Statens haverikommission
Swedish Accident Investigation Authority





Final report
SHK 2023:12e

Seaplane accident at Lake Siljan, Dalarna County on 18 July 2022 involving the aeroplane N747HJ of the model UC-1 Twin Bee

File no. L-70/22

23 October 2023

SHK investigates accidents and incidents from a safety perspective. Its investigations are aimed at preventing a similar event from occurring in the future, or limiting the effects of such an event. The investigations do not deal with issues of guilt, blame or liability for damages.

The report is also available on SHK´s web site: www.havkom.se

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This document is a translation of the original Swedish report. In case of discrepancies between this translation and the Swedish original text, the Swedish text shall prevail in the interpretation of the report.

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CONTENT

General Observations

The Swedish Accident Investigation Authority (Statens haverikommission – SHK) is a state authority with the task of investigating accidents and incidents with the aim of improving safety. SHK accident investigations are intended to clarify, as far as possible, the sequence of events and their causes, as well as damages and other consequences. The results of an investigation shall provide the basis for decisions aiming at preventing a similar event from occurring in the future, or limiting the effects of such an event. The investigation shall also provide a basis for assessment of the performance of rescue services and, when appropriate, for improvements to these rescue services.

SHK accident investigations thus aim at answering three questions: *What happened? Why did it happen? How can a similar event be avoided in the future?*

SHK does not have any supervisory role and its investigations do not deal with issues of guilt, blame or liability for damages. Therefore, accidents and incidents are neither investigated nor described in the report from any such perspective. These issues are, when appropriate, dealt with by judicial authorities or e.g. by insurance companies.

The task of SHK also does not include investigating how persons affected by an accident or incident have been cared for by hospital services, once an emergency operation has been concluded. Measures in support of such individuals by the social services, for example in the form of post crisis management, also are not the subject of the investigation.

Investigations of aviation incidents are governed mainly by Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation and by the Accident Investigation Act (1990:712). The investigation is carried out in accordance with Annex 13 of the Chicago Convention.

The Investigation

SHK was informed on 17 July 2022 that an accident involving an aircraft with the registration N747HJ had occurred at Lake Siljan in Dalarna County, on the same day at 16:08 hrs.

The accident has been investigated by SHK represented by Mr Jonas Bäckstrand Chairperson until 19 April 2023, Ms Kristina Börjevik Kovaniemi Chairperson from 20 April 2023, Mr Johan Nikolaou, Investigator in Charge, Mr Mats Trense, Operations Investigator, Mr Tony Arvidsson, Technical Investigator (aviation), and Mr Tomas Ojala, Investigator specializing in Fire and Rescue Services.

SHK has been assisted by Magnic AB as an expert in video and audio analysis.

Mr Mitchell Gallo from the National Transportation Safety Board (NTSB) has participated as an accredited representative from the USA.

Mr Thomas Kostrzewa has participated as an accredited representative from the Bundesstelle für Flugunfalluntersuchung (BFU) Germany until 29 March 2023. Mr Klaus-Uwe Fuchs has thereafter represented the BFU.

Mr Johannes Woldrich from the Civil Aviation Safety Investigation Authority (BMVIT) has participated as an accredited representative from Austria.

Ms Susanne Schramm and Mr Gabriel Ivan has participated as advisers on behalf of the European Union Aviation Safety Agency (EASA).

Mr Magnus Axelsson and Mr Daniel Wastesson has participated as advisers on the behalf of the Swedish Transport Agency.

The following organisations have been notified: EASA, The European Commission, NTSB, BFU, BMVIT and the Swedish Transport Agency.

Investigation material

- Documentation of the aircraft at the bottom of Lake Siljan has been obtainned.
- The area of the accident has been investigated.
- The aircraft has been recovered and examined.
- Interviews have been conducted with
  - witnesses to the accident, the owner of the aircraft, and other persons who had contact with the pilots during the day of the accident, and
  - flight schools that train and have trained pilots on the aircraft type.
- The aircraft's ADS-B registrations have been obtained from the Air Navigation Services of Sweden (LFV) and the flight tracking service Flightradar24.
- Actual weather for the area has been obtained.
- Information from devices and instruments in the aircraft (ADS-B, FLARM and engine data) has been acquired. BFU and NTSB have assisted SHK with downloading registered data from the instruments.

A factual meeting was held on 2 May 2023. At the meeting, SHK presented the facts obtained during the investigation, available at the time.

Final Report SHK 2023:12e

Aircraft:	
Registration, type	N747HJ,
Model	UC-1 Twin Bee
Airworthiness	Valid Certificate of Airworthiness
Serial number	024
Owner	Privat owner
Time of occurrence	18 July 2022, 16:08 hrs in daylight Note: All times are given in Swedish daylight-saving time (UTC[1] + 2 hours)
Place	Lake Siljan, Dalarna County, (position 60°53N 014°42E, 160 metres above mean sea level)
Type of flight	Private
Weather	According to Mora Airport Metar[2]: wind 200 degrees, 9 knots, varying between 150 to 240 degrees, visibility more than 10 kilometres, scattered clouds at 5 100 feet, temperature/dew-point +21/+11°C, QNH[3] 1012 hPa
Persons on board:	2
crew members including cabin crew	2
passengers	0
Injuries to persons	Two fatally injured
Damage to aircraft	Destroyed
Other damage	Fuel and oil leakage in the water
Instructor:	
Age, licence	62 years, CPL[4]
Total flying hours	About 5 200 hours[5], of which 99 hours on type
Flying hours previous 90 days	Unknown
Number of landings previous 90 days	Unknown
Student:	
Age, licence	22 years, CPL
Total flying hours	1 117 hours, of which 11/0[6] hours on type
Flying hours previous 90 days	105 hours
Number of landings previous 90 days	60

[1] UTC – Coordinated Universal Time.
[2] Metar – METeorological Aerodrome Report.
[3] QNH (Question Nil Height) – The atmospheric pressure adjusted to the mean sea level.
[4] CPL – Commercial Pilot License.
[5] The instructors total flight time is estimated as he had 5 125 hours five months before the accident.
[6] The student had 11 hours during operations on land of the aircraft type and 0 hours sea.

SUMMARY

A seaplane instructor and two students were at Lake Siljan to carry out seaplane training within the framework of an Austrian ATO. However, the instructor had not yet completed his annual refresher training for the flight school and, pending doing so, conducted a number of flights with the students as a private flight.

On July 18, one of the students was planned to make his first flight on sea with the instructor. The intention was to perform repeated take-offs and landings on Lake Siljan together with the instructor. The session had a high degree of difficulty and was likely designed based on the student having previous experience on the aircraft type.

The weather observation indicated good visibility with high cumulus clouds and moderate variable winds from the southwest. The flight took off from Siljansnäs Airport. After completing several landings, the aircraft turned to an east-north-easterly direction over Sollerön island for another landing. In connection with the landing attempt, the aircraft tipped forward and flipped around. The instructor and the student where fatally injured.

The aircraft is believed to have been configured for landing on water with the landing gear retracted before the accident. No technical fault with the aircraft that may have affected the accident has been identified.

Causes/Contributing Factors

The accident was caused by the flight being planned and executed in such a way that the degree of difficulty became too high in relation to the instructor's recency on type and the student's seaplane experience.

Before the landing, no reconnaissance was performed, which has contributed to the landing being carried out at high speed, in tailwind and probable rough sea in relation to the aircraft's limitations.

Safety Recommendations

EASA is recommended to:

- produce safety-promoting materials for seaplane operations and inform relevant actors. *(SHK:2023:12 R1)*

1. FACTUAL INFORMATION

1.1 History of the Flight

1.1.1 Preconditions

A seaplane instructor and two students, residing in Germany, were in Sweden to carry out seaplane training. The training was to be carried out on the UC-1 Twin Bee. The owner of the aircraft was one of the two students. The other student was authorized to fly the aircraft type on land, but was there to obtain the MEP (sea)[7] class rating.

The seaplane training was to be carried out within the framework of an Austrian ATO[8]. However, the instructor had not performed his annual refresher training for the training organisation and carried out the flights as pilot in command as a private flight. As a result, he was not approved to carry out the training through the ATO. While waiting to complete the refresher training, the instructor performed a number of training flights with the two students at Lake Siljan during the period 17–18 of July 2022.

The first training session on July 18th was performed by the instructor and the owner of the aircraft. Later that day, the instructor conducted another flight with the second student. The intention was to carry out repeated "Splash and Go's" on Lake Siljan i.e. landings on water followed by a direct take-off.

The aircraft was refuelled before the flight and had 280 litres of fuel on board.

According to weather observations, the weather conditions showed good visibility with high scattered cumulus clouds and variable south-westerly winds.

Figure 1. The Aircraft before the accident. Photo: © Sven Vollert.

[7] MEP(sea) – Multi Engine Piston sea.
[8] ATO – Approved Training Organisation.

1.1.2 Sequence of Events

The flight took off at 15:40 from runway 32 at Siljansnäs Airport. Over Lake Siljan, two traffic circuits were carried out with a number of "Splash and Go's" in each circuit. The landings were performed in a westerly direction, (see Figure 2). After completing a "Splash and Go" south of Sollerön, the aircraft turned right to an east-northeast direction for an approach and water landing. During the landing attempt, the aircraft crashed and sank. The accident occurred at 16:08 at position 60 53N 014 42E, 161 metres above sea level.

A group of people on the mainland witnessed parts of the flight. After a while, a cascade of water appeared and a thunder-like bang was heard. With binoculars, the aircraft could be seen floating upside down on the water surface. They understood that an accident had occurred and alerted SOS Alarm. A rescue operation was started. Both pilots were fatally injured.

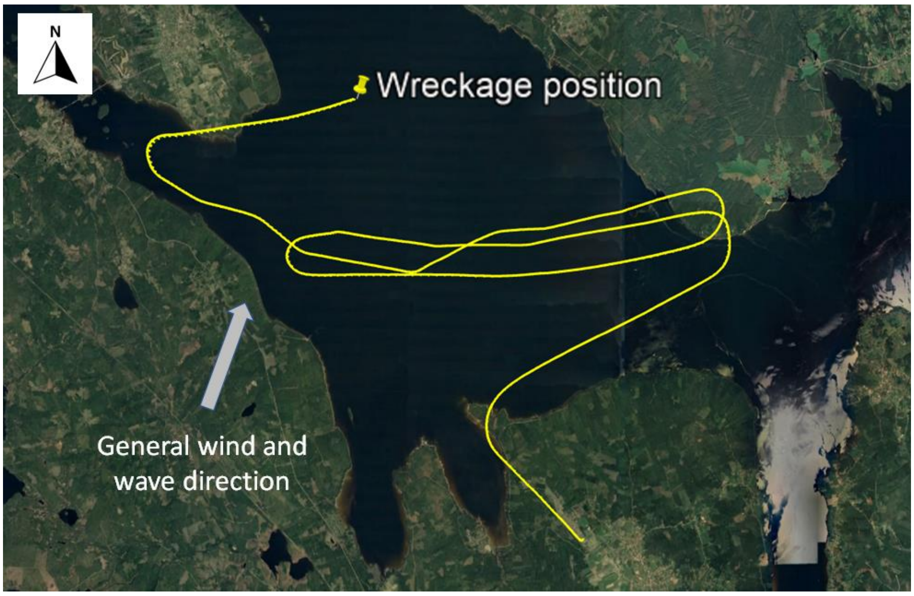


Figure 2. Sensor data from ADS-B shows the aircraft's route from the airport in Siljansnäs to the accident site east of Sollerön. Markings by SHK. Image: Google Earth © Lantmäteriet D no R6174919_0001.

1.2 Injuries to Persons

	Crew members	Passengers	Total	Others
Fatal	2	0	2	-
Serious	-	-	0	-
Minor	-	-	0	Not applicable
None	-	-	0	Not applicable
Total	2	0	2	-

1.3 Damage to Aircraft

Destroyed.

1.4 Other Damage

1.4.1 Environmental Impact

Fuel and oil spill in the Lake Siljan.

1.5 Personnel Information

1.5.1 Qualifications and Duty Time of the Pilots

Instructor

The instructor, 62 years old, had a commercial pilot license (CPL) with a valid MEP(sea)[9], a valid medical certificate and authorization to conduct training on the Class rating.

The instructor's logbook has not been found. Therefore, the total flight time is estimated on the basis that he had 5 125 hours of flight time five months before the accident. The number of landings on the type at the same time was 337, however, it is not clear how many of these landings are on sea.

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	3	Unknown	Unknown	5 200
Actual type	1	1	3	99

Number of landings actual type previous 90 days: 14 (of the 14 landings 12 where performed on sea).

Skill Test for MEP (sea) was performed on the type in June 2008.

Latest PC[10] was conducted on 31 August 2021 on type. According to the PC documentation glossy water landings was performed.

The student

The student was 22 years old and had a commercial pilot license, (CPL), had a valid MEP (land) to operate the aircraft type on land and a valid medical certificate.

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	0	0	72	1 117
Actual type land	0	0	3	11
Actual type sea	0	0	0	0

Number of landings actual type previous 90 days: 5 (zero on sea).

The pilot had completed difference training[11] and PC on the type for land operations on 18 September 2021.

9 MEP(sea) – Multi Engine Piston Sea.
10 PC – Proficiency Check.
11 Difference Training – instructor-led training between different variants of the same type or on special equipment.

1.6 Aircraft Information

The model UC-1 Twin Bee is a five-seat, high-wing, twin-engine amphibious aircraft, which means it can be operated both on land and at sea. It is just under 10 metres long and has a wing span of just over 13 metres.

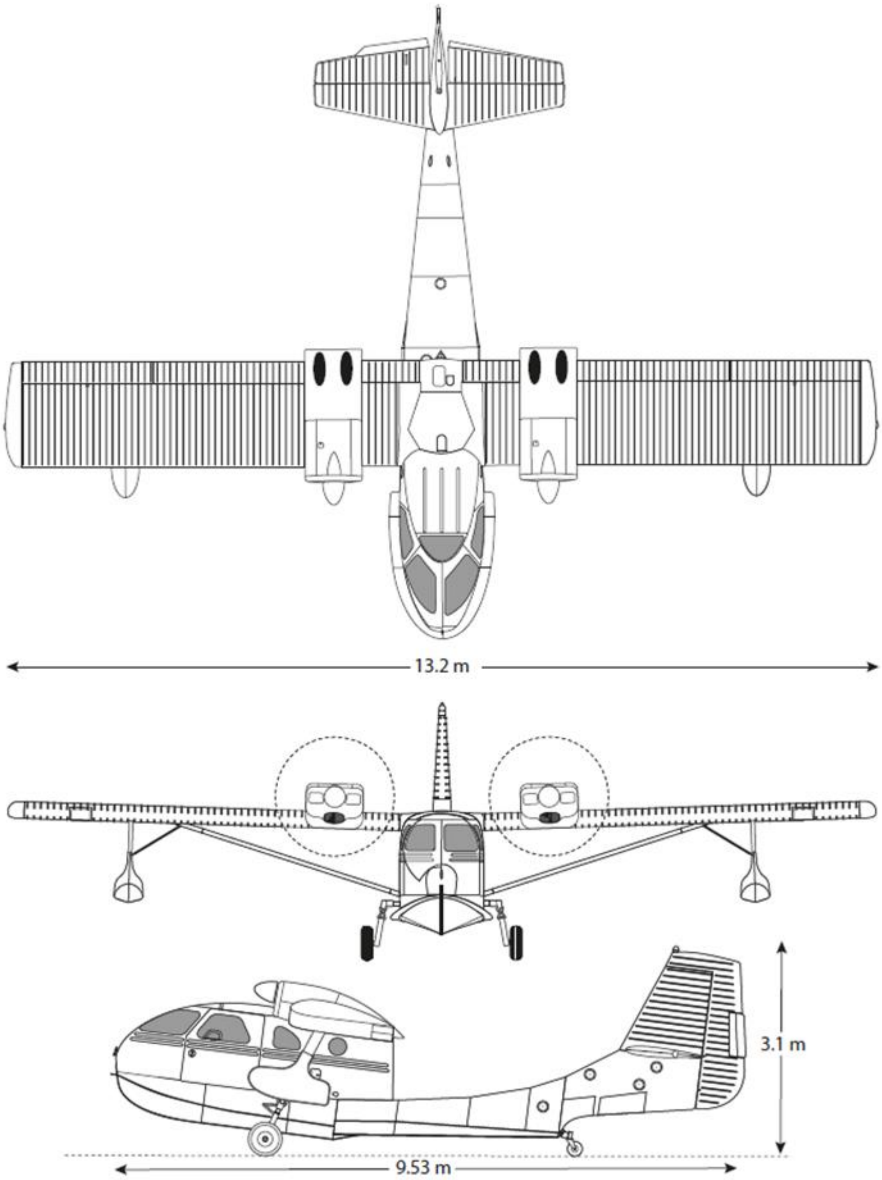


Figure 3. Image of the type of aircraft.

Aircraft History

The UC-1 Twin Bee is a conversion of the Republic RC-3 Seabee amphibian. The type certificate was issued in 1965 under the Federal Aviation Administration (FAA) "Civil Air Regulations" (CAR) Part 3 for normal category.

The aircraft's single pushing engine was replaced in the conversion with two pulling engines on the wings. The original wing span was increased by adding a 3-foot wing-root extension on each side between the engines and the fuselage. The hull was stretched 3 feet by inserting a "plug" just aft of cabin. The rudder and trim-tab area were increased. The fuel capacity was also increased.

N747HJ had Serial number 24 and was the last aircraft to be converted.

1.6.1 Airplane

TC-holder	Legend Aviation & Marine, LLC	
Model	UC-1 Twin Bee	
Serial number	024	
Year of manufacture	1987	
Gross mass, kg	Max take-off 1 723, current 1 646	
Centre of gravity	Within limits.	
Total flying time, hours	771	
Flying time since latest inspection	9	
Number of cycles	Unknown	
Type of fuel uplifted before the occurrence	Avgas 100LL	
Engine		
TC-holder	Lycoming Engines	
Type	IO-360-B1D	
Number of engines	2	
Engine	No 1	No 2
Serial number	L-24401-51A	L-24400-51A
Total operating time, hours	771	771
Operating time since inspection, hours	9	9
Propeller		
TC-holder	McCauley	
Type	HC-C2YK-2RBF	
Propeller	No 1	No 2
Serial number	BC652B	BC651B
Total operating time, hours	46	46
Operating time since inspection, hours	9	9
Deferred remarks	None	

1.6.2 Engines

The aircraft was equipped with two Lycoming IO-360-B1D fuel-injected piston engines each producing 180 horsepower (134 kW) at 2 700 rpm.

1.6.3 Propellers

The propellers installed on the aircraft were two-bladed constant speed propellers.

The blades are made of aluminium. Propeller rotation is clockwise in the direction of flight. The blade angles are controlled with single-acting hydraulics, with the possibility to feather. Reversal is not available on this model.

1.6.4 The Flight Control System

The aircraft model is equipped with a conventional control system. Ailerons, elevators and rudders are operated with a steering wheel and rudder pedals. Transfer of the control movement to the rudder surfaces takes place with stainless steel cables and push rods.

The aircraft is equipped with an elevator trim and a rudder trim that is operated with cranks on the trim panel in the ceiling. The transmission of the control movement to the rudder surface takes place with stainless steel cables.

Wing Flaps

The wing flaps are of the split flap type and extend from each wing trailing edge. They span between the fuselage to the inboard end of the ailerons. The flaps are operated electro-hydraulically via a hydraulic pump.

1.6.5 The Landing Gear System

The hydraulically manoeuvred landing gear is maintained in the up or down lock position by the geometry of the linkage. The linkage is designed to remain locked until hydraulic pressure is applied to the hydraulic actuating cylinder.

The tail wheel is rotated to the up and down position and the main gear is retracted and extended.

The landing gear must be in the retracted position during water operations.

1.6.6 The Hydraulic System

The flaps, the main landing gear and the tail wheel retracts up and down hydraulically. The landing gear lever and flap lever controls the action of the hydraulic fluid for the respective system. In order for the landing gear and flaps to move to the selected position, the hydraulic system is manually activated either through a button on the control column that activates the electric pump or with a hydraulic hand pump, (see Figure 4).

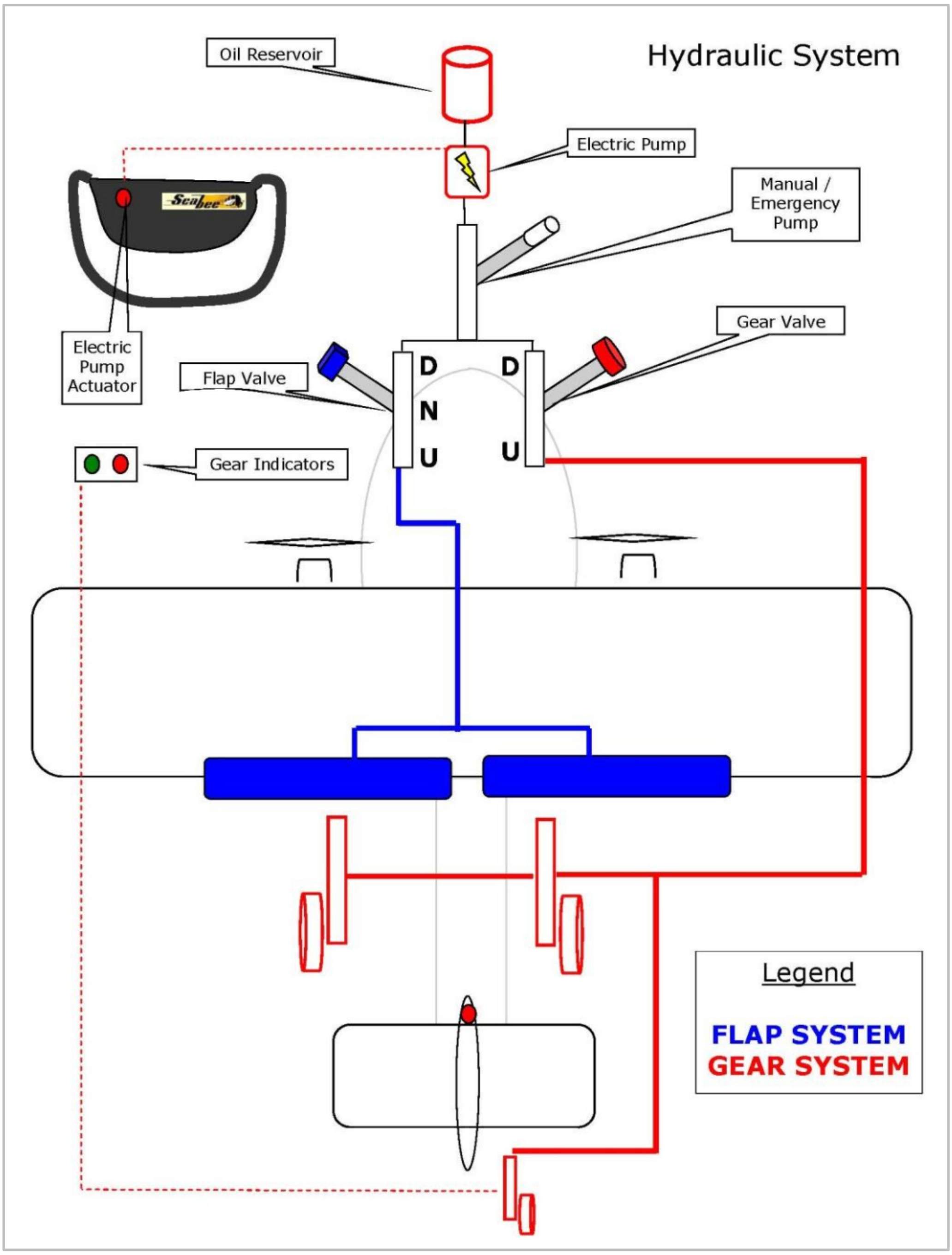


Figure 4. Schematic view of the hydraulic system. Image: FAA Approved Flight Manual.

1.6.7 The Fuel System

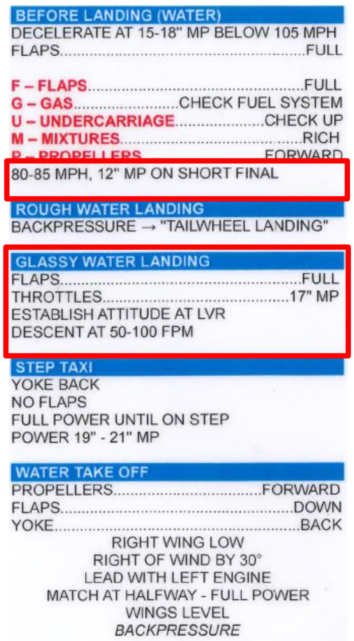
The aircraft has two fuel tanks in the fuselage. A main fuel tank is located in the rear of the cabin and holds 321 litres. An auxiliary fuel tank holding just under 61 litres is located in the rear of the fuselage under the horizontal stabilizer. The auxiliary fuel tank must be filled for take-off and landing on water.

1.6.8 Manuals

There was a flight manual (AFM[12]) for the aircraft. The flight manual describes limitations, normal flight operating procedures, emergency procedures and performance information.

Checklists

The aircraft's checklist included a specific section for water operations, (see Figure 5). For normal landing, the airspeed at short final should be 80–85 mph with a manifold pressure of 12 inches. For glossy water landings, the manifold pressure should be 17 inches. A specific speed for glossy water landing is not mentioned in the checklist.


BEFORE LANDING (WATER)
DECELERATE AT 15-18" MP BELOW 105 MPH
FLAPS........................FULL

F – FLAPS........................FULL
G – GAS........................CHECK FUEL SYSTEM
U – UNDERCARRIAGE........................CHECK UP
M – MIXTURES........................RICH
P – PROPELLERS........................FORWARD
80-85 MPH, 12" MP ON SHORT FINAL

ROUGH WATER LANDING
BACKPRESSURE → "TAILWHEEL LANDING"

GLASSY WATER LANDING
FLAPS........................FULL
THROTTLES........................17" MP
ESTABLISH ATTITUDE AT LVR
DESCENT AT 50-100 FPM

STEP TAXI
YOKE BACK
NO FLAPS
FULL POWER UNTIL ON STEP
POWER 19" - 21" MP

WATER TAKE OFF
PROPELLERS........................FORWARD
FLAPS........................DOWN
YOKE........................BACK
RIGHT WING LOW
RIGHT OF WIND BY 30°
LEAD WITH LEFT ENGINE
MATCH AT HALFWAY - FULL POWER
WINGS LEVEL
BACKPRESSURE

Figure 5. The aircraft checklist for water operations. Speed at short final and glossy water landings boxed in red.

[12] AFM – Aircraft Flight Manual with the last revision number 14 issued in 1979.

The red text on the checklist "FGUMP(T)[13]" was presented on the aircraft's instrument panel and was used instead of the checklist on landing, (see Figure 6).

Figure 6. FGUMPT marked the instrument panel marked by SHK with red frame. Photo: Private..

Training Documentation

According to interviews, the instructor had provided the students with training materials from the TWIN SEABEE UC-1 Study Guide. It describes, among other things, the operation of the aircraft type on land and water and the memory items.

According to the Study Guide, the final speed and manifold pressure should be:

- Normal water landing (short final): 80–85 mph and 13 inches.
- Glossy water landing: 65 mph and 16–17 inches.

Furthermore, it is stated that a complete traffic circuit should be carried out when landing on water to ensure good conditions for a safe landing.

The maximum recommended wave height is 45 cm (18 inches) for water operations.

1.6.9 *Flight Characteristics*

The aircrafts engines and propellers are mounted above the airframe's Centre of Gravity. This means that when the engine power is increased the thrust tends to pitch the nose down and when the power is reduced the nose tends to pitch up, (see Figure 7).

Figure 7. Pitching forces for the aircraft type.

[13] FGUMPT – Flaps, Gas, Undercarriage Mixture, Propeller, Trim.

1.7 Meteorological Information

At the time of the accident on Lake Siljan at 16:08, Mora Airport (15 km northwest of the accident site) reported an average wind of 200 degrees (southwest on average, with a variable wind direction between 150 and 240 degrees) 9 knots (5 m/s), visibility above 10 km, scattered clouds at 5 100 feet, temperature/dewpoint +21/+11°C and QNH 1012hPa.

With reference to the current weather at Mora Airport, it is SMHI's assessment that the waves moved in a north-easterly direction (about 020 degrees) with a wave height of between 0.3 and 0.6 metre (max 0.9 metre). The higher values in the northern part and the lower values in the southern part of Siljan.

SHK has obtained wind data from several measuring stations in the area around Siljan from vackertväder.se, which is presented in Figure 8. Weather data shows variations in wind direction and velocity in the area.

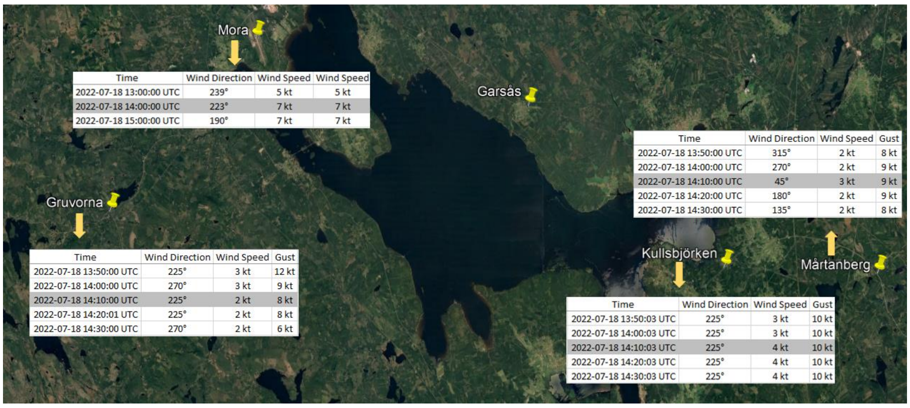


Figure 8. Wind data from vackertväder.se in the area. Wind speed in knots. Image: Google Earth with text by SHK. Image: Google Earth © Lantmäteriet D no R6174919_0001.

According to the owner who flew the flight before the accident flight, the wind and wave conditions varied on the lake. It was rough around Sollerön, while it was calm on other parts of Siljan.

1.8 Aids to Navigation

Not applicable.

1.9 Communications

Not applicable.

1.10 Aerodrome Information

Not applicable.

1.11 Flight Recorders

There was no permanently installed flight or voice recorder in the aircraft. This is not required for the aircraft type.

SHK has obtained recorded information from ADS-B[14], FLARM[15] and engine data, (see Figure 9).

The recordings of sensor data for each equipment ends at different times. This is because the devices did not shut down normally when the power to the devices was suddenly interrupted. Registrations that have been temporarily saved on a volatile memory and not written to a non-volatile memory are then lost. The frequency at which the data is saved from the volatile to the non-volatile memory is different for each device.

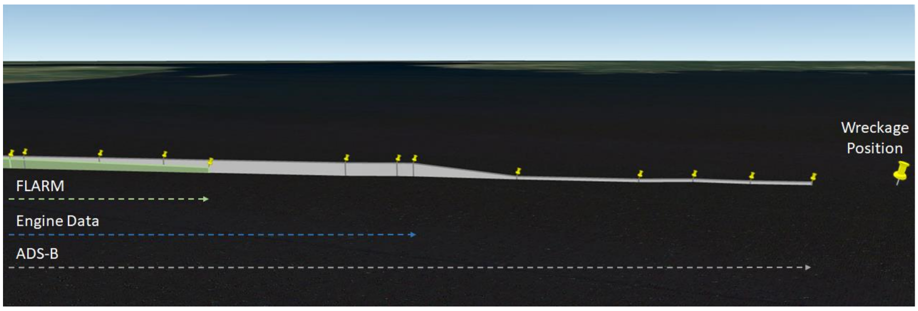


Figure 9. The dashed line illustrates the registration for the respective sensor data equipment and when the registrations ends. The flightpath is schematically illustrated based on altitude and position registrations. Image: Google Earth with tracks added by SHK.

1.11.1 Registrations from ADS-B

The aircraft's transponder was equipped with an ADS-B function. The transponder records GPS data and is connected to the aircraft's static system. The transponder sends the ADS-B information to ground stations twice a second.

ADS-B information has been obtained from two different providers (LFV and Flightradar24).

The information included lateral position, barometric altitude, speed, track, and time for each registration. The altitude was coded in increments of 25 feet (7.62 metres). In addition to the above information, the information from Flightradar24 also show the vertical speed coded in increments of 64 feet per minute.

The time specifications from the two suppliers are not completely comparable. This is because LFV's time indication is based on the aircraft's ADS-B information, while Flightradar24 indicates the time based on when the information arrived at their server. There may therefore be some delay in the time indication from Flightradar24.

The ADS-B registrations ends at 16:08:21.

[14] ADS-B – Automatic Dependent Surveillance-Broadcast.
[15] FLARM – Flight Alarm.

1.11.2 Registrations from FLARM

The FLARM unit was equipped with an internal GPS and pressure sensor for altitude indication.

The information included lateral position, barometric altitude, GPS altitude, time for each registration and estimated position error. The altitude was encoded in an increment of 3.28 feet (1 metre).

The FLARM registrations ends at 16:08:11.

1.11.3 Engine Data Readout

The aircraft was equipped with two CGR-30 engine instruments that display engine information and also record engine data.

Since the recorded time was not synchronized to Coordinated Universal Time (UTC), the time entries needed to be synchronized. This was carried out with the help of a film from the take-off of the accident flight taken by a private person. The sound recordings from the film have been analysed. By using the frequency from the sound of the propeller, the propeller speed has been calculated and compared with the engine data. The results are presented in Figures 10 and 11.

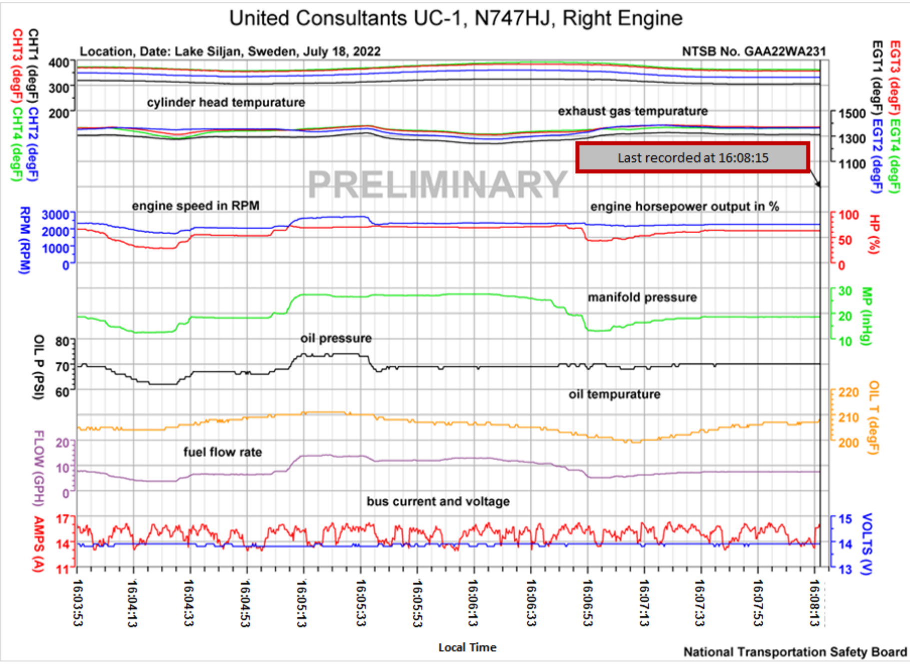


Figure 10. Recorded engine data for the left engine during the last part of the flight. The time for the registrations has been calculated with an accuracy of 2–3 seconds. Image: NTSB. Timestamps replaced by SHK.

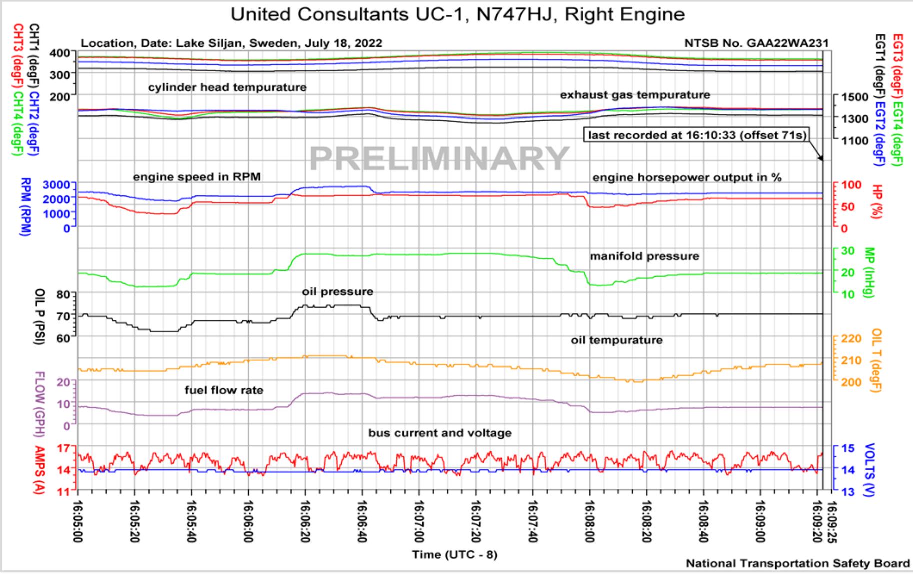


Figure 11. Recorded engine data from the right engine during the final part of the flight. The time for the registrations has been calculated with an accuracy of 2–3 seconds. Image: NTSB. Timestamps replaced by SHK.

The registrations ends at 16:08:16 for the left engine and 16:08:15 for the right engine.

1.11.4 Compilation of Registrations

The flight path has been visualized using position recordings from FLARM, (see Figure 12). The flight path shows two traffic circuits with a number of "Splash and Go's" in a westerly direction. After completing a "Splash and Go" south of Sollerön, the aircraft turned east-northeast for a new approach. The different colours symbolize different heights above the water/land where red is near land/water with a transition to blue at higher altitudes.

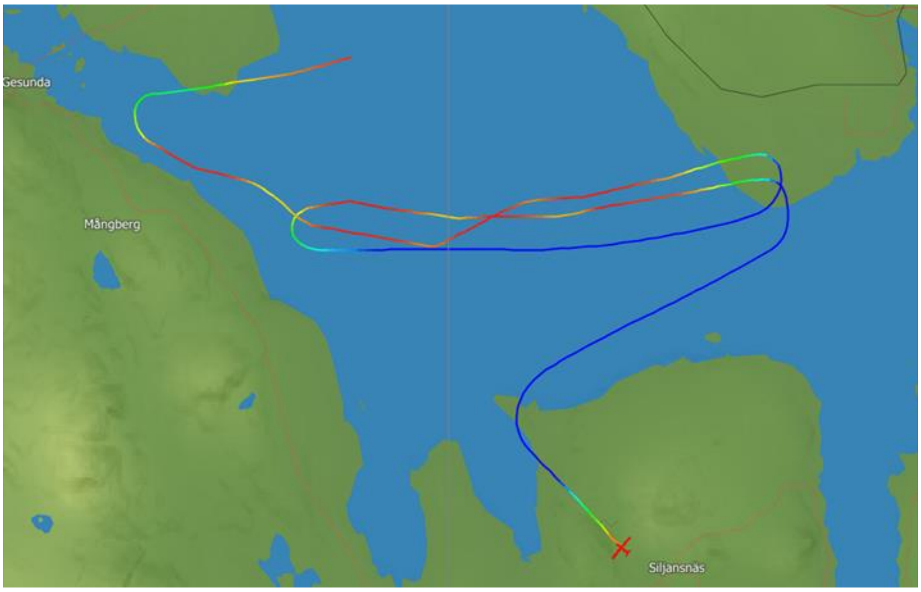


Figure 12. The flight path of the accident flight. Image: SeeYou with tracks added by SHK.

Figure 13 shows the last recorded minutes of the flight from Sollerön and the position of the wreckage.

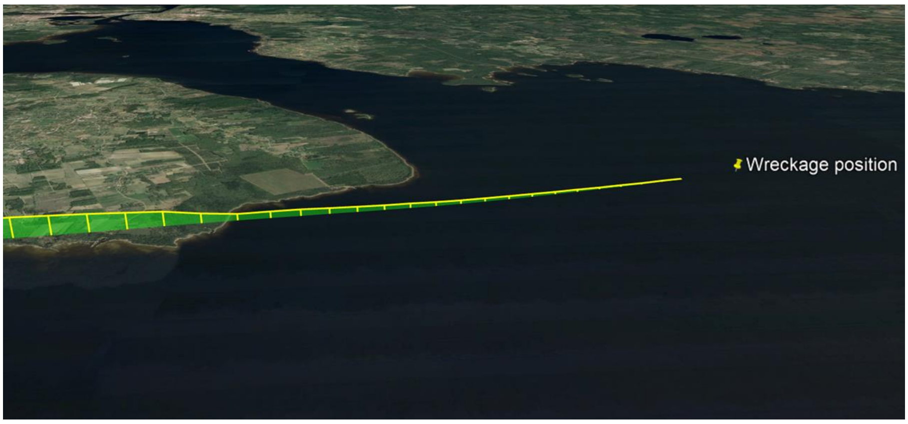


Figure 13. The last part of the flight before the accident. Image: Google Earth with tracks added by SHK.

In Figure 14 a compilation of the registrations from FLARM and engine data during the last two minutes of the accident flight is presented. The compilation shows that the approach was stable in the final phase of the flight in terms of speed and rate of descent. Engine data did not show any major engine power changes. The right and left engine manifold pressure were relatively constant at 19 and 20 inches during the last 40 seconds the flight.

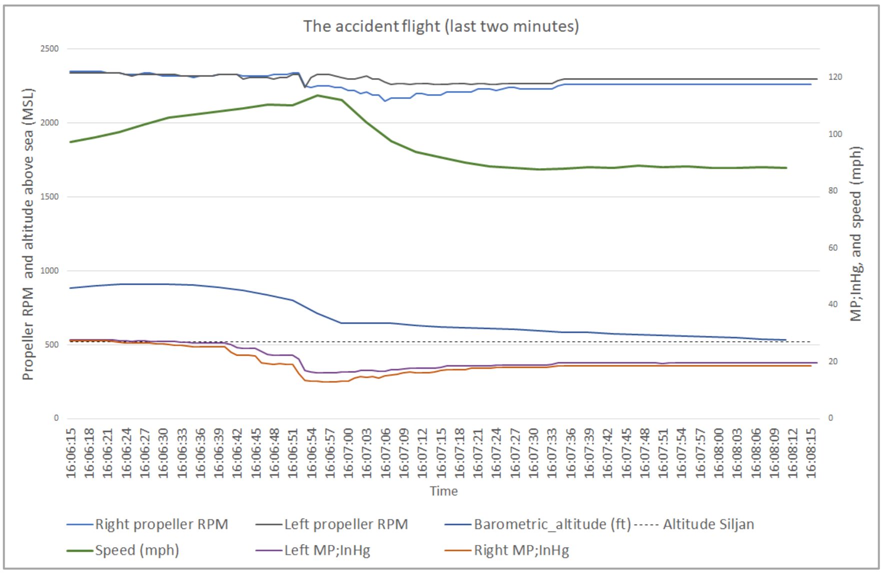


Figure 14. Recordings from FLARM and engine data.

Figure 15 shows speed, altitude and the calculated vertical rate of descent from the FLARM recordings during the last minute of the flight.

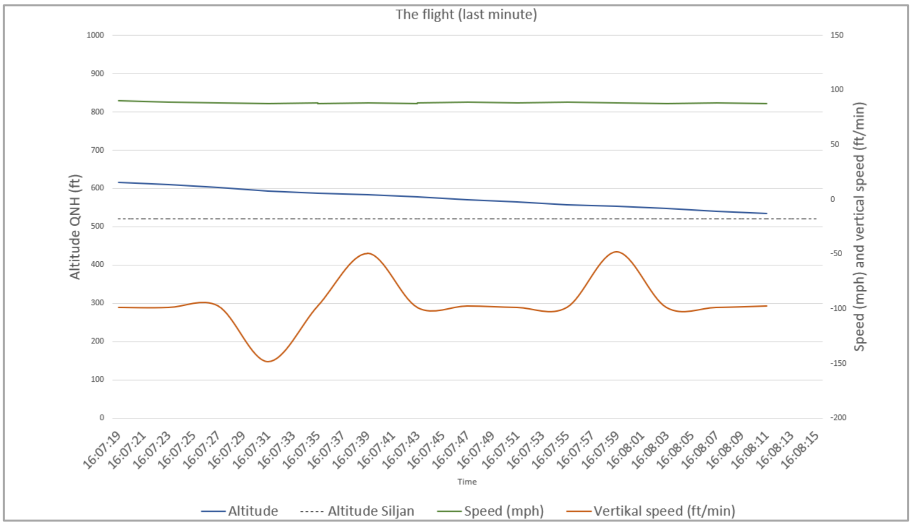


Figure 15. The last minute of flight.

Figure 16 shows a compilation of data from FLARM (time, altitude and speed) and ADS-B (time, altitude, speed and vertical descent rate) during the last seconds of the flight. From the ADS-B data and FLARM data, it can be concluded that there were no significant changes in altitude and that the speed and the vertical rate of descent have been constant until the last registration.

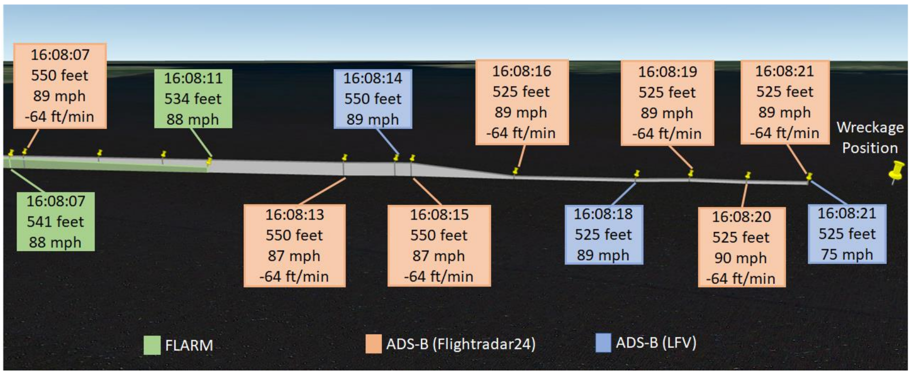


Figure 16. Registrations from FLARM and ADS-B from the last seconds of the accident flight. Altitudes are adjusted for atmospheric pressure reduced to mean sea level (QNH). Image: Google Earth with tracks added by SHK.

At the last time stamps at 16:08:21 there are two registrations, one from LFV and one from Flightradar24. However, the registration from Flightradar24 is somewhat delayed in relation to the actual time when the information was registered in the aircraft (see section 1.11.1) and thus refers to a time slightly before the registration according to LFV's data.

The distance between LFV's and Flighradar24's position indication at 16:08:21 is one metre. The difference in recorded speed between the position readings is 14 mph, indicating a sudden decrease in speed.

1.11.5 Investigation of Mobile Phone

The student's phone has been analysed but no information of relevance to the investigation has been found.

1.12 Accident Site and Aircraft Wreckage

1.12.1 Accident Site

Siljan in Dalarna is Sweden's seventh largest lake in terms of size. The lake is 161 metres (528 feet) above mean sea level and has an area of 293 square kilometres. Greatest depth is 134 metres. There are large variations in wind intensity and wave height on the lake.

The aircraft was located by the police at a depth of 23 metres. The position was in the aircraft's direction of travel east of Sollerön 60 metres after the last sensor registration, (see Figure 17).

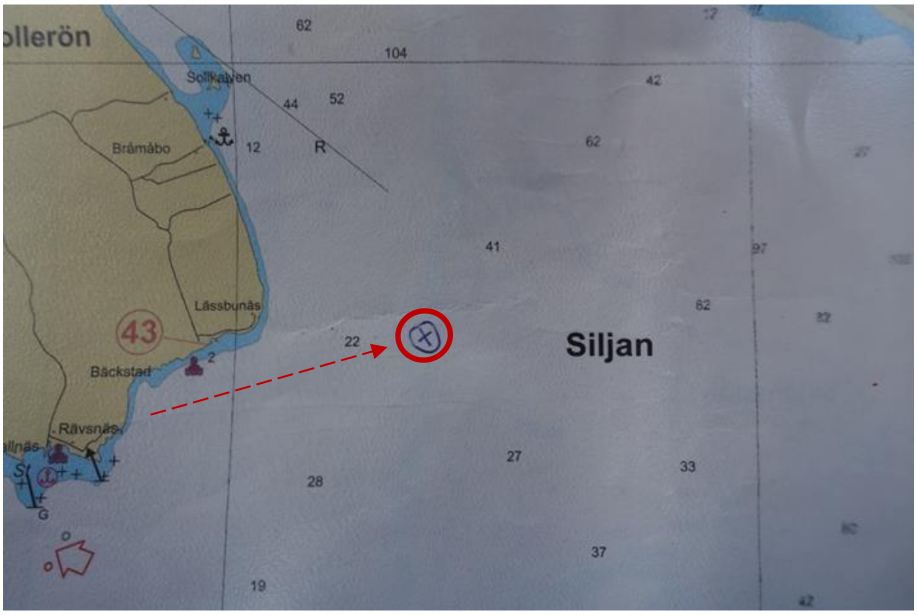


Figure 17. The final position of the aircraft. Image: © Maritime Administration permit no. 23-00227.

1.12.2 Aircraft Wreckage

The accident site was documented by police divers who were able to establish that the aircraft was upside down on the bottom of the lake.

From the video films, the following damages could be ascertained

The aircraft's cabin structure and nose were heavily damaged, (see Figure 18). The entire hull and the keel were damaged and had compression creases, (see Figure 19). Parts of the hull and the keel were missing.

Large compression creases were found along the sides of the bottom hull. There were also large fractures on the sides of the bottom hull at and around the step. The damage was so severe that the tail boom was almost separated from the hull. The top of the rudder was damaged.

None of the sponsons on the wings were damaged.

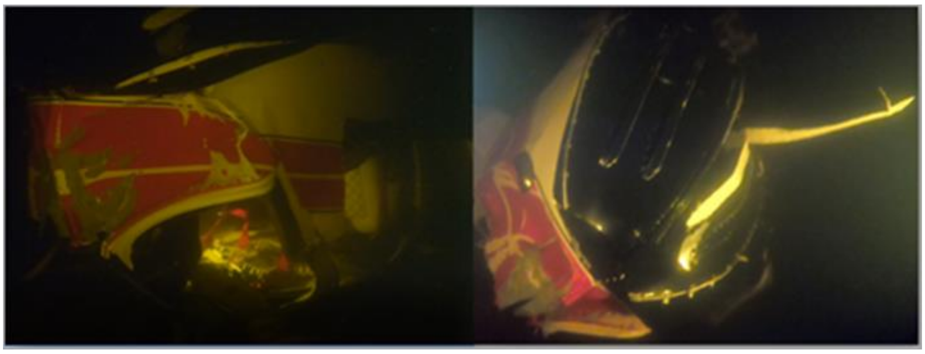


Figure 18. The nose and forward part of the keel of the aircraft. Image: The Swedish Police.

The main landing gear was not in the up-locked position.

Figure 19. The left part of the picture shows the damage to the keel and where parts of the keel plates are missing. The right picture shows damage to the side of the bottom hull at the step. The position of the main landing gear after the accident is also visible. Photo: The Swedish Police.

From the films, the following configuration could be ascertained

The landing gear lever was in the DOWN position. The flap lever was in the DOWN position. Wing flaps were in the DOWN position. The left fuel valve was in the OFF position. The right fuel valve was in the ON position, (see Figure 20).

All engine and propeller controls located in the celling were in the full forward or near full forward position, (see Figure 20).

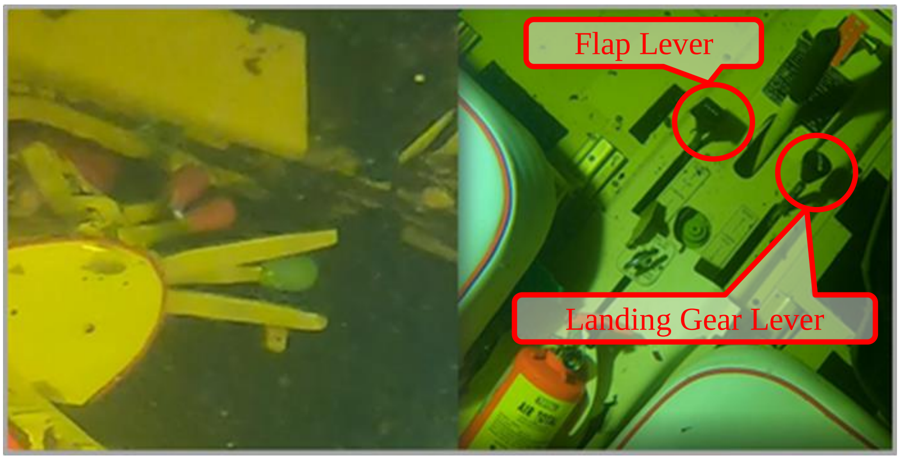


Figure 20. The picture on the left shows the engine and propeller controls. The image to the right shows the landing gear lever, flap lever and fuel selector positions. Photo: The Swedish Police. Markings inserted by SHK.

The tail wheel appeared to be in the UP position, (see Figure 21).

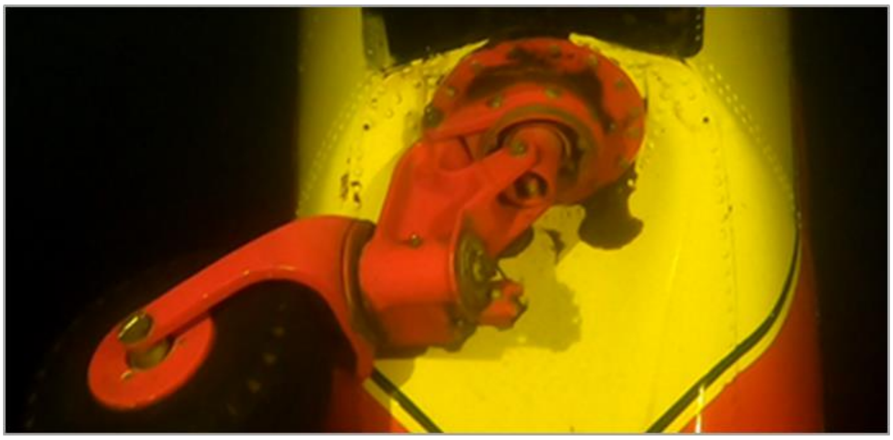


Figure 21. The position of the Tail Wheel during the diving. Photo: The Swedish Police.

The elevator trim indicator was in the full nose down position. The rudder trim indicator was in the full left position. The elevator trim tab appeared to be in the full up position. The rudder trim tab appeared to be in the full left position.

The left pilot's seat waist belt and associated shoulder harness were buckled. The waist belt was unfastened by police divers.

The right pilot seat waist belt was unbuckled. The waist belt and associated shoulder harness were not fastened.

The backrest of the left pilot's seat was bent backwards.

1.12.3 Wreckage Salvage

Just over a month after the accident, the aircraft was salvaged together with small parts and the aircrafts left door that were in the vicinity of the aircraft.

When the aircraft was lifted out of the water, instruments important to the investigation were placed in distilled water.

The aircraft was transported to shore where an initial technical examination was carried out. Before transportation for further examination at SHK's premises the wings were removed and the tail boom was sawed off approximately one meter behind the step.

Figure 22. The aircraft during the salvage on the Lake Siljan.

Figure 23. The aircraft during the salvage on the Lake Siljan.

1.12.4 *Technical Examination of the Aircraft*

Structural Damages

The entire left wing showed compression damage on the upper side of the wings leading edge. The right wing leading edge showed compression damage located primarily between the fuselage and engine nacelle. The cabin roof was dented.

The nose had big dents. The forward part of the airframe had been compressed backwards and bent down to the left. The keel showed signs of both compression folds and tensile failure. Large compression creases were found along the sides of the bottom hull, (see Figure 24).

Figure 24. Left side of bottom hull, keel, nose and cabin. The fuselage is upside down in the picture.

At the aircraft's landing gear and forward to the first bulkhead, large parts of the keel plate were missing or pushed back in the direction of travel, (see Figure 25). A damage to the keel bar at the first bulkhead showed that it had bent downwards and broken off. At the same bulkhead, the keel plate had also been pulled out of its rivet attachments. The bulkhead behind the main landing gear had been pushed back in the direction of travel and punctured the main fuel tank. Also, the bulkheads behind had been pushed back.

Figure 25. The left picture shows the damage to the keel. The arrow points to the pushed back keel plates. The right picture shows the bent and broken keel bar. The fuselage is upside down in the picture.

Flight Control System

The elevator rudder trim tab was found to be in the full up position. The rudder trim tab was found to be in the full left position. In the rudder and elevator trim systems, one of the two trim rudder wires in each system were torn off. Damage to pulleys and their attachments in the trim system showed that large forces overloaded the system. Other parts of the control system have been examined and no other deviations have been found.

Engine and Propeller

During the examination of the engines and propellers, the following could be established:

- The throttles on both engines were in the full power position.
- The propellers could be turned without abnormal resistance.
- Both propellers had clear impact marks on the leading edge of the propeller blades. No noticeable bending of the propeller blades could be noted.
- No failure of the aircraft's engines or propellers that may have affected the sequence of events has been identified.

Fuel System

The left fuel valve was in the off position. The fuel valves were inspected and it was found that the control could be pushed to both the open and closed positions with normal resistance. The fuel valve selectors had no locking position.

The aircraft and engine fuel systems have been investigated. The main fuel tank and auxiliary fuel tank were damaged and all the fuel had leaked out.

Available engine data showed no signs of fuel supply problems.

Main Landing Gear

The mechanical locking (over centre link) was unlocked. The attachment to the structure in the keel for the mechanical linkage had been damaged. Both nipples to the pressure and return side of the hydraulic actuating cylinder were torn off.

The Cabin

A cover mounted on the cabin floor, just behind the landing gear lever, had been bent and pushed forward. This meant that the landing gear lever could not be positioned in the up position after the accident.

Both locks on the cabin doors were in the locked position. The left door had come off the rear hinges. On both doors' large parts of the upper part of the window frame were missing. The doors also had clear impact marks from the propeller blades.

The backrest structure on the left pilot's seat bent backwards. The backrest could therefore be pushed back to a horizontal position without extensive force.

Summary conclusions of the technical investigation

- The tail wheel and the main landing gear are activated hydraulically simultaneously via a button on the left steering wheel when extending and retracting.
- The main landing gear mechanical lock was unlocked, the landing gear lever was in the down position and the tail wheel was in the up locked position.
- The attachment to the structure in the keel for the landing gear link had extensive damage. Both nipples to the pressure and return side of the hydraulic actuating cylinder were torned off.
- The damage that occurred on and around the main landing gear's linkage most likely occurred during the course of the accident. These damages, in turn, have probably affected the landing gear linkage so that the landing gear has moved to a partially extended position.
- Based on the damage to the yaw and elevator trim systems, both trim systems are deemed to have been pulled to their end positions during the accident sequence.
- Since no major increase in engine power or speed has been registered during the last part of the flight, it is considered that the position of the throttles was moved to the full forward position during the final part of the flight.
- The damage to the propeller blades and the corresponding damage to the cabin doors shows that the engines produced power during impact.
- Left fuel valve was in the off position. Since the left engine had power and there was no special locking position for the fuel valve selector, it is assessed that the left fuel valve selector ended up in the off position during the accident sequence.
- No damage or remains from foreign objects have been identified.

1.13 Medical and Pathological Information

Nothing indicates that the pilots' mental or physical fitness was impaired before or during the flight.

The results of the autopsy report indicate that both pilots where fatally injured due to drowning.

1.14 Fire

Not applicable.

1.15 Survival Aspects

1.15.1 Rescue Operation

An alarm call was received by SOS Alarm at 16:14 from witnesses who had seen the aircraft east of Sollerön. Several other people who heard the bang when the plane hit the water also called 112.

A number of people went by boat to the site, but could not find the aircraft. They could smell fuel in the area where the aircraft had previously been seen floating upside down.

SOS Alarm contacted JRCC[16], alerted the Norra Dalarna Fire Brigade and several ambulances and informed the police. The ambulance helicopter in Mora was also alerted, but they wanted to wait with their intervention due to a technical update of the helicopter. The JRCC in turn alerted the SAR helicopter and SSRS[17]. The JRCC also wanted the ambulance helicopter to participate because they could start searching over Siljan 40 minutes before the SAR helicopter was on the scene. After dialogue between the JRCC and the crew of the ambulance helicopter, the helicopter was able to take off towards Siljan at 16:50.

The Norra Dalarna fire brigade launched boats to get out to the accident site. The first boat arrived at 16:45 and was met by some people in a boat who showed where they judged the impact site to be. The rescue service's boat and several private boats began to search around the site, but neither the aircraft, wreckage nor any survivors were found.

After the ambulance helicopter arrived and began searching at 17:18, they were able to see wreckage parts and what could be a person in the water. After the rescue boat continued the search at that location, one person was found. Resuscitation attempts were started immediately after the person was transferred into the boat and transported to land and there handing over care to the paramedics. The person was later pronounced dead in hospital.

In the meantime, JRCC had sought information about the aircraft and those on board. They were able to notify the emergency services on site that there were two people on board. As the impact site was located, JRCC terminated the air rescue service at 17:32. Municipal emergency services and the search for one more person continued.

The municipal rescue service's scuba divers arrived at the scene at 17:45. However, no diving was carried out because the risks were considered to be too great in relation to what could possibly be saved

[16] JRCC – Joint Rescue Co-ordination Centre.
[17] SSRS – Swedish Sea Rescue Society.

considering the depth of the site. The search on the water continued with boats from the rescue service and SSRS, but no survivor was found and the rescue service ended at 18:35.

The police, who were responsible for searching for missing persons, began the search for the missing person. Two days after the accident, the police were able to conduct dives. The student was found outside the aircraft with his seat belt around his waist.

The aircraft was equipped with an emergency transmitter (ELT) of the type Kannad ELT 406. No distress signal from the transmitter was registered.

1.15.2 Position of Crew and Passengers and the use of Seat Belts

The student was seated in the left pilot seat and was fastened with a waist belt and an associated shoulder harness. The instructor normally only used the waist belt. The instructor's waist belt was unbuckled. The waist belt showed signs of being subjected to severe tightening at the attached to the structure of the aircraft.

Both pilots were, according to information, using manual inflatable life jackets. The student was found next to the aircraft with the life jacket inflated. The instructor's life jacket was found inflated next to the instructor.

1.16 Tests and Research

1.16.1 Mass and Balance Calculation

SHK has carried out calculations of the aircraft's mass and balance for the accident flight. The calculation shows that both the mass and balance were within the approved area for take off and landing at sea, (see Figure 26).

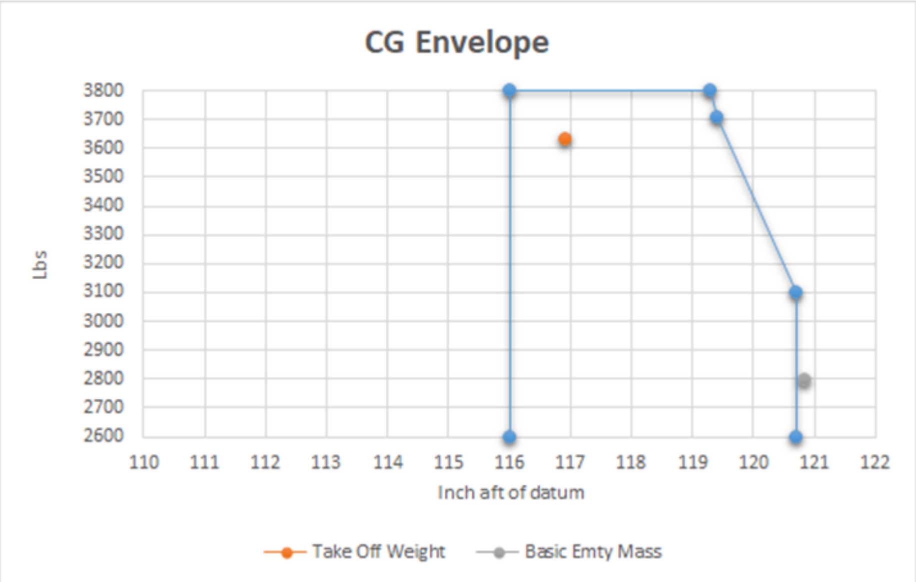


Figure 26. Mass and balance at the flight.

1.17 Organisational and Management Information

1.17.1 The Training Organisation

The ATO had the aircraft N747HJ on its list of approved aircraft for training. The instructor was on the flight school's list of approved instructors to provide both theoretical and practical training. According to the ATO, the instructor was not authorized to carry out the training at the time of the accident because he had not carried out the required recurrent refresher training.

In the ATO's training manual dated 1 January 2022, the training for multiengine seaplanes (MEP (sea)) was included.

1.18 Additional Information

1.18.1 Planning for Landing on Water

Landing Area Reconnaissance

In water operations, the pilot must make a number of judgments about the safety and suitability of the landing area, evaluate the characteristics of the water surface, determine wind direction and speed, and choose a landing direction[18].

The pilot therefore needs to circle the landing area and examine it carefully for obstacles such as pilings or floating debris, and to note the direction of movement of any boats that may be in or moving toward the intended landing site. The pilot should also pay attention to indications of currents.

Figure 27. The aircraft in the air during the accident flight over Lake Siljan after a previous landing. Photo: © Sven Vollert.

[18] EASA AMC1 FCL.A(b) states i.e. that the training for seaplane operations should provide knowledge of how reconnaissance of the landing area should be carried out. Educational materials and documentation have, among other things, developed by FAA and KSAB.

Sea State Evaluation

The pilot needs to consider wind direction, wind velocity, wave direction, wave height and any currents. To ensure that all relevant information has been collected, at least one reconnaissance circuit around the landing area is required.

The shape of coastlines and hills affects wind direction and can cause significant variations from one area to another. If the wind is from a certain direction on one side of the lake, it is not obvious that it will come from the same direction on the other side of the lake.

Wave height depends on three factors: wind speed, how long time the wind has been blowing over the water and the distance over which the wind acts on the water. The wave height, wavelength and the distance between swells are important parameters to consider when landing. Landings should as far as possible be carried out into the wind.

1.18.2 Landing on Water

Water landings should be performed at the lowest possible speed with correct attitude and without side drift.

In order to obtain hydrodynamic carrying capacity, the bottom of the aircraft has a so-called step which is a notch or break in the hull which causes the water to release from the underside. The landing attitude must be such that the step makes the first water contact. It is crucial that the step breaks the surface for the hydroplaning to function as intended, (see Figure 28).

Figure 28. The aircraft lands on the step.

Assuming that the hull of the aircraft contacts the water surface without the step breaking the water surface, the water will be carried upwards along the hull. The reaction force from the water acting upwards will pull the aircraft downward and deeper into the water. This in turn means that the contact area with the water increases, which increases friction, i.e. the braking force against the water becomes greater, (see Figure 29).

Figure 29. The hull of the aircraft contacts the water surface without the step breaking the water surface.

1.18.3 Glossy Water Landing Procedure

When landing on glossy water, it can be difficult to find reference points on the water surface. Under these conditions, other reference points are used, such as e.g. a shoreline. If it is not possible to fly along the shoreline, you can instead cross it at the lowest safe height.

During the last part of the approach the speed should be ten percent above stall speed[19] with a high nose attitude and a descent rate about 150 feet per minute. With constant power and high nose attitude, the rate of decent will be relatively stable, (see Figure 30).

On contact with the water surface, a nose-down tendency arises which is caused by the water resistance of the hull. To counteract this, the throttle should be cut off and the steering wheel pulled back.

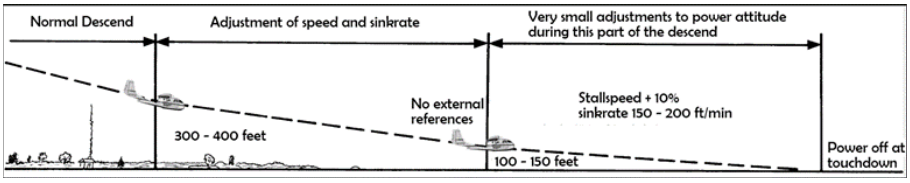


Figure 30. Approach profile for glossy water landing. Image: KSAB Seaplane handbook. Adjustments made by SHK.

It's not that often that glossy water conditions prevail. To maintain a glossy water landing proficiency, a pilot therefore needs to practice glossy water landings, so-called simulated glossy water landings.

[19] The Stall Speed of the UC-1 Twin-Bee is 49 mph in the landing configuration with Flaps Full.

1.18.4 Surprising and Sudden Events

There are obvious difficulties in predicting how an individual will act in a sudden and unexpected situation. The difference between, for example, beginners and experts can generally be described as the extent of their experience and practice. Situations that have been rehearsed, or that the individual has tangible experience of, can more frequently be said to have prepared them for such sudden and surprising occurrences. However, even experienced pilots may act in an unexpected way precisely because the response to a sudden and surprising stimulus is not directly voluntary and has an emotional component. What often characterises this sort of response is that the action is immediate and aims to resolve the present emergency situation rather than the situation as a whole.

1.18.5 Actions Taken

None.

1.18.6 Similar Events

SHK has investigated an accident that occurred on 11 August 2012 with a LAKE 250 type flying boat with registration N84142 (RL 2013:09).

A number of accidents have occurred with the aircraft type in question. Among other things, the NTSB has investigated an accident that occurred on 4 June 2008 involving airplane N9509U in Bunnell, Florida (Final Report NYC08CA241).

1.19 Special Methods of Investigations

Not applicable.

2. ANALYSIS

2.1 Initial Starting Points

Through analysis of recorded data, the flight path has been determined. The aircraft is considered to have been configured for landing on water before the accident. Recorded engine data shows that both engines have been operating satisfactorily up to the end of the recording. No aircraft technical faults or damage to the aircraft from foreign objects, that may have affected the accident, has been identified. Therefore, the analysis is focused on operational aspects and management of risks.

The life jacket that was inflated next to the instructor when he was found on the surface of the water has been examined and showed no defects. According to witnesses, the instructor was wearing the life jacket before the flight, but it has not been possible to determine why the instructor wore no life jacket after the accident.

The rescue service measures are deemed relevant and reasonable in the prevailing conditions. SHK has therefore had no reason to further analyse the rescue operation.

2.2 Pre-Flight Conditions

The instructor had good flying experience, but had limited recency on the type.

The student was authorized to fly the type on land, but had no experience of seaplane operations.

Reportedly, the flight was a lesson for seaplane training. On the same day, the instructor had performed another flight with landings at Lake Siljan with the other student.

Information about how the instructor conducted previous training flights suggests that it was the student who performed the landings. However, this has not been established with certainty.

The checklist stated the speed for short final in normal water landing (80–85 mph). Glossy water landing speed (65 mph) was not provided.

The weather conditions were good with cumulus clouds and moderate winds from the southwest.

The waves moved in a north-easterly direction with an estimated wave height of between 0.3 and 0.6 metres on Lake Siljan. In the northern part, the waves were probably in the higher part of the span. The exact wave height at the time of the accident has not been determined, but it probably exceeded the aircraft's limitation of 0.45 metres.

2.3 Initial Course of Events

The aircraft took off from Siljansnäs Airport for landings in a westerly direction on Lake Siljan. Two traffic circuits with a number of "Splash and Go's" were performed in each circuit. No reconnaissance of the landing area was carried out.

After the last landing before the accident, the aircraft climbed in a right-hand turn over Sollerön to continue in an east-north-easterly direction for a new approach in some tailwind.

From the sensor data, it can be determined that the aircraft descends rapidly when passing the shoreline. Thereafter, the rate of descent was reduced to less than 100 feet per minute and was thereafter stabilized. Speed and engine values were stable until the end of the respective recording.

The final approach corresponds to a glossy water landing profile, (see Section 1.18.2). However, the aircraft's speed was significantly higher than the recommended, which resulted in a lower pitch attitude compared to a glossy water approach, see further section 2.5.

In order to be able to more precisely determine the time of the accident, a closer analysis of the ADS-B data has been carried out, (see Figure 31). At the last registrations (16:08:21) the distance between the positions is one metre and the decrease in speed is 14 mph. The rapid decrease in speed between these positions indicates that this is when the accident sequence begins.

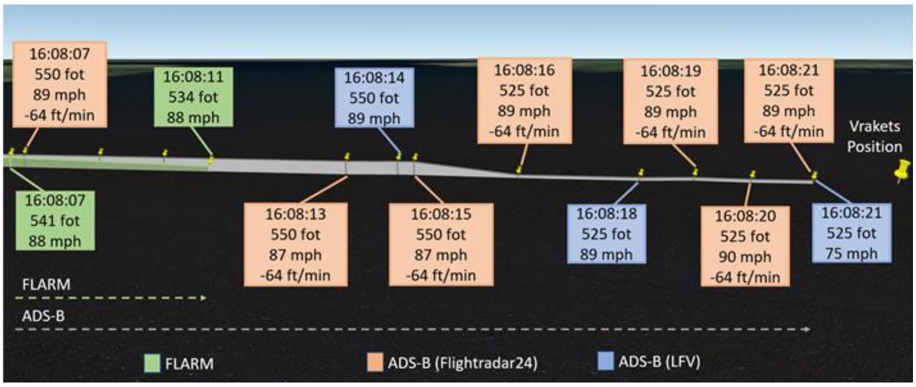


Figure 31. Information from FLARM ends at 16:08:11 and then ADS-B information is presented until the last registration at 16:08:21.

Calculations of the aircraft's descent angle based on sensor data from FLARM show that with a constant vertical speed, the aircraft could have contacted the water surface before 16:08:21. An explanation for this could be that the aircraft bounced on the first water contact before the accident sequence begins. Another possibility is that the aircraft's vertical speed changed slightly at the end of the approach and thus changed the descent angle.

2.4 The Course of the Accident

Based on the technical investigation, sensor data and the wind and water conditions at the time of the accident, a probable course of the accident has been determined.

The aircraft was at high speed and low pitch attitude when the accident sequence began and the front part of the fuselage hit the water surface. The high speed of the aircraft resulted in high water resistance when the fuselage hit the surface of the water. This caused the aircraft to pitch forward and the nose pushed deeper into the water which caused the water resistance to increase even more, (see Figure 32). The engines, which are placed high, contributed to the pitching motion. In case of possible engine power application, the tipping movement is reinforced. However, the engine power at water contact has not been possible to determine.

The forward part of the airframe had been compressed and bent down and to the left. The damage to the front aircraft structure is considered to have been caused by the forces that arose when the nose was pushed into the water.

Figure 32. Principle sketch, the aircraft tips forward and the nose is pushed into the water.

The keel plates and bottom hull had significant damage. During the compression of the hull, the keel spar has most likely been bent downwards and broken off. The water forces have been so great that parts of the keel bar have come loose. In connection with that, parts of the bottom skin have been damaged. The water forces have then pushed a large part of the hull skin backwards. Also, the bulkhead at the main landing gear and the bulkheads behind the main landing gear were heavily damaged.

There were also large fractures on the sides of the bottom hull at and around of the step. The location and nature of the damage indicate that the aircraft has been affected by heavy deceleration and rapid movements in pitch, (see Figure 33).

Figure 33. Principle sketch, the aircraft decelerates sharply and tips forward.

The aircraft's wings were damaged when the aircraft flipped and hit the water, (see Figure 34). The compression damage on the left wing indicates that the aircraft had a slight yaw and that the left wing hit the water first and therefore absorbed most of the energy. After that, the cabin roof was also pushed in and the aircraft ended up upside down and then sank.

Figure 34. Principle sketch, the aircraft turns around.

2.5 Why was the speed higher than recommended?

The approach profile on the last landing attempt is consistent with a glossy water landing profile. The aircraft's speed and engine power were significantly higher than recommended for a glossy water approach. The speed was consistent with the recommended speed for a normal approach. However, during a normal landing, a flare is included, where the engine power is reduced, the pitch attitude is increased and the air speed is reduced so that the aircraft lands on the step at the lowest possible speed on the water. Based on the available sensor data, a flare appears to be missing during the accident. This also indicates that the intention has been to demonstrate a glossy water landing.

Before landing a memory mnemonic, FGUMPT, was normally used to ensure that the aircraft was properly configured for landing. The memory items list was used to ensure that the critical actions from the checklist were performed. The speed or engine power settings to be used was not included in FGUMP, but the pilot was assumed to have knowledge of this.

It can be stated that the instructor had good Seaplane experience, but low recency on type. During the last 14-years his flight time on the type has been 99 hours. The instructor thus probably had a limited experience of performing glossy water landings with the type in recent years. In the previous landings, normal water landings were performed and thus the speed for normal landing was used. It is therefore likely that the same speed was used during the accident flight as during previous landings, which also explains the higher engine power that was used.

2.6 Training Session Design

The instructor had trained the student on previous occasions. The flight, which was the student's first at sea, was probably designed based on the assumption that the student had previous flying experience of the aircraft type on land. The session contained several successive landings ("Splash and Go"), which means a high workload. This applies in particular to a pilot who has not previously carried out landings on sea.

The student had not been gradually trained to flying at sea and thus had limited possibilities to handle unexpected situations. The reaction to a surprising and sudden event is often an involuntary action aimed at solving the current situation. It is therefore difficult to know how the student might have reacted to a surprising event, for example if a bounce occurred in conjunction with the landing attempt. Even if the instructor was at the controls, it may also have been difficult for him to intervene.

Overall, the flight had a high degree of difficulty and resulted in a high work load.

2.7 Overall Assessment

No appropriate reconnaissance of the landing site was carried out during the accident flight.

There were no glossy water conditions during the flight. However, the approach profile and available sensor data indicate that the intention was to carry out a simulated glossy water landing, which is common during training.

The aircraft's speed was higher than the recommended indicated speed for a glossy water approach and landing and the aircraft thus had a lower pitch attitude at water contact. The landing was carried in tailwind, which meant that the aircraft had a higher speed over the water. At the landing site, the lake was likely rough relative to the limitations of the aircraft. In light of the conditions prevailing at the landing site, the aircraft may have bounced on the water surface before the accident sequence began.

The level of difficulty of the flight was too high in relation to the instructor's and the student's experience of landing at sea with the aircraft type.

Under these circumstances, the conditions for a safe landing were limited. At the water contact when the aircraft began to decelerate and pitch downwards, there was no possibility for the pilots to prevent the accident sequence of events.

2.8 Guidance Material for Seaplane Operations should be Produced

There is no common guidance material for seaplane operations in Europe from EASA. Such common material for seaplane operations could contribute to increased knowledge of the risks of seaplane operations and increased safety in the operation. Therefore, EASA should produce safety-promoting material that aims to increase safety in seaplane operations.

3. CONCLUSIONS

3.1 Findings

a) The flight was conducted as a seaplane introduction as a private flight with an instructor and a student.
b) The instructor was authorized to perform the flight as a private flight.
c) The instructor had limited recensy on type.
d) The aircraft had a valid Certificate of Airworthiness.
e) No technical fault on the aircraft which may have affected the accident sequence has been identified.
f) No signal from the emergency transmitter (ELT) has been registered.
g) No reconnaissance for the landings has been carried out.
h) Two traffic circuits with a number of landings were performed before the accident.
i) The approach had a glossy water approach profile.
j) The glossy water approach was carried out in tailwind and at a higher speed than recommended.
k) The wave height has occasionally exceeded the aircraft's limitation.
l) There is no indication that the aircraft collided with any object on landing.
m) The damage to the aircraft indicates that it flipped over at landing.
n) Both pilots were wearing life jackets and seat belts at the take off from Siljansnäs.
o) Both pilots were fatally injured in the accident.

3.2 Causes/Contributing Factors

The accident was caused by the flight being planned and executed in such a way that the degree of difficulty became too high in relation to the instructor's recency on type and the student's seaplane experience.

Before the landing, no reconnaissance was performed, which has contributed to the landing being carried out at high speed, in tailwind and probable rough sea in relation to the aircraft's limitations.

4. SAFETY RECOMMENDATIONS

EASA is Recommended to:

- Produce and distribute safety-promoting materials for seaplane operations to relevant parties. *(SHK:2023:12e R1)*

The Swedish Accident Investigation Authority respectfully requests to receive, by 23 January 2024 at the latest, information regarding measures taken in response to the safety recommendations included in this report.

On behalf of the Swedish Accident Investigation Authority,

Kristina Börjevik Kovaniemi Johan Nikolaou