AIRCRAFT ACCIDENT REPORT

OCCURRENCE NUMBER 05/40

SEAWIND 3000C
ZK-SWT
Lake Taupo
16 Jan 2005

Glossary of abbreviations used in this report.

AD	Airworthiness Directive
AIP	Aeronautical Information Publication
ARA	annual review of airworthiness
BFR	bi-annual flight review
CAA	Civil Aviation Authority
CAR	Civil Aviation Rule(s)
km	kilometre(s)
LAME	Licensed Aircraft Maintenance Engineer
NZDT	New Zealand Daylight Time
NZST	New Zealand Standard Time
PPL(A)	Private Pilot Licence (Aeroplane)
UTC	Coordinated Universal Time
WGS-84	World Geodetic System1984

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Aircraft Type, Serial Number and Registration:	Seawind 3000C ZK-SWT
Number and Type of Engines:	One, Lycoming IO-540-K1B5
Year of Manufacture:	1999
Date and Time: [1]	16 Jan 2005, 2010 hours[1]
Location: [2]	Lake Taupo Latitude: S 38° 44' Longitude: E 176° 04'
Type of Flight:	Private
Persons on Board:	Crew: 1 Passengers: 1
Injuries:	Crew: 1 fatal Passengers: 1 minor
Nature of Damage:	Moderate damage to nose gear and canopy.
Pilot-in-Command's Licence	Private Pilot Licence (Aeroplane)
Pilot-in-Command's Age	60 years
Pilot-in-Command's Total Flying Experience:	1429 hours, including 221 hours on type, 114 water landings
Information Sources:	Civil Aviation Authority field investigation
Investigator in Charge:	Mr T P McCready

[1] Times are NZDT (UTC + 13 hours)

[2] WGS-84 co-ordinates

Synopsis

The Civil Aviation Authority (CAA) was notified of the accident which had occurred on Lake Taupo on Sunday at 8.10 pm on 16 January 2005. The Transport Accident Investigation Commission was also notified, but declined to investigate. A CAA on-site investigation was commenced the following morning.

The aircraft was conducting a water take-off from Lake Taupo and was seen to porpoise three times on the lake surface before coming to rest inverted and partially submerged. The passenger swam out of the wreckage but the pilot had to be rescued under water. He did not regain consciousness and died the following day.

1. Factual information

1.1 History of the flight

1.1.1 On Sunday 16 January 2005 the homebuilt amphibian ZK-SWT, accompanied by two other land based homebuilt aircraft, departed from Tauranga airport and flew to Taupo where the two accompanying aircraft landed at Taupo airport while ZK-SWT landed on Lake Taupo a short distance away from the airport.

1.1.2 The group of aviators had lunch on the beach and then prepared to conduct flights from the water. The four-seater aircraft attempted a take-off with two pilots in the front seats and their wives in the two rear seats. During this take off a boat wake was struck with sufficient force to cause the rear left seated passenger to be thrown into the lap of the passenger next to her. In doing so, the severity of the impact caused the loss of her headset from her head and bruising to her hips from the seatbelts. The take-off was aborted and the aircraft returned to the beach. The force of water in the nose area had damaged the nose landing gear doors and blown the nose locker hatch off the aircraft. This was retrieved by a passing boat. The aircraft had also taken on some water in the cabin.

1.1.3 The landing gear was cycled through extension and retraction, and then a second take-off was attempted with only the two pilots on board. It was aborted again after failing to get off the water. The pilot seated in the passenger seat later described the aircraft performance as “sluggish and not wanting to get off the water”.

1.1.4 The aircraft was then water-taxied further around the lake front to the Two-Mile Bay boat ramp where the aircraft was moved into the car park. The nose landing gear doors were found damaged so these were removed. A ball-end in the nose wheel actuating mechanism was found snapped off so one of the accompanying pilots flew his aircraft from Taupo to Tauranga to get replacement parts, which were then fitted to the aircraft.

1.1.5 While the aircraft was in the car park the Operations Manager of a local helicopter company offered to call for assistance from a number of LAMEs employed at his company. This offer was declined by the Seawind pilot. A passer-by also twice offered to drive the pilot and passenger to their base in Tauranga but this offer was also declined.

1.1.6 A third take-off attempt or trial run was then conducted with both the nose locker hatch and nose landing gear doors removed, but this was unsuccessful partly due to the amount of water entering into the nose compartment. The aircraft was returned to the beach adjacent to the boat ramp. Here the aircraft was tilted over with the left wing down while the damaged nose area was worked on by the three homebuilder/pilots.

Figure 1: Missing hatch (circled) while leaving boat ramp for third attempt.

1.1.7 To prevent water entry into the nose landing gear wheel well, a corrugated plastic “Danger” sign was obtained from a construction site. This sign was folded along the middle to match the “V” shaped contour of the hull and taped along two sides to the aircraft hull. This was to cover the wheel well opening left by the previously removed nose landing gear doors. The nose locker hatch was also fitted and sellotaped into position.

1.1.8 A fourth take-off was attempted by the pilot along with his wife as passenger with the intention of flying back to Tauranga airport. The aircraft was seen by a number of witnesses to porpoise three times, flip over, and come to rest with the cockpit area submerged.

1.1.9 The accident occurred in daylight, at approximately 2010 hours NZDT, on Lake Taupo, at an elevation of 1172 feet, latitude S 38° 44', longitude E 176° 04'.

1.2 Injuries to persons

Injuries	*Crew*	*Passengers*	*Other*
Fatal	1	0	0
Serious	0	0	0
Minor/None	0	1	

1.3 Damage to aircraft

1.3.1 The aircraft was damaged but was recovered and is now being rebuilt in Australia.

1.4 Other damage

1.4.1 Nil.

1.5 Personnel information

1.5.1 The pilot obtained his PPL(A) in July 1987 and held a Class 2 medical certificate valid to 12 October 2005.

1.5.2 He had recorded 1428 flight hours which included approximately 11 hours in the last 90 days.

1.5.3 ZK-SWT had been flown exclusively by the pilot and he had recorded 220.3 hours, including 114 water landings, in the aircraft. He had also flown the aircraft throughout its test flight period, having been granted a test pilot approval on 20 September 1999.

1.6 Aircraft information

1.6.1 The Seawind 3000C Serial Number 35 ZK-SWT was constructed over a 6 year period from kitset design by the pilot and his wife who was the passenger in this accident.

1.6.2 The aircraft first flew in October 1999 and after a successful test flight programme the aircraft was granted an airworthiness certificate on 14 June 2002.

1.6.3 The last airframe logbook entry dated 7 November 2004 recorded 214 flight hours. Routine maintenance had been carried out, including an Annual Review of Airworthiness in conjunction with a 100 hour inspection on 25 November 2004. An additional 6.3 hours were recorded in the Technical Log recovered from the aircraft.

1.6.4 The engine had been removed from another aircraft, ZK-JSB, and fitted to ZK-SWT during the aircraft construction.

1.6.5 The variable pitch propeller was fitted new and, like the airframe, had recorded 214 flight hours. It had undergone a calendar inspection on 29 September 2003.

1.7 Meteorological information

1.7.1 The weather was not considered a factor in this accident. There was a light 5 knot northerly wind across a relatively calm lake surface. The take off direction was to the North with a setting sun to the West.

1.8 Aids to navigation

1.8.1 Not applicable.

1.9 Communications

1.9.1 A review of the Taupo Unicom communication recordings by the Taupo airport Manager revealed no recorded transmissions were received throughout the day from ZK-SWT.

1.9.2 The radio was found switched off, as was the transponder.

1.10 Aerodrome information

1.10.1 The area of operations of the aircraft on Lake Taupo was within 1 nm of Taupo airport and so was within the Mandatory Broadcast Zone. It was also so close to the airport that it was within the circuit area of runway 17/35. The Western Helicopter Arrival and Departure area (a low level helicopter route) also crosses this area.

1.10.2 Lake Taupo is listed as a non-certified water aerodrome, and in the AIP (which pilots review before operating at aerodromes) is the following operational requirement:

"No operator or pilot may operate into the aerodrome without first obtaining from the aerodrome operator (Taupo Harbour Master) a full briefing of limits, restrictions and other control measures which are from time to time necessary for the proper use of the public lake and the protection of persons and property."

1.11 Flight recorders

1.11.1 Nil

1.12 Wreckage and impact information

1.12.1 The aircraft remained floating inverted in the water with the cabin area submerged. Due to approaching darkness the Taupo Coast Guard towed the aircraft to the sheltered and shallow waters of Two Mile Bay.

1.12.2 The following morning the investigation was commenced initially by shallow free diving on the aircraft for an external inspection. The airframe was found complete except for the canopy. The nose wheel was noted as extending freely and the water rudder was extended. The elevator trim tab was in the UP position and the rudder trim was at the RIGHT position. The flaps were found set to the normal take-off position. The aircraft was then recovered by crane to dry land.

1.12.3 External inspection revealed that the main impact was taken by the nose and the left wing which was damaged and almost separated from the aircraft. The right wing was relatively undamaged and approximately 80 litres of fuel was drained from it.

1.12.4 The cockpit canopy was shattered with only the rearmost section remaining. The canopy latch on the right (passenger's) side was distorted while the left (pilot's) side latch was undamaged.

1.12.5 Cockpit inspection revealed the following switch and control positions:

Radio: OFF

Transponder: OFF

Master Switch: ON

Strobe Lights: OFF

Mixture: FULL RICH

Throttle: IDLE

Fuel shut off: ON

1.12.6 The nose section inspection showed the nose locker hatch separated at the glue line of the hinge. This had occurred at the first take-off attempt. Lengths of a clear Sellotape type material remained on the hatch and nose section. The red "Danger" sign that had been covering the nose landing gear was found split in two along the fold line and some red dye/ink from the sign had transferred to the right side of the aircraft nose.

Figure 2: Failed Sellotape used to secure nose hatch for flight

1.12.7 The reason the nose landing gear was free to extend was a broken ball-end in the mechanism.

1.13 Medical and pathological information

1.13.1 The pilot subsequently died of head injuries.

1.14 Fire

1.14.1 Fire did not occur

1.15 Survival aspects

1.15.1 Rescuers were on the scene extremely quickly due to a commercial yacht hire business at Two Mile Bay having an inflatable boat for immediate use when recovering inexperienced customers.

1.15.2 Neither the pilot nor the passenger wore one of the life-jackets carried in the aircraft and stowed in the seat pockets. The passenger extricated herself from the aircraft while underwater in a distressed state. She was some distance from land, in a cold lake with diminishing daylight, so the prompt arrival of rescuers was significant.

1.15.3 One rescuer dived three times before releasing the pilot from his seatbelt. The rescuer, a glider pilot, was initially confused underwater expecting a four point harness found in gliders but this aircraft was equipped with an automotive style diagonal belt.

1.15.4 Both occupants were transferred to shore in the inflatable boat with CPR being administered to the pilot on the way. He died later the following day.

1.16 Tests and research

1.16.1 Nil

1.17 Organisational and management information

1.17.1 Nil

1.18 Additional information

1.18.1 A number of witnesses came forward with information following the accident. This was because the aircraft had attracted a lot of attention from passers-by during the afternoon while repairs were undertaken at a busy boat ramp.

1.18.2 All agreed that the aircraft porpoised about three times during the accident sequence. Some were adamant that the aircraft struck a boat wake late in its take-off run, while others were equally convinced that a wake was not present. Most viewed the accident from some distance away.

1.18.3 One witness, (an Operations Manager for a South Island helicopter company) viewed the accident side-on from a lake front motel room and described the aircraft nose rising quite steeply, not high, but enough for the aircraft to become fully airborne 2-3 feet off the water and wings level. The aircraft nose then dropped at a reasonably rapid rate and the aircraft contacted the water in a nose-down attitude.

1.18.4 The aircraft passenger, who was experienced with the aircraft take off characteristics, described being acutely aware of the noise of the water on each take-off run and always being relieved when water contact was lost once airborne. She remembers that occurring on this occasion.

1.19 Useful or effective investigation techniques

1.19.1 Nil

2. Analysis

2.1 From an investigative point of view this accident scenario began in the early afternoon on the first take-off attempt.

2.2 The aircraft was operating from the surface of Lake Taupo without the required authorisation as detailed in the AIP landing charts and that authorisation, if sought, would not have been given. The Taupo Harbour Master, a career mariner and experienced aircraft pilot, considered that the intensity of water borne traffic and subsequent wakes would have been hazardous to an amphibious aircraft which sat so low in the water. The day of the accident was one of the first summer weekends for Lake Taupo after a particularly cold Christmas period, so he anticipated a lot of water activity for the day.

2.3 The aircraft struck a wake on the first take-off attempt with sufficient severity to cause bruising to a passenger, and the impact damaged the nose landing gear doors and blew off the nose locker hatch due to the inrush of water through the nose landing gear wheel well. The design of the door system is such that the lightly skinned doors have no internal stop to limit door movement inwards from water contact, and the doors rest on the nose wheel. Water impact forces are transferred to the doors, then the wheel and retraction mechanism. The failure of a ball end in the retraction mechanism at this point (which required a replacement part to be obtained) is significant as the same part was found broken after the fourth and final take-off attempt later in the day. Enquiries revealed that damage to the doors had occurred to this aircraft four times previously and at least once to the other Seawind operated in New Zealand.

2.4 The overload failure of the ball end allowed the nose wheel to hang freely instead of being held in the retracted position. This was also noted by the accident investigator, who free dived on the wreckage before the aircraft recovery from the water. The nose wheel hanging freely possibly accounted for the aircraft not wanting to get off the water during the second attempt because it would have created increased water drag.

2.5 After the damage was incurred the aircraft was technically and legally unserviceable. It required inspection, damage assessment, and repair followed by a release to service from a Licensed Aircraft Maintenance Engineer (LAME). Instead, the pilot obtained a replacement ball end part, fitted it, and removed the damaged nose wheel doors, intending to fly without them and without the nose locker hatch.

2.6 The offer of assistance to seek advice and help from local Taupo aircraft engineers (LAMEs) was declined. What may not have been apparent to the pilot was that those engineers and other local aviation people are familiar with the commercial operation of the Taupo Cessna 206 float plane that has operated from the lake for over 20 years and the aircraft is often recovered across the land to the nearby Taupo airport for maintenance. The Seawind, if recovered by the locals, would likely have been handled in the same manner. Had that offer been accepted the urgency to have the Seawind aircraft flying that day would have diminished, with security and maintenance facilities being readily available. In addition, ample alternative transport and accommodation arrangements were available in Taupo township with rental cars and motels within walking distance from the subsequent accident area. A repeated offer was also made to drive the couple to their home base of Tauranga.

2.7 On completion of the build project homebuilt aircraft are required to be maintained and inspected by a Licensed Aircraft Maintenance Engineer (LAME) who records the work in the aircraft logbook and certifies that work with a Release To Service. This requirement for LAME maintenance is often a contentious issue with homebuilders who, after building the aircraft, expect to be able to maintain it themselves. However that is only allowed for after a three-day course in which a Maintenance Approval may be gained. Alternative methods to gain the required Maintenance Approval are to self study the requirements and pass a CAA approved oral examination.

2.8 What is often not appreciated by homebuilders is that maintenance of an aircraft involves an entirely different skill set from the building/assembly of an aircraft. A LAME is required to apply research skills into approved repair criteria, assess damage, provide correct parts, and certify his work to a myriad of technical and legal requirements covered in Civil Aviation Rules. This is common in many different professional engineering disciplines. To assist the LAME there is a suite of manuals associated with the aircraft, detailing repair limitations, procedures, and approved repair products. This is not commonly found in homebuilt manuals which usually deal with the assembly process only.

2.9 LAMEs are also examined in Human Factors, which deals with the problems associated with working under pressure, particularly in this case involving the conduct of field repairs away from home base. A LAME must have five years' experience before the granting of a license and typically doesn't get involved in serious supervisory decision making until about 10 years of experience is gained. That experience is largely gained under the supervision of more experienced engineers, so in addition to gaining engineering knowledge they are able to observe the daily pressures of engineering decision-making.

2.10 Homebuilders in contrast, while confident in their abilities due to the construction of often only a single aircraft, are required to pass a three-day course or oral examination to gain a Maintenance Approval.

2.11 In the events preceding this accident three experienced and respected homebuilder/pilots were faced with aircraft serviceability problems in a field environment. They may have developed a mind set of what is commonly referred to in the aviation industry as "get-home-itis". This is a situation in which normally conservative and capable engineers and pilots bend to the pressure of getting the aircraft home, and make uncharacteristic decisions in attempting to do so; often when better options are available. Many accidents are caused by get-home-itis, particularly in weather related decisions. Such decisions involving maintenance issues are not quite as common, but had a LAME conducted these repairs he or she would have been likely to have faced a CAA review of their suitability to hold a license. A number of licensed engineers were interviewed as part of this investigation and they expressed concern regarding homebuilders' carrying out their own aircraft maintenance.

2.12 After a third take-off attempt resulted in an excessive amount of water entering the nose locker area, subsequent aircraft repairs were of a standard not acceptable in aircraft engineering. Local engineering offers were declined and the pilots' Tauranga based LAME was never consulted, despite being available on cell phone during the weekend.

Figure 3: Danger sign fitment with one piece of Sellotape on each side. Nose landing gear would have been retracted.

2.13 Attachment of the folded "Danger" sign to cover the nose landing gear area was achieved by application of only one piece of Sellotape either side of the sign, in contrast to the multiple strips of Sellotape used on the hatch. Once the aircraft was airborne it would have been possible to lower the landing gear and "blow" the danger sign off, thus allowing a land based landing at Tauranga airport.

2.14 The nose locker hatch was also secured with Sellotape. The hatch had previously failed at the hinge, which was a glued joint. The numerous strips of Sellotape showed overload stretching failure consistent with being forced off from a water load coming up through the nose locker. This water entered via the nose landing gear door area. This method of securing the hatch is even more remarkable given the aircraft design with the propeller placed immediately above and behind the cabin, as severe propeller damage would have been likely if the hatch had departed the aircraft during flight.

2.15 Enquiries as to why this technique was used revealed that this accident pilot had recovered another Seawind aircraft, which had been damaged in a similar scenario, from Tory Channel and had flown that aircraft back to Tauranga with the hatch Sellotape, so he probably gained confidence from this. The recovery had been from a land-based airport and the pilot did not consult with his engineer on that occasion.

2.16 The time of the accident was at 8:10 pm NZDT which, if the take off had been successful, would have allowed approximately 55 minutes until Evening Civil Twilight to fly a minimum direct flight of 65nm to Tauranga. While this was achievable, the timing is significant in that it was the pilot’s last chance to fly home that night. As detailed in paragraph 1.12.5, a number of items and actions that would normally be expected to be operated or carried out were not. These included the radio and transponder being switched off, no radio calls being recorded, the elevator trim position and water rudder remaining extended. These anomalies indicate that the pilot may have rushed his take-off preparations due to the tight time constraints.

2.17 The exact cause of the upset which produced the pitching of the aircraft into the water through porpoising actions could not be identified with certainty. However the aircraft did get airborne off the water. The elevator trim tab being fully up would indicate that the pilot was trimming the aircraft to the nose down position. It was confirmed by examination that the flaps had been set for take-off. The rudder trim was at full right and the aircraft contacted the water left wing down.

2.18 The extreme elevator trim position suggests that the aircraft may have been out of balance longitudinally during the take-off. That might be attributed to undetected water in the keel from the previous incidents. Also a lateral imbalance may have been present due to a fuel imbalance from previously working on the aircraft while beached – the left wing was the low wing during that work exercise. These possibilities could not be determined at the accident site. The elevator trim is an electric trim system which could have motored to that position after the accident due to water contact. An experienced operator in Australia also raised the possibility of inadvertent trimming of the elevator, which he had experienced and written about. In that article he had suggested a change to the trim switch.

2.19 The witness considered in the best position to view the accident saw it from side-on. He was an experienced pilot and suggested that the aircraft became airborne too early from a wake and settled back into the water.

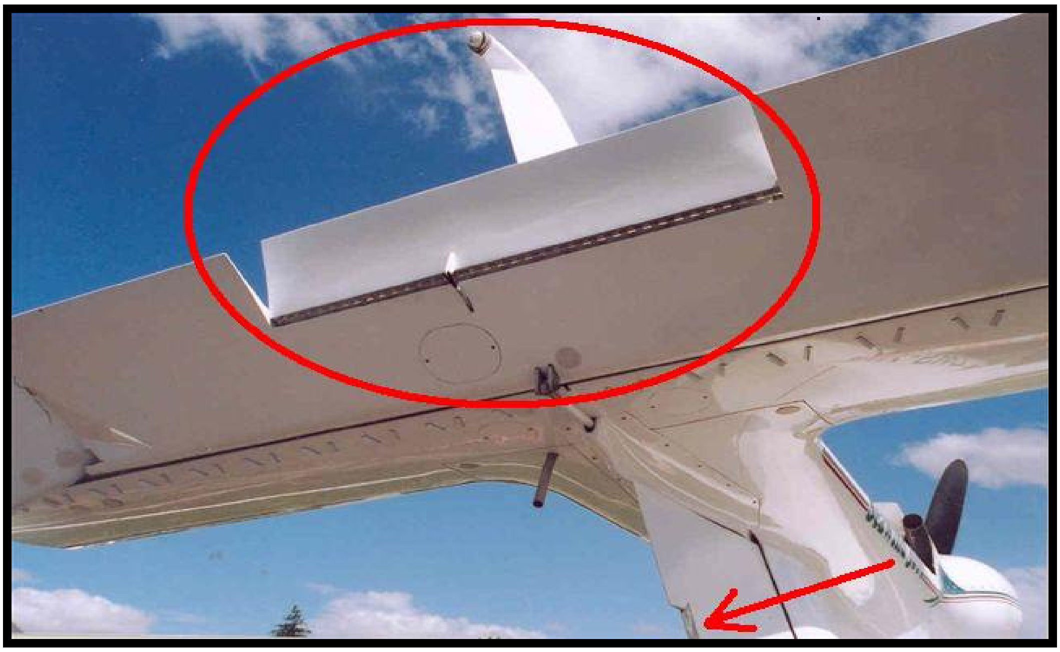


Fig 4: Elevator trim tab (circled) trimmed Nose Down, and rudder trim tab (arrowed) deflected full Right.

2.20 The pitch-down just after the aircraft became airborne and the loss of the "Danger" sign cover combined to create a solid water-brake surface in the nose landing gear bulkhead of sufficient force to cause the Sellotape to fail and to blow off the hatch cover and induce further pitching oscillations. These were probably exacerbated by the pitch change from the rapid closing of the throttle and the weight of the engine and propeller which were positioned high above the aircraft centre line.

2.21 The initial nose-high attitude of the aircraft on leaving the water is unusual, because with flap set the aircraft is configured to fly off the water in a near level attitude. This is to avoid dragging the tail in the water and producing a pitch down.

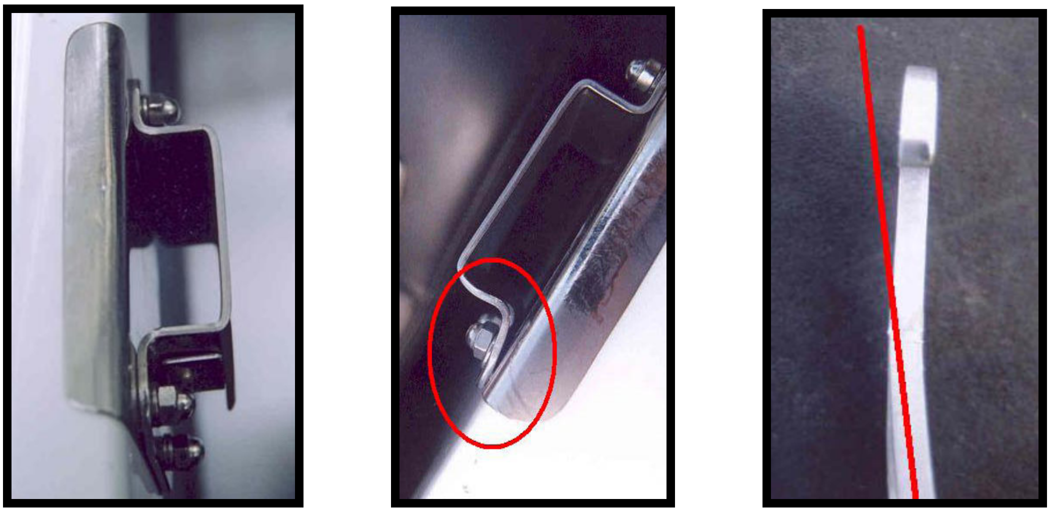
2.22 The effect of the low and bright sunlight across the across water on the pilot's vision in determining his height off the water was considered however there is no conclusive evidence to support this being a factor in the accident.

2.23 Advice from an experienced Seawind instructor in the USA was sought regarding the various possible scenarios present in this accident, including the pilot attempting to land back onto the water. In general terms he advised that, during landing: *The magic number for touching the step (the aft part of the forward hull), is 60 KIAS (or 68 MPH). If you are appreciably faster than this, the nose will have a tendency to dig in. If you're slow (even 58 KIAS) the airplane will bounce nose up with any appreciable chop. Either of these scenarios complicates the landing solution.*

Fig 5: Typical take off attitude in smooth water conditions.

2.24 The aircraft entered the water left wing down and the cabin canopy was forced off to the right. The loss of the canopy probably contributed to the pilot's head injuries rendering him unconscious. That circumstance, combined with the aircraft flipping inverted in the water, turned this survivable accident into a fatality.

2.25 The lack of any damage to the pilot's side cabin latching mechanism consistent with that found on the passengers latch mechanism indicates that the pilot's side may have been unlatched, although the departure sequence of the canopy could not be determined as it was not recovered.



UNDAMAGED **DAMAGED**

Figure 6: CANOPY LATCHES: pilot's undamaged latch bracket (left) and passenger's damaged latch bracket (centre) and bent latch (right).

3.Conclusions

3.1 The pilot was appropriately licensed and rated for the flight and held a current medical certificate.

3.2 The aircraft was not airworthy at the time of the accident due to repairs having been carried out which were not – and would not have been – certified by a Licensed Aircraft Maintenance Engineer.

3.3 While a number of scenarios exist, no conclusive reason could be determined for the aircraft pitching down onto the water again.

3.4 On contact with the water during the pitch-down the signage covering the nose landing gear failed and the bulkhead acted as a water-brake, causing the aircraft to porpoise.

3.5 The water force into the nose wheel well blew off the nose locker hatch which had also been taped on. This was a repeat of the first incident sequence earlier in the day and identical to a previous incident to another Seawind aircraft.

3.6 The aircraft was being operated on Lake Taupo without the permissions required as detailed in AIP New Zealand Lake Taupo Operational Requirements. The permission from the Harbour Master would not have been granted, given the level of other activities on the lake.

3.7 Unauthorised and unrecorded repairs and maintenance by homebuilders are a source of complaint by Licensed Aircraft Maintenance Engineers concerned about their liabilities after their certification for previous maintenance.

3.8 No life jackets were worn and, if it had not been for the prompt intervention of bystanders, a second fatality in this accident may have been likely.

4. Safety recommendations

4.1 No new recommendations were developed as a result of this accident. Established communication, aerodrome and engineering procedures are already in place.

5. Safety actions

5.1 Training was conducted by the CAA at Tauranga on 30-31 July 2005 for the issue of Part 66 Maintenance Approvals. This will continue at other venues around New Zealand. Homebuilders have been reminded of the legal requirement to obtain a maintenance approval and training before maintaining or repairing aircraft.

Authorised by:

Mr Richard White

Manager Safety Investigation Unit

26/4/2007

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