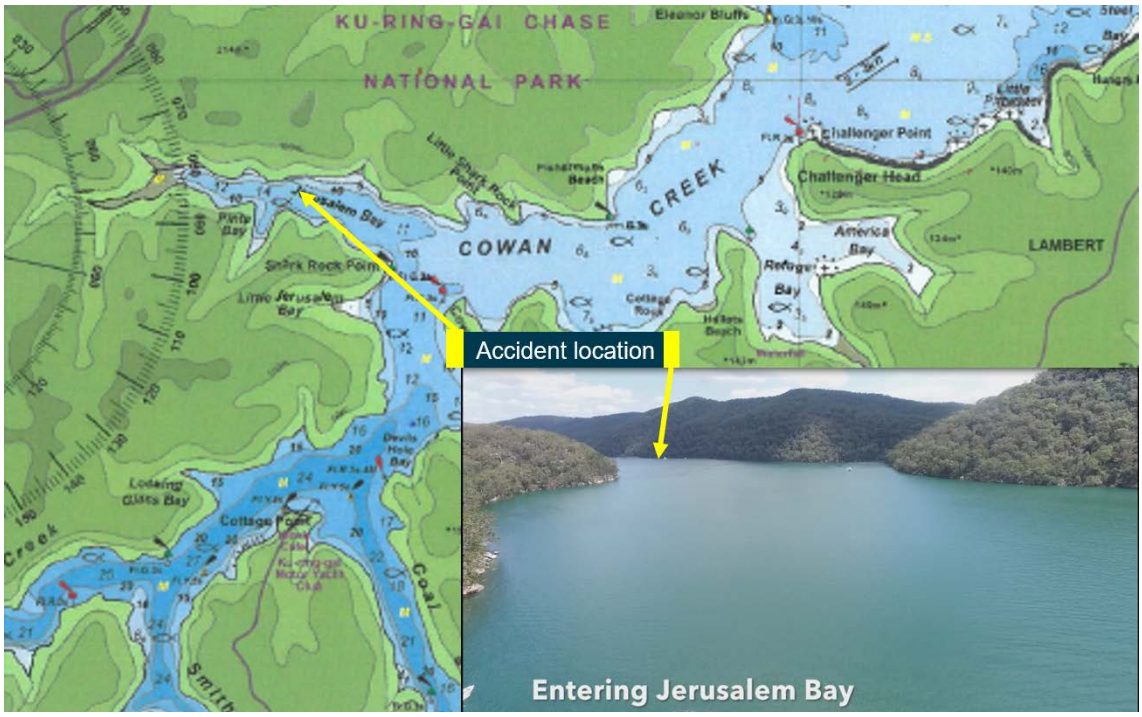


Source: Google earth, modified by the ATSB from passenger images and witness interviews

VH-NOO travelled about 1.75 km from the end of the right turn near Little Shark Point to the steep right turn in Jerusalem Bay.

[5] Estimated by witnesses to be 80˚- 90˚ bank angle.

Figure 5: Cottage Point area with Jerusalem Bay entry viewed from Cowan Creek



Source: CAMTAS International P/L (map), NSW Police Force (inset), annotated by ATSB

Context

Pilot information

The pilot's logbook combined with the operator's records showed a total flying experience of about 10,762 hours up until 30 December 2017. The majority of this experience was on floatplanes; estimated to be at least 9,000 hours. In the previous 90 days, the pilot had flown about 147 hours, and in the previous 30 days the pilot had flown about 61 hours.

Pilot's licence

The pilot commenced flying in Canada in 1997 and obtained his Canadian Commercial Pilot (Aeroplane) Licence in 1998. He also attained his multi-engine rating in 1998, floatplane endorsement and instrument ratings in 1999, and later his Air Transport Pilot (Aeroplane) Licence.

On 4 May 2012, the Civil Aviation Safety Authority (CASA) first issued the pilot with an Australian Commercial Pilot (Aeroplane) Licence. On return to Australia after working as a pilot overseas for about 3 years, CASA reissued the pilot with the licence on 21 March 2017 following a flight review and proficiency check. The pilot held single-engine and multi-engine aeroplane class ratings; and floatplane, manual propeller pitch control, and retractable undercarriage design feature endorsements; and a multi-engine instrument rating. The pilot's current CASA licence, found in the wreckage, was annotated indicating that he had obtained a gas turbine engine design feature endorsement on 16 June 2017 and conducted a single-engine aeroplane flight review on 29 June 2017, valid to 30 June 2019. A regulatory and safety review conducted by CASA found that the pilot was qualified to conduct the flight.

The pilot held an Australian Class 1 Aviation Medical Certificate valid until 6 March 2018 and he was reported to have a high standard of health and fitness.

At the time of the accident, the pilot also held valid Canadian and Republic of Maldives Airline Transport Pilot (Aeroplane) Licences.

Floatplane experience

The pilot's logbook showed that he had experience on a number of float-equipped aircraft including the Cessna 172, 182, 185, 206 and 208, and the de Havilland Canada DHC-2 and DHC-6. A summary of the pilot's floatplane experience is below.

- In 2000-2002, the pilot commenced flying the Cessna 185 on a regular basis and conducted two flights in the DHC-2. In 2003, the pilot regularly flew the Cessna 206.
- From late 2004 to mid-2005, the pilot was flying in The Republic of Maldives as a copilot on the DHC-6. In 2007 the pilot returned to Canada and continued flying floatplanes, which included the DHC-2 and Cessna 182.
- Between December 2011 and April 2014, the pilot flew with Sydney Seaplanes. During this time, the pilot accrued about 447 hours on VH-NOO and 351 hours on the operator's other DHC-2 aircraft.
- From mid-2014 to 2017, the pilot primarily flew in The Republic of Maldives as a copilot and captain on the DHC-6.
- In May 2017, the pilot recommenced with Sydney Seaplanes. He accrued about 88 hours on VH-NOO, 24 hours on their other DHC-2 aircraft, and about 269 hours on the Cessna 208 amphibious aircraft.

Training and checking

On return to Australia in May 2017, the operator's records indicated the pilot completed the following training and checks on the DHC-2 and Cessna 208 amphibious aircraft.

Training and checks on the DHC-2

- On 2-3 May 2017, the pilot completed pilot induction training, which included a theory and flight component.
- On 3 May 2017, the pilot completed the operator's DHC-2 engineering, data and performance questionnaire, which assessed the pilot's knowledge of the aircraft.
- On 5 May 2017, the pilot completed:
  - An operator proficiency check flight to a number of locations including Cottage Point. The flight included emergency actions such as engine failures after take-off and during cruise. The pilot was rated highly.
  - An ALA authorisation check for various locations including Cottage Point. This check assessed the pilot's preparation for the flight; route knowledge; consideration for wires, water depths/channels, tidal effects; and awareness of en route facilities such as communications and emergency facilities. The check indicated a high standard of proficiency.
  - The low-level manoeuvring proficiency check, which the pilot was assessed as being at a high standard. This included:
    - level steep turns in the cruise configuration
    - climbing steep turns in the take-off configuration
    - descending steep turns in the landing configuration
    - missed approach/go-around
    - stall and recovery in the approach configuration
    - manoeuvring at low-level after take-off and before landing.
  - Non-technical skills training in communication, situational awareness, decision making and workload management.

Training and checks on the Cessna 208 (amphibious)

- On 16 June 2017, the pilot completed the operator's Cessna 208 amphibian endorsement systems questionnaire.
- In May-June 2017, the pilot successfully completed training, which included areas on pre-flight preparations, landing operations, water operations, airwork (medium level turns, steep turns, climbing/descending normal and steep turns, stalling in various aircraft configurations), and emergencies such as engine failures and ditching etc.
- On 29 June 2017, the pilot completed an operator proficiency check.
- On 27 July 2017, the pilot completed the ALA authorisation and low-level manoeuvring proficiency checks. Of note, the pilot was assessed as being at a high standard.
- On 20 June 2017, the pilot completed the engine compressor/turbine water wash course.

Additional training

The pilot had completed a flight crew dangerous goods and non-dangerous goods course, human factors flight operations refresher training, fuel barge training, and a CASA alcohol and other drugs 'managing risk' training module. In addition, the pilot had completed Civil Aviation Order 20.11 emergency procedures training on both the DHC-2 and Cessna 208 aircraft on 5 May 2017.

Cottage Point flight experience

According to the operator's estimates, the pilot had flown at least 780 flights to/from Cottage Point. CASA's post-accident regulatory safety review also determined that the pilot was familiar with the area in which the accident occurred.

On the day of the accident, the pilot had conducted seven flights in VH-NOO. This included two short scenic flights over Sydney Harbour, four flights to/from Cottage Point, and one positioning flight without passengers from Cottage Point to Rose Bay. The accident flight was a return flight to Rose Bay.

72-hour prior history

The pilot's personal routine in the 3 days prior to the accident was unknown; however, a friend reported that the pilot's daily routine was regimented and consistent. The pilot would exercise regularly, eat healthily, and would usually go to bed around 2100 on a work night. The friend further indicated that the pilot's work schedule generally commenced between 0700-0800 and finished at 1700-1800.

Between 24-27 December, the pilot had time off work. He then flew in the 3 days leading up to the accident. The pilot's first flight on 31 December (day of the accident) was scheduled for 1000. Work colleagues and persons at Cottage Point who conversed with the pilot prior to this flight and throughout the day reported that he appeared normal, up-beat and happy.

At about 0630 on the morning of the accident, the pilot phoned a long-term friend in Canada, whom he spoke to regularly. The friend reported that the conversation was normal and positive, and the pilot talked about his future personal and career plans.

Aircraft information

The float-equipped DHC-2 Beaver is a predominately all-metal high-wing aircraft designed to carry one pilot and seven passengers. VH-NOO was manufactured in 1963 and first registered in Australia in 1964 (Figure 6). Viking Air (Canada) has been the type certificate holder since 2006. The aircraft was powered by a Pratt & Whitney 'Wasp Junior' R-985 nine-cylinder, single-row, air-cooled radial engine, which drove a Hartzell HC-B3R30-4B three-blade propeller. The aircraft was operated in the visual flight rules day charter category and had a current maintenance release, issued on 9 November 2017 at 21,786.6 hours total time-in-service.

Figure 6: de Havilland Canada DHC-2 Beaver floatplane, registered VH-NOO

Source: Sydney Seaplanes

Maintenance history

The aircraft's logbook statement indicated that it was being maintained in accordance with the operator's approved system of maintenance. This program consisted of daily inspections, engine checks every 50 hours ('A check'), engine and airframe 'periodic' inspections every 100 hours or 6 months ('B check'), numerous other specialised inspections, and the requirement to comply with the appropriate airworthiness directives and Civil Aviation Orders.

A periodic inspection of the aircraft was completed on 6 November 2017 and a new maintenance release was issued. A scheduled engine change was also carried out at this time. The replacement engine had been originally fitted to the operator's other DHC-2, VH-AAM. At about 95 hours' time-in-service on VH-AAM, metal contamination was detected. The engine was disassembled, inspected and reassembled by a maintenance organisation in the United States with nil defects evident. The maintenance organisation advised that insufficient cleaning of the engine at the last overhaul may have been the reason for the suspected metal contamination. The engine was test run satisfactorily before being returned and fitted to VH-NOO. At that time, other inspections and rectifications were carried out. To allow access for this work, the rudder, elevators and horizontal stabiliser were removed and subsequently refitted.

On 11 December 2017, an 'A Check' was carried out at 21,835.9 hours total time-in-service. This check involved inspections on the engine, the floats and their associated components. Two minor additional maintenance items were carried out at this time, consisting of the propeller leading edge being dressed and a leak in the primer system being rectified. The associated worksheets did not identify any further defects.

Previous accident

The ATSB investigated a fatal accident involving the same aircraft, then configured for aerial agriculture operations including a fixed undercarriage. That accident occurred on 15 November 1996. The aircraft was rebuilt in 1999 and converted to a floatplane. A Certificate of Airworthiness was issued and the aircraft re-entered service in December 1999, initially as VH-IDI and then

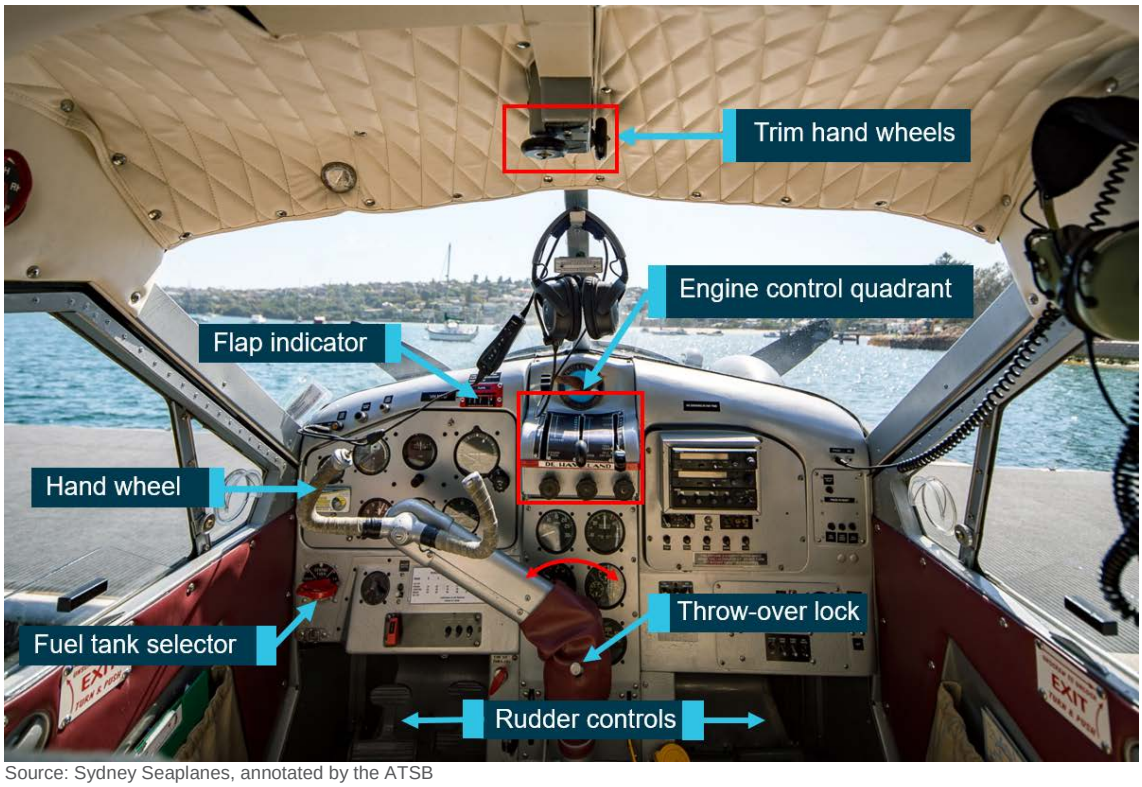
registered as VH-NOO, in February 2000. Sydney Seaplanes acquired the aircraft in 2006. There was nothing to indicate the rebuild 18 years before had any connection with this accident.

Aircraft system controls

The location of the key aircraft system controls in VH-NOO are detailed below (Figure 7).

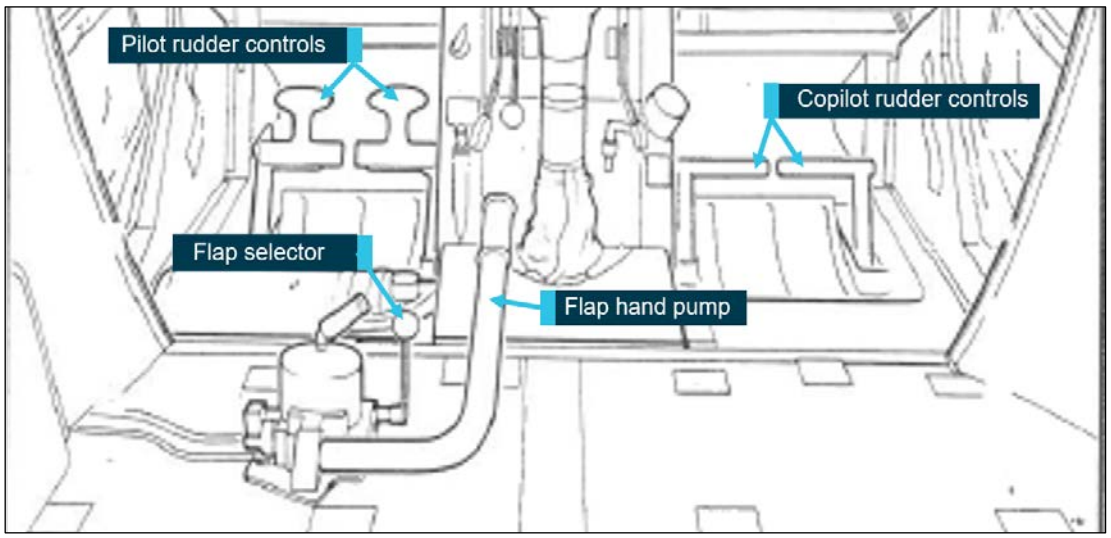
- **Engine controls:** The propeller (left), throttle (middle) and mixture levers (right) were located in the engine control quadrant on the top of the pedestal. A friction control lock was located below each lever.
- **Flight control system:** The flight control system on the DHC-2 is conventionally operated by a control column and rudder pedals (Figure 7). VH-NOO was fitted with a single control column on the pilot's side and dual rudder controls. The rudder pedals on the copilot's position were as per standard fitment (Figure 8). The upper portion of the control column, including the hand wheel could be 'thrown-over' for use by a copilot in the right seat. This could be done during level cruising flight without disturbing the balance of the aircraft. A bolt at the hinge point of the control column locked the hinged upper portion of the column in position.
- **Trim system:** Trim tabs were fitted to the elevator and rudder, which could be adjusted by the pilot by manipulating hand wheels on the cockpit roof.
- **Flaps:** The wing flap selector, UP and DOWN, and hydraulic hand pump were located on the right side of the pilot's seat. Intermediate positions of the flaps were made by moving the selector to either the UP or DOWN position and then pumping the hand pump to the desired position shown on an indicator ('FULL', 'LAND', 'TOFF' and 'CLIMB') located above the instrument panel.
- **Fuel system:** The aircraft was fitted with three fuel tanks in the fuselage (front, centre and rear) and a supplementary fuel tank in each wingtip. The operator reported that they very rarely used the wingtip tanks. The tank selector was located to the left of the instrument panel.

Figure 7: VH-NOO cockpit showing the aircraft system controls



Source: Sydney Seaplanes, annotated by the ATSB

Figure 8: VH-NOO rudder and flap controls



Source: DHC-2 Beaver Flight Manual, annotated by the ATSB

Environmental information

Bureau of Meteorology

The nearest Bureau of Meteorology automatic weather station (AWS) was located at Terrey Hills, about 11 km south-south-east of Jerusalem Bay. Another AWS was located at Gosford about 22 km north-north-east of Jerusalem Bay. At 1500 on the day of the accident, the Terrey Hills AWS recorded the wind at 13 km/h (about 7 kt) from the north-east. The Gosford station recorded the wind at 20 km/h (about 11 kt) from the east-north-east. The Bureau of Meteorology analysed the meteorological conditions in the accident area and advised that:

- The forecast low-level winds at 1400 and 1700 showed that the winds near the surface were from the east, north-east at about 15 kt, backing around to the north.
- Weather radar imagery showed there was no rain in the area.
- Based on the height and orientation of the terrain in Jerusalem Bay, and the assumption that the wind flow was from the north-east at about 10-15 kt, the wind would have been flowing over the hills into the bay. Based on the wind strength, it was reasonable to assume that moderate turbulence due to orography would have been unlikely. However, light turbulence could not be discounted.

Bureau of Meteorology tidal recordings at the Ku-ring-gai Yacht Club (near Cottage Point), stated that it was low tide at 1400 indicating that the tide was in-coming at the time of the accident.

Other pilot observations

The pilot who departed Cottage Point shortly before VH-NOO stated that the conditions were considered standard and estimated the wind was from the north-east at about 15-20 kt, with an occasional gust. The water conditions were not choppy and no white caps were visible.

Witness observations

Witnesses positioned in Jerusalem Bay generally indicated that the wind was directly into the bay at various strengths, which would have resulted in the aircraft experiencing a tailwind at the time the aircraft entered Jerusalem Bay. A detailed review of the witness observations in both Cowan Creek and Jerusalem Bay is being finalised and will be included in the ATSB's final investigation report.

Interpretation of passenger photographs

The ATSB sought the opinion of several experienced floatplane pilots on the meteorological conditions based on the photographs taken by the passenger on board VH-NOO (Figure 2). Those pilots estimated that the conditions were:

- A 15-18 kt breeze on the water and was considered to be a standard day.
- The wind was 12-15 kt from the north, north-north-east. The wind was coming over the hills and onto the water, and you would expect some gusting and very minor wind shear. The cloud was at 1,500 ft or higher.
- The wind was 10-15 kt, possibly up to 20 kt. There was overcast[6] cloud, probably at 3,000-4,000 ft.

Communications

A review of Airservices Australia audio recordings of the applicable air traffic control frequency between 1430 and the time of the accident found nil radio calls broadcast by the pilot. However, given the low altitude of the aircraft, any calls made would have been shielded by the terrain. A review of the surveillance data did not identify any radar returns in the vicinity, most likely due to terrain shielding. The lowest radar return observed in that area at other times was 700 ft. Airservices advised that there was nil notice to airmen[7] relevant to the area of operation leading up to, and on the day of the accident.

It was common practice for the operator's pilots to make radio broadcasts when departing Cottage Point, to alert other aircraft in the immediate vicinity of their presence and intentions. The operator's other DHC-2 had departed Cottage Point about 10 minutes prior to VH-NOO. The first broadcast heard from that pilot was when he was in the Pittwater and northern beaches area. Further, by the time VH-NOO had taken off, the pilot of the other aircraft was on a different radio frequency and did not hear any radio calls from VH-NOO.

Within the cabin, all of the occupants wore headsets. The pilot's headset had a microphone so that he could make radio calls and talk to the passengers. The passenger headsets were not fitted with microphones; they could listen to the pilot, but could not communicate with him or broadcast externally. If the passengers wanted to communicate, they had to talk above the engine noise.

Recorded information

Passenger camera

During the aircraft examination, a Canon EOS 40D digital single-lens reflex camera (DSLR) containing a compact flash (CF) card was found inside the cabin (Figure 9). The camera was identified as belonging to the front right seat passenger.

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6 Cloud cover: in aviation, cloud cover is reported using words that denote the extent of the cover – 'overcast' indicates that all the sky is covered.

7 A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

Figure 9: Passenger camera as found in the aircraft (left) and CF card removal (right)

Source: ATSB

The CF card (Sandisk 32 GB Extreme PRO 160 MB/s) was cleaned and dried before X-ray examination. Corrosion was identified and the card was unable to be read directly by the ATSB's standard card reader. The four memory chips and one controller chip were removed from the CF card and transplanted onto a donor CF card circuit board.

The CF card contained 362 images for a total of 1.30 GB. A forensic reader was used to extract an additional 50 images to total 412 images of 1.46 GB.

Five[8] photographs were taken while the passengers boarded the aircraft at Cottage Point at about 1457. An additional 22[9] photographs were taken during the taxi and after becoming airborne from Cottage Point along Cowan Creek, from 1505 to 1512. These were taken through either the front windscreen or the front right passenger window. Nine[10] of these photographs were taken while airborne over a 39-second interval. The last photograph on the CF card (412) was through the front windscreen with the aircraft in a right bank over Little Shark Rock Point heading south towards Cowan Bay (Figure 12).

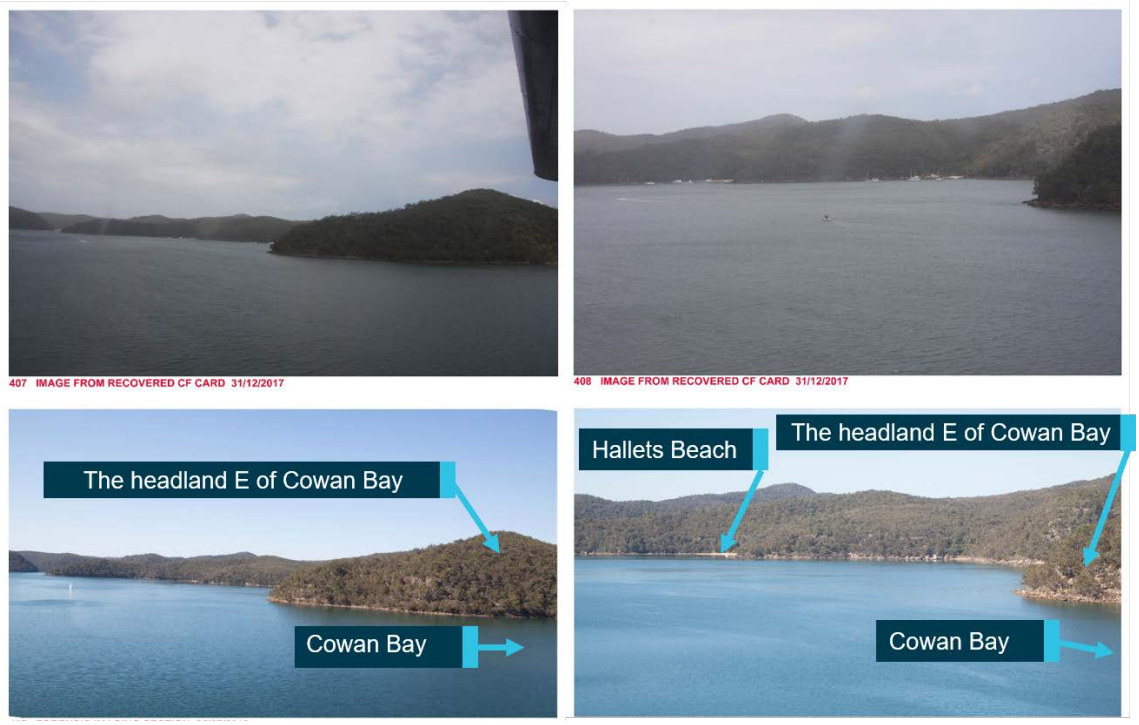
The NSW Police Force (police) Forensic Imaging section conducted a re-enactment flight to establish the aircraft's location and altitude at the time each of the passenger photographs were taken. This was done by matching the focal length and aperture setting using a DSLR camera on board the police helicopter over Cowan Creek. Figure 10, Figure 11 and Figure 12 show a comparison of the passenger (top) and forensic imaging (bottom) photographs taken as the flight progressed.

[8] 000386.jpg to 000390.jpg
[9] 000391.jpg to 000412.jpg
[10] 000404.jpg to 000412.jpg

Figure 10: Comparison photographs for CF card images 405 (looking forward) and 406 (looking forward)

Source: NSW Police Force, annotated by ATSB

Figure 11: Comparison photographs for CF card images 407 (looking right) and 408 (looking right)



Source: NSW Police Force, annotated by ATSB

Figure 12: Comparison photographs for CF card images 410 (looking right) and 412 (looking forward)

Source: NSW Police Force, annotated by ATSB

Table 1 details the respective camera setting for each photograph taken by the passenger, and the aircraft's location (latitude and longitude) and altitude established by the police.

Table 1: Camera settings, locations and altitude for comparison photograph

Photograph	Aperture	Focal length	Time hh:mm:ss	Estimated Latitude	Estimated Longitude	Estimated Altitude
405	f/20	17 mm	15:11:50	33.599550°S	151.215141°E	43 ft
406	f/18	17 mm	15:11:57	33.598109°S	151.216812°E	77 ft
407	f/16	17 mm	15:12:07	33.595871°S	151.218732°E	140 ft
408	f/14	41 mm	15:12:13	33.594448°S	151.219963°E	140 ft
410	f/14	41 mm	15:12:23	33.593285°S	151.222965°E	175 ft
412	f/14	41 mm	15:12:29	33.593329°S	151.225653°E	175 ft

Source: ATSB and NSW Police Force

Using the information in Table 1, a flight path model was developed for the portion of the flight where camera images were available (Figure 13 and Figure 14).

Figure 13: View towards Jerusalem Bay of flight path developed from passenger images

Source: NSW Police Force, Google earth, annotated by the ATSB

Figure 14: View towards Hawkesbury River of flight path developed from passenger images

Source: NSW Police Force, Google earth, annotated by the ATSB

Passenger mobile phone

A passenger's Apple iPhone 5s was recovered on 12 January 2018 from Jerusalem Bay by the police. The phone was repaired by the police State Electronic Evidence Branch and the contents of the phone examined. An image taken prior to boarding VH-NOO at Rose Bay and images taken on board the aircraft at 1502 were used to correlate the time of the front seat passengers DSLR camera and to identify the passenger seating positions.

On the release of the preliminary factual report on 31 January 2018, the ATSB appealed for more witnesses to the flight of VH-NOO. As a result, a witness contacted the police and ATSB to provide an eyewitness account of the flight path and the images of VH-NOO as seen at Figure 3.

Wreckage recovery and examination

Recovery

The aircraft came to rest upside down on the floor of Jerusalem Bay. The wreckage was located near the entrance to Pinta Bay (Figure 15) at a depth of about 14 m. A significant quantity of fuel leaked from the aircraft and was observed in the water. On 4 January 2018, the aircraft was recovered from the water, where it was established that both wings and floats had become separated from the fuselage with the left wing located about 75 m East of the main wreckage (fuselage, tail, engine, floats and right wing). The aircraft was retrieved during three 'secure and lift' operations undertaken by the NSW Police Diving Unit and a barge operated crane crew. These were:

- the main sections of both aircraft floats and the right wing
- the main fuselage including the engine, propeller and tail section
- the left wing.

The police conducted further diving operations to retrieve the remaining aircraft debris and items on-board at the time of impact.

Figure 15: VH-NOO accident location in Jerusalem Bay

Source: NSW Police Force, annotated by the ATSB

Aircraft wreckage

The aircraft was transported to secure facilities at Bankstown Airport, NSW for further examination by the ATSB. Examination of the aircraft wreckage indicated that (Figure 16):

- all major sections of the aircraft structures were recovered
- there was no evidence of a birdstrike or collision with an object prior to take-off or in-flight
- there was no evidence of an in-flight break-up or pre-impact structural damage
- there was no evidence of a pre-existing aircraft defect
- the front of the aircraft and float tips had been significantly damaged
- both the wings and floats had separated from the fuselage during the impact sequence
- both wing front spars had fractured in overload
- damage was consistent with the aircraft being slightly right wing down when colliding with the water and the fuselage then likely cartwheeled span-wise, to the right
- there was flight control continuity throughout, indicating no evidence of flight control issues[11]
- the throw-over control column was positioned on the pilot's side
- the fuel was selected to the centre tank and all fuel filler caps were found secured
- the cabin carbon monoxide detector in the cockpit showed nil indication of gas
- there was no cockpit voice or flight data recorder (nor was there a regulatory requirement for an aircraft this size to be fitted with them)
- there was no commercial video recording equipment fitted to the aircraft.

Figure 16: Wreckage examination

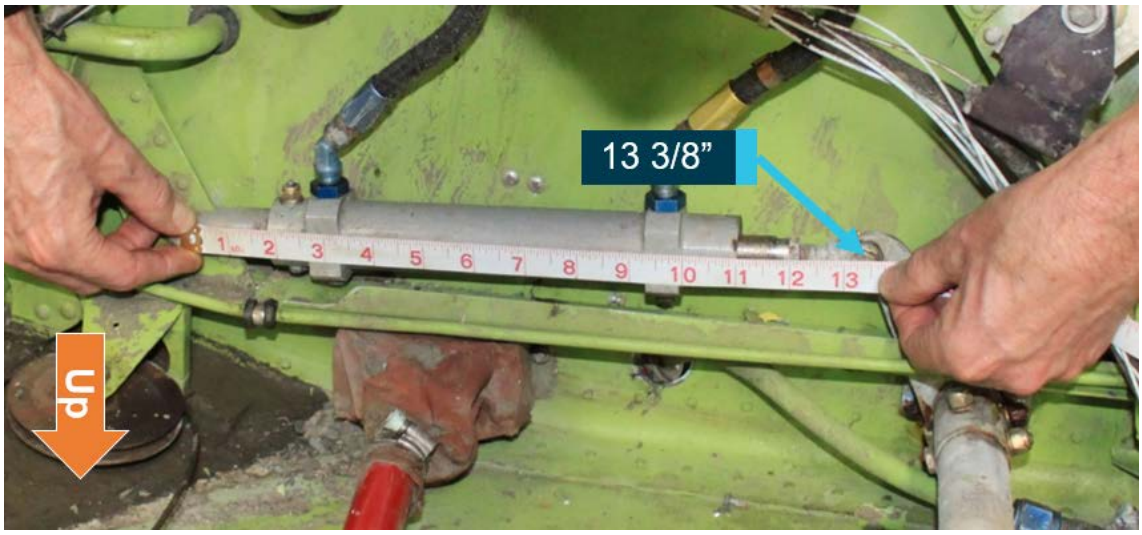
Source: ATSB

Aircraft configuration

The examination found that the flap actuator was extended to 13 3/8" (Figure 17), which according to the aircraft maintenance manual wing flap settings, was consistent with 'climb' flap of 15° being selected. The rudder trim was selected to the right, indicative of normal operations in this type of aircraft, and the elevator trim was neutral, consistent with normal operations for a 'full load'.

[11] Flight controls inside the aircraft were connected to flight control surfaces on the aircraft structure.

Figure 17: Flap actuator



Source: ATSB

Fuel testing

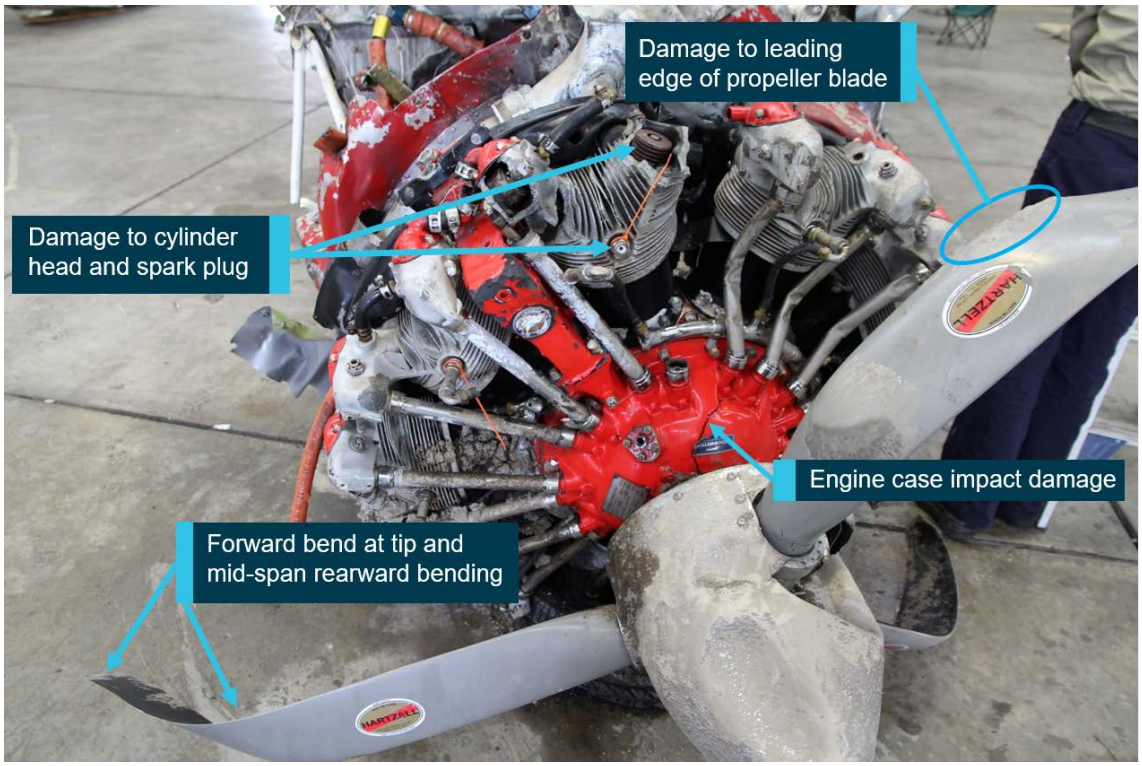
Fuel samples were collected by the police from the operator’s refuelling point at Rose Bay. The fuel was tested by the ATSB for the presence of water, with nil indications found. A visual inspection did not identify any particle matter in the fuel. In addition, there were no reports of fuel quality concerns with the operator’s other DHC-2 aircraft utilising the same fuel source.

Engine and propeller examinations

The engine and propeller examinations were conducted at separate maintenance facilities under ATSB supervision. These examinations did not identify any pre-existing damage or conditions that may have contributed to the accident. Specifically, the examinations identified that (Figure 18):

- damage was consistent with the aircraft impacting the water in a steep nose-down attitude
- some of the supercharger section impeller intermediate drive gear teeth had sheared in overload, which was consistent with the engine producing power at the time of the collision with water
- one propeller blade had forward bending at the tip, then mid-span rearward bending, which was consistent with the engine driving the propeller at impact
- one propeller blade had damage that corresponded to impact damage on one of the engine cylinders, indicative of the propeller rotating as the impact forces bent it backward the propeller was rotating under power but likely at less than full power.

Figure 18: Damage to the engine and propeller, oriented upside down



Source: ATSB

Operational information

Cottage Point departure

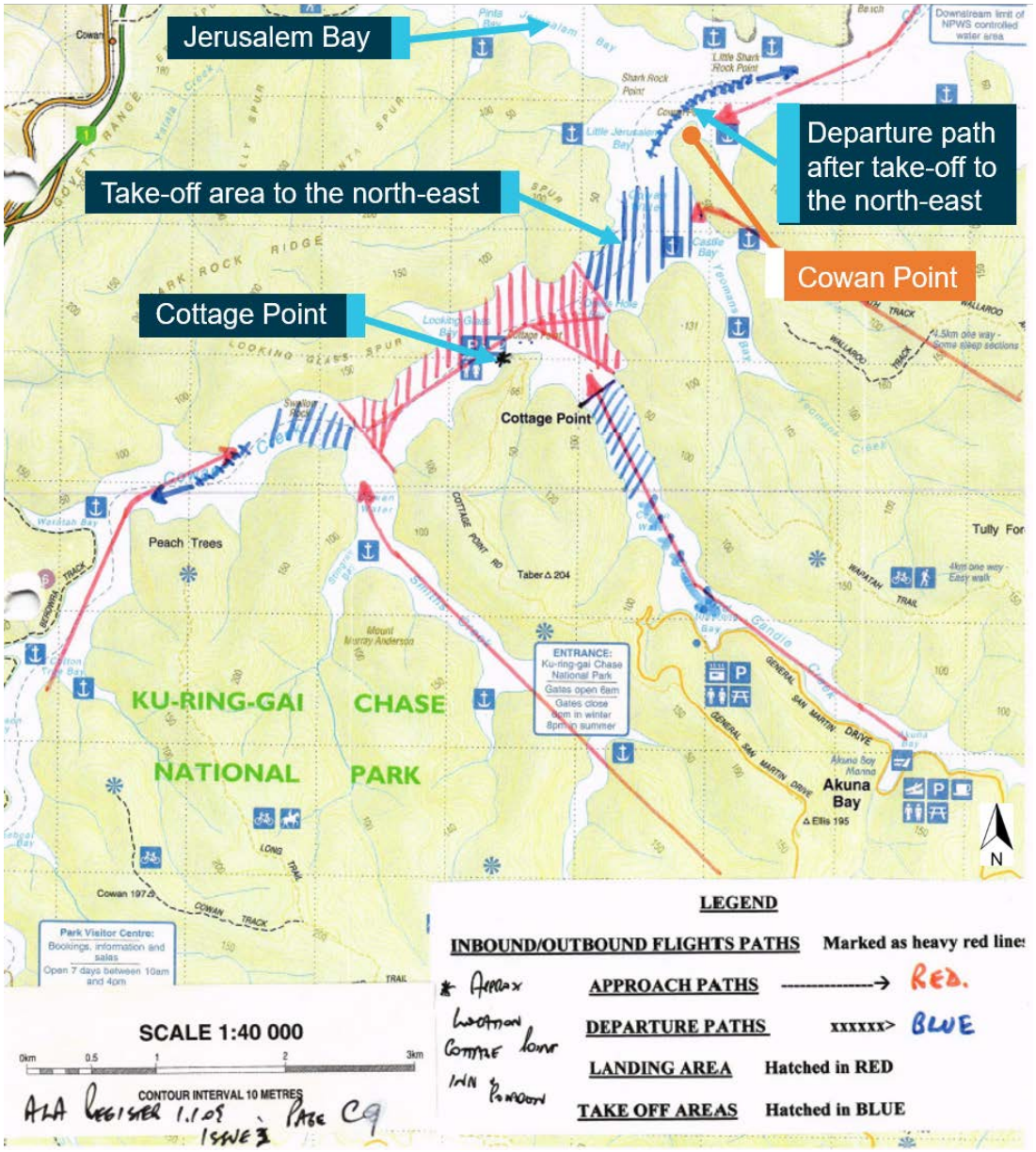
Cottage Point is located at the junction of Cowan Creek, and Coal and Candle Creek in the Ku-ring-gai Chase National Park, about 26 km north of Sydney Harbour. Cottage Point was considered one of the operator's most popular destinations, which was about a 20-minute flight from Rose Bay.

The operator's authorised landing area (ALA) register provided their pilots with details on each of the locations they operate to, including Cottage Point. This included information such as the recommended approach, go-around and departure paths; environmental considerations; passenger facilities; and any limitations or potential hazards such as weather, wires, water depths/channels, tidal effects etc. The intent of the register was to supplement a thorough inspection and assessment of the alighting area by the pilot prior to landing or departing.

Figure 19 shows the recommended flight paths for Cottage Point. The blue hatching and crossed-lines respectively represent the take-off area and departure paths, while the approach paths and landing areas are shown in red. Specifically relating to the accident flight, the recommended take-off area was to the north-east of Cottage Point. After take-off, the departure path was to follow the river to the north-east passing Cowan Point.

The register also noted that there was limited very high frequency communications in the Cottage Point area due to terrain shielding. However, a relay of any radio broadcasts may be possible using overflying aircraft. In addition, it also stated that, if the wind conditions exceeded 30 kt, the ALA was considered unusable.

Figure 19: Cottage Point diagram of the recommended flight paths from the ALA register



Source: Sydney Seaplanes, annotated by the ATSB

A review of the standard departure from Cottage Point typically taken by the other pilots is being finalised for inclusion in the ATSB's final investigation report. This will specifically examine the departure path and aircraft configuration. Further, an assessment of any applicable video from previous passengers, the standard flight conducted by the operator and recorded by the police, expert opinion of the passenger photographs, and witness observations on the day of the accident will be included in the report.

Weight and balance

The aircraft's weight and balance at the time of departure from Cottage Point was estimated using the pilot's weight from a previous trip record, passenger weights provided at the time of booking the flight, baggage weights from the aircraft wreckage, and the fuel load determined from re-fuelling and trip records. The seating positions were ascertained from a review of the passenger photographs. The calculations established that the aircraft's take-off weight was between 2,297 kg and 2,309 kg. The aircraft's maximum take-off weight was 2,309 kg. Based on these estimates, and using the operator's loading systems, the aircraft was within the forward and aft centre of gravity limits.

Organisational and management information

Sydney Seaplanes

Sydney Seaplanes has been operating since 2005. Based out of Rose Bay, they conduct scenic flights around the Sydney area, and fly to numerous restaurants and accommodation in the region, with 27,000 passengers travelling per year. At the time of the accident, they had five aircraft, two DHC-2, two Cessna 208's, and one Cessna 206.

Air operator's certificate

A CASA air operator's certificate (AOC) was re-issued to the operator on 25 June 2015, valid until 30 June 2018. The AOC schedule stipulated that the operator was approved to conduct charter operations only (passenger and cargo) and was authorised to operate the Cessna 208 in this category. Further, the operator was authorised to conduct charter operations in single-engine piston aircraft with a maximum take-off weight less than 5,700 kg, such as the DHC-2, other than amateur built or kit-built aircraft. This was limited to Australian registered aircraft in Australian territory.[12] In addition, for operations conducted in the authorised aircraft types above, the operator was permitted to conduct amphibious operations and operate aircraft fitted with float alighting gear.

Subsequent to the accident, the operator's AOC was re-issued on 19 June 2018, valid until 30 June 2021, with the same provisions stipulated above.

CASA surveillance

On 19 September 2017, CASA conducted an on-site audit of Sydney Seaplanes, which included an examination of both airworthiness and flying operations, and an observation flight on the DHC-2. CASA found the operator to be compliant and the activities observed were very efficiently conducted and in a professional and confident manner, with nil non-compliance notices or observations issued.

CASA post-accident regulatory and safety review

Following the accident, CASA conducted a regulatory and safety review. The review found no evidence to suggest that the operator and maintenance provider were non-compliant with the provisions of their respective AOC and Certificate of Approval. The review did not identify any immediate action that CASA should consider in the interests of aviation safety.

Safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk.

The ATSB has been advised of the following proactive safety action taken by Sydney Seaplanes in response to this accident.

- Immediately following the accident, Sydney Seaplanes suspended operations. They resumed operations in their Cessna 208 amphibious aircraft on 15 January 2018, with an interim provision of having two crew on board. The company did not resume operations in the DHC-2 aircraft until they were satisfied that there was no mechanical failure or fuel contamination that contributed to the accident of VH-NOO.
- All pilots received re-currency training on all the frequently used ALA's.
- All pilots completed refresher helicopter underwater escape training.

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[12] Operations authorised to be conducted in Australia may also be conducted into, or out of Australia up to a distance for 200 NM from mainland Australia, Tasmania and the Australian Torres Strait Islands, and not in airspace of another Contracting State.

- All aircraft have been fitted with GPS tracking devices, which provide real-time positioning information and flight data.

Ongoing investigation

As part of the investigation, the ATSB has interviewed Sydney Seaplanes' pilots and management, a considerable number of witnesses, and several floatplane experts; conducted a detailed examination of the aircraft and reviewed the maintenance history; analysed information from photographic footage taken during the accident flight and on previous flights; and engaged an aviation medical specialist. The ATSB investigation is continuing and will include consideration of the following:

- the flight path taken on the day of the accident compared with the standard departure from Cottage Point typically taken by the other pilots
- finalise witness information
- the pilot's health and medical history
- occupant egress and survivability
- aircraft performance and handling characteristics
- similar occurrences in Australia and internationally and associated safety recommendations
- fitment of lightweight flight recording systems (Eurocae document ED-155) for passenger operations in aircraft with a maximum take-off weight less than 5,700 kg.

Once the draft report has been completed, directly involved parties (DIPs) will be offered the opportunity to review and comment on the factual accuracy of the report. The final report will be released following the review of any DIP submissions. The ATSB will bring any safety issues identified during the course of the investigation to the attention of those affected and seek safety action to address the issue.

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The information contained in this interim factual report is released in accordance with section 25 of the Transport Safety Investigation Act 2003 *and is derived from the initial investigation of the occurrence. Readers are cautioned that new evidence will become available as the investigation progresses that will enhance the ATSB's understanding of the accident as outlined in this report. As such, no analysis or findings are included in this update.*