ACCIDENT

Aircraft Type and Registration:	Brandli Cherry BX-2, G-BXUX
No & Type of Engines:	1 Continental Motors Corp C90-12F piston engine
Year of Manufacture:	1999
Date & Time (UTC):	21 July 2008 at 1940 hrs
Location:	Clipgate Farm Airstrip, Canterbury, Kent
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to the landing gear and associated mechanism, propeller and engine shock-loaded
Commander's Licence:	Private Pilot's Licence
Commander's Age:	61 years
Commander's Flying Experience:	429 hours (of which 322 were on type) Last 90 days - 5 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and AAIB examination of the aircraft

Synopsis

Whilst taking off at a relatively high weight from an undulating grass airstrip, a partial failure of the wooden structure supporting the right main landing gear occurred. The aircraft climbed away safely and, after several low passes along the runway for observers to assess the damage, the landing gear collapsed when the aircraft landed. It was determined that the structure which failed had probably been weakened over a period of time by the aircraft's operation from the undulating grass surface of the runway at its home airfield.

History of the flight

The aircraft was based at Clipgate Farm Airstrip, whose grass runway is, in places, uneven. The pilot had planned a short local flight with a friend, who was also a pilot. The takeoff progressed normally until rotation, at which point a significant "crack/bang" was heard; the aircraft continued to accelerate and climbed away. The pilot climbed the aircraft to circuit height, but found that he was unable to retract the landing gear. Both occupants thought that a part of the gear may have broken off, although no debris was visible on the runway surface.

The passenger used a mobile phone to contact the airfield owner, who asked for someone to attend the airfield in order to inspect the landing gear while the aircraft

conducted a low pass. This was done and the observer advised that the right landing gear leg appeared to be partially retracted and trailing rearwards. The pilot then contacted the pilot of another aircraft by radio, who was a Light Aircraft Association (LAA) Inspector who had taken off shortly before G-BXUX, and requested that he land and conduct a similar inspection during another low pass. These observations confirmed the earlier findings and additionally noted that the left main gear and nose leg appeared to be in their normal extended positions.

The pilot and passenger decided to request that the emergency services attend the airfield, following which they would carry out what they expected to be a crash-landing. They also discussed the operation of the canopy, including the method of its emergency release, should that be necessary.

After the arrival of the emergency services, the pilot flew a long, flat approach and touched down approximately 60 m beyond the threshold. The landing gear collapsed immediately on touchdown and the aircraft skidded on its belly for about 40 m before coming to rest. Both occupants were uninjured and left the aircraft without difficulty.

Initial examination of the aircraft revealed that the right wheel had completely detached from its leg during the landing, due to a failure of a weld in a steel fitting at the bottom of the leg. This had required repair on an earlier occasion. The pilot considered the possibility of the weld having partially failed during the takeoff roll which would have allowed the leg to dig into the ground and, potentially, impart high load to the structure. However, there were no marks on the runway to support this sequence of events.

Landing gear description

The Brandli Cherry BX-2 is a two seat, low-wing monoplane, with retractable landing gear, constructed primarily of wood covered with fibreglass cloth. It is designed for 'home' construction. The landing gear is directly operated by a system of cables and pulleys connected to a handle mounted below the instrument panel. Each main landing gear retracts upwards into the wing, rotating about a longitudinal pivot in the area where the cockpit floor joins the fuselage side, formed by forward and aft located bearings. The main and nose legs extend with the aid of gravity and are retracted by means of a spring-assist mechanism. Operation of the gear handle also operates the main gear downlock by rotating two pulleys, one for each main gear leg, mounted on the front of the main spar. Each of these is connected to a cam plate on the rear face of the spar where the cam slot engages with a roller on a 'downlock block'. This simply consists of a block of wood, hinged along its lower edge, where it joins the main structure in the fuselage keel area. When the gear is extended, the cam rotates the downlock into a position such that the top of the leg, ie the portion above the pivot, rests on stops attached to the block's upper edge where landing loads from the leg are reacted.

Figure 1 shows the interior of the aircraft together with the relevant components. A fuselage crossbeam, located aft of the main spar, functions as a structural member which provides for the location of the rear pivot bearing of each main landing gears.

Aircraft examination

It was apparent that some structural damage had occurred in the region of the right landing gear pivot, in that the rear pivot bearing, located in the end of the fuselage crossbeam, had moved in a rearwards

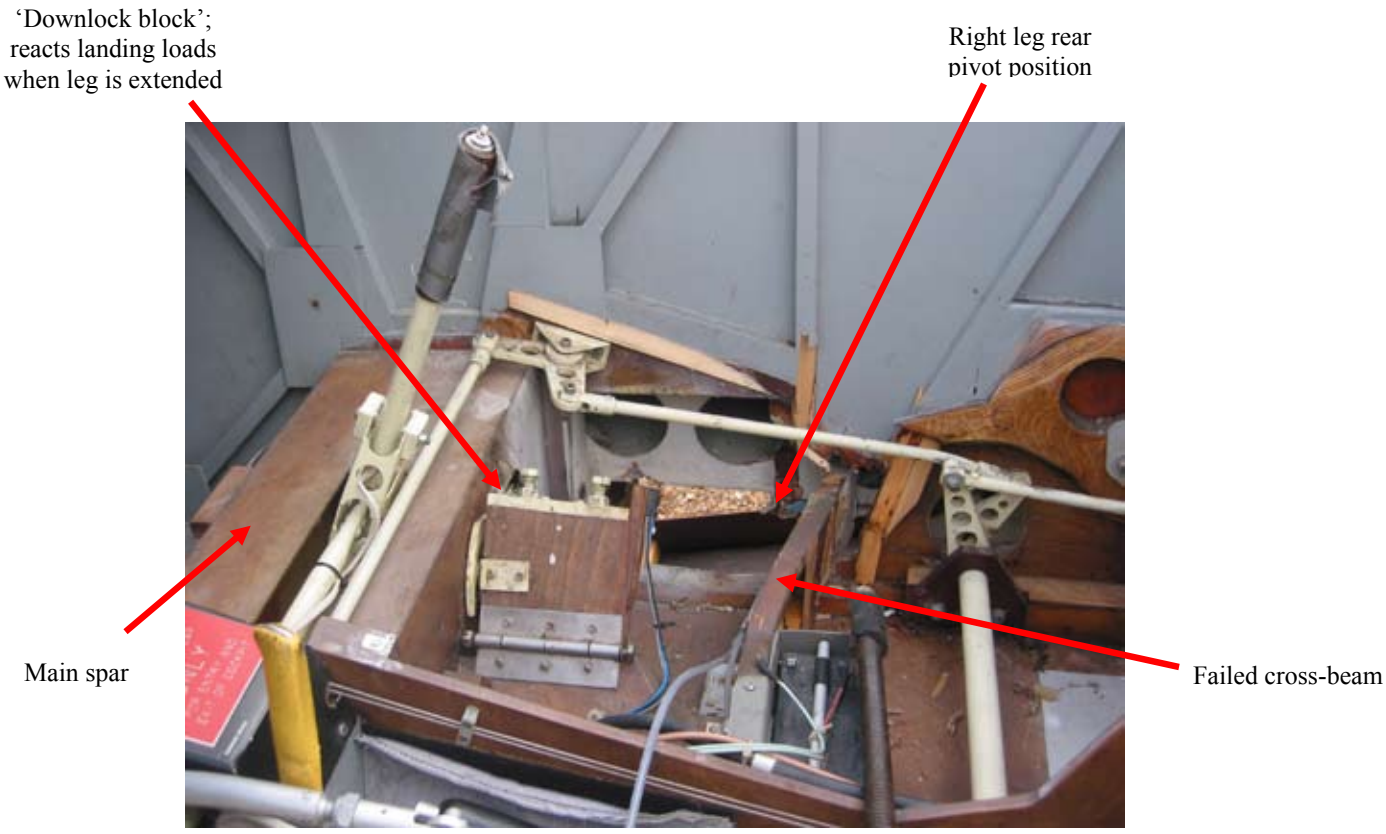

Figure 1
View of right hand side of cockpit

direction. This movement of the bearing was associated with a failure of the crossbeam. It was difficult to differentiate between the damage arising during the takeoff event and that which occurred on landing. However, the fact that the leg was observed to be trailing when the aircraft was airborne suggests that the rear pivot bearing was no longer properly located which, in turn, means that the cross-beam had failed by this time.

Figure 2 shows a partial reconstruction of the failed section of the crossbeam, with the rear pivot of the leg located in a wooden block at the outboard portion of the beam. It is apparent that the wood fibres around part of the circumference of the rear face of the locating hole have been crushed by the bearing bush, to the extent that they are standing proud of the surface. This damage is consistent with the leg moving in a rearward and upward direction. It is likely that the crossbeam would need to be secure and in position in order to react the forces generated by the leg in damaging the bearing hole. If so, it follows that at least some of the damage to the hole preceded the beam failure. It should be noted that the crossbeam consisted not of a single plank of timber, but was in fact built up using square-section Sitka spruce strips, top and bottom, with facings made from ply. This was typical of the lightweight construction methods used throughout the aircraft.

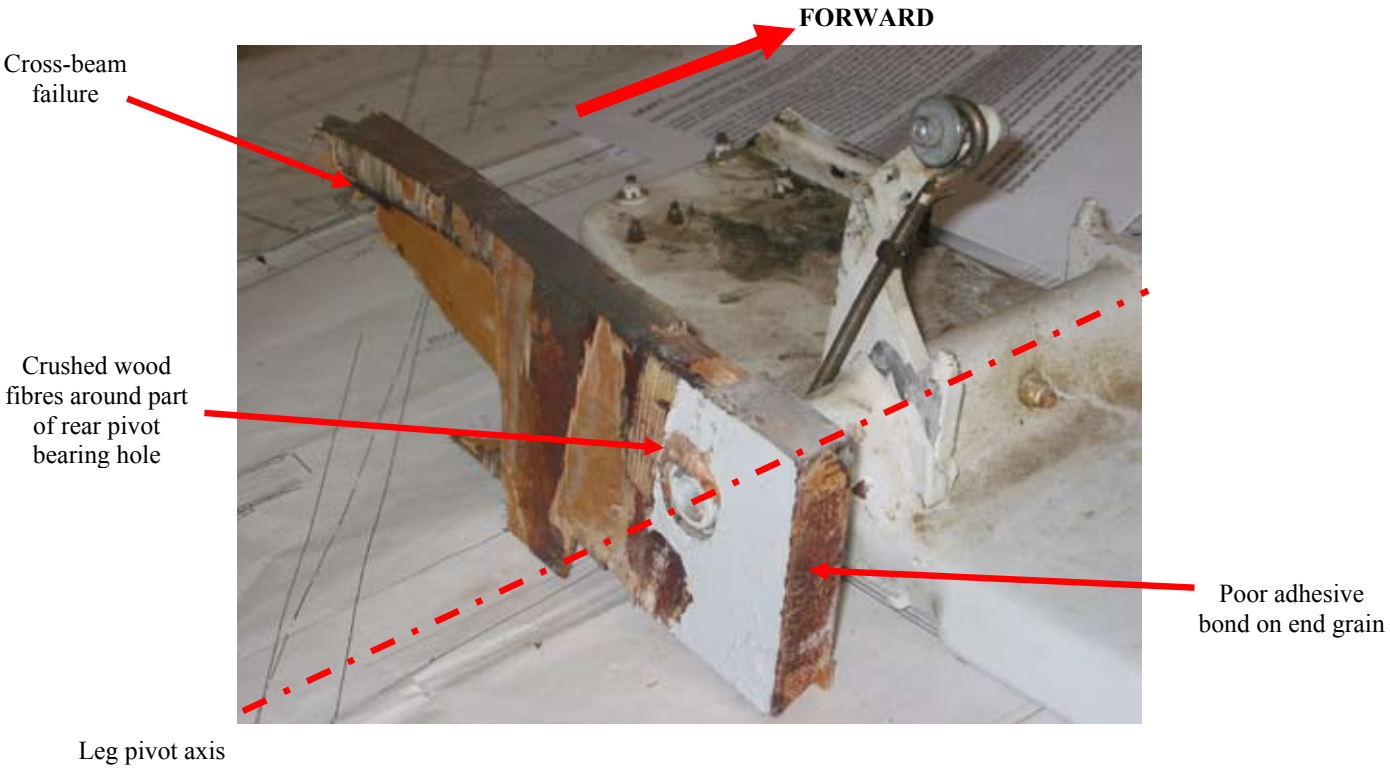

Figure 2

Partial reconstruction of failed fuselage crossbeam and right main leg

Figure 2 also shows the undamaged end of the beam which had been bonded to structure within the wing root. The fact that the adhesive can be seen without any wood fibres attached is indicative of a poor bond. Furthermore, bonds on 'end grain' surfaces such as this are generally avoided in wooden structures. However, the plans for the aircraft did not show any carry-through structure that linked the beam with the wing root, suggesting that the beam end was intended to be stabilised by its bond with the cockpit floor, together with a filleted joint to a plywood panel on the cockpit sidewall. A photograph of the intact left side of the beam is shown in Figure 3. On the right side, the plywood panel had failed due to the aft movement of the crossbeam.

Discussion

Whilst the crash-landing undoubtedly caused additional damage to that which occurred during the takeoff, evidence was present that suggested the initial failure was centred on the rear pivot of the right landing gear leg. It is possible that fore and aft movement of the leg under normal landing load, caused a progressive weakening of the bond between the bottom of the beam and the cockpit floor, together with the observed damage around the circumference of the rear pivot bearing locating hole. On the day of the accident it is possible that the combined effect of the increased aircraft weight with two occupants on-board, and the loads generated from undulations on the grass runway, precipitated the failure of the crossbeam, resulting in the audible "crack/bang", and the loss of the leg's location at its aft end.

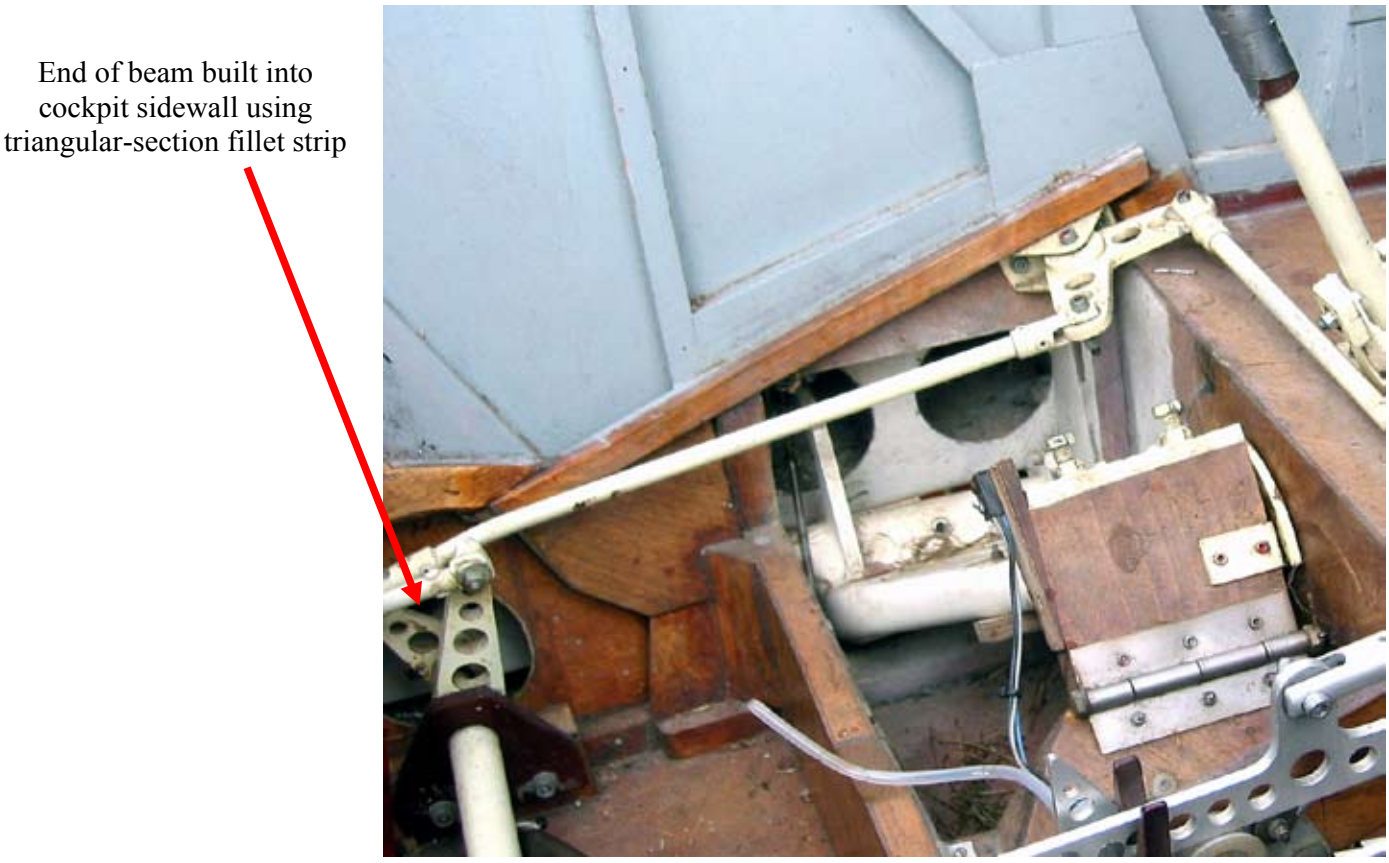

Figure 3

View of left side of cockpit, showing how the intact end of the cross-beam is built into the sidewall

In the absence of any structure linking the end of the crossbeam to the wing root, it is possible that the aircraft builder took the opportunity to apply adhesive to the ends of the crossbeam simply because they abutted some available structure within the wing root. However, the resulting poor bond would have contributed little to the overall strength and stability of the landing gear installation.

The generally lightweight nature of the structure around the ends of the crossbeam, although clearly necessary in this type of aircraft, gave rise to concerns as to whether it was sufficiently robust to withstand operations from unpaved surfaces. Similar concerns were raised by the pilot over the welded fitting that attached the wheel to the main landing gear leg.