



Accident to the amphibious PIPER - PA18 “Super Cub”
registered **F-HYHB**
on 7 March 2023
at Biscarrosse - Parentis seaplane base (Landes)

Time	Around 15:10 ¹
Operator	Aquitaine Hydravions
Type of flight	Local instruction flight
Persons on board	Pilot in training and instructor
Consequences and damage	Landing gear structure and floats damaged, engine submerged

This is a courtesy translation by the BEA of the Final Report on the Safety Investigation. As accurate as the translation may be, the original text in French is the work of reference.

**Rupture of forward float interconnecting strut during
water landing, in instruction**

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on statements.

The pilot in training, accompanied by an instructor, took off at around 15:00 from Biscarrosse - Parentis aerodrome for the second training flight with a view to obtaining a SEP H (seaplane) rating. The pilot carried out a reconnaissance (at high and low altitudes) of Biscarrosse-Parentis lake in order to select a suitable area for a water landing. He estimated that the wind was coming from the north-west and chose an area parallel to the north shore of the lake. The approach was carried out with a vertical descent speed of roughly 300 ft/min and an indicated airspeed of 60 mph. The instructor specified that just after making contact with the surface of the water, he felt the aeroplane deviate to the left. He attributed this deviation to the pilot making a slight error in the control of the path. The latter continued the water landing until the seaplane had completely slowed down. The instructor and the pilot in training then discussed this unsatisfactory water landing.

Given the light wind, the next take-off was on a south heading. During the take-off run, the pilot noticed a slight vibration that was not perceived by the instructor. He carried out a second approach following the same path as before. On coming into contact with the water, the aeroplane violently swerved to the left. The right wing touched the surface of the water causing the aeroplane to rotate to the right, nose down. The floats and struts ruptured. The two occupants evacuated the cockpit, inflated their lifejacket and each took position on a float. During the evacuation, the instructor checked that the landing gear was retracted (in “Up water” position) with the four blue lights illuminated.

The instructor raised the alert at his club using his mobile phone kept in a watertight pouch hanging around his neck. The Aquitaine Hydravions club management sent a four-seater seaplane (Cessna 185) to provide them with help. On arriving close to the survivors, the pilot of the Cessna suggested that they stay with the damaged aeroplane which was floating and stable on the water

¹ Except where otherwise indicated, the times in this report are in local time.

surface, and wait for the responders to arrive by boat to avoid them having to get into the water. The emergency services arrived approximately 45 min after the accident by which time the occupants of F-HYHB were starting to suffer from hypothermia.



Figure 1: occupants waiting for emergency services (source: Aquitaine Hydravions)

2 ADDITIONAL INFORMATION

2.1 Site and wreckage information

The wreckage did not sink and was recovered by a retrieval company mandated by the club. The following observations were sent to the BEA on completion of the examination carried out by members of the club.

The four brackets of the horizontal float interconnecting struts on the left and right floats had ruptured. The left and right wings were damaged and the wing struts were deformed or broken. The float struts had been torn off.

2.2 Aircraft information

The aeroplane has a total fuel capacity of 136 l divided between two tanks. The maximum permissible take-off weight with floats is 906 kg and landing weight is 860 kg.

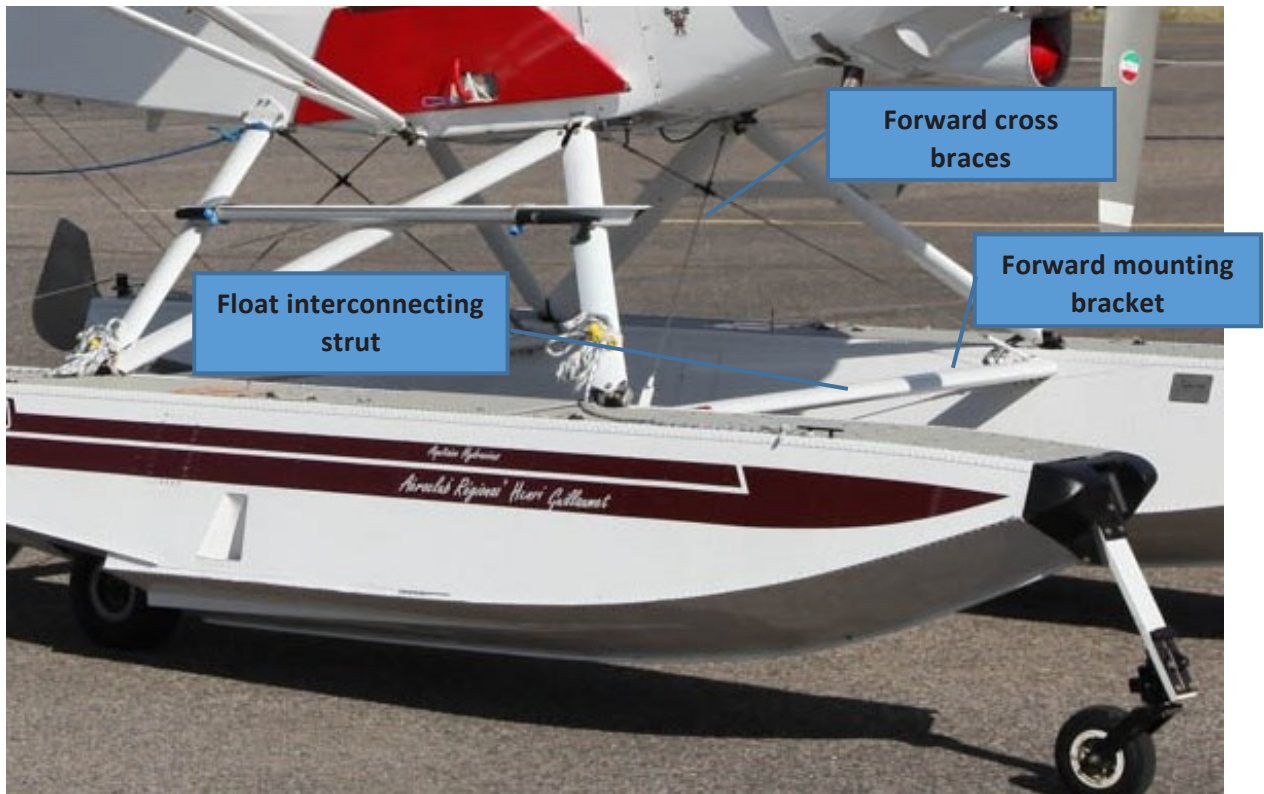


Figure 2: Wipline floats equipping a club PA18 (source: club)

2.2.1 Maintenance

Wipline 2100 floats manufactured by Wipaire, equipped the PA18 Super Cub registered F-HYHB under STC² SA00713CH.

The maintenance manual stated that the float interconnecting struts must be inspected every 100 h. However, this was a visual inspection without disassembly which meant that it was not possible to monitor the fatigue of the mounting brackets of the float interconnecting struts.

Wipaire specified that the damage usually observed is characteristic of a ductile failure process due to overloading (following a hard water landing).

The floats were built in 2000. They underwent a general overhaul in 2019 when they had logged 3,050 flight hours. The day of the accident, they had totalled around 3,600 flight hours³.

2.2.2 Metallurgical Examinations

During the examinations carried out at the BEA, it was observed that the four mounting brackets of the float interconnecting struts had ruptured in line with one of their bore holes⁴:

- the forward right-hand bracket had ruptured at around 5 cm from its attachment with the float and showed no significant distortion;
- the other three brackets had failed flush with their attachment with the float. The deformations observed bore witness to forward-to-aft forces exerted on the seaplane.

² Supplemental Type Certificate.

³ i.e. around 25,000 water landings.

⁴ Areas of stress concentration.

Optical microscopy observations of the forward right-hand bracket rupture found several oxidised and matted cracking fronts (areas A, B and C). There were also several radial secondary cracks initiated in line with the ruptured bore hole. The ruptured bore hole was out-of-round and showed signs of fretting⁵.

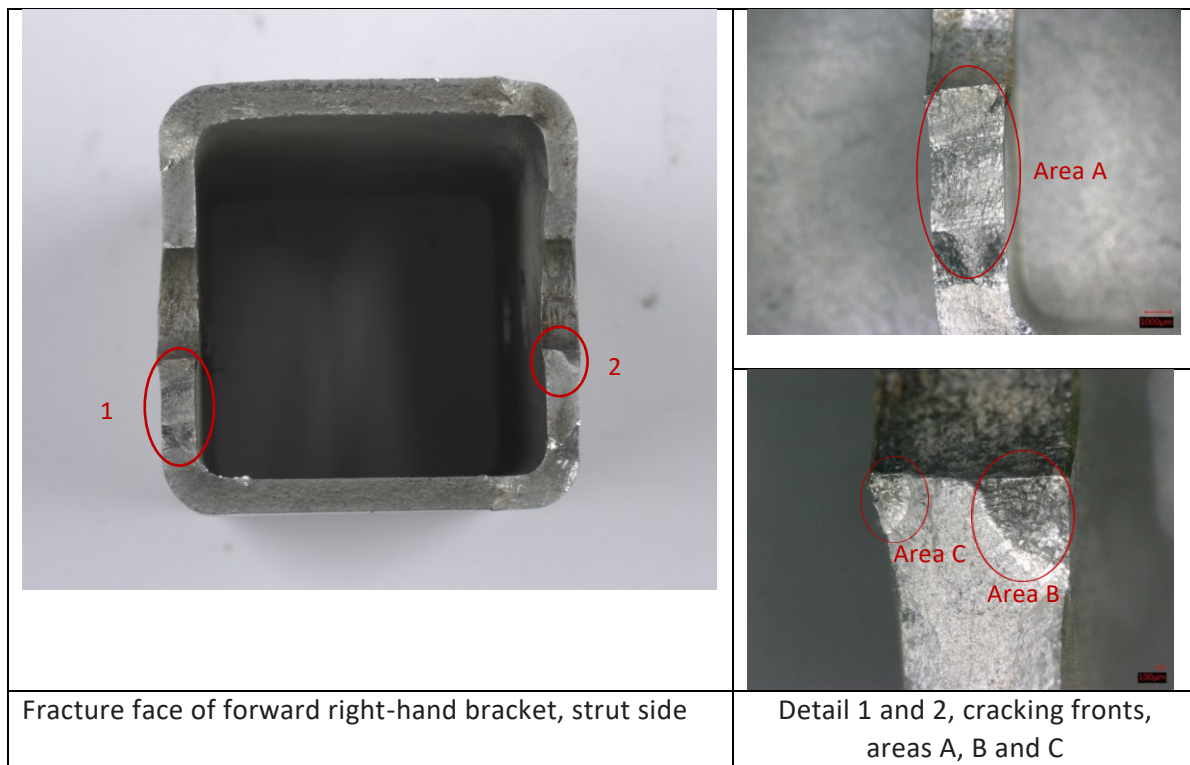


Figure 3: observations of bracket rupture with optical microscope (source: BEA)

The examination of the forward left-hand bracket revealed a 7 mm radial crack initiated in line with the bore symmetrical to that of the ruptured forward right-hand bracket. These two bore holes, in the forward brackets, hold the lower fasteners of the forward cross braces.

The examination of the ruptures of the forward right-hand bracket (excluding areas A, B and C), forward left-hand bracket, aft right-hand bracket and aft left-hand bracket showed matt and grainy faces with little oxidation.

Micro-fractographic investigations were carried out by means of a scanning electron microscope on the fracture face of the forward right-hand bracket and on the crack fracture face in the forward left-hand bracket, which was opened in the laboratory.

The examinations revealed micro fatigue striations on the cracking fronts of both faces. Away from these fronts, dimples were found, which are characteristic of a ductile failure process due to overloading.

The comparative examination of the forward left-hand and right-hand brackets showed a similar development of fatigue destruction.

⁵ Wear phenomenon of two surfaces subjected to an oscillatory movement of very low amplitude..

The asymmetry between the upper and lower rupture of the forward right-hand bracket suggests a succession of upward bending-type loadings. These loads can be observed during high-speed manoeuvres on a choppy water surface.

The out-of-round of the upper bore hole of the forward right-hand bracket may be associated with upward bending (as suggested above) combined with forward to aft loading of the bracket. These loads are mainly encountered when navigating on rough water, on the step⁶ or in a turn.

2.2.3 Aquitaine Hydravions flying club

Aquitaine Hydravions flying club, based at Biscarrosse-Parentis aerodrome, is an Approved Training Organisation (ATO) for training for the SEP (H) rating. The seaplane base situated on the nearby Lac de Parentis, reduces the flight time required to fly to the instruction area.

The training courses are entrusted to around twenty volunteer or professional instructors. The seaplanes are maintained by mechanics holding the EASA-Part 66 approval.

The club has a fleet of three tandem two-seat amphibious PA18-160 seaplanes, and a five-seat amphibious Cessna 185.

The PA18s are used for instruction, issuing and renewing the SEP (H) class ratings. In this context, they perform on average seven water landings per flight hour. The club records the water landing cycles on the return of each flight but this information is not used in the scope of scheduled maintenance. This intensive use exceeds that foreseen by the manufacturer of the landing gear.

In addition to the more frequent water landings, the instruction flights require navigation on the step in both straight paths and turns. These manoeuvres make demands on the floats and induce bending loads in the horizontal float interconnecting struts and their brackets.

2.3 Meteorological information

The meteorological conditions estimated by the French met office, Météo-France, on the site and at the time of the accident were the following: wind from 70°, 10 to 15 kt, CAVOK, temperature 10°C.

2.4 Pilot information

2.4.1 Instructor

The day of the accident, the 77-year-old instructor held a valid PPL(A) licence with SEP (land and seaplane) and instructor ratings. He had logged a total of 9,500 flight hours, including 137 hours on seaplanes and 90 hours in seaplane instruction.

2.4.2 Pilot under instruction

The 37-year-old pilot in training held a valid aeroplane private pilot licence (PPL(A)) with the SEP (land) rating. He had logged a total of 105 flight hours, including 1 hour 30 minutes on seaplanes.

⁶Navigation on the step consists of taxiing at high speed (around 40 kt for the PA18), with the water rudders raised.

3 CONCLUSIONS

The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation.

Scenario

The rupture of the right-hand bracket of the forward float interconnecting strut was initiated by fatigue cracking. The cracking had spread slowly and progressively from the bore hole during in-service use of the assembly. The part finally ruptured when the remaining section of the bracket, not consumed by the cracking, had become insufficient to withstand the applied load, probably during the previous water landing. During the last water landing, the three other mounting brackets experienced ductile failure due to the overload stresses from the sudden deceleration caused by the right, then left, floats moving apart on contact with the water.

The instructor's analysis that the pilot was having difficulties in controlling the path did not lead him to suspect a fault in the equipment. Neither did the instructor detect the vibration observed by the pilot during the following take-off nor did he decide to interrupt the instruction session and land at Biscarosse aerodrome to check the floats.

Contributing factors

The following factors may have contributed to the rupture of the mounting bracket of the float interconnecting strut during the water landing:

- the float manufacturer's maintenance programme not taking into account operations such as those of this ATO, characterised in particular by a large number of water landing cycles;
- the impossibility to detect the growth of the cracks from bore holes inside the struts during pre-flight inspections or routine maintenance.

The following factors may have contributed to the instruction session being continued until separation of the floats:

- the difficulty for the instructor to interpret the deviation from the path during the previous water landing as anything other than a piloting error on the part of the pilot in training;
- the failure of the instructor to detect, and the failure of the pilot to report, the vibrations observed by the latter during the subsequent take-off.

Safety lessons

Based on the information provided in the scope of this investigation, Wipaire plans to ask for an additional inspection for aeroplanes principally used by training organisations. It is planned that this inspection will include the removal of the float interconnecting strut and the search for out-of-round or cracking in the bolt attaching holes. If damage is observed, the mounting bracket will have to be replaced. Wipaire also plans to warn operators (or maintenance organisations) of the importance of the securing tension of the cross braces, as they transmit the loads to the brackets. All of the structure may be affected if the cross braces are too tight or too slack.

The club, whose main activity is training for and issuing the SEP(H) rating makes intensive use of its seaplanes by accumulating numerous water landing cycles. At a meeting of the club's board, its directors decided to amend the maintenance programme to adapt it to the particular use of the PA18s, anticipating the manufacturer's future instructions.

The BEA investigations are conducted with the sole objective of improving aviation safety and are not intended to apportion blame or liabilities.