

ACCIDENT

Aircraft Type and Registration:	Grob G109, G-CLIA	
No & Type of Engines:	1 Limbach L 2000-EB1AA piston engine	
Year of Manufacture:	1982 (Serial no: 6108)	
Date & Time (UTC):	28 May 2021 at 1630 hrs	
Location:	Husbands Bosworth, Leicester	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Extensive damage. The starboard wing and fuselage broke in two, the left wing broke but remained attached. Propeller damaged	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	59 years	
Commander's Flying Experience:	169 hours (of which 38 were on type) Last 90 days - 5 hours Last 28 days - 5 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The pilot seated in the left seat was nominated as pilot in command, and the co-owner, a qualified pilot, instructor and examiner was seated in the right seat and nominated as a passenger for the flight. During the takeoff, aircraft acceleration was sluggish, and the pilot called out his intention to stop. The passenger called out that he had control, and shortly afterwards the aircraft became airborne. It quickly became apparent that the aircraft was not climbing and, after reaching a maximum height of 100 ft agl, it began to descend. It was turned towards a field, but the right wing struck a tree as it descended, causing the aircraft to rotate through 180° and pitch down before striking the ground in a nose-down attitude. The canopy flew open and forward, and both occupants were able to leave the aircraft without assistance. Neither occupant was injured.

The takeoff had been attempted with the propeller in coarse pitch leading to a significant loss of performance.

History of the flight

The pilot arrived at Sulby Airstrip with the intention of flying the aircraft solo for a local flight before landing at the longer Husbands Bosworth Airfield to collect the co-owner. Both pilots had flown the aircraft from Sulby together on previous occasions but had noted that the performance was marginal for the 410 m of runway available if the wind was not favourable.

Despite there being a headwind at Sulby on the day, the pilot decided that he would still fly the aircraft solo and arranged the pickup at Husbands Bosworth. Having completed the pre-flight actions, the pilot took off from Sulby, climbing to 1,200 ft aal before completing a 15-minute local flight during which the propeller was set to coarse pitch. Positioning to join the circuit at Husbands Bosworth, the pilot recalls reselecting fine pitch, before completing a normal landing on Runway 27. After taxiing in, the aircraft was shut down and the pilot exited the aircraft.

Later, having pushed the aircraft into position for starting, both occupants boarded the aircraft and the pilot commenced the pre-start procedures using the aircraft checklist. After the engine was started, the aircraft was taxied for takeoff, backtracking the runway. Once the pilot was happy with the position, both pilots noted that there was a glider on finals so the takeoff was commenced without delay. The pilot had missed the final power check, which required the engine to be run at full power and a check of the maximum rpm to be performed to confirm that the propeller was in fine pitch.

The pilot described the aircraft as sluggish on the takeoff roll and, as the aircraft approached the half-way point of the runway, he checked that the airbrakes were stowed, and the rpm was within normal limits as he was expecting to be airborne by this point. Seeing the yellow winch caravan at the end of the runway approaching, the pilot called out his intentions to abort the takeoff and stop. The passenger in the right seat, then called out that he had control and the pilot let go of the controls. Shortly afterwards the aircraft became airborne, although it was immediately clear that it was not climbing away as expected. The aircraft reached approximately 100 ft agl before beginning to descend. The pilot called to the passenger, who was now flying the aircraft, that there was a suitable field to their left. The aircraft banked left but struck a tree with the right wing as it descended. It turned through 180° before pitching down and striking the ground nose first. The canopy flew open and forward, and both occupants were able to vacate the aircraft without injury. The aircraft was extensively damaged. Figure 1 shows it in its final position.



Figure 1

G-CLIA after the accident (used with permission)

Aircraft information

The Grob G109 is a single engine motor glider with a manually controlled variable pitch propeller.

Propeller pitch

The pitch of the propeller is the angular setting of the blades. This setting affects the efficiency, fuel economy, rate of acceleration and maximum speed of an aeroplane. A propeller with a low blade angle (fine pitch) will rotate easily, taking less of a 'bite' of air each rotation. This allows the engine to spin the propeller at high speed (rpm). Fine pitch is preferable for takeoff and landing, which occur at lower speeds, with the propeller able to rotate at maximum rpm and produce the greatest thrust.

With a higher blade angle (coarse pitch) the propeller will take a larger 'bite' of air with each rotation, but it will limit the maximum speed at which the engine can operate. Cruise speeds are relatively higher and coarse pitch offers a more efficient configuration for this phase of flight. Using the propeller in coarse pitch for takeoff reduces aircraft performance significantly as the propeller rotates at a reduced maximum rpm compared to a finer pitch.

A variable pitch propeller can be compared to the gears in a car in that pulling away or driving slowly is most effective in a low gear (fine pitch on the propeller) but that as the car accelerates, a higher gear (coarse pitch on the propeller) is selected to increase efficiency. Trying to pull away in a high gear in a car also results in poor performance.

Grob G109

The propeller can be set to two pitch settings, fine (known as the climb or start setting) and coarse (known as cruise setting). The propeller can also be feathered completely with the engine off and the propeller windmilling for gliding.

The pitch of the propeller is adjusted using a pull-out propeller control knob in the cockpit, with the feathering accomplished by a separate and lockable feathering handle. For takeoff and climb the propeller is set to fine pitch. In the cruise the propeller can be adjusted to coarse pitch by ensuring the rpm is within limits specified in the pilot handbook, then pulling out the propeller control knob around 7 cm momentarily. There will be an approximately 500 rpm drop if the pitch change has been successful. The maximum rpm will also be lower in coarse pitch than with the propeller in fine pitch. There are no other indications in the cockpit of the position the propeller is in. The propeller can be returned to fine pitch using the same technique.

The pilot of G-CLIA indicated that changing the propeller from fine to coarse pitch was more difficult, and often required more than one attempt. Changing back to fine pitch was more straightforward, almost always changing on the first attempt.

The pilot also commented that after a recent change of propeller, the maximum rpm in fine pitch was lower than normal by around 200 rpm. This meant that the difference between fine and coarse pitch was also less than normal at 300 rpm.

Aircraft examination

The propeller and hub were removed from the aircraft and examined by the AAIB. The examination of the pitch control guides within the hub showed damage that was consistent with the propeller being in coarse pitch when it struck the ground.

Aircraft performance

With the aircraft propeller in fine pitch and at maximum takeoff weight, the performance charts for the aircraft indicate that it requires around 360 m of dry grass to become airborne. Taking into consideration that the grass may have been damp, the expected takeoff distance should be increased by 30%¹ giving a maximum expected distance of 470 m. Information supplied by the pilot showed that the aircraft took over 900 m before it became airborne.

The aircraft performance section of the pilot handbook indicates that the landing distance for an aircraft at maximum takeoff weight is 205 m. With the 30% factored for damp grass this gives 267 m. The runway at Husbands Bosworth is 1,200 m long although G-CLIA did not start its takeoff roll from the beginning of the runway but from a point approximately 25 m in. The distances show that it is likely that almost until the aircraft was airborne there was sufficient distance to abort the takeoff and stop. CAA Safety Sense Leaflet 7b² suggests that you should nominate a decision point which it describes as:

'Decision point: you should work out the runway point at which you can stop the aeroplane in the event of engine or other malfunctions, e.g. low engine rpm, loss of ASI, lack of acceleration or dragging brakes. Do NOT mentally programme yourself in a GO-mode to the exclusion of all else.'

Personnel

The pilot, who was sitting in the left seat, had less experience and had been converted onto the aircraft type by the passenger sitting in the right seat who was a qualified instructor and examiner. Although the left seat pilot was nominated as pilot in command, it was the passenger who took control at the critical point on the takeoff roll. There had been no discussion between the parties before the flight about their roles should there be an emergency or unexpected occurrence.

Analysis

Examination of the propeller and hub showed that the propeller was in coarse pitch when it struck the ground. Given the deficiency in takeoff performance demonstrated by the long takeoff roll and the inability of the aircraft to climb away, it was considered that the takeoff was attempted with the propeller in coarse pitch. Although the pilot in command recalled completing the engine start and post start checks from the checklist, the position of the propeller was not picked up. Due to a glider on finals, the pilot did not perform the

Footnote

¹ CAA The Skyway Code Version 3 (March 2021) Page 49 available from <https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=7920> [accessed August 2021]

² CAA Safety Sense Leaflet 7b Aircraft performance available from <http://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=1913> [accesses August 2021]

engine power checks prior to takeoff, which would have required the engine to be run up to full power to check the rpm was correct for fine pitch. This was the last chance for the pilot to identify that the propeller was not in the correct pitch for takeoff. It was not possible to determine when the propeller was placed in coarse pitch or whether the landing at Husbands Bosworth and the subsequent start-up had occurred in coarse pitch despite the use of the checklist.

The reduction in maximum rpm in fine pitch after the change of propeller may also have contributed to the occupants not recognising the incorrect pitch setting, because they were used to seeing a narrower margin of change than the normal 500 rpm.

It is likely, given the runway remaining when the pilot in command called that he was going to abort the takeoff and stop, that the aircraft would have successfully stopped in the distance remaining, but the passenger either did not hear the pilot in command or did not consider there was enough distance to stop. In continuing the takeoff roll, the aircraft became airborne without sufficient power to climb away. Despite attempting to position the aircraft for a field landing, the right wing struck a tree leading to the aircraft striking the ground causing severe damage.

Flying together can bring great benefits through the exchange of knowledge, greater lookout, and additional mental capacity, but it can also bring the possibility of confusion over who has control of the aircraft especially when unexpected events happen. It is best to discuss these issues with the other pilot before commencing the flight. It may be that, should there be an emergency, the more experienced pilot will assume control, but this should be clearly discussed and agreed beforehand so that both parties are clear about their roles and responsibilities during the flight.

Conclusion

The accident flight takeoff was attempted with the propeller in coarse pitch. Despite using the checklist for the engine start and after start procedures the incorrect position of the propeller was not picked up. The last chance to check the propeller position during the final power checks was omitted probably due to the presence of a glider on finals and a perceived need to be airborne and out of the way before it landed. Whilst this is an understandable action on behalf of a pilot not wanting to be in the way of another aircraft, doing things at haste risks forgetting or missing vital actions that could compromise the safety of the aircraft and its occupants.

The pilot realised that the aircraft was not accelerating as normal and announced his intention to stop. It is likely that there was sufficient runway to abort the takeoff and stop the aircraft until shortly before the aircraft became airborne. The passenger, who was also a qualified pilot, either did not hear the call made by the pilot of his intention to stop or did not believe there was sufficient room to stop and took control of the aircraft. The aircraft became airborne with insufficient performance to climb away and so began to descend. Although the aircraft was positioned towards a field, the right wing struck a tree and the aircraft struck the ground.

Using a decision point on the runway would have given both occupants a good understanding of where it was possible to abort the takeoff rather than continue with insufficient performance. Discussions amongst pilots before the flight can also ensure that should an emergency or unexpected event occur, both pilots know what their roles are to be and what responsibilities they have in controlling the aircraft.