Australian Government

Australian Transport Safety Bureau

Collision with terrain involving Cessna 208 Caravan, VH-WTY

11 km north-east of Hamilton Island Airport, Queensland on 28 January 2016

ATSB Transport Safety Report

Aviation Occurrence Investigation

AO-2016-007

Final – 25 June 2020

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Publishing information

Published by: Australian Transport Safety Bureau
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Addendum

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Safety summary

What happened

VH-WTY at Chance Bay earlier on 28 January 2016

Source: Used with permission

On 28 January 2016, the pilot of a Cessna Aircraft Company C208 Caravan amphibian aircraft, registered VH-WTY, was flying 10 passengers on a charter flight over the Great Barrier Reef, Queensland. Before returning to Hamilton Island, the flight was scheduled to stop for about 90 minutes at Chance Bay, Whitsunday Island, about 11 km north-east of Hamilton Island Airport. During the attempted water landing, the aircraft bounced twice on the water's surface. The pilot then initiated a go-around and the aircraft bounced a third time. While attempting to climb out of the bay, the aircraft clipped trees and collided with terrain. The pilot and all passengers safely exited the aircraft with minor injuries. The aircraft was destroyed.

What the ATSB found

The ATSB found that the aircraft was flown beyond the aircraft landing area northern boundary before the first bounce off the water. This, combined with the delay in initiating a go-around, reduced the options and margins available for a safe outcome.

The engine operating limitations contained in the float operations pilot operating handbook supplement were also not consistent with other publications and may have influenced the power level applied by the pilot during the go-around.

What's been done as a result

The float manufacturer-published pilot operating handbook supplement was amended with respect to engine operating limits.The operator advised they have taken action to enhance or update existing procedures and checklists for their float plane operations.

Safety message

Charter seaplane operations present unique challenges, particularly in relation to the water landing environment. Variable sea conditions and the possibility of sharing the landing area with marine vessels and people mean that every landing has the potential to be markedly different.

A go-around is a normal procedure and a safe option whenever landing conditions are not satisfactory. However, it is important to consider aircraft performance and local conditions when planning an escape route, including conducting 'mental rehearsals' of standard procedures. In addition, making an early decision to conduct a go-around significantly reduces the associated risk.

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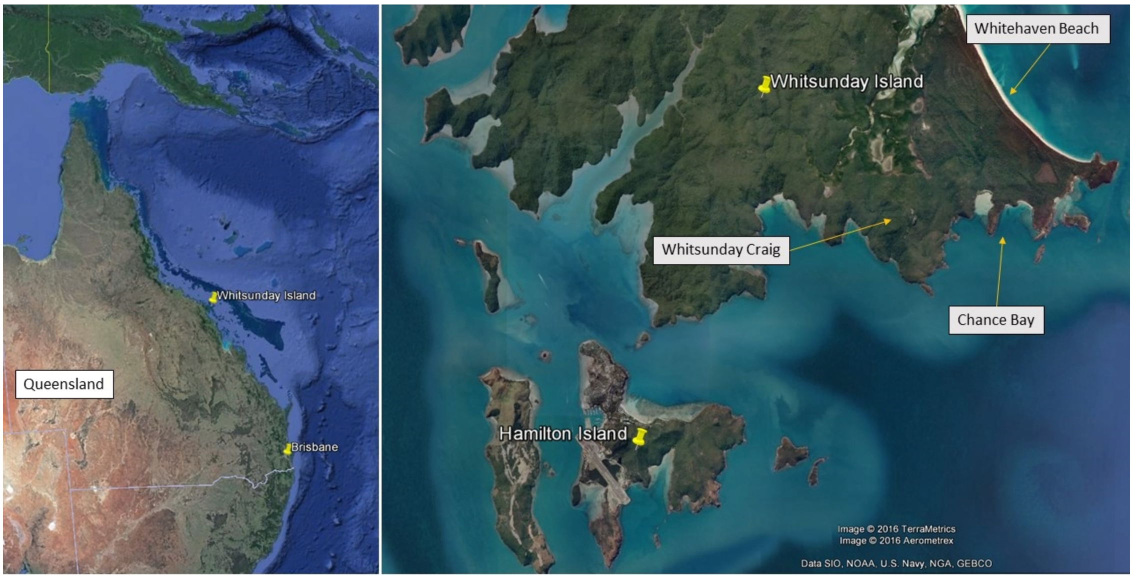
The occurrence

On 28 January 2016 the pilot of a Cessna Aircraft Company Caravan 208 amphibian aircraft, registered VH-WTY (WTY) was conducting a series of charter flights in the Whitsunday region of Queensland.

The pilot was conducting his third flight of the day when the aircraft departed Hamilton Island Airport at about 1415 Eastern Standard Time[1] with 10 passengers on board. The tour included a scenic flight over the Great Barrier Reef for about 50 minutes before heading to Chance Bay, on the south-east tip of Whitsunday Island, about 11 km north east of Hamilton Island Airport (Figure 1). Following a water landing at Chance Bay, the group was to spend 90 minutes at the beach before a short flight back to Hamilton Island. The tour was originally planned to include a landing at Whitehaven Beach, however wind conditions at the time required the water landing be altered to Chance Bay.

Figure 1: Google Earth overview showing Whitsunday Island location



Source: Google Earth, modified by the ATSB

Radar surveillance data showed WTY approach Whitsunday Island from the north and conduct an orbit about 2 km north of Whitehaven Beach at about 1510, before heading toward Whitehaven Beach. WTY flew over the southern end of Whitehaven Beach and the strip of land that separates it from Chance Bay. At about 1515, after crossing Chance Bay beach in a southerly direction, WTY descended below radar surveillance for the remainder of the flight.

The pilot advised that he flew WTY over the western end of Chance Bay's main beach in order to conduct a visual pre-landing check of the bay. The pilot noted the positions of various vessels moored in the bay to determine the best taxi path to the beach. During this fly-over, the pilot also noted the sea state and observed evidence of wind gusts on the water surface. The pilot then initiated a right downwind turn toward the landing area. The approach was from the south with the intent to land in the most suitable location within the designated landing area and then taxi to the beach.

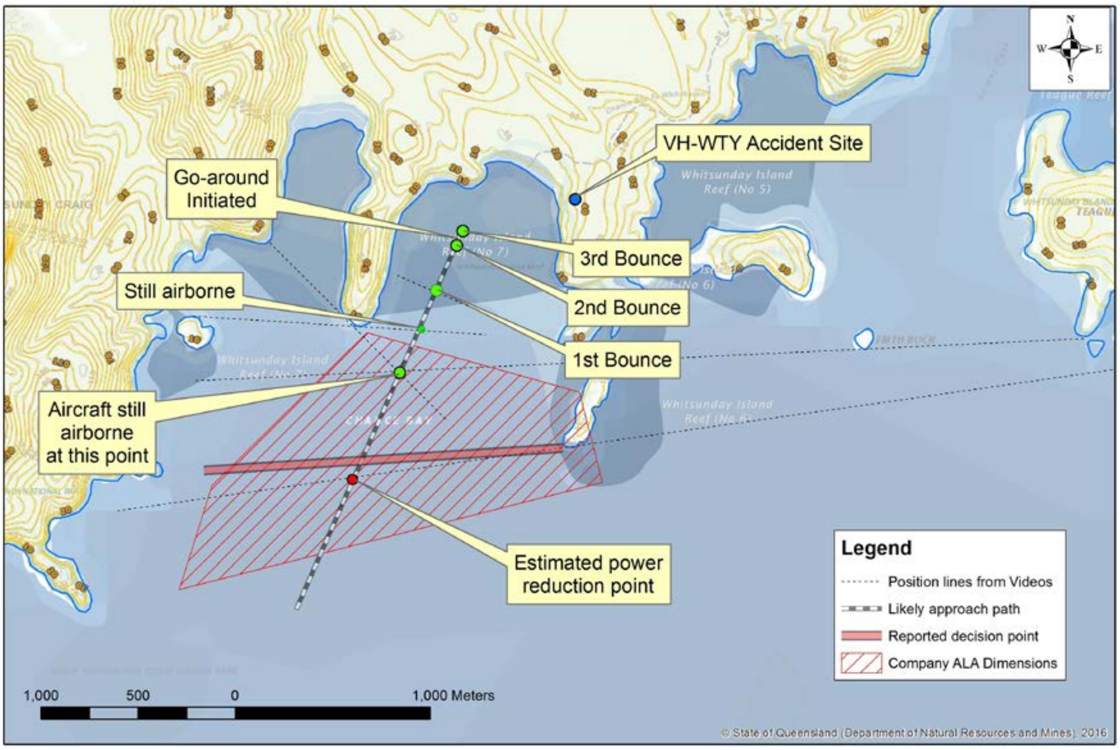
The pilot reported setting up for landing at about 50 ft above the water and then delayed the landing in order to fly through an observed wind gust. Passenger video footage indicated that, during the subsequent landing, WTY bounced three times on the surface of the water (Figure 2). After the second bounce, with WTY getting closer to the beach and terrain, the pilot increased engine power and initiated a go-around. The third bounce, which occurred almost immediately

[1] Eastern Standard Time (EST): Coordinated Universal Time (UTC) + 10 hours.

after the second, was the most pronounced and resulted in the aircraft rebounding about 30 to 50 ft above the water. While increasing power, the pilot perceived that the torque was indicating red, suggesting an over-torque for the selected propeller configuration. Noticing that the climb performance was less than expected with the flaps at 30˚, the pilot stopped increasing power and reduced the flap to 20˚.

As the aircraft climbed straight ahead towards a saddle, climb performance was still below the pilot's expectations and he assessed that WTY would not clear the terrain. In response, the pilot turned right to avoid the surrounding rising terrain.[2] WTY clipped trees during this turn, before colliding with terrain and coming to rest in dense scrub about 150 m from the eastern end of the main beach, near the top of the ridge. The pilot promptly advised the passengers to exit and move away from the aircraft. Some of the 11 people on board suffered minor injuries but all were able to quickly leave the aircraft. There was no post-impact fire.

Figure 2: Aircraft track toward Chance Bay main beach, showing approximate bounce locations and VH-WTY final position



Source – Basemap – State of Queensland, modified by ATSB

The aircraft's fixed emergency beacon self-activated during the collision with terrain and was detected by the Australian Maritime Safety Authority (AMSA), resulting in a search and rescue response being initiated by the Joint Rescue Coordination Centre (JRCC) Australia. The pilot reported also activating his personal locator beacon, however this was not detected by AMSA. In addition, the pilot used the company satellite phone to advise the operator of the occurrence and current status of all on board. At about the same time, several witnesses who were located in Chance Bay made their way to the aircraft before assisting everyone down to the beach. A tourist boat was utilised to transfer the pilot and passengers to Hamilton Island, arriving at about 1600. From there, one passenger was transferred by helicopter to Mackay for further treatment.

[2] The terrain rose to about 30 m at the saddle and about 50 m at the ridge to the east of the bay. More detail in the section titled *Chance Bay*.

Context

Pilot information

The pilot commenced flying in November 2008, was issued a Private Pilot Licence (Aeroplane) in July 2010 and a Commercial Pilot Licence (Aeroplane) in June 2012. The commercial licence was endorsed with a class rating for single-engine aircraft and design feature endorsements for floatplane,[3] manual propeller pitch control, retractable undercarriage and gas turbine engine. The pilot held a class 1 aviation medical certificate with no restrictions, and also held a valid boat driver's licence to allow operation as pilot-in-command of floatplanes, when operated on the water. The pilot commenced flying with the operator in May 2014.

To be a charter pilot on single-pilot, single-engine floatplane aircraft (Beaver and C208 Caravan as operated by the operator), under day VFR operations, the company required a pilot to have the following minimum qualifications and experience:

- Commercial Pilot Licence(Aeroplane)
- type or class endorsement
- minimum of 50 hours on type or equivalent type
- minimum of 250 water landings.

The pilot had accrued about 1,350 hours of total flying experience, which included 483 water landings across several aircraft types, including the company-operated Cessna Aircraft Company C208 Caravan (C208 Caravan), and de Havilland Canada DHC-2 (Beaver). The pilot also flew the company land-based GippsAero GA8 Airvan.

Table 1 shows the total number of water landings conducted by the pilot in WTY at Whitehaven Beach and Chance Bay, and Table 2 shows the number of water landings conducted by the pilot, in WTY in the last 90 days. In total on the C208 Caravan, the pilot had accrued about 230 hours and 165 water landings.

The pilot advised he had conducted one go-around during line operations. This was carried out about 18 months previously, in the Beaver at Whitehaven Beach. In addition, all of the pilot's training flights into Chance Bay had been conducted in the Beaver.

Table 1: Pilot-conducted water landings in VH-WTY for Whitehaven Beach and Chance Bay

	Whitehaven Beach	Chance Bay
Dual (ICUS)	34	0
Solo	117	14
Total	**151**	**14**

Table 2: Water landings by pilot in VH-WTY in last 90 days. Figures in brackets show water landings conducted in other aircraft types.

	November 2015	December 2015	January 2016	Total
Whitehaven Beach	18 (2)	29 (6)	20 (4)	67 (12)
Chance Bay	5	1	5	11
Reef / other	9 (1)	9 (8)	9 (8)	27 (17)

[3] A seaplane is a fixed-wing aircraft that can operate from the water and is identified by two categories: floatplanes, having pontoons or floats as landing gear, and flying boats, where the main source of buoyancy is the fuselage. Amphibian aircraft are capable of routinely operating from land or water. All three terms are often interchanged.

The pilot had conducted five water landings at Chance Bay during January 2016, all in WTY. This included two landings on 24 January 2016, and one at about 1205 on 28 January 2016, prior to the occurrence landing at about 1515.

The pilot's training records also show a 'line check proficiency report', conducted on 13 November 2015, which included water landings at Hardy Reef and Whitehaven Beach. The report identified that this line check was conducted with a 'light load'. The comments section of the report included the following:

> after splash-n-go at Hardy, slow to feed in full PWR once airborne, speeds ok, just need to get the power in faster with heavier loads in confined spaces.

The pilot passed the proficiency check and there was no record of any further training, or dual flights, being conducted.

In summary, at the time of the occurrence, the pilot was suitability qualified and authorised to operate the C208 Caravan in Chance Bay. Drug and post-incident alcohol testing did not identify any substance that could have impaired the pilot's performance.

Sleep and work history

On the day of the occurrence the pilot woke up at about 0530, and arrived at work at 0645. He undertook three flights totalling 3.3 hours of flying. The occurrence took place at 1515, therefore meaning he had been at work for about 7.5 hours, and awake for about 8.5 hours. The pilot flew for approximately 5 hours the previous day and had two days off prior to that.

The pilot reported that he usually obtained about 8 hours of sleep per night and that he was healthy and not overly-tired at the time of the occurrence. There was no evidence that the pilot was experiencing a level of fatigue known to affect performance at the time of the accident.

Operator information

The operator had been the sole general aviation service provider for the privately owned Hamilton Island Resort since June 2010. They operated a fleet of 16 aircraft, which included light helicopters and fixed-wing aircraft. Hamilton Island was the main operating base for charter flights and tours to Hayman Island, Whitsunday Island and the Great Barrier Reef. The Civil Aviation Safety Authority (CASA) issued an air operator's certificate (AOC) that permitted charter flights and specified aerial work applications.

Civil Aviation Regulation (CAR) 215 *Operations manual* required an operator to provide an operations manual for the use and guidance of operations personnel. The operator's operations manual was prepared in accordance with CASA guidelines, was reportedly available to all personnel, and was last updated in 2011. In July 2017, the operator submitted to CASA, and had accepted, a revised operations manual which included a description of a safety management system (SMS) that was to be implemented. There is currently no requirement for a SMS for this type of operation. However, CASA encouraged all operators to develop and maintain an SMS.

Aircraft information

General

VH-WTY (WTY) was an unpressurised, single-engine, high wing, turboprop amphibian aircraft that could accommodate up to 14 people, operated by a minimum crew of one. WTY was manufactured in the United States in 2010 and was powered by one Pratt & Whitney Canada (PWC) PT6A-114A turboprop engine. The aircraft had Wipaire Inc. (Wipaire) floats fitted on 1 June 2011. WTY was first registered in Australia on 18 July 2011. At the time of the accident, WTY had accumulated about 1,510 hours' time in service.

A periodic inspection was completed on 27 November 2015 and WTY was issued with a maintenance release that was valid for 12 months or 100 hours. At the time of the accident the maintenance release was current and no defects or endorsements were recorded. The aircraft log book identified that no significant items of maintenance had been carried out since the last periodic inspection. The pilot reported that they had no concerns with aircraft serviceability at the time of the accident and review of the engine data log[4] identified no anomalies.

Engine operating limits

The engine operating limits were published in the Cessna Caravan model 208 G1000 pilot's operating handbook (POH) and the Wipaire POH supplement[5] for amphibian floatplane operations. The engine was operation-limited by factors including torque, temperature or gas generator revolutions per minute (RPM), as well as propeller RPM, and was determined by whichever limit was reached first. With respect to torque, the maximum was advised to be 1,865 ft-lb. A torque of 1,970 ft-lb was permitted as long as the propeller RPM was set to ensure the maximum-rated 675 shaft horsepower was not exceeded. The Cessna POH *torque indications* description stated that 'the redline varies from 1865 to 1970 ft-lb depending on prop RPM'.

Transient limitations for engine parameters including torque, gas generator RPM and propeller RPM are available for periods requiring increased engine performance. Table 3 shows the published transient torque available and its time limitation.

Table 3: Maximum transient torque available and associated time limitations

Manufacturer publication	Maximum torque (ft-lb)	Time limitation (seconds)
PWC Maintenance Manual	2,400	20
Cessna Caravan POH	2,400	20
Wipaire POH supplement	2,200	2

While increasing power during the initial stages of the go-around, the pilot recalled that the indicated torque was at the 'second red line', which he advised was about 1,970 ft-lb and an over-torque for the propeller condition. A review of the engine data log indicated a recorded maximum torque value of 1,882 ft-lb.

Several Caravan pilots were asked about their understanding of available transient power and all quoted 2,200 ft-lb or 2,400 ft-lb for the time limit of 2 seconds. The occurrence pilot advised that he was aware of the availability of transient torque but could not recall the specific figures. It was reported that while the availability of transient power may have been mentioned during training, it is generally not demonstrated due to increased risk of engine damage. The operator has since included a copy of the flight manual engine limitation section in the daily engine trend record folders in the aircraft, and also in a quick reference guide that included other performance and operational guidance from the flight crew operating manual. The purpose was to serve as memory prompts for pilots on documents frequently handled by them.

The ATSB advised Wipaire of the apparent discrepancy with their POH supplement engine limitations section regarding the transient torque and time available limit. A revised Wipaire POH supplement, with a transient torque of 2,400 ft-lb for 20 seconds, was issued on 22 December 2016, which was in line with the engine manufacturer's limits. See the section titled *Safety issues and actions*.

Weight and balance

The occurrence flight was one of several standard tours offered by the operator. Therefore, a typical payload was available for each tour. The available payload considered aircraft basic weight and standard fuel burn for each leg, among other details. The operator advised that passengers

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[4] The aircraft was fitted with an *Aircraft Data Acquisition System – digital,* which monitored and recorded certain engine and airframe data parameters.

[5] The information contained in the POH supplement 'supplements or supersedes the basic manual in those areas listed'.

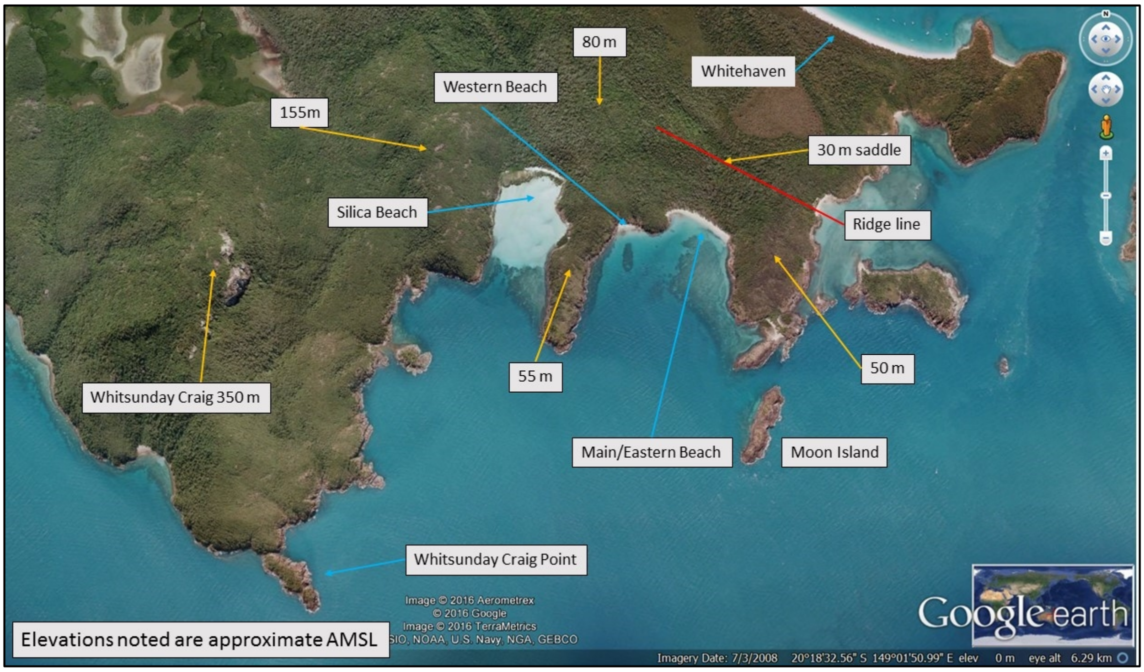
reported their weight at the time of booking and this figure was recorded on the flight manifest. A computer program was utilised by the operator to determine the aircraft's position in the weight and balance envelope for each flight. A review of the operator-supplied data indicated that WTY was within weight and balance limitations at the time of the collision with terrain.

Chance Bay

Chance Bay is located at the south-east point of Whitsunday Island (Figure 1) and is separated from Whitehaven Beach by a strip of land about 1,400 m wide. Whitsunday Craig is about 350 m elevation and is about 2.5 km to the west of the bay. The terrain falls away from Whitsunday Craig over a distance of 1-1.6 km and consists of undulating hills with rock formations near the water surface.

Chance Bay is characterised by surrounding terrain, being semi-circular in shape (Figure 3). The height of the terrain surrounding the bay is generally from about 35 to 80 m. The ridge line (marked in red) varies from about 60 m elevation in the west to about 50 m at the eastern end of the island. The lowest point (saddle) in this ridge line is about 30 m elevation and is located about 280 m inland from the main beach.

Figure 3: Chance Bay overview showing local features and elevations



Source: Google Earth, modified by the ATSB

For most of the year the Whitsunday area experiences south-easterly winds and Whitehaven Beach is the preferred tour destination for operators. It was reported that for about 20 per cent of the year, the winds shifted to be predominantly from the north, which produced conditions that are unsuitable for floatplane operations at Whitehaven Beach. During these periods, Chance Bay was the alternative landing area for local operators. Chance Bay was also identified as a preferred marine vessel anchorage in northerly winds.

Aeroplane landing areas

Civil Aviation Regulation 92 (CAR 92) defined the requirements for use of aerodromes, including those which are authorised and registered. Other places, if suitable, may be used for the purposes of the landing and taking-off of aircraft. In all cases, CAR 92 identified the responsibilities of both the pilot in command and the operator and required:

> …and, having regard to all the circumstances of the proposed landing or take-off (including the prevailing weather conditions), the aircraft can land at, or take-off from, the place in safety.

CASA also published the Civil Aviation Advisory Publication (CAAP) 92-1 (1) *Guidelines for aeroplane landing areas*[6] to set out factors that may be used to determine the suitability of a place for the landing and taking-off of aeroplanes.

Chance Bay and Whitehaven Beach were identified as ‘regular aircraft landing areas’ that had been defined in accordance with Schedule 7 of the Great Barrier Reef Marine Park Authority (GBRMPA) – Plan of Management 2008. The operator maintained a company register of its authorised aeroplane landing areas (ALA) for floatplanes, which were approved for use by the chief pilot. Whitehaven Beach and Chance Bay were included in this register and were identified as meeting the ‘minimum standard for a landing area…as specified in CAAP 92-1(1)’. Each operator-registered ALA consisted of an area map showing the ALA boundary and a written guide detailing operational and other information unique to that ALA.

The ALA was the preferred landing area for each location. However, the operator advised that it was possible to occasionally land outside the ALA. This allowed aircraft to land further from the beach, before the ALA, when location conditions and/or proximity of other vessels required it.

CAAP 92-1(1) provided guidance on various aspects of water alighting areas in terms of water channel width, depth and length. No specific dimensions were provided for the length of a water landing area, however the CAAP indicated that the length of the water channel was to be equal to or greater than that specified in the aeroplane’s flight manual. If the distances in the flight manual were un-factored, with allowance for degradation in aeroplane performance due to the prevailing conditions, then 15 per cent was to be applied to the distance. The CAAP included guidance for the calculation of approach and take-off area obstruction splays, however the supplied diagram only applied to floatplanes up to 2,000 kg maximum take-off weight. Both floatplane types operated by the company were above that weight.

The company operations manual specified that aircraft landing areas and water alighting areas were to comply with the CAAP. In addition, the company operations manual gave consideration to degradation in aircraft performance, in that any take-off distance was to be increased by a factor of 15 per cent and landing distance increased by 43 per cent. When these factors were applied to the C208 Caravan aircraft flight manual data, for operations on float landing gear, the take-off distance required was 1,256 m and the landing distance 926 m.

Operator’s aircraft landing area details

The operator’s ALA register included a map showing details for Chance Bay (refer to Appendix A), which was a marine chart showing bathymetric data for the water areas. Topographical information included 100 m contours and a spot height at the eastern end of Whitehaven Beach. The northern ALA boundary was about 950 m from the beach and the southern boundary, depending on the approach flown, was between 1,500 m and 2,300 m from the beach.

The operator’s published guide for Chance Bay ALA included, in part, the following points:

> …
>
> Operations will not take place without prior approval from chief pilot when winds exceed 20 kts[7]
>
> Strong[8] northerly winds will produce severe turbulence and down drafts.
>
> …
>
> Chance Bay can be very difficult to work out of. Ensure you fly over the area before landing. Always observe the ALA limits. Ensure you always allow yourself an escape route…Note: Very important to set up an undershoot approach and plan escape route at this location.

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6 Released July 1992 and current at the time of the occurrence.

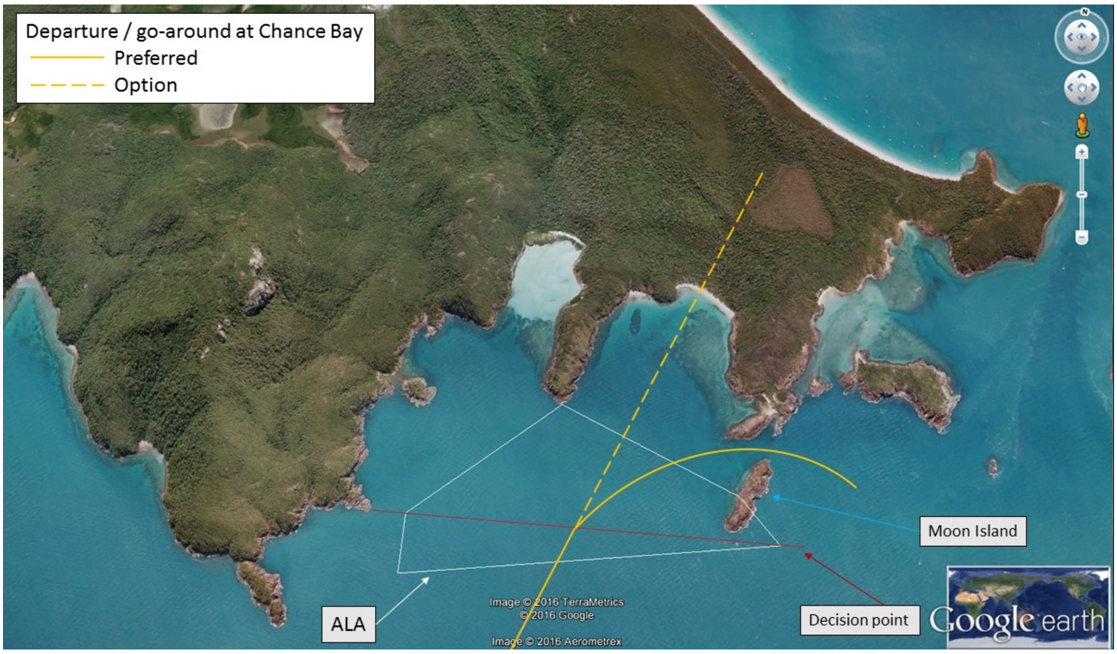
7 The operator authorised the pilot to operate in Chance Bay in ‘20-25 kt’ in the Beaver on 19 November 2014 and in the C208 Caravan on 2 September 2015.

8 The ALA Guide did not clarify the velocity of ‘strong winds’. The Beaufort Wind Scale identified strong as 22-27 kt.

A number of pilots who were interviewed by the ATSB all described the approach into Chance Bay as being a 'dead end landing' due to the terrain surrounding the cove. Therefore the importance of setting up an undershoot approach[9] and to plan an escape route for the location was also reinforced. Further, any decision to go-around was to be made early.

The operator advised their preferred departure or go-around route was a right turn over water, through the approximately 130 m clearance between the south-eastern most tip of Whitsunday Island and the northern tip of Moon Island (Figure 4). The terrain on either side of this route is less than 20 m above mean sea level. Flying straight ahead, over the saddle, was not the preferred departure path, but it was an option shown to company pilots. If a go-around was initiated early, the right turn departure was the safest option and allowed a water landing in the event of a precautionary or emergency situation. The pilot reported utilising either departure track, as dictated by the conditions at that time. Refer to Appendix B for the Chance Bay ALA containing hand written notes and annotations that were in addition to the company register.

Figure 4: Typical approach path at Chance Bay showing preferred and optional departure and/or go-around path. Also noted is the location of the ALA boundary and the pilot defined decision point.



Source: Google Earth, modified by the ATSB

The pilot had nominated a *decision point* (aiming point) for his operations into Chance Bay (refer Figure 4 and Appendix B). This point was devised in conjunction with the company senior floatplane pilot as a line between easily identifiable topographical features, being a point of land below Whitsunday Craig and the southern tip of Moon Island, about 1,500 m from the beach. The pilot described the decision point as, 'if you're not happy with what you see in front of you, if you're not stabilised, you go-around'.

From the decision point onward, the pilot could not use the preferred departure path to conduct a go-around ('preferred departure / go-around' identified in Figure 4). However, the option to conduct a straight ahead go-around remained, or a turning departure over the terrain to the right of the bay, if initiated early enough to ensure terrain clearance.

9 An undershoot approach by an aircraft is one, which if continued to the surface would result in the aircraft landing before the desired touchdown point. Several seaplane pilots described an undershoot approach, in this context, as that which will result in the aircraft descending to just above the water surface and maintaining this position. When nearing the aiming point the pilot can then gently land the aircraft at the first available area of suitable water.

A calculation of the climb performance of the C208 Caravan in the go-around configuration revealed that the aircraft was capable of climbing at 800 ft per minute when a straight ahead go-around was conducted. That climb rate was dependent upon the aircraft being established in the correct configuration.[10] The point at which the aircraft could no longer theoretically out-climb the terrain was almost coincident with the shoreline. Therefore, in practical terms, to provide an adequate margin above terrain, an aircraft conducting a straight ahead go-around would have to be established in the climb configuration before that point.

In summary, the ALA, as defined in the operations manual, was appropriate for conducting operations in the Caravan, when adhering to the ALA boundaries, nominated decision point and escape routes. Company guidance indicated that operations could be conducted outside of the ALA when operationally required, however the operator's preference was to land further away from the beach and undertake a longer taxi into the bay, rather than landing between the ALA and the beach.

Guidance material from international regulators

When landing at an airport, the pilot can expect the runway surface will be flat and free of obstacles. In contrast, the United States Federal Aviation Administration (FAA) published a *Seaplane, Skiplane, and Float/Ski equipped Helicopter Operations Handbook* (2004),[11] which stated that water landings have no defined runway and are subject to wind and sea state affecting the landing surface. It is also common for floatplane pilots to share their landing areas with marine vessels and people.

The Civil Aviation Authority of New Zealand[12] published the Takeoff and Landing Performance booklet, which detailed factors that affect aircraft performance and included the following advice:

- plan to clear obstacles on the climbout path by at least 50 ft
- always nominate a decision point where you will discontinue the approach if things are not going as expected
- even after having worked out your aircraft's take-off or landing performance, it is prudent to add a contingency to allow for other factors that you may have overlooked.

The United Kingdom Civil Aviation Authority (UKCAA)[13] published the Civil Aviation Publication (CAP) 793 *Safe operating practices at unlicenced aerodromes*. This CAP highlighted the importance of the pilot being 'well aware of the performance characteristics of their aircraft and the aerodrome dimensions' and that their 'operating practices should be appropriate and proportionate to the activity'. In addition, the UKCAA published a Safety Sense Leaflet series which included guidance for *strip flying* and *aeroplane performance*. These leaflets included recommendations to:

- use maps to determine accurate elevations
- check the strip is long enough and add a 30 per cent margin for safety
- remember that aeroplane performance figures are obtained using a new aeroplane, flown by an expert pilot under specific conditions
- be clear about your go / no go decision process
- consider surrounding terrain—if there are hills nearby, check that you will have a rate or angle of climb sufficient to out-climb terrain. Even a moderate wind may cause significant down draughts.

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[10] That configuration was: take-off power, 1,900 propeller RPM, inertial separator normal, climb speed of 79 knots and flaps 30°.

[11] FAA publications can be accessed via www.faa.gov

[12] CAA NZ publications can be accessed via www.caa.govt.nz

[13] UK CAA publications can be accessed via www.caa.co.uk

In combination, the guidance material recommended that a pilot should examine their intended landing area thoroughly before landing. This allows the pilot to choose the best landing area and plan a safe, conservative path for a go-around should the landing need to be aborted. The landing area should also include a predetermined 'aiming point' to assist with the decision to commit to land or initiate a go-around. In this case, the ALAs published in the company register defined the boundary only.

Recorded engine and video data

Data was recovered from the on-board digital data acquisition system, which received information directly from a Garmin G1000.[14] This system recorded a number of different engine operating parameters along with airspeed, altitude and temperature. The data was extracted and validated by the engine manufacturer.

The propeller speed and gas generator (engine) speed data was analysed in conjunction with video footage from several of the passengers. From this data it was possible to plot the flight path in relation to the landing area and bounce locations (Figure 2).

The data from the engine logger correlated with the video evidence and indicated that the established approach path aimed for an initial touchdown beyond the northern boundary of the ALA, leading to the pilot overflying the ALA before the aircraft touched down. Airspeed data showed that the aircraft was operating close to the stall speed when the go-around commenced, and that the airspeed did not significantly increase, or reach the airspeed for the optimal go-around climb configuration, before the aircraft impacted terrain.

Operational information

Go-around

Whenever landing conditions are not satisfactory, a go-around should be initiated.[15] The pilot can then bring the aircraft around for another landing or continue to an alternate site. A go-around is also known as a balked landing and can be initiated either before or after an aircraft has touched the water (in this case). A go-around is considered a normal procedure and, although it is not often required, with appropriate training, planning and preparation it should not result in increased risk.

The company operations manual required that pilots adhere to the manufacturer's POH, any associated supplements and the CASA-approved company checklists for normal and emergency procedures. The aircraft checklists included the abbreviated normal procedures published in booklet form and a control wheel flip card, and were required to be carried on every flight. In addition, the operations manual required pilots to demonstrate proficiency in recall of the checklists at no less than 12-month intervals.

The operations manual procedures for take-off stated 'all water take-offs shall be with 20˚ flap set'. The manual recommended initial climb speeds were 80 kt for flaps 20°, 85 kt for flaps 10° and 95 kt for flaps retracted. The procedures for a balked landing were contained within the normal procedures and operations sections of the manual. It outlined that the aircraft needed to achieve an indicated airspeed of 81 kt in the climb out.

Consistent with the Wipaire POH supplement, the operator's procedure for a baulked landing commenced with flaps 30 (as configured for landing) and throttle advanced to take-off power. The

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14 The Garmin G1000 is an integrated flight instrument system typically composed of two display units, one serving as a primary flight display, and one as a multi-function display. Manufactured by Garmin, it serves as a replacement for most conventional flight instruments and avionics.

15 ATSB Safety Watch *Handling approach to land* details the benefits of standard procedures to reduce workload during critical phases of flight and the importance of an early decision to go-around. This can be viewed via www.atsb.gov.au

following step in the checklist was to retract the flaps to 20 degrees to achieve the maximum rate of climb.

Meteorological information

Hamilton Island area

Hamilton Island is part of the Whitsunday Islands archipelago and is located approximately 900 km north of Brisbane. The weather is classified as subtropical with year-round warm temperatures averaging 23˚C in winter and 30˚C in summer. The wet season occurs typically December to February with humid days, averaging around 75 per cent, which are often broken by tropical showers.

Weather conditions and wind velocity

The Bureau of Meteorology (BoM) forecast for the area indicated the presence of variable north-westerly winds, up to 5,000 ft, of about 10 kt. Information from the radiosonde trace from Townsville and the marine forecast indicated that the surface winds were about 10 kt from the north-north-east. BoM observations at Hamilton Island between 1500 and 1530 indicated a wind of about 14 kt from the north-west.

The BoM advised there are local effects at Hamilton Island Airport which can affect velocity in the synoptic situation that was present on the day. The BoM advised that the wind direction at Chance Bay at the time of the occurrence was likely to have been about 10 kt from the north-west. In addition, BoM indicated that it was unlikely that turbulence due to the nearby terrain would have been present at Chance Bay due to the wind strength in the lowest part of the atmosphere. However, light turbulence could not be excluded.

Witnesses positioned on marine vessels in Chance Bay reported north-west variable winds of about 10 kt, gusting to 15 kt. They described the sea surface as ‘smooth’.

The pilot reported observing, during the pre-landing flyover, evidence of ‘bullets’ coming from the north-west on the surface of the water within Chance Bay. Bullets were described by several pilots as a phenomena associated with wind gusts contacting the water surface and creating visually darker patches. Riley (2009) indicated that these phenomena result from a combination of terrain and atmospheric conditions, including:

- winds, of 15 kt or greater, predominantly blowing from the south-east over water then encountering the terrain of the Whitsunday Islands and being forced aloft
- an inversion between about 500 to 2,000 m in a stable atmosphere.

The combination of the inversion and stability of the atmosphere compresses the airflow and increases its velocity. The stability of the atmosphere forces the air to descend on the leeward side of the terrain. When the increased velocity air encounters the sea surface it forms the bullets, which poses problems to mariners and to aircraft operating on the water.

The BoM report indicated that, while there was an inversion layer present at approximately 1,500 m, the 10 kt wind velocity was below that expected for the formation of bullets. Additionally, according to the Beaufort wind scale, for whitecaps to appear the wind must be 11-16 kt. FAA H-8083-23 *Seaplane Operations Handbook* indicated that ‘when the wind increases to a velocity of 12 knots, waves will no longer maintain smooth curves. The waves will break at their crest and create foam – whitecaps’.

Several pilots with experience operating in Chance Bay advised that the area can be affected by turbulence and/or down drafts.[16] This turbulence most likely resulted from Whitsunday Craig being in the path of west to north-westerly winds and the airflow ‘wrapping around’ the southern coast of the island. In addition, it was reported the turbulent air became more pronounced as you proceeded further into the bay. The pilots advised that these conditions reduced the approach and

[16] Downdrafts are described as a bulk downward movement of air such as commonly found on the lee side of a mountain.

departure options and necessitated the adjustment of procedures to suit different aircraft performance.

In summary, while accurate weather observations for Chance Bay were not available, witness videos showed some areas of possible wind gusts, with the appearance of darker patches of water on the surface. In these patches, no lifting of water and almost no whitecaps are seen, indicating wind at or below 12 kt. Wind direction on the day was consistent with possible turbulence, the severity being dependent on the wind velocity. The pilot reported the conditions on this flight were similar to those of earlier in the day, with perhaps a slight increase in wind velocity. The pilot also advised that he had previously conducted operations in Chance Bay in windier conditions.

Wind gusts and aircraft handling

Several floatplane pilots (including a flight instructor) advised of the importance of flying through a wind gust and landing the aircraft on the water when in smoother air. It was also reported that a pilot should avoid rushing to land before a wind gust.

The accident pilot described his understanding of the standard procedure when encountering a gust, which included:

- reducing power by a small amount to counter the increased lift associated with entering the wind gust, then
- increasing the power to control aircraft descent resulting from the reduced lift when exiting the wind gust.

This procedure is the correct technique for flying the DHC-2 Beaver aircraft. However, a flight instructor indicated that the use of power to counter the effects of winds gusts on landing in the C208 Caravan was not appropriate due to the increased mass of the aircraft, and had advised the pilot of this during initial C208 Caravan training, when this incorrect technique had been observed. It was reported that best practice for flying through a gust in a Caravan is through manipulation of the flight controls rather than increasing or decreasing power, which has a slower response time.

The pilot indicated that he elected to delay the landing, in order to fly through the wind gust, and used the alternating power technique previously mentioned. After exiting the first gust, the pilot observed a second wind gust, and delayed the landing further, using the same alternating power technique.

The recorded engine data was inconsistent with the pilot's report of altering engine power as he flew through wind gusts. It was not possible to determine the level of influence of the reported wind gusts had on the aircraft bounces, or if general aircraft handling technique contributed in this instance.

Site and wreckage

The ATSB did not attend the accident site but did interview the pilot, the operator, several witnesses, passengers and accident site visitors. In addition, the ATSB reviewed supplied images and video footage. Video footage from the flight and information from the pilot did not indicate any issues with aircraft operation prior to the collision with terrain. However, video footage and engine data were consistent with the engine not having been fully shut down before the pilot exited the aircraft.

WTY collided with trees and then the terrain, part-way up the ridge about 150 m from the eastern end of Chance Bay main beach. WTY was located at an elevation of about 40 m and the height of the ridge was about 50 m. The aircraft came to rest upright and in dense foliage (Figure 5). WTY was described as being oriented facing back toward the bay, which was consistent with the aircraft being in a right turn and the flight path being disrupted during the collision with terrain. The pilot reported there was no evidence of fuel leak and there was no pre- or post-impact fire.

The float landing gear (pontoons) had splayed outwards and upwards until they were aligned with the fuselage, which, together with the nature of the foliage, may have provided some cushioning effect to the fuselage during the impact with terrain. Both wings remained attached to the fuselage, but the impact sequence had forced the wings rearwards. As a result, the flaps and the trailing edge of both wing root ends had entered the cabin, however there were no reports of passenger injuries associated with this. The position of the flaps was consistent with being fully-extended (30˚), which corresponded with an image of the flight control pedestal showing the flap selector lever near to 'full'.

It was reported that the pilot's door (forward left) was utilised for evacuation, as exit via the rear cabin left passenger door was hindered by foliage. One passenger also reported a drop of a few feet, from the pontoon to the ground, due to the aircraft position on top of foliage. Egress to the ground was via the pontoon and then all persons on board assembled a short distance from the aircraft before the group walked to Chance Bay main beach.

Figure 5: VH-WTY wreckage, located in dense foliage

Source: Gordon Simmons

Survivability

Civil Aviation Order (CAO) 20.11 defined the requirements for emergency and life-saving equipment and passenger control in emergencies. The below paragraphs review the CAO requirements relevant to this operation and the overall emergency response.

Forced landing preparation

Pre-impact actions have the potential to reduce the severity of a collision with terrain. The operator's published pre-impact actions included, but were not limited to:

- activating the emergency locator transmitter (ELT)[17]
- briefing passengers, including their requirement to adopt the brace position

[17] Emergency locator transmitter (ELT): a radio beacon that transmits an emergency signal that may include the position of a crashed aircraft, activated either manually or in the crash.

- configuring the aircraft and engine, including turning off fuel selector and battery master switch, among other actions
- transmitting a mayday call giving position and intentions.

The pilot reported that the requirement for a forced landing was not considered during the go-around attempt.

Briefing

The operator advised that passengers were shown a generic briefing video on the bus, while being transferred to the airport. If passengers made their own way to the airport, then a briefing video was shown to them upon their arrival.

The pilot provided a safety briefing to the passengers at the aircraft, just prior to departure from Hamilton Island. This briefing was specific to the aircraft type.

Seatbelts

The aircraft was fitted with lap-sash seatbelts in the passenger seats and five-point harnesses in the pilot and co-pilot seats. The pilot explained the seat belt operation to the passengers, and the requirement to keep them fastened for the duration of the flight, prior to boarding the aircraft. Additionally, the pilot reported visually checking the passengers' seat belts prior to departure from Hamilton Island. Video footage of several passengers, from just prior to take-off, showed their seatbelts were fastened. In addition, audio from the footage included the pilot advising them to keep seatbelts fastened.

While flying over Chance Bay and setting up for landing, the pilot reminded the passengers to make sure their seatbelts were fastened for landing. Some of the passengers interviewed also recalled the pilot advising them to check their seatbelts prior to the landing at Chance Bay.

The United States' National Transportation Safety Board (NTSB) published safety report SR 85-01 General aviation crashworthiness project: Phase 2 - *Impact Severity and Potential Injury Prevention in General Aviation Accidents*. In terms of the potential benefits of shoulder harnesses (specifically, some form of upper body restraint), the safety report commented on the extent of any injuries in case of an accident, as follows:

> There were five survivable accidents in which shoulder harnesses were worn by only one of two front-seat occupants. A comparison was made of the relative injuries of each occupant. It was found in each case that injury severity was less for the occupant who wore the shoulder harness.
>
> For example, in one accident each of two occupants sustained serious injuries, but the pilot, wearing a shoulder harness, sustained a broken leg and a slight concussion while the passenger without a shoulder harness sustained severe head injuries. The differences in the injuries in these comparisons were related to head and upper body injuries. Those persons who wore shoulder harnesses had markedly fewer head injuries.

The NTSB research also showed that if an aircraft occupant wore a shoulder harness, they increased their chances of survival by 20 per cent. Further, the chance of serious injury was decreased by 32 per cent. The FAA published Advisory Circular (AC) 21-34 *Shoulder Harness – Safety Belt Installations* in 1993. This AC described the various forms of shoulder harnesses and detailed the safety benefits of correct installation and use. Pilot and passenger survivability on WTY was likely enhanced through correct utilisation of the available seat belts.

Pilot emergency training

The pilot had completed the flight crew emergency procedures training within the previous 12 months, as was required by CAO 20.11. This CAO did not require training and demonstration of aircraft-related procedures such as emergencies and shut down process.

Life jackets

Each passenger was provided with a pouch-style life jacket prior to the flight departing Hamilton Island, as required by the regulations. The pilot provided a safety brief and demonstration on how to wear and use the passenger life jackets. The pilot wore his own vest-style life jacket, which also contained the pilot's PLB in a pouch.

Safety equipment

The aircraft was fitted with a fixed ELT, which self-activated during the collision with terrain. In addition, the operator required that each pilot equip themselves with a personal locator beacon (PLB) that was suitable for overwater operations. The pilot reported activating his PLB once everyone had evacuated the aircraft.

There was also a satellite phone on board the aircraft due to the occasional requirement for extended offshore operations. The pilot used this phone to contact the operator and advise of the accident.

Emergency response

The Australian Maritime Safety Authority (AMSA), reported that the aircraft's ELT beacon was detected at about 1519 and a search and rescue phase was initiated by Australia's Joint Rescue Coordination Centre (JRCC). In addition, the ELT beacon was detected by several aircraft flying in the area and they advised air traffic control, who subsequently passed the information on to the JRCC at about 1528. The JRCC monitored and coordinated the search and rescue phase. The pilot's PLB was not detected by the AMSA.

As the ELT was registered, the JRCC's first attempt to contact the operator was at 1526. It was reported that the operator was initially unsure of the JRCC's report of ELT activation as the flight following of WTY had been cancelled. At about 1528, the operator advised the JRCC they had dispatched one of their helicopters to Chance Bay. At 1543, the operator advised the JRCC that the pilot had contacted them via the satellite phone.

Several vessels were moored in Chance Bay and those on board who witnessed the accident contacted the local volunteer marine rescue (VMR) via marine radio. The VMR Mackay log indicated they received the first notification at about 1515 and subsequently advised VMR Whitsunday. VMR Mackay monitored the situation until advised that all persons on board the aircraft had arrived at Hamilton Island at about 1616.

Related occurrences

A review of the ATSB occurrence database from 1969 to February 2016 identified only one other aviation occurrence in Chance Bay. This, and other similar occurrences are detailed below.

Operational and decision making occurrences

ATSB investigation 200204857

The pilot of a de Havilland Beaver floatplane registered VH-BVA was conducting a charter positioning flight from Hamilton Island Marina to Chance Bay, Whitsunday Island. He had landed at Chance Bay seven times in the previous two days. Weather conditions recorded at the Hamilton Island automatic weather station indicated a 7 - 10 knot wind from the north-west. Witnesses in Chance Bay said that the surface wind in the bay was 2 - 5 knots and the water surface was smooth, but not glass. The pilot said that he commenced a straight-in approach to Chance Bay but elected to go-around due to the increased number of vessels moored in the bay since the previous flight. During the subsequent landing the left wing of the aircraft collided with the rear mast of an anchored ketch resulting in substantial damage to both. There were no injuries to the pilot or the three occupants of the ketch.

The investigation found that the technique employed by the pilot to achieve the intended touchdown was not appropriate for floatplane operations. In response, the operator revised the floatplane operations section of their operations manual. In addition, an experienced floatplane pilot provided a report to the operator regarding company floatplane operations. Recommendations from that report included:

- additional theoretical and practical training and checking for company floatplane pilots
- development of a company-specific pilot training guide; and
- review and amendment as required of the company floatplane authorised landing area guide

ATSB investigation 199802830

On Sunday, 26 July 1998, at about 1324 local time, a Cessna A185E floatplane, VH-HTS, crashed onto a ridge forming the southern shore of Calabash Bay NSW. The accident occurred during a go-around manoeuvre following an unsuccessful landing approach to the Berowra water alighting area. All on board suffered fatal injuries and the aircraft was destroyed.

The investigation found that the circumstances of the accident were consistent with uncontrolled flight into terrain. The decision by the pilot to carry out a go-around into a confined area surrounded by steep-sided terrain was the culminating factor in a combination of local factors, organisational deficiencies and inadequate safety defences. Local factors included a lack of formal procedures to provide safe methods of operation, and commercial pressures. Organisational deficiencies were also identified, concerning the management and conduct of charter operations carried out by that company.

Safety analysis

The pilot of VH-WTY was conducting a tourist flight in the Whitsunday area with 10 passengers on board, that included landing in Chance Bay. During a go-around that followed an aborted approach to the water landing site, the aircraft collided with terrain.

The pilot was appropriately qualified to conduct the flight and there was no evidence that an aircraft-related issue contributed to the occurrence. This analysis will examine the operational aspects associated with the attempted landing and decision to go-around, which preceded the collision with terrain.

Development of the accident

Terrain surrounding the Chance Bay water landing area poses two significant operational landing hazards:

- significant mechanical turbulence/downdrafts in adverse wind conditions
- go-around options reduce to zero the further an aircraft approaches in to the bay.

Both of these hazards were identified in the operator's aircraft landing area (ALA) guidance, with specific emphasis on the need to operate within the ALA limits and maintain an escape route.

On this occasion, the pilot delayed touching down on the water until he assessed that he was past a wind gust. While that decision was motivated by a desire to avoid unsuitable landing conditions, it resulted in the aircraft first touching down beyond the ALA and significantly closer to the terrain surrounding Chance Bay than recommended. That situation was further aggravated by two further bounced water contacts as the approach was continued towards the beach, before the go-around was initiated.

Continuation beyond the nominated decision point removed the preferred option to abort the landing and turn right to depart Chance Bay over water. However, despite progressing further into the bay, the option to conduct a missed approach straight-ahead over the saddle remained.

A straight-ahead departure from the go-around point was within the documented performance capabilities of the Caravan in the optimal configuration, however the pilot assessed that the aircraft was not climbing as expected and would not clear the terrain. This resulted in the decision to turn away from the saddle, exposing the aircraft to higher terrain to the east of the beach. The turn also positioned the aircraft downwind, which also adversely affected the climb profile. These factors combined to result in the accident.

The pilot had recent familiarity with Chance Bay, having flown there 11 times in the past 90 days in WTY, including on the morning of the accident. The pilot had also been shown and had used, the straight-ahead departure over the saddle toward Whitehaven Beach. However, the pilot had not conducted a go-around in any aircraft at Chance Bay during line operations, nor conducted a go-around in the Caravan with a loaded aircraft weight.

This may have influenced his knowledge and judgement around the expected performance of the aircraft, including not using the available transient power or the correct go-around airspeed, and the distance required to safely conduct a go-around. Despite this, flying well beyond the decision point and persisting with conditions that were not conducive for a safe landing meant that the decision to conduct a go-around was made late in the approach. The late decision reduced the options and margins available for a safe outcome and ultimately led to the ground collision.

Approach and landing is the most common phase of flight for aviation accidents, accounting for approximately 65 per cent of all accidents. A Flight Safety Foundation study[18] of 16 years of

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[18] Flight Safety Foundation *Go-around Decision Making and Execution Project* can be viewed via www.flightsafety.org

runway excursions determined that 83 per cent could have been avoided with a decision to go-around. The study identified that just over half of the landing excursions followed a fully stable approach; in these instances the flight became unstable only during landing.

Whenever landing conditions are not satisfactory, a go-around should be initiated. A go-around is considered a normal procedure, however, they can present challenges, especially when initiated late in the approach or during landing. Good flight preparation includes completing a mental rehearsal before departure and prior to the approach to land. By having plans and procedures in place, the pilot will reduce their workload during critical stages of flight and also in the event of any emergencies. Recurrent training into ‘challenging’ environments is helpful in maintaining consistent operational procedures and identifying any non-standard practices.

Safety equipment and procedures

The pilot reported that the preparation for a forced landing was not considered during the go-around attempt. As such, no pre-impact preparation was conducted or briefed to the passengers. The pilot did however, maintain control of the aircraft during a rapidly changing sequence of events. Continued pilot control, the crashworthiness of the aircraft, combined with all persons on board wearing shoulder-restraint seatbelts, likely resulted in minimal injuries being sustained, even without impact preparedness. The characteristics of the foliage contacted may also have cushioned the impact.

The pilot did not completely shut down and secure the aircraft before evacuating, which increased the risk of a post-impact fire. However, the passengers were consistent in their recollection of the pilot’s prompt and effective handling of the aircraft evacuation and relocation of everyone to a safe distance from the aircraft.

Cancelling flight following prior to landing increased the risk of delay to an emergency response. However, the self-activation and detection of the emergency locator transmitter resulted in prompt initiation of a search and rescue coordination. Use of the satellite phone also provided the means for communication with the operator’s main base.

The occurrence highlighted the importance of emergency training, available equipment and defined safety-related procedures combining to increase safety to all on board the aircraft.

Findings

From the evidence available, the following findings are made with respect to the collision with terrain involving amphibian Cessna Aircraft Company C208 Caravan aircraft, registered VH-WTY that occurred at Chance Bay, 11 km north-east of Hamilton Island airport, Queensland, on 28 January 2016. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factors

- The aircraft's initial touches with water were past the nominated decision point and beyond the northern boundary of the ALA, which reduced the safety margins available for a successful water landing or go-around.
- The pilot initiated a go-around without using all available power and the optimal speed, turned towards higher terrain and placed the aircraft in a down-wind situation, which ultimately resulted in the collision with terrain.

Other findings

- The aircraft was equipped with lap-sash seatbelts, which have been demonstrated to reduce injury, and the use of emergency beacons and satellite phone facilitated a timely response to the accident.

Safety issues and actions

Proactive safety actions

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 actions in response to this occurrence.

Engine operating limits

Wipaire Inc. published an amendment to the pilot operating handbook supplement for the Cessna 208 amphibian on 22 December 2016. The engine operating limits now identify that a transient torque of 2,400 ft-lb is available for 20 seconds, which is consistent with the engine manufacturer's recommendations.

Aircraft operator

The operator advised they have enhanced/updated existing procedures and checklists for their float plane operations. Among other things, this included provision of engine limitation figures, including transient power, on documents used by pilots, as well as revision of the Chance Bay ALA guidance, incorporating detailed orographic information in addition to that included on the Whitsunday visual terminal chart.

General details

Occurrence details

Date and time:	28 January 2016 – 1518 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	11 km north-east Hamilton Island Airport, Queensland	
	Latitude: 20° 18.27' S	Longitude: 149° 02.73' E

Pilot details

Licence details:	Commercial Pilot Licence (Aeroplane), issued June 2012
Endorsements:	Single Engine Aeroplane; Tail wheel undercarriage; Manual Propeller Pitch Control; Retractable Undercarriage; Floatplane; Gas turbine engine
Ratings:	Nil
Medical certificate:	Class 1, valid to March 2016
Aeronautical experience:	Approximately 1,350 hours
Last flight review:	May 2015

Aircraft details

Manufacturer and model:	Cessna Aircraft Company C208 Caravan	
Year of manufacture:	2010	
Registration:	VH-WTY	
Operator:	Hamilton Island Air	
Serial number:	20800522	
Total Time In Service	1,510.0	
Type of operation:	Charter	
Persons on board:	Crew – 1	Passengers – 10
Injuries:	Crew – 0	Passengers – 1
Damage:	Destroyed	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- interviews with the pilot, passengers, operator, other pilots and a flight instructor
- engine data
- aircraft, engine and float manufacturers
- the Bureau of Meteorology
- the Australian Maritime Safety Authority.

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Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

Draft reports were provided to the pilot, the operator, the pilot's flight instructor, the Civil Aviation Safety Authority, Transportation Safety Board of Canada, National Transportation Safety Board (United States), the aircraft, engine and float manufacturers, Australian Maritime Safety Authority and Airservices Australia.

Submissions were received from the pilot, the operator, the engine manufacturer and the Civil Aviation Safety Authority. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

Appendices

Appendix A – Chance Bay ALA published information

WHITSUNDAY AIR SERVICES
COMPANY REGISTER
AUTHORISED LANDING AREAS
FOR SEAPLANES

1 CHANCE BAY

LOCATION : S/W WHITSUNDAY ISLAND

OPERATOR : GBRMPA

COMMUNICATION : VHF TO TWR/CTAF, BASE ON WATER, MARINE VHF
ATC CLEARANCE REQ WHEN CLASS D AIRSPACE ACTIVE

MARINE TRAFFIC : MANY YACHT & CRUISE VESSELS WHEN WIND IS FROM THE NORTH

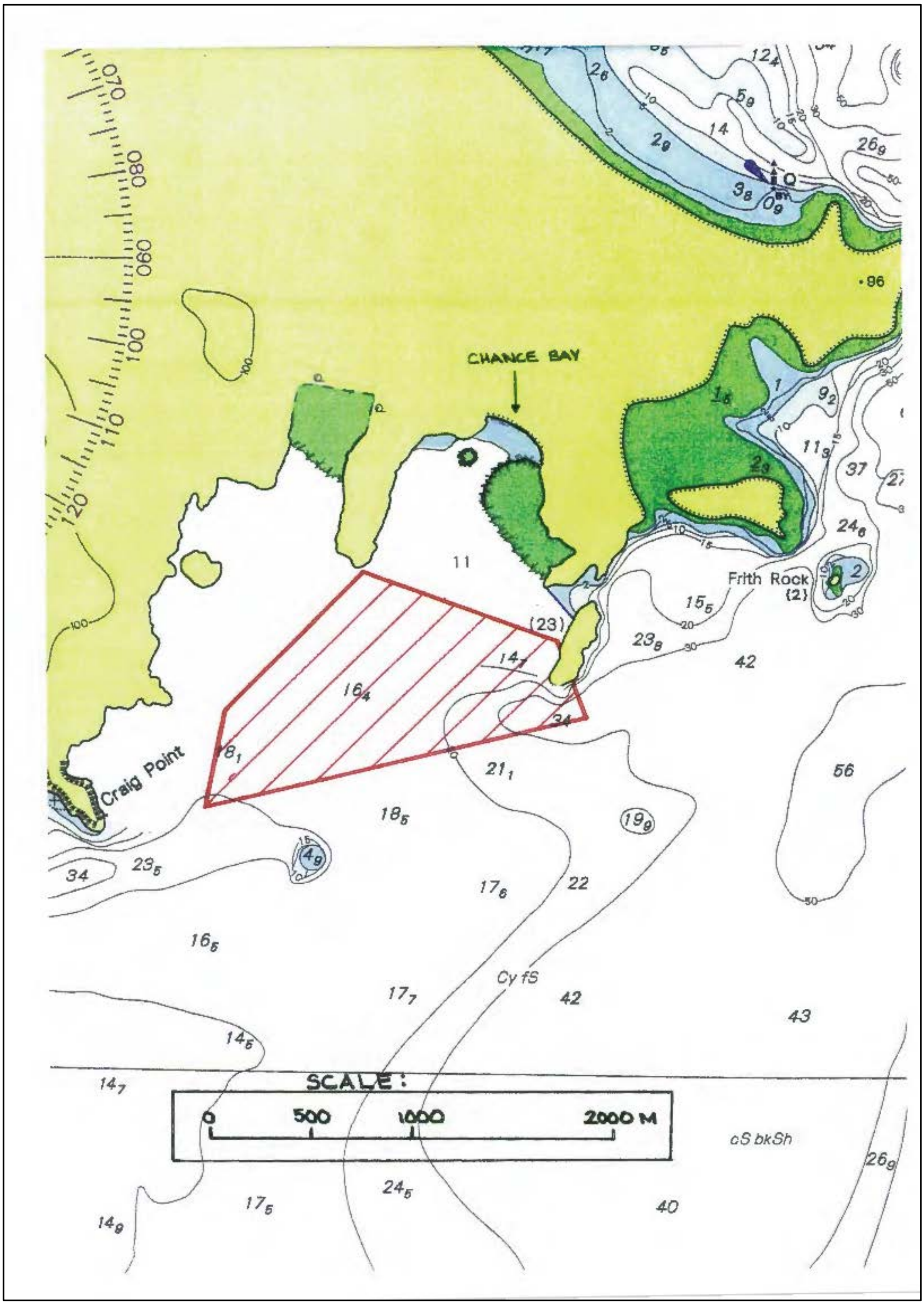
TIDAL EFFECT : CHANCE BAY BEACH HAS A 50 METRE PLATEAU AT APPROX MID TIDE. CARE SHOULD BE TAKEN TO ENSURE A/C DOES NOT BECOME STRANDED ON SAND WHEN TIDE IS OUT GOING.

TURBULENCE : **OPERATIONS WILL NOT TAKE PLACE WITHOUT PRIOR APPROVAL FROM CHIEF PILOT WHEN WINDS EXCEED 20 KTS**
STRONG NORTHERLY WINDS WILL PRODUCE SEVERE TURBULENCE AND DOWN DRAFTS. TAXI TIME OF AT LEAST 15 MIN MAY BE REQUIRED BEFORE DEPARTURE. MAJORITY OF DEPARTURES WILL BE TOWARD THE NORTH EAST.

SEA SWELL : LARGE RESIDUAL SWELL CAN BE EXPECTED. THERE WILL BE MANY OCCASIONS WHEN PARALLELING THE SWELL AND ACCEPTING A COMPONENT OF CROSS WIND WILL BE REQUIRED.

BEACHING : BOTH BEACHES ARE OK FOR BEACHING (Refer Tidal effect)

SPECIAL NOTES : **CAUTION** - BEWARE CORAL REEFS AND BOMMIES.
CHANCE BAY CAN BE VERY DIFFICULT TO WORK OUT OF. ENSURE YOU FLY OVER THE AREA BEFORE LANDING. ALWAYS OBSERVE THE ALA LIMITS. ENSURE YOU ALWAYS ALLOW YOURSELF AN ESCAPE ROUTE. REMAIN WELL CLEAR OF ALL VESSELS. KEEP A WATCH FOR BOAT SWELL COMING IN FROM THE SOUTH. ALWAYS ALLOW YOURSELF AMPLE ROOM FOR TAKEOFF AND LANDING.
NOTE : VERY IMPORTANT TO SET UP AN UNDERSHOOT APPROACH & PLAN AN ESCAPE ROUTE AT THIS LOCATION.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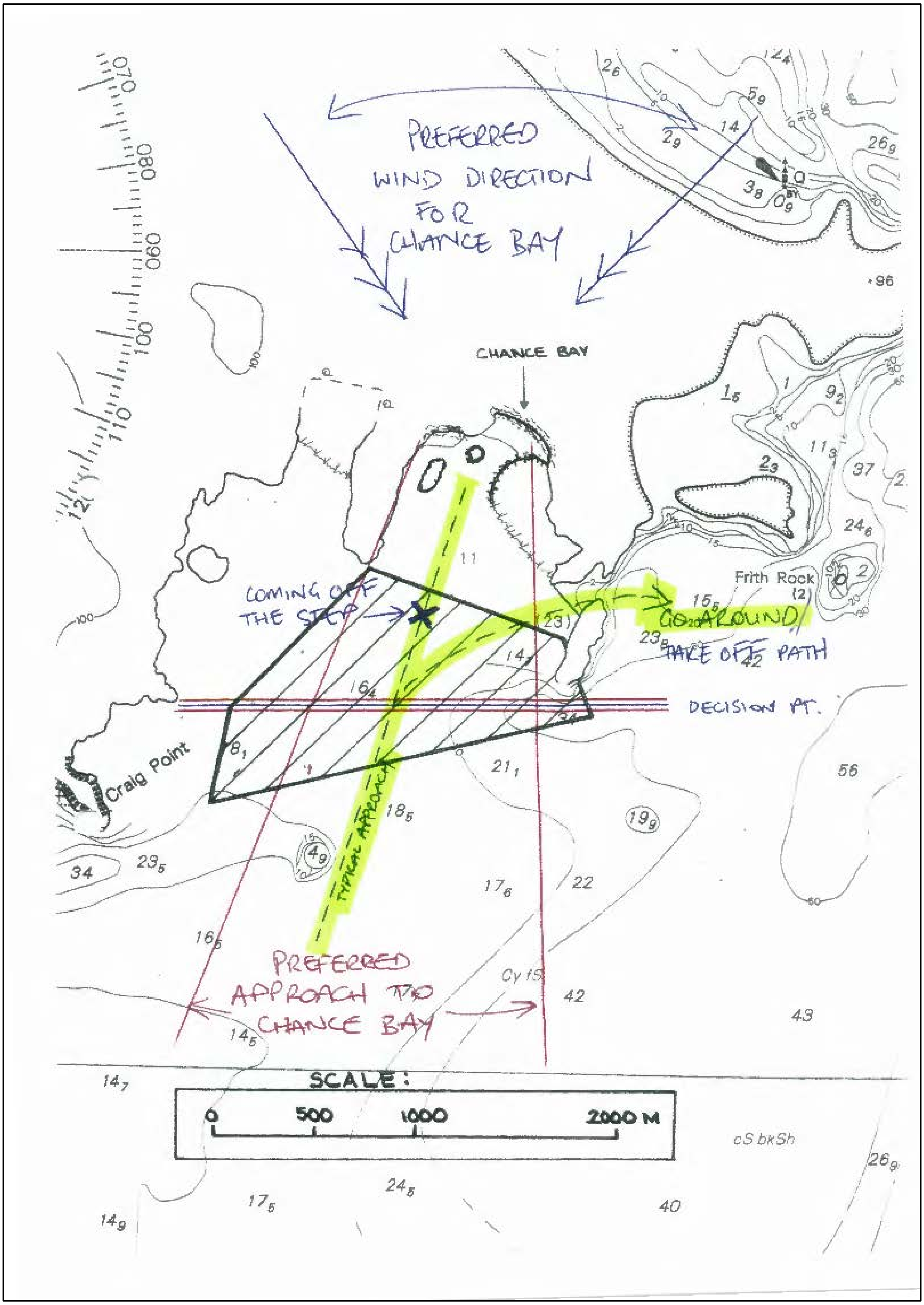
Appendix B – Chance Bay ALA additional guidance



Australian Transport Safety Bureau

The ATSB is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within ATSB's jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Terminology used in this report

Occurrence: accident or incident.

Safety factor: an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, current risk controls and organisational influences.

Contributing factor: a factor that, had it not occurred or existed at the time of an occurrence, then either:

(a) the occurrence would probably not have occurred; or

(b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or

(c) another contributing factor would probably not have occurred or existed.

Other factors that increased risk: a safety factor identified during an occurrence investigation, which did not meet the definition of contributing factor but was still considered to be important to communicate in an investigation report in the interest of improved transport safety.

Other findings: any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which ‘saved the day’ or played an important role in reducing the risk associated with an occurrence.