Investigation report

D6/2010L

An ultralight amphibian aircraft crashed into water in Taipalsaari on 26 June 2010

Translation of the Finnish original report

OH-U567

SeaMax M-22

INVESTIGATION NUMBER: D6/2010L **INVESTIGATOR:** Kalle Brusi
INVESTIGATION COMPLETED: 9.6.2011

Time:	26 June 2010 at 11:40
Location of incident:	Taipalsaari, south-east of Kutvele canal
Aircraft type:	SeaMax M-22
Registration:	OH-U567
Engines:	Rotax 912 ULS 100 hp
Year of manufacture:	2007
Type of flight:	Sport aviation
Damage to aircraft:	The aircraft was destroyed in the accident.
Number of persons:	1
Pilots:	**Pilot-in-command:** Age 47
Licences:	UPL, GPL, MGPL
Flying experience:	**Total:** About 300 hours (ultralight, sailplane, powered sailplane), a few hours with seaplanes **On type:** About 40–45 hours, most of which was not sea flying.
Weather:	Wave height about 0.3 metres. Wave direction from south. Wind 5–6 knots from south. Good visibility. No precipitation, few clouds. Barometric pressure 1008 hPa. Visual meteorological conditions (VMC) prevailed at the aerodrome of departure.

Translation: Leila Iikkanen

SYNOPSIS

An aviation accident occurred on Saturday 26 June 2010 at 11:40 Finnish local time (UTC +3 h) in the village of Kyläniemi in Taipalsaari. A two-seater SeaMax M-22 ultralight amphibian aircraft, registration OH-U567, crashed into water on take-off. The pilot, who was alone in the aircraft, was severely injured. The aircraft was destroyed.

On 30 July 2010, Accident Investigation Board (AIB) Finland appointed investigator Kalle Brusi to investigate the accident by its decision D6/2010L.

The material used in the investigation is stored at Accident Investigation Board of Finland.

1 FACTUAL INFORMATION

1.1 Preparations and accident flight

After the last flight of the previous day, the pilot moved the aircraft to the sand shore. He pulled the aircraft on the shore with landing gear retracted, and it was stored there for the night so that the rear part was in water or slightly above water level.

The pilot intended to fly to Immola aerodrome (EFIM). Before the flight, he checked the aircraft as usual and used the bilge pump for about 10 seconds. After this the pilot and his assistants pushed the aircraft into the water rear first. The pilot water-taxied the plane towards Kutvele canal. During taxiing, the waves occasionally broke over the hull. Water had condensed inside the canopy. The pilot tried to take off, but the aircraft would not lift off the water, and he tried again. During take-off, the aircraft did not start planing normally and the tail was lower than usual. The climb angle was rather steep immediately after take-off. The water rudder was down at take-off. The pilot tried to make the climb angle lower, without succeeding. He then reduced engine power, which caused a sudden nose-up movement. The plane stalled immediately and fell into the lake in a steep angle from a height of more than 20 metres. The pilot exited the aircraft, inflated the life vest and remained floating close to the aircraft. (Figure 1)

An eyewitness, who had been acting as an assistant, saw that the plane made a longer take-off run than usual before becoming airborne. The assistant told that the plane climbed rather steeply upwards, then dipped downwards and up again before crashing into water. He described the flight path as similar to that of a ”nodding” paper plane. One eyewitness filmed the accident flight on video.

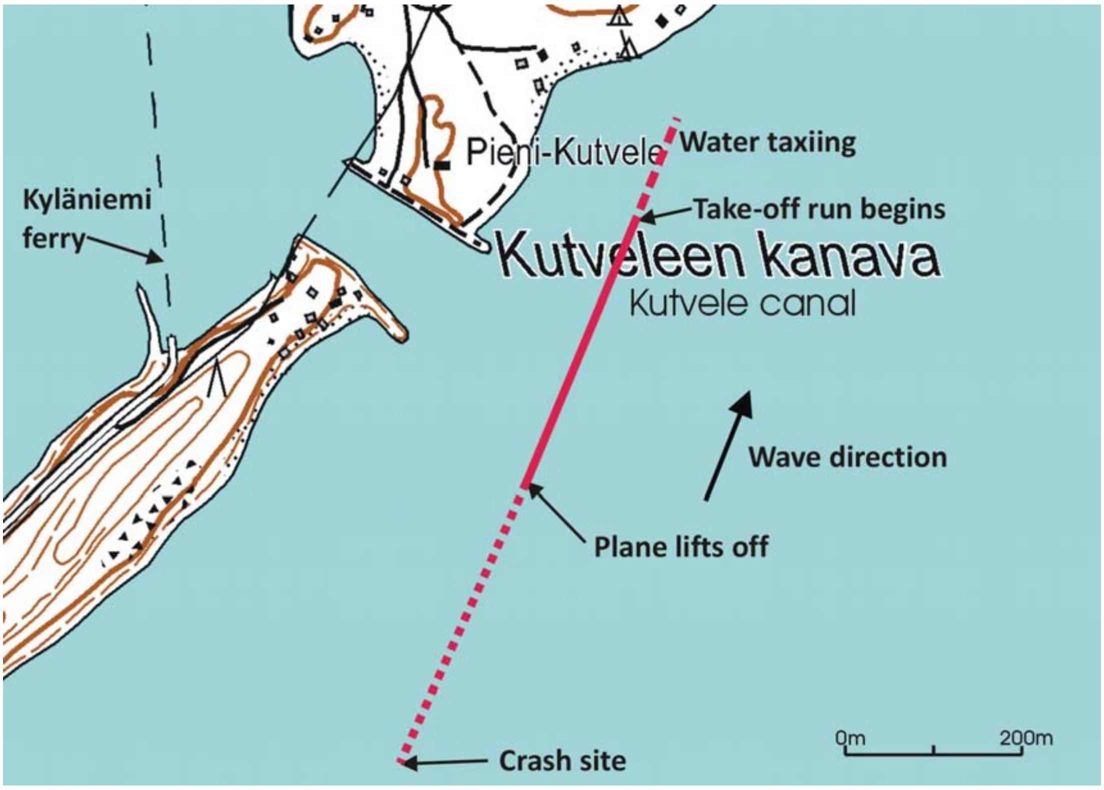

Figure 1. Accident flight shown on a map. (KTJ/Ministry of Justice/National Land Survey of Finland)

1.2 Events after the flight

The pilot's assistants drove to the accident site on a motor boat and lifted him aboard on a platform at the rear of the boat. The pilot had severe pain in his back, and was transported to the shore on the platform. A police patrol arrived at the site and tested the pilot for alcohol with a breath test, which showed 0.00 per mille. The pilot was transported to Southern Carelia central hospital by ambulance.

An emergency call was made from the accident site at 11:41:37 and the first alarm was given at 11:43:26. The first vehicle at the site was a patient transport unit, which arrived at 12:07:09. After that came two rescue units, two patient transport units, a command vehicle and a lead vehicle. In all, there were 19 rescue crew members at the site. The mission had been classified as ”air traffic accident: minor”.

Figure 2. The destroyed aircraft waiting to be lifted from water. (Southern Carelia Police Department)

1.3 Observations made of the aircraft

The aircraft was destroyed in the accident. The rear part of the fuselage had broken off at the root of the tail (Figure 3). The area of fuselage below the engine mounting and wing has sustained considerable damage. The extra weight fitted in the aircraft nose to be used on flights with only one person on board had partly fallen through the fuselage. The engine carburettors and exhaust pipe had been torn off. The wings were badly damaged, the right wing more severely than the left. Soil and water was found in the pitot-static tubes, which were otherwise intact. The soil and water had probably got into the system after the accident. The elevator push rod had broken off at the same location as the fuselage. The fracture surface of the broken push rod was inspected, which showed that the fracture was not due to fatigue. No water was found in the chemical test of fuel.

Figure 3. The aircraft straight after recovery from water. (Southern Carelia Police Department)

In normal operations, water may have entered the fuselage at several points. There are openings in the landing gear wells, through which water may have got into the fuselage in rough sea conditions. The bilge pump opening may also have let some water in while the pump was not in operation. In addition, there is an opening in the lower part of the rudder, through which some water may have flowed into the fuselage. The bilge pump is located inside the fuselage, in the lower part of the step designed to facilitate water planing. It would have been very difficult to detect any water in the fuselage, since there is no sensor or inspection hole for the purpose. The operation of the bilge pump can be heard if the engine is not running. In test conditions, the bilge pump removed about 20 litres of water per minute (about 3 decilitres per second).

The flight manual and operating manual give no instructions on how to remove water from the aircraft. The performance values for the bilge pump are not provided either. According to the operating manual, the aircraft may not be operated if the waves are higher than 20 cm. While the aircraft stands parked in water, water should be removed at 30-minute intervals. The check list instructs to remove water and then turn the bilge pump off. Pilot interviews revealed great differences in bilge pump operation and different views on water tightness of the aircraft: some pilots use the bilge pump only occasionally, others nearly all the time. According to the aircraft manufacturer, there is an auxiliary device related to the water removal system on sale in Brazil, but at least in Finland the owners of this aircraft type did not know about such a device.

Based on mass and balance calculations, the maximum certificated take-off mass was not exceeded and the centre of gravity was within acceptable limits, if any water inside the fuselage is not accounted for.

Figure 4. Bilge pump operating switch.

1.4 Pilot’s flying experience and actions

The pilot had gained his seaplane rating only shortly before the accident. According to the pilot, there are no proper instructions on how to use the bilge pump, and it is not necessary to operate the bilge pump very often as the plane is rather water-tight. He told that the pump had only been operated occasionally for a few times during training. In the pilot’s opinion, occasional use of the bilge pump is sufficient to remove water.

The pilot had not noticed any malfunction in the engine on the accident flight or over the last few days. The plane lifted off on the second take-off attempt. The pilot felt that the water run was longer than usual. When airborne, the aircraft did not gain height normally in relation to flight speed. The climb angle was higher than usual, and the pilot could not correct the flight attitude. According to the pilot, the aircraft flew in a “nodding” way, until the nose pitched up and the plane fell down in the water in a steep angle.

The pilot estimated that the elevator control mechanism might have failed or that there might have been water in the fuselage, since full elevator deflection was not sufficient to stop the steep climb. The pilot had flown 40–45 hours on the type on question, but had only a few hours of sea flying experience.

1.5 Flight instructor interview

According to the flight instructor who had given the pilot's seaplane training, the bilge pump should be operated as required on the check list while the plane was in water and not on dry ground. The flight instructor told that the pilot had steered the plane into an excessively steep climb angle on take-off for a few times during training.

2 ANALYSIS

2.1 General

The aircraft control system was found to have been fully operative before impact. The elevator trim was serviceable and correctly adjusted. The flap setting was appropriate for take-off. The soil found in the pitot-static tubes had presumably got into the system only after the accident. The aircraft was very probably fully serviceable before hitting the water.

When interviewed, the pilot told that he normally only used the bilge pump occasionally on seaplane flights. According to the aircraft operating manual, take-offs and landings should not be made when the waves are more than 20 cm high. Water may also have accumulated in the fuselage during the previous day and night, as the aircraft was stored for the night so that at least a small amount of water may have got into the fuselage from an opening below the rudder. The pilot operated the bilge pump for about ten seconds before the plane was pushed into the water. The plane was pushed into the water tail first, which may also have caused some water to enter the fuselage. The bilge pump was not used at all while in water. The pilot tried to take off, but the aircraft would not lift off the water on the first attempt. A picture taken after the accident shows that the bilge pump switch was in "off" position (Figure 4). Some water may have accumulated in the fuselage during water taxiing, take-off attempt and take-off.

The water planing attitude on take-off was slightly different from usual, which may have been caused by higher resistance of the rough sea, a take-off mass higher than usual and a centre of gravity problem. The flight path of the aircraft also indicates a centre of gravity problem (Figure 5).

The pilot had very little flying experience on seaplanes. In general, a small amount of flying experience on type (in this case sea flying experience) is often a contributing factor in ultralight aircraft accidents (AIB Safety Report S1/2009L). If the aircraft fails to lift off on first attempt, the cause should be determined before attempting to take off again.

It is well possible that some water had got into the aircraft. Based on the mass and balance calculation, there should have been tens of litres of water before the centre of gravity would move outside the allowable limits (Figure 6). The arching parts of the aircraft fuselage are open in the middle, and at a high pitch angle, any water inside could flow to the rear part rather rapidly. The effect of water movement has not been taken into account in this calculation, since it was estimated that a static centre of gravity calculation will explain most of the suspected centre of gravity problem. The aircraft fuselage can easily hold tens of litres of water.

Many aircraft manufacturers use a service bulletin distribution system, through which aircraft owners are directly informed e.g. of any changes to maintenance instructions and other type-specific flight safety issues. The manufacturer of the aircraft destroyed in this accident would certainly benefit from such a system. For example, information about more detailed operating instructions for the water removal system could be distributed through service bulletins. However, the Finnish Aviation Act does not require a service bulletin distribution system for the aircraft type in question.

2.2 Video

Figure 5 shows pictures extracted from a video of the accident. The flight path of the aircraft could be concluded from the video. Wave height was about 30 cm. The elevator seemed to be working. The pictures show that the water rudder was down on take-off, and the ultimate loss of control at the final stage of the flight can also be seen. As shown on the video, the sharp nose-up movement occurred at the same time as engine power was quickly reduced. In aeroplanes where the engine is located above the centre of gravity, reducing power causes a pitch up moment. Nevertheless, in SeaMax this movement is very small. Propeller slipstream makes the elevator and rudder much more effective. In this accident, probably the most significant factors causing the nose-up movement were the centre of gravity problem and a loss of elevator power when the effect of slipstream ceased.

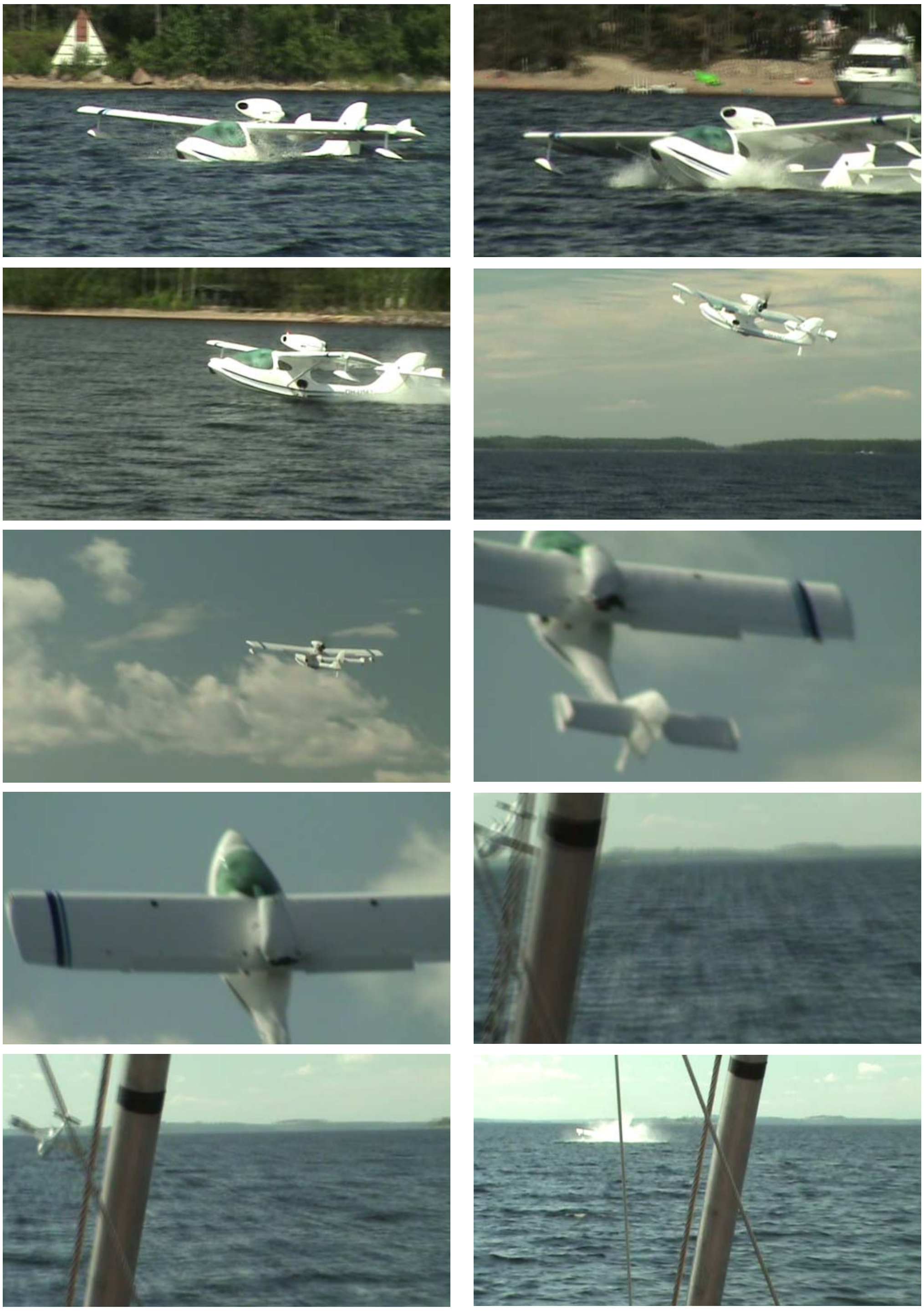

Figure 5. A series of pictures of the accident. The pictures are positioned in a chronological order from left to right and from above downwards.

2.3 Mass and balance calculations

Judging from the uncontrolled nose-up movement, the aircraft centre of gravity was probably behind the aft limit. In the investigator's opinion, this was caused by a significant amount of water in the rear fuselage. The amount of water and its effect on the aircraft centre of gravity is illustrated in Figure 6, taking into account the loading of the aircraft in the accident situation including the fuel and the pilot. The figure shows how the centre of gravity position may vary if the amount of water (its centre of gravity) is located in the very aft part of the fuselage, within an area of one metre in length. It can be seen in the picture that if the amount of water is 25 litres, the centre of gravity position will remain between the allowed forward and aft limits, even if all the water is in the rearmost part of the fuselage. However, the maximum certificated take-off mass would be exceeded with a smaller amount of water. There must be over 25 litres of water before the centre of gravity moves behind the allowable aft limit.

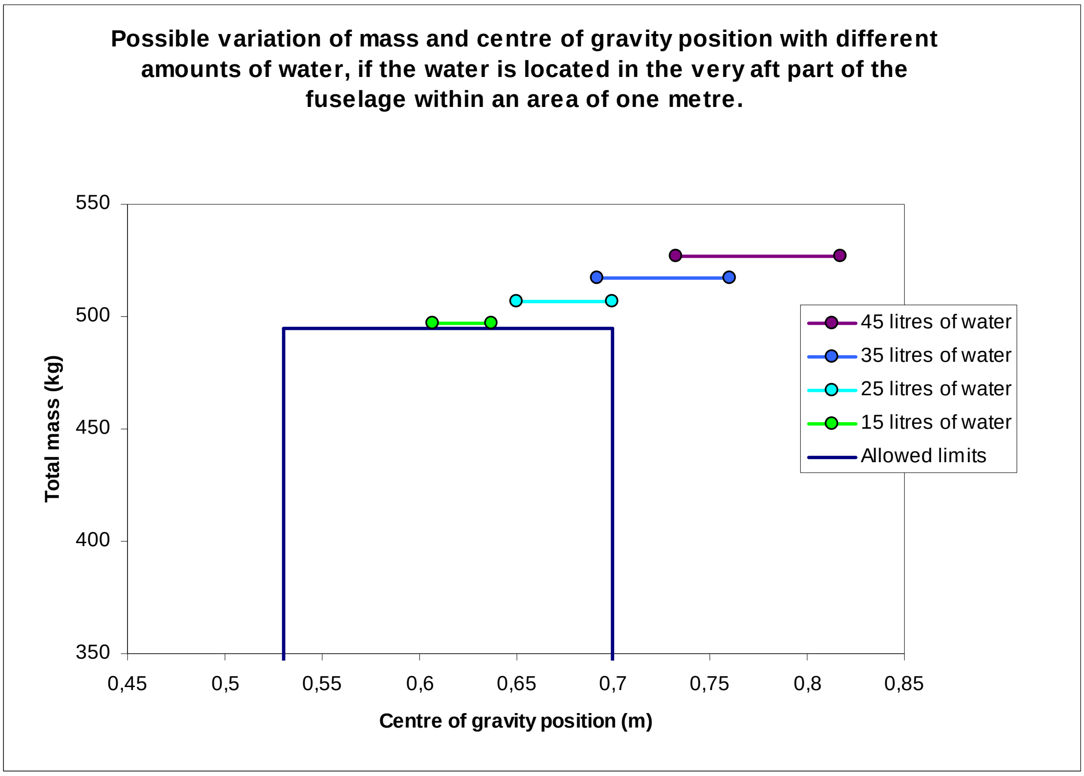

Figure 6. Effect of different amounts of water on the centre of gravity position.

The movement of the water may also have rocked the aircraft and made it more difficult to control. After take-off, the water probably ran to the rear part of the fuselage due to the aircraft climb attitude. This moved the centre of gravity even farther aft, decreasing the longitudinal stability of the aircraft and making it harder to control during climb. In the end, the aircraft became unstable and the pilot lost control immediately when reducing engine power. Figure 6 shows that a few litres of water would not have been sufficient to move the centre of gravity behind the allowed limit.

3 CONCLUSIONS

3.1 Findings

1. The pilot had the licences and ratings required to fly the aircraft.

2. The aircraft was airworthy.

3. The aircraft was probably technically serviceable when departing for the flight.

4. The weather was otherwise good for flying, but wave height was higher than allowed in the aircraft operating manual.

5. There are no detailed instructions for removing water from the fuselage in the aircraft operating manual.

6. The centre of gravity was probably too far aft, since there was a large amount of water in the rear fuselage.

7. The aircraft failed to lift off on the first take-off attempt.

8. The aircraft did not start planing normally.

9. The pilot lost control of the aircraft during the second take-off attempt.

10. After a short flight, the aircraft fell down in the water.

11. The pilot was severely injured.

12. The aircraft was destroyed on impact.

3.2 Probable cause

The pilot lost control of the aircraft soon after take-off. It is very probable that there was water in the fuselage, for which reason the centre of gravity was too far aft. This led to the loss of control of the aircraft.

4 SAFETY RECOMMENDATIONS

4.1 Actions taken

In the original draft report, there was a safety recommendation concerning the removal of water from the hull. After the draft Final Report was sent to the aircraft manufacturer for comments the manufacturer published a technical information letter on the subject and updated the Aircraft Operating Instructions & Aircraft Flight Training Supplement manual. Therefore the safety recommendation was moved under the chapter “Actions taken”.

4.2 Safety recommendations

1. Several aircraft manufacturers use a service bulletin distribution system, through which aircraft owners and operators can be directly informed e.g. of any changes to aircraft maintenance instructions and provided with other flight safety information. Airmax Construções Aeronáuticas Ltda does not have such a system.

    Based on the investigation, it is recommended that Airmax Construções Aeronáuticas Ltda introduce a system for distributing service bulletins about the aircraft it manufactures.