BEA
Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile
www.bea.aero
@BEA_Aero

SAFETY INVESTIGATION REPORT

Accident to the SCHEMPP HIRTH - JANUS CM[1] registered F-CVAS on Thursday 25 August 2022 at Albertville

Time	13:12[2]
Operator	Private
Type of flight	Local
Persons on board	Pilot and passenger
Consequences and damage	Pilot and passenger fatally injured, glider destroyed
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.	

Engine failure during self-launch take-off, loss of control in initial climb, collision with ground

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on statements and data from the glider's FLARM.

At 13:07, the pilot, accompanied by a passenger, started up the glider's engine on the apron (see Figure 1, point 1). He backtracked the runway of Albertville aerodrome, lined up on runway 23, and then took off (point 2). During the climb, at a height of around 50 m, he started a RH turn (point 3). Ten seconds later, the glider reached a maximum height of around 60 m (point 4). A witness on the ground heard the engine stop. The glider started to descend before pitching down and colliding with the ground at the edge of the A43 motorway.

[1] Glider equipped with a sustainer engine.

[2] Except where otherwise indicated, the times in this report are given in local time.

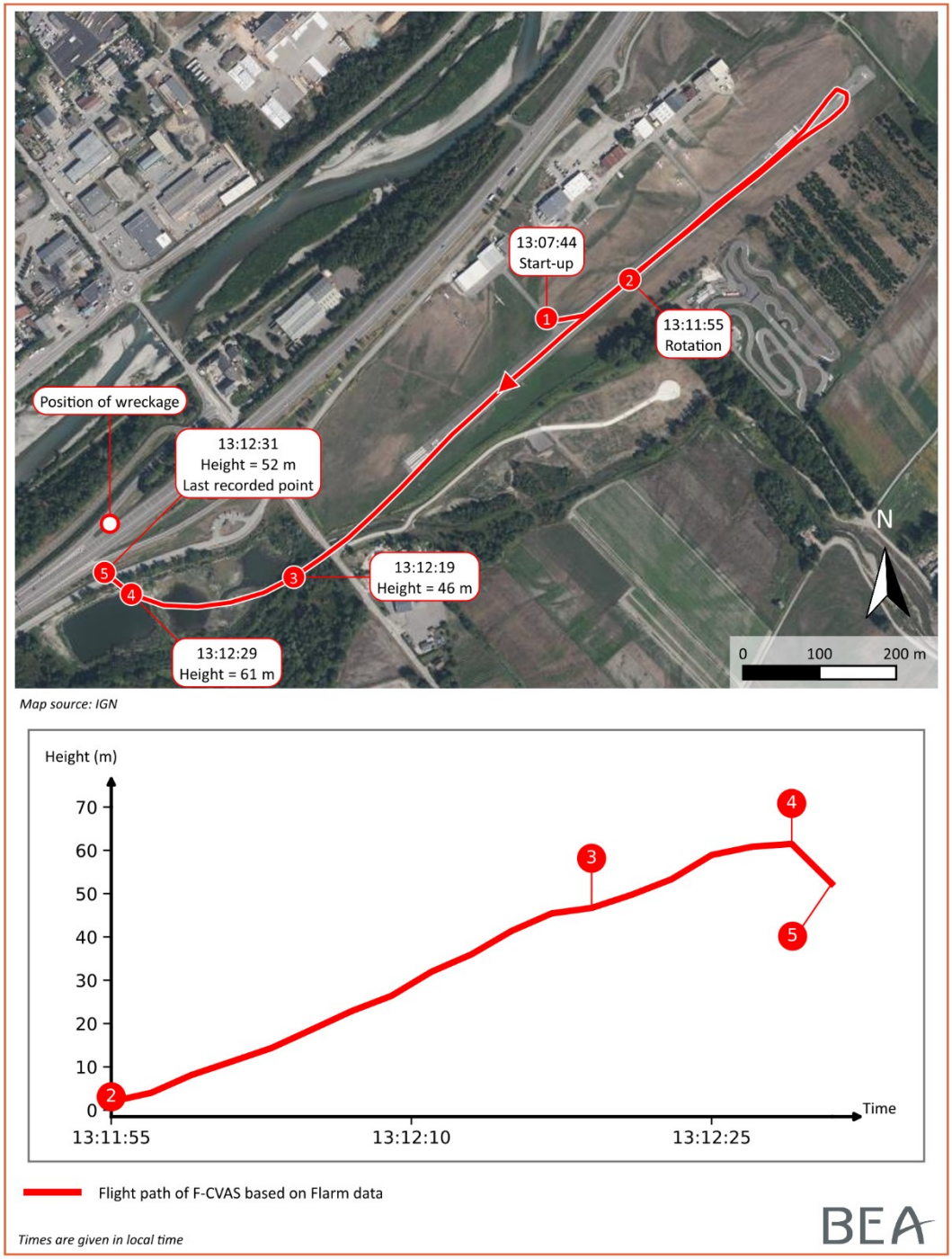

Figure 1: accident flight path

2 ADDITIONAL INFORMATION

2.1 Site and wreckage information

2.1.1 Examination of wreckage on site

The wreckage was located around 400 m from the end of runway 23. It was complete and grouped together. The self-launching glider had collided with the ground with a steep nose-down attitude and then bounced rearwards before coming to a stop. The propulsion system was in the extended position. All of the damage observed on the airframe was the result of the accident, in particular:

- the cockpit was destroyed;
- the leading edge of the left wing was damaged from where it had collided with a road sign;
- the tail had ruptured.

2.1.2 Examination of powerplant

The powerplant was composed of a Rotax 535C twin cylinder, two-stroke, liquid-cooled engine providing a maximum power of 60 hp for a speed of 7,200 rpm. According to Avirex, one of the main Rotax engine repair centres in France, production of the engine ceased at the end of the 1990s, and of the associated parts around ten years later. However, Rotax still holds the engine type certificate and in this respect, ensures the continued airworthiness of the engine.

On the wreckage, the powerplant was still attached to its mount which was in turn attached to the structure of the glider. The drive belt between the engine and the propeller was found next to the wreckage. The axis of rotation of the propeller was no longer parallel to the axis of rotation of the engine due to the deformation of the propeller mount.

When manually actioned by the pulley, the engine freely rotated with no hard point.

The examination of the engine found:

- that the rotor of the electrical generator and the crankshaft were no longer mechanically coupled together due to the rupture of the keyway which participates in connecting the rotor and the crankshaft;
- that the nut holding the rotor on the conical end of the crankshaft was loose and that there were no signs of Loctite type thread lock;
- rubbing (fretting) marks over all the contact surface between the rotor and the crankshaft, indicating progressive loosening of the nut.

The keyway would therefore have been subject to shear stress each time the engine was started up due to the progressive loosening of the nut. These stresses very probably led to the rupture of the keyway during the flight thus causing the malfunction of the ignition system (rotation of the electrical generator rotor stopping) and as a consequence, the in-flight shutdown of the engine.

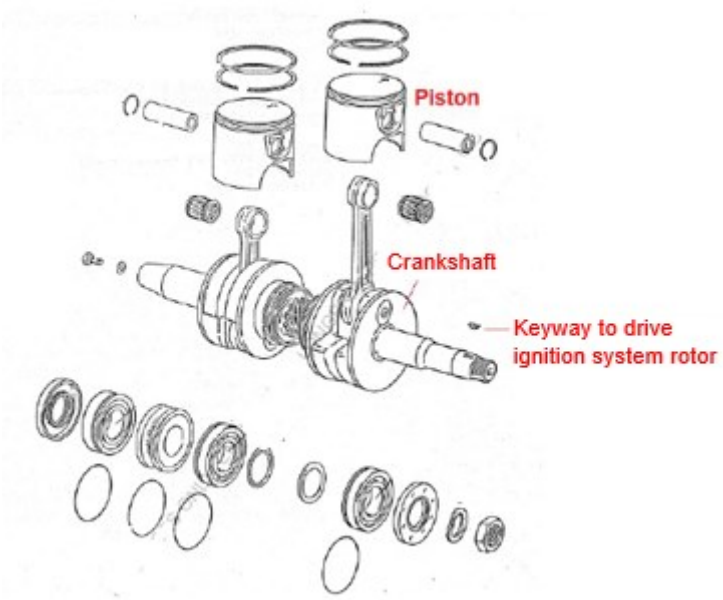

Figure 2: sub-assembly of Rotax 535C engine block (source: Rotax, annotations BEA)

Figure 3: sheared keyway at end of crankshaft (source: BEA)

The examination of the engine also found:

- significant rubbing marks on the piston skirts, indicating that there had been one or several seizures[3] prior to the accident without it being possible to date them; Avirex informed the BEA that they were not aware of a seizure having led to the rupture of a keyway;
- abnormally high play between the pistons and the cylinders given the engine operating time since the repair carried out in July 2018;
- the presence of Rotax 503 pistons.

2.2 Maintenance information

The flight logbook provided to the BEA started on 6 December 2019. The previous logbook was not found.

[3] This phenomenon can appear on a hot engine and can be reversible once the engine is cold.

Based on the documents concerning the maintenance of the self-launching glider (airworthiness documents, logbook, invoices), the last maintenance operations carried out were the following:

Date	Job carried out	Source	Engine hours
24 January 2018	Removal of engine, replacement of seals and segments, reinstallation of engine	Invoice	
12 July 2018	Engine rebuild	Invoice	
17 April 2019	Airframe annual inspection 3844:36	Cardex[4] and logbook	Cardex: 285
27 May 2021	Airframe annual inspection 4015:02	Cardex and logbook	Cardex: 325 Flight logbook: 295
23 May 2022	Airframe annual inspection 4108:50	Cardex and logbook	Cardex and logbook: 326

Figure 4: maintenance history of F-CVAS

The ARC[5] was renewed on 23 May 2022 by a G-NAV[6] airworthiness review member of personnel who carried out annual inspections and issued ARS. The latter indicated that he had not been aware of the repairs carried out on the engine in 2018. They were carried out by a non-approved maintenance workshop, Aéro-light, were not the subject of an ARS and were not mentioned in the continuing airworthiness documentation, which is contrary to the requirements of regulation (EU) No. 1321/2014[7].

The workshop indicated that in July 2018, following an engine seizure, as the spare parts for the Rotax 535C were no longer available, the owner, on the workshop's proposal, accepted the replacement of parts such as the pistons, with those designed for Rotax 582 and 503 engines and the application of the associated repair procedures[8]. It was not possible to determine if the use of these replacement parts might have contributed to the seizure(s) that subsequently occurred. The nut linking the rotor and the crankshaft was removed and re-fitted during the operation in 2018. The investigation was not able to determine if other operations were subsequently carried out.

The maintenance programme for F-CVAS (issue of 14 May 2022) was based on the EASA generic Minimum Inspection Programme (MIP), supplemented notably by Rotax SB 535-009 R1 regarding the engine maintenance and preservation procedure. The maintenance programme and the Cardex (printed from the G-NAV tool) specify an inspection of the engine pistons and segments every 300 h. No indication of this inspection having been carried out appeared in the continuing airworthiness documents. Based on these documents, the engine had logged 326 operating hours on 23 May 2022 (see Figure 4) and the owner did not request the performance of the maintenance

[4] Status of continuing airworthiness of F-CVAS.

[5] The glossary of abbreviations and acronyms frequently used by the BEA can be found on its web site.

[6] *Groupement pour la Navigabilité des Aéronefs du Vol à Voile* – an approved association to ensure the continuing airworthiness and renewal of ARCs of aircraft belonging to FFVP clubs and pilots.

[7] COMMISSION REGULATION (EU) No 1321/2014 of 26 November 2014 on the continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organisations and personnel involved in these tasks (**Version in force the day of the accident**).

[8] Contrary to the requirements of the above-mentioned regulations, which call for approval of modifications in order to certify a new configuration.

tasks given in SB 535-009 R1 during the maintenance check in May 2022. The check of the pistons and segments would have probably detected the presence of pistons 503 instead of 535 and the significant rubbing marks on the piston skirts. However, this check would probably not have detected the loosening of the nut which led to the rupture of the keyway as this check does not require the removal of the parts concerned.

The non-compliance with SB 535-009 R1 was not detected during the airworthiness review to renew the ARC.

The comparison of the flight logbook and the airworthiness documents found inconsistencies in the calculation of the engine operating hours. The glider did not have an engine hour meter. In the flight logbook, these hours were only indicated for flights from 2022 onwards; an operating time of 20 min was indicated for each flight.

2.3 Meteorological information

The data from Albertville aerodrome weather station indicated for 11:00:

- an outside air temperature of 29°C;
- wind from 240° of approximately 4 kt with gusts at 9 kt.

The images from the aerodrome's security camera showed that the sky was clear.

2.4 Pilot information

The pilot had been the owner of the glider for several years. The later was based at Albertville aerodrome.

The pilot held a Sailplane Pilot Licence (SPL) obtained in 2013 with a self-launch rating. He had logged more than 1,200 flight hours.

The last flight noted in the logbook was in May 2022. The flights recorded by the Albertville ramp agent indicated that around ten flights were subsequently carried out before the day of the accident.

3 CONCLUSIONS

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

Scenario

After taking off, in climb at a height of around 60 m, during a RH turn, the gilder's engine shut down. The keyway which participates in connecting the electrical generator rotor and the engine crankshaft probably ruptured, leading to a failure of the ignition system and then the engine shutdown. Thread lock had not been applied to the nut holding the rotor on the end of the crankshaft. This led to the progressive loosening of the nut and finally to the rupture of the keyway (see paragraph 2.1.2). The pilot quickly lost control of the glider which collided with the ground.

The pilot who was the owner of the glider, had used a non-approved workshop to carry out the repairs to the engine with the use of replacement parts designed for a different engine model, which could have contributed to engine seizures (see paragraph 2.2). The investigation was not able to determine if these seizures contributed to the failure of the keyway, and if so, to what extent.

4 RECOMMENDATIONS

Note: in accordance with the provisions of Article 17.3 of Regulation No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation, a safety recommendation in no case creates a presumption of fault or liability in an accident, serious incident or incident. The recipients of safety recommendations shall report to the safety investigation authority which issued them, on the measures taken or being studied for their implementation, as provided for in Article 18 of the aforementioned regulation.

Continued airworthiness of the Janus CM

Compliance with the continuing airworthiness regulations does not allow owners of older aircraft whose type certificate is kept valid by the manufacturer but for which production has been discontinued and spare parts are unavailable, to continue operating their aircraft without resorting to the certification of modification(s) when this is possible.

The French and European authorities, the glider manufacturer, Schempp Hirth and the engine manufacturer, Rotax, are aware of this situation, but do not offer a solution for the Janus CM, whose engine spare parts have not been available for over twenty years.

According to the authorities, only the certification of modifications could possibly allow the glider to continue to operate; this solution appears a priori complex and costly for the owners.

The owners and other parties ensuring the continuing airworthiness of these aircraft may be tempted to bend the rules, for example by using parts from other aircraft models or other engines and by using non-approved workshops for maintenance operations.

The replies given by Schempp Hirth, Rotax and the European and French authorities to the BEA's questions seem to indicate that this situation de facto leads to a cessation of glider operations as soon as it becomes necessary to replace an engine part that is no longer produced. This raises the question of whether it is pertinent to maintain the validity of the type certificate for the Rotax 535C engine. Precise information from the glider manufacturer would also help to better inform Janus CM owners.

Consequently, the BEA recommends that:

- ***Whereas there is no regulatory solution, other than the certification of part modifications, to enable owners of certified aircraft whose parts are no longer produced or are no longer available, to continue operating the aircraft concerned when a part has to be replaced;***

- *Whereas the type certificates of these aircraft or engines are valid;*
- *Whereas EASA has indicated that other aircraft types may be concerned;*

EASA, in coordination with the manufacturers, Schempp Hirth and Rotax, clarify the situation and status of aircraft and engines whose type certificates are still valid, but for which spare parts are no longer available. [Recommendation FRAN 2024-018]

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