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Summary Report

A summary investigation, in accordance with Article 46 of the Ordinance on the Safety Investigation of Transport Incidents from 17th December 2014 (OSITI), as of 1st February 2015 (SR *742.161*) was carried out with regards to the serious incident. This report was prepared to ensure that lessons can be learned from the incident in question.

The definitive version of this report is the original report in German and therefore binding.

Aircraft	Schempp-Hirth Flugzeugbau, Arcus M				D-KEJB
Operator	Private				
Owner	Private				
Pilot	British citizen, born 1948				
Licence	Sailplane Pilot Licence (SPL) according to European Union Aviation Safety Agency (EASA), issued by United Kingdom Civil Aviation Authority				
Flying experience	**total**	4850 h	**during the last 90 days**		14 h
	on type	51 h	**during the last 90 days**		4:45 h
Location	Bellechasse airfield (LSTB)				
Coordinates	--		**altitude**		--
Date and time	19 June 2019, 13:15 hrs (LT[1] = UTC[2] + 2 h)				
Type of operation	Private				
Flight rules	Visual Flight Rules (VFR)				
Point of departure	Bellechasse airfield (LSTB)				
Destination	Bellechasse airfield (LSTB)				
Flight phase	Take-off and climb				
Type of serious incident	Runway excursion				

Injuries to persons	**Crew**	**Passengers**	**Third persons**
Minor	0	0	0
None	1	1	not applicable

Damage to aircraft	Slightly damaged
Other damage	Slight damage to the field

[1] LT: Local Time

[2] UTC: Universal Time Coordinated

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Factual information

Course of events

On Wednesday, 19 June 2019, the pilot and the passenger, both experienced pilots, met at Bellechasse airfield to conduct a local flight in the self-launching two-seater glider Arcus M, registered as D-KEJB. The fuel tank in the fuselage was completely filled and there were about 10 litres of water ballast in the fin.

Shortly after 13:10 hrs, the D-KEJB left the stand next to the runway, initially in the direction of the threshold of runway 08, and then taxied along the entire runway to the take-off position of runway 26. There, the usual checks were carried out, including an engine check. According to the two pilots, the procedure in the event of an engine failure was discussed and it was decided at which point the take-off should be aborted at the latest (abort point).

Shortly before 13:15 hrs, the take-off run was initiated on runway 26. According to the pilot, the engine developed its usual power, but in his opinion, the glider did not accelerate normally, possibly because of the grass along the runway, which was somewhat taller. At the abort point, the required speed had almost been reached, so he continued the take-off run, but there was no further acceleration. The flaps were in the +2 position. Consequently, the glider overran the end of the runway and came to rest in an adjacent cornfield, where the corn was about 80 cm high, approximately 100 m from the end of runway 26 (cf. figure 1).

Figure 1: End position of the D-KEJB in the cornfield, photographed in a westerly direction from the field path running parallel to the runway. The red and white marking indicates the end of runway 26.

An eyewitness watching the take-off run from the edge of the runway saw how the aircraft seemed to lift off very slightly towards the end of the runway and then touched the crops in the adjacent field with the underside of the fuselage. Up until this point, he had not noticed any reduction in the engine regime. The glider then flew a short distance above an area of terrain

depression, before descending in a stable glide onto the corn field and came to a standstill after a turn of about 180° around the vertical axis.

The two pilots were able to leave the glider uninjured. There was minor damage to one winglet[3].

The pilots stated that the glider was in perfect technical condition. They did not claim any technical causes for the serious incident.

Findings

Bellechasse airfield (LSTB) has a grass runway of 520 x 40 m with runway direction 08/26. The reference altitude is 1421 ft AMSL[4], corresponding to 433 m/M. At a distance of about 1000 m after the end of runway 26, a high-voltage power line runs approximately at right angles to the runway direction. At the time of the serious incident, the height of the grass along the runway was about 20 cm. According to the eyewitness, who was himself a glider pilot, the runway was dry; according to the two occupants, the grass was still slightly damp due to the rainfall of the last few days and the ground was possibly somewhat softer than usual for normal summer conditions.

The tracks in the cornfield between the end of runway 26 and the glider's final position showed that the D-KEJB did not roll along the entire distance of approximately 100 m but had also been flying over some sections of the field. No tracks in the crops could be found in the terrain depression at the end of runway 26.

The weather was sunny with a few high clouds. On the ground, a light wind was blowing from the southwest and the temperature was around 25 °C. The QNH[5] pressure value was 1013 hPa. The flight weather forecast, issued at 05:00 UTC, warned of high temperatures for the whole of Switzerland and pointed out that the density altitude[6] should be observed.

According to the information in the flight preparation, the total mass of the glider at the time of take-off was around 785 kg and the centre of gravity was in the second third of the permissible range according to the manufacturer. The maximum take-off mass of the Arcus M is 800 kg.

Both pilots had many years of gliding experience in various countries. The pilot sitting in the front and actively flying had a total flight experience of almost 5000 h, of which about 50 h were on the Arcus M. The pilot sitting in the back had 7000 h of experience, of which about 200 h were on the Arcus M.

The D-KEJB was manufactured in April 2019 and registered under the name of the front-seat pilot in May 2019.

[3] Winglets: Upward or downward extensions attached to the ends of the wings of an aircraft which reduce vortex formation and thereby improve the aerodynamic properties.

[4] AMSL: Above Mean Sea Level

[5] QNH: Pressure reduced to sea level, calculated with the values of the ICAO standard atmosphere.

[6] The density altitude describes the instantaneous air density at a certain location converted to an altitude which has the same properties as the ICAO standard atmosphere. With increasing temperature or decreasing air pressure, the density altitude increases and thus, among other things, the take-off and landing distance of an aircraft is increased.

With regard to the expected take-off distances, the flight manual states in chapter 5:

5.2.3 Startstrecken (bei Windstille)

Alle Angaben gelten für ICAO-Standardatmosphäre und maximaler Flugmasse von 800 kg und vorderster Schwerpunktlage:

Rollstrecke:	233 m
Startstrecke (15 m Hindernis):	450 m
Abhebegeschwindigkeit:	ca. 82 km/h
Fluggeschwindigkeit beim Überfliegen des 15 m Hindernisses:	95 km/h

	Druckhöhe ü. NN (m)	Außenlufttemperatur ° C			
		- 15° C	0° C	+ 15°C	+ 30°C
Rollstrecke (m)	0	183	207	233	260
	500	199	225	253	283
	1000	216	245	275	308
	1500	235	266	300	335
	2000	257	291	327	365
Gesamtstartstrecke (m) bis zum Überfliegen eines 15 m Hindernisses	0	354	400	450	504
	500	384	435	490	548
	1000	418	474	533	596
	1500	456	516	580	649
	2000	497	562	633	707

Die angegebenen Startstrecken gelten für den Start auf einer Hartbelagpiste

Eine harte ebene Graspiste verlängert die Rollstrecke um ca. 20% der angegebenen Werte.

Warnung:

Feuchter und weicher Boden verlängert die Rollstrecke und damit die Startstrecke **beträchtlich**.

Figure 2: Take-off distances as specified in the flight manual

Analysis

According to the two pilots, the glider did not reach the necessary speed during the take-off run. As a result, it rolled over the end of the runway and came to a halt in the cornfield. However, the eyewitness's observation and the traces in the cornfield show that the glider was flying over the crops for some distance, probably aided by the depression in the terrain after the end of runway 26. In any case, the energy available at the end of the runway was so high that the glider, partly rolling, partly flying, still covered a distance of about 100 m before it was slowed down asymmetrically by the crops, which resulted in a turn of approximately 180° around the vertical axis. It is, therefore, more likely to have been an involuntary landing after a failed take-off attempt, than a simple runway excursion. In particular, the high energy present at the end of the runway and the observation of the eyewitness show that, at least up until this point, no attempt was made to abort take-off.

According to the flight preparation, the glider was close to the maximum take-off mass of 800 kg approved by the manufacturer, with a total mass of approximately 785 kg. According to the information in the flight manual (cf. figure 2), the take-off run on a hard surface runway is 283 m and the take-off distance over a 15 m obstacle is 548 m, if the conservative values of a pressure altitude of 500 m and a temperature of 30 °C are assumed. If a 20 % distance increment for a firm, level grass runway is added, which in the present case was probably too optimistic in view of the grass height along the runway and the moisture that may still have been present, this results in values around 340 m and around 660 m respectively. These figures underline the fact that, in view of the existing runway length of 520 m, the distance margins were small.

The higher mass of the glider, the slightly taller grass, the approximately 80 cm high crops at the end of the runway, the temperature which was about 13 °C above the standard temperature for Bellechasse airfield according to the International Standard Atmosphere (ISA) as well as the lack of wind - all these factors accumulated and led to an insufficient take-off performance for a safe take-off.

The pilots were very experienced, and it can, therefore, be assumed that they were aware of all these adverse factors. However, they apparently underestimated the cumulative effect or overestimated the take-off performance of the self-launching glider, which can possibly be explained by their rather limited experience on this type of glider. Although they had the impression that the Arcus M did not accelerate normally to reach the necessary speed at the defined abort point, the pilots decided to continue the take-off, which was not safety conscious. A take-off abort-point, that has been briefed, is useless and ineffective if it is not implemented consistently.

Conclusions

The serious incident, during which a self-launching two-seater glider overshot the end of the grass runway on take-off and came to rest in a cornfield, was due to the insufficient performance of the glider for a safe take-off, given the prevailing conditions and the fact that the take-off was not aborted on time.

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