

## ACCIDENT

<b>Aircraft Type and Registration:</b>	Flight Design CT2K, G-CBUF	
<b>No &amp; type of Engines:</b>	1 Rotax 912 ULS piston engine	
<b>Year of Manufacture:</b>	2002	
<b>Date &amp; Time (UTC):</b>	10 June 2006 at 2005 hrs	
<b>Location:</b>	High Wych, near Sawbridgeworth, Hertfordshire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 1
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Damage to engine firewall and tail	
<b>Commander's Licence:</b>	National Private Pilot's Licence	
<b>Commander's Age:</b>	55 years	
<b>Commander's Flying Experience:</b>	386 hours (of which 151 were on type) Last 90 days - 116 hours Last 28 days - 30 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and additional AAIB enquiries	

## Synopsis

Whilst in a steep continuous orbit to the left at relatively low level, the engine stopped suddenly, leaving little time for the pilot to plan for a forced landing. After touching down in a field of standing corn, the aircraft flipped over on to its back. The occupants were uninjured and vacated the aircraft through the doors.

Two Safety Recommendations are made relating to the fuel system design.

## History of the flight

The CT2K is a high wing, side-by-side two-seater aircraft in the Microlight Category, with the fuel tanks located in the inboard sections of the wings. The

fuel selector in the cockpit allows the engine to be supplied from either the left or right tank, but not both simultaneously.

Prior to the flight, the pilot conducted an inspection of the aircraft, noting that the left fuel tank was virtually empty and that the right tank contained around 40 litres. Each tank has a maximum capacity of approximately 65 litres. The pilot stated that, as he normally flew the aircraft solo from the left seat, a fuel imbalance in favour of the right tank helped to equalise the lateral weight distribution and thus prevent a tendency for the aircraft to turn to the left. On this occasion, although he was taking a passenger, he accepted the as-found

fuel state on the aircraft as being adequate for the intended flight, which was a photographic sortie over his passenger's house.

After taking off from Hunsdon in Hertfordshire, the pilot established radio communication with Stansted tower and requested clearance to enter Stansted Control Zone. This was granted, subject to the aircraft remaining below 1,000 ft QNH, which allowed a maximum height of approximately 750 ft agl in the area of interest. Some time later, the pilot put the aircraft in a sustained 40° banked turn to the left and, after about three orbits, the engine stopped suddenly. The limited height available allowed the pilot only enough time to level the wings and prepare for a landing in a field ahead. This contained a crop of standing corn and, after touching down, the aircraft pitched over onto its back. However, the occupants were uninjured and left the aircraft via the doors.

### Examination of the aircraft

The pilot returned to the field the following day in order to recover his aircraft. He found approximately 10 litres of fuel remaining in the right tank, together with evidence of a slow fuel seepage that had occurred while the aircraft had lain in its inverted attitude. The flight had been approximately one hour in duration and, based on a fuel consumption of around 12 litres/hour, the pilot considered there would have been some 25 litres in the tank at the time of the accident. This was well above the three litres normally considered to be unusable fuel.

The aircraft was subsequently examined by a representative from the manufacturer and, in the absence of any evidence of a mechanical problem with the engine, the most likely cause of the engine stoppage was considered to have been fuel starvation.

Whilst the aircraft had been in the sustained left turn, deviation from balanced flight could have resulted in the body of fuel in the right tank moving outboard and away from the fuel outlet. In the CT2K, this is located in the aft, inboard region of the tank. After the accident, the pilot commented that he had put the aircraft in a left turn because he was concerned that the fuel state would be more likely to uncover the fuel outlet in the right tank had he conducted a turn to the right, although this was less convenient for his passenger to take photographs<sup>1</sup>.

### Fuel system design issues

CT2K aircraft registered in countries other than the UK are equipped with a fuel system that allows fuel to be supplied to the engine from both tanks simultaneously; UK registered examples only allow fuel to be fed from either one tank or the other, but not both. This is because the aircraft type was certificated in the UK against the Civil Aviation Authority's British Civil Airworthiness Requirements (BCARs) Section S. Although the fuel system is, in practice, a 'gravity feed' system, the engine is fitted with a fuel pump and hence is 'technically' regarded a pumped system. As such, the fuel system needed to comply with Fuel System (General) paragraph S951(a) of the BCARs, which states that:

*'Each fuel system must be constructed and arranged to ensure a flow of fuel at a rate and pressure established for proper engine functioning under any normal operating conditions.'*

### Footnote

<sup>1</sup> In a perfectly balanced turn, ie, with the slip ball centred, fuel would not flow inboard or outboard in a tank. However, when orbiting with reference to a ground feature, particularly with low fuel level, it is possible that such a turn might not always be in perfect balance, with the attendant risk that the fuel outlet may become uncovered if, in this case, the aircraft was skidding to the right.

Also, section S951(b) states that:

*'Each fuel system must be arranged so that no fuel pump can draw fuel from more than one tank at a time. Gravity feed systems may not supply fuel to the engine from more than one tank at a time, unless the airspaces are interconnected in a manner to ensure that all interconnected tanks feed equally.'*

In order for the CT2K aircraft to comply with the BCAR requirements for a gravity feed system, the tank vents would need to be connected together. This would complicate the wing construction in a microlight aircraft in which the wings are designed so that they easily can be removed for storage and transportation. Aircraft delivered to the UK were equipped with a left tank/right tank fuel selector and no interconnection of the tank airspaces, which were independently vented to atmosphere, thus complying with the BCAR S951(b) requirement for a pumped system. However, the UK company that represents the aircraft manufacturer has indicated that this arrangement has given rise to a number of incidents of fuel starvation.

The CT2K has been superseded by the CTSW, which has a shorter wingspan but is identical in most other respects. The UK certification basis for the latter aircraft was a hybrid of the European Aviation Safety Agency (EASA) Certification Specifications for Very Light Aircraft, (EASA CS-VLA) Parts C and D (respectively Structure, and Design and Construction), and BCAR Section S for everything else. Approval was granted by the CAA working in conjunction with the British Microlight Aircraft Association (BMAA). It is worth noting that, although the CS-VLA specifications were not used for the fuel system, the relevant Fuel System (General) paragraph is worded identically to that contained in the

BCAR quoted above. Despite this, all CTSW aircraft in the UK are fitted with fuel selectors that allow fuel to be supplied simultaneously from the left and right tanks.

### Safety Recommendations

Although all CTSW aircraft and all non-UK registered CT2K's have identical non-pressurised fuel systems which can supply fuel from both tanks at the same time, UK registered CT2K aircraft do not have this capability, despite the various (microlight) design requirements in other countries permitting simultaneous supply from both tanks<sup>2</sup>. In the case of UK CTSW aircraft, it would appear that a different interpretation of the S951 requirements to that applied to the CT2K, has not resulted in a common design being adopted. Whilst this might be indicative of a 'common sense' approach, it also demonstrates an inconsistency in the application of the relevant design requirements by the CAA.

BCAR Section S is periodically reviewed by a working group, chaired by the CAA and involving the BMAA, the Popular Flying Association (PFA) and UK manufacturers. The following Safety Recommendation is therefore made to the CAA:

#### Safety Recommendation 2006-105

It is recommended that the British Civil Airworthiness Requirements Section S Working Group of the Civil Aviation Authority, review the Section S Fuel System design requirements to ensure that any present or future requirements are applied in a consistent manner to UK registered aircraft.

#### Footnote

<sup>2</sup> The CT2K aircraft is a microlight as defined by Annex II of Regulation 1592/2002 and therefore does not fall under the jurisdiction of EASA and is only subject to national approval. Accordingly CAA has no influence on how such types are regulated in other European countries.

In response to the issues raised in this report, the CAA has made the following comments:

*'Whichever tank had been selected, assuming it contained usable fuel, there should have been uninterrupted flow to the engine, during any normal flight operating condition. A 'both' selection if available may not have helped in this case as one tank was empty. It appears that this particular design, with large flat horizontal surfaces to the base of the tanks, could result in fuel not being available at the single pick-up position. A review of the fuel feed arrangements from the tanks is recommended for this particular aircraft to ensure fuel flow under all likely operating conditions in accordance with BCAR S 951(a). Simply applying a 'non-compliant' tank feed (both selection) arrangement, as recommended by AAIB, is not supported without appropriate review of the whole fuel system, including consideration of S 951(a).'*

In the case of the accident to G-CBUF, it is possible that fuel starvation occurred whilst the aircraft was in a sustained, steep, imbalanced turn to the left, in which the fuel in the right tank moved outboard, uncovering the fuel outlet. Fuel in the left tank would have tended to move inboard under these circumstances, which, had a

suitable fuel selector been fitted, would have maintained fuel to the engine. Whilst the pilot has indicated that there was little useable fuel in the left tank on this occasion, it is probable, had an alternative selector been fitted, that there would have been a more equal fuel distribution between the tanks prior to the flight. The following Safety Recommendation is therefore made to the manufacturer's UK agent, P&M Aviation:

#### **Safety Recommendation 2006-106**

It is recommended that P&M Aviation review the fuel system design of the CT2K aircraft and consider making available to UK owners a modification that makes the fuel system the same as that approved in the CTSW version of the aircraft, ie, the ability to feed fuel to the engine from both fuel tanks simultaneously.

In response to the issues raised in this report, the BMAA have stated:

*'....the BCAR Section S working group met on 3/8/06 and an amendment to S951 was discussed with a view to clarifying the situation, as per recommendation 2006-105. A draft form of wording has been put together which is likely to go into the next revision paper for Section S, and addresses the issues of tanks effectively interconnected by atmospheric pressure.'*