ACCIDENT

Aircraft Type and Registration:	Pietenpol Air Camper, G-OHAL	
No & Type of Engines:	1 Continental Motors Corp C90-14F piston engine	
Year of Manufacture:	2008 (Serial no: PFA 047-12840)	
Date & Time (UTC):	25 July 2014 at 1130 hrs	
Location:	Shenington Airfield, Oxfordshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Landing gear collapsed, engine shock-loaded, damage to lower fuselage	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	55 years	
Commander's Flying Experience:	1,877 hours (of which 1 was on type) Last 90 days - 64 hours Last 28 days - 21 hours	
Information Source:	AAIB Field Investigation	

Synopsis

During the final stages of the approach to land, despite the pilot's actions, the aircraft did not enter the flare which resulted in a heavy landing and caused the landing gear to collapse. This was probably the result of a combination of a higher than normal rate of descent, low airspeed and a lack of elevator effectiveness as the aircraft was operating at its forward Centre of Gravity (C of G) limit.

History of the flight

The aircraft was owned and operated by a syndicate, some of whom had limited experience flying tailwheeled aircraft. To increase their experience they engaged the pilot, a flying instructor experienced in flying the Piper Supercub, to give them instruction. Prior to carrying out instruction, the pilot arranged to carry out a familiarisation flight in the aircraft. A member of the syndicate, who had recently completed the aircraft's Permit to Fly airtest, briefed the pilot on its handling characteristics. He stated that this briefing included the expected takeoff, climb and stall speeds together with a recommendation that should a high rate of descent develop during the approach to land, or in the event that the aircraft bounced on landing, that "one should apply at least half throttle instantly".

During the pre-flight preparation it was found that, with the pilot flying solo, the aircraft would be outside of the Centre of Gravity (C of G) limitations. To bring the aircraft's C of G into an

acceptable position, a member of the syndicate agreed to fly as a passenger in the forward cockpit. Recalculation confirmed that the C of G was then at the forward limit.

The prevailing weather conditions reported the wind as being from 40º at 9 kt. The pilot's understanding was that the aircraft's landing gear may be susceptible to damage from side loads, so it was decided to fly from Turweston (Runways 09/27 in use) to Shenington (Runway 05) where into-wind landings could be carried out.

The pilot reported that the aircraft did not take off at the briefed speed of 40 mph, but had to be positively rotated at 45 mph. During the climb the pilot noted that the control forces required to maintain the climb where higher than anticipated, despite the use of full 'nose-up' trim. It was reported that the aircraft would not maintain a climb at the briefed speed of 55 mph, but could be trimmed to climb at 65 mph. In order to become more familiar with the aircraft's handling, the pilot performed a series of steep turns and stalls at a safe altitude. No abnormalities were observed whilst completing the turns, but it was reported that the aircraft entered the stall at 50 mph; the stall speed that had been recorded during the aircraft's previous air test was 38 mph.

The aircraft was then flown to Shenington Airfield for an into-wind landing on the grass area alongside Runway 05L. The initial approach was flown at 65 mph, with the engine at low power, full aft trim and a significant rearward stick force required to prevent an increase in speed. The recommended approach speed was 55 mph with a threshold speed of 50 mph. The pilot stated that a "steeper than normal" approach, using sideslip, was flown in order to avoid an "obstruction" in the grass area before the touchdown zone. Prior to touchdown, the pilot recovered from the sideslip and attempted to flare the aircraft. The pilot estimated the aircraft's speed after recovery from the sideslip was between 50 mph and 55 mph, with the engine at low power. Despite moving the control column fully rearwards, the aircraft did not enter a flare before it struck the ground. This resulted in the collapse of the main landing gear, penetration of the lower fuselage by a landing gear strut and the propeller striking the ground. The aircraft subsequently came to rest and both occupants were uninjured.

The Pietenpol Air Camper

The Pietenpol Air Camper is a two-seat, plan-built, parasol-winged monoplane designed in the 1920's. A number of modifications have been produced since the type's initial design which improves the wing and wing strut arrangements, allow the installation of Rolls-Royce Continental engines and improve the landing gear. These modifications have been reviewed by the Light Aircraft Association (LAA) and are considered to form part of the design standard for the aircraft. The design documentation allows the position of the wing to be repositioned from its datum position so that an owner can 'optimise' the aircraft's C of G to meet their requirements.

Prior to its acquisition by the syndicate, the wing of G-OHAL had been positioned four inches forward of the plan datum position. After acquisition by the syndicate, in 2012, the aircraft had undergone a period of maintenance during which time the wing had been repositioned to the original datum point. After maintenance the aircraft had been reweighed and its C of G position recalculated.

In comparison to other aircraft designs, the Air Camper has a relatively low lift to drag ratio. In the event that the airspeed reduces below the desired speed, the nose of the aircraft must be lowered through a greater angle than in an aircraft with a relatively high lift to drag ratio, or engine power increased rapidly to recover the loss of airspeed. These characteristics are normally associated with microlight aircraft rather than aircraft such as the Piper Supercub.

Investigation

The aircraft was examined by the AAIB. No evidence was found of a pre-accident defect or restriction to the rudder and elevator control circuits. During the recovery process the wings had been removed from the aircraft which precluded testing of the 'complete' aileron circuit. There was no evidence of a restriction or defect in the aileron controls. Examination confirmed that the horizontal stabiliser angle was within the limits defined in the approved documentation.

Testing of the pitot static system, from the wing disconnect, to both cockpits confirmed that no leaks were present and that the airspeed gauges were accurate to within 1 mph. The removal of the wings prevented a test of the complete system, but tests on the section of the pitot static system located in the wing showed no evidence of leaks, blockage or restriction.

Inspection of the forward cockpit confirmed that the floor immediately below the seat had been penetrated by a landing gear strut; it had not penetrated the seat pan. The extent of the damage to the lower fuselage was discussed with the LAA who confirmed that, as a result of this accident and a number of other events, they were reviewing the penetration protection provided by a number of aircraft seats.

Using the weights provided by the pilot and the syndicate member who had briefed the pilot, the aircraft's weight and balance were recalculated. This confirmed that the aircraft had been at its maximum takeoff weight prior to takeoff and that the aircraft's C of G was on its forward limit. Based on the difference in the aircraft's weight between the accident flight and the Permit to Fly airtest, the predicted takeoff, climb and stall airspeeds were recalculated with the following results, Table 1.

	Takeoff	**Climb**	**Stall**
Air test recorded speeds	40	55	38
Reported speeds	45 (rotation speed)	65	50
Calculated speeds	43	58	41

Table 1

Aircraft speed calculations

The calculated speeds demonstrate that there would have been an increase in those recorded during the Permit to Fly airtest when the aircraft was operating at its maximum takeoff weight. The reported takeoff speed and the calculated takeoff speed are of the same order. However, the difference between the reported and calculated climb and stall speeds is significant and may have been attributable to the effects of the C of G position. The forward C of G position during the flight would require greater downforce on the horizontal tail to achieve longitudinal trim which would have the effect of further increasing the wing-loading. A secondary effect was a decrease in the ability of the elevator to pitch the aircraft 'nose-up'. In this case the 'fully nose-up' elevator may have insufficient authority to induce a stall and the aircraft may have descended, nose-high without the wing achieving a stalled condition.

The LAA commented that aircraft designs, such as the Pietenpol Air Camper, which have limited elevator effectiveness when operated near the forward C of G limit, show significant differences in the minimum achievable flying speed with small movements of the C of G position. The LAA also commented that small changes in engine power setting can, in such aircraft, produce significant changes in the minimum flying speed due to the improvement in elevator effectiveness, and increased wing lift generation from the propeller slipstream.

Due to the "obstruction" before the touch down zone, the pilot flew a "steeper than normal" angle of descent which resulted in an increased rate of descent. The use of sideslip during the latter stages of the approach further increased the rate of descent. The relatively high stick forces reported by the pilot during the descent may have been influenced by the forward C of G position of the aircraft. The loss of airspeed during the later stages of the approach would have reduced the effectiveness of the elevator and limited its ability to arrest the aircraft's rate of descent. In addition, the engine was operating at a low rpm minimising the effect of the propeller wash over the elevators, further decreasing their effectiveness. The failure of the aircraft to enter a flare before striking the ground was probably the result of a combination of higher than normal rate of descent, low airspeed and a lack of elevator effectiveness.