# Slingsby T67B Firefly G-BLTV

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| **AAIB Bulletin No: 8/2003** | **Ref: EW/C2002/11/01** | **Category: 1.3** |
| Aircraft Type and Registration: | Slingsby T67B Firefly, G-BLTV | |
| No & Type of Engines: | 1 Lycoming O-235-N2A piston engine | |
| Year of Manufacture: | 1985 | |
| Date & Time (UTC): | 3 November 2002 at 1352 hrs | |
| Location: | Withycombe Farm, near Banbury, Oxon | |
| Type of Flight: | Training | |
| Persons on Board: | Crew - 2 | Passengers - Nil |
| Injuries: | Crew - 2 (Fatal) | Passengers - N/A |
| Nature of Damage: | Aircraft destroyed | |
| Commander's Licence: | Commercial Pilot's Licence with Flying Instructor Rating | |
| Commander's Age: | 46 years | |
| Commander's Flying Experience: | 1,600 hours (of which approximately 200 hours were on type) | |
| | Last 90 days - 49 hours | |
| | Last 28 days - 9 hours | |
| Information Source: | AAIB Field Investigation | |

**Synopsis**

The two pilots had briefed for a spinning detail as part of a Flying Instructor's course at Oxford (Kidlington) Aerodrome. Some 24 minutes after departure, witnesses saw the aircraft descending in a spinning manoeuvre just to the west of Banbury. The aircraft continued this manoeuvre until going out of sight. It impacted the ground in an erect attitude, at a high vertical rate of descent and with almost no rotational movement. Neither pilot was wearing a parachute and both were fatally injured on impact. After ground impact, an intense fire started.

**Background to the crew**

The commander was an experienced instructor with current instructional ratings on his licences in both the UK and the USA. In 2001, he had contacted a CAA approved Flying Instructional Course (FIC) organisation based at Oxford (Kidlington) Aerodrome with the intention of qualifying for additional ratings. Then, between September and December 2001, he completed a Multi-Engined (ME) and an Aerobatic course with this organisation, which led to additional Flying Instructional qualifications. The Aerobatic course comprised eight hours ground training and five hours flight training and was completed to a high standard; the flight training was completed on a Slingsby T67M aircraft and included a detail of spinning on 15 December 2001. Then, in March 2002, he commenced a course with the same organisation to enable him to teach qualified

pilots to become Flying Instructors. This comprised 14 hours ground training and 4 hours flight training before he successfully completed a ground and flight examination with a CAA approved examiner. The course included a detail of spinning on 6 April in a Slingsby T67M, when the Instructor considered that spins, both to the left and right, had been well flown. Since then, the commander had operated with the same organisation as a FIC approved Instructor. On 13 July 2002, he commenced flying with the other pilot involved in the fatal accident.

This other 'student instructor' pilot had been an observer on helicopters with the Royal Navy from 1993 to 2002. He had completed a UK PPL course in April 2000 before progressing to a Joint Aviation Authorities (JAA) CPL course in the UK, which he completed in January 2002. In July 2002, he commenced training to become a flying instructor with the FIC approved organisation at Oxford Aerodrome. His allocated primary instructor was the commander on the fatal flight on 3 November. Between July and November, he had flown a total of 23 flights; of those, all were in a Piper PA-28 and 14 were with his allocated instructor and his reports indicated that he was progressing well. His flying log books showed that he had not flown a Slingsby T67 prior to the accident flight but that he had recorded spinning in a PA-38 on a flight in January 2002.

On the day prior to the accident, the student instructor had been at Oxford Aerodrome but was unable to fly because of the weather conditions; the commander did not attend on that day. The student, together with another student and an instructor, had spent the day reviewing the contents of different training details. This included a briefing by the instructor on the theory and practice of spinning. During this brief, the instructor pointed out the height loss to be expected during 'spinning' and the requirement to have recovered by 3,000 feet agl. The instructor also confirmed during the briefing that the student had previously experienced spinning.

**History of flight**

On the day of the accident, both pilots had other flights prior to the accident flight. They flew one training flight together in a PA-28 and each flew a training flight in a PA-28 with other pilots. These pilots considered that the two pilots involved in the accident appeared well and, during the morning, a further pilot saw the two accident pilots briefing for a forthcoming flight.

Prior to the accident flight, G-BLTV had been flown twice by other pilots. The first flight of the morning involved some aerobatic manoeuvres, including a loop and an aileron roll, and the pilots who flew the aircraft confirmed that it appeared fully serviceable. One of these pilots recalled that the control column appeared slightly stiff when he moved it rearwards during checks prior to flight. However, he was able to achieve full control movement and subsequently noted no airborne unserviceabilities. Discussions with these pilots revealed that the aircraft had approximately 4 gall imp of fuel indicated on the gauges just prior to the accident flight and that the flight instruments and stall warning device worked as normal. The only known loose articles in the cockpit were a small fuel strainer under the left seat and a paper checklist under the right seat.

The weather was good with a surface wind of 210°/10 to 15 kt, visibility of 10 km, rain showers and scattered cloud at 1,500 feet and 2,500 feet amsl. In accordance with normal practice, a 'Departure Authorisation Form' was completed. This indicated that the flight would depart with the two pilots involved in the accident at 1315 hrs for a duration of 45 minutes.

A recording of the Oxford 'Tower' radio traffic on frequency 133.425 MHz, included transmissions relating to G-BLTV. The crew called the tower at 1306 hrs for clearance to taxi to the fuel pumps. A subsequent check indicated that 57.32 litres (12.6 gall imp) of fuel was uploaded; this would result in approximately 16.6 gall imp of fuel in the aircraft. Then, at 1319 hrs the crew called for taxi clearance and subsequently reported ready for departure at 1326 hrs. At 1328 hrs, G-BLTV was cleared for takeoff on Runway 19. After departure, at 1332 hrs, the crew reported that the aircraft was leaving the 'Zone' and requested a Flight Information Service; ATC replied with a confirmation of that service and no subsequent transmissions were heard from G-BLTV.

There were only a few witnesses to the manoeuvres of the aircraft during the flight. One witness was standing with her partner about 1.5 km south of the accident site. She described the visibility as

excellent and the weather as bright and sunny with a few scattered clouds. She heard the sound of a small aircraft and looked up to see it in the direction of Banbury and apparently flying towards her. The wings were level and the engine was "steady". As she watched it, "The engine spluttered once or twice then stopped completely, almost immediately. The right wing dipped right down, the tail came up and the plane began spiralling anticlockwise to the ground." As the aircraft descended, it continued to spiral with the tail higher than the nose. She could not be certain of the number of turns but counted at least seven. At one point, she had the impression that the aircraft seemed to hesitate, pointing in her direction before continuing the spiral. As her concern mounted, she took out her mobile phone and began to dial the emergency services. The aircraft disappeared behind some trees and shortly afterwards a plume of black smoke appeared. The police arrived very quickly and she accompanied them to the scene. Another witness near Banbury also saw the aircraft flying in a straight line before the sound of the engine stopped and the aircraft went into a spinning manoeuvre. She thought that it described about five turns before she lost sight of the aircraft. During these manoeuvres, she could hear a noise "as if an attempt was being made to restart the engine"; she could not see if the propeller was turning. Both of these witnesses considered that the aircraft was at a reasonable height and estimates from the position of one of the witnesses indicated an altitude of around 4,000 to 5,000 feet agl. One further witness only saw the aircraft during the spinning manoeuvre at an estimated 500 to 600 feet agl. This witness could neither see any smoke or flame, nor hear any engine noise. He described the rate of rotation, and the aircraft attitude, as constant but thought that the radius of turn was increasing as the aircraft descended. None of the witnesses saw the aircraft impact the ground.

The Fire Service was alerted at 1353 hrs and the first vehicle was on the scene of the accident at 1403 hrs. By then, the fire was smouldering and was brought under control using foam extinguishant. Fire vehicles from both Banbury and Kidlington attended the scene.

**Aircraft description**

The Slingsby T67B Firefly was developed in 1982 from the original wooden Slingsby T67A and is predominantly made from glass reinforced plastic (GRP). The aircraft is a low-wing monoplane with a fixed tricycle landing gear and has a MTWA of 862 kg. The fuselage is strengthened by GRP frames, upon which are mounted supports for the flying control systems. It accommodates two people seated abreast in the cockpit, who are protected by a single piece canopy that slides aft from its latched position. Power is provided by a single Lycoming four cylinder, horizontally opposed, air cooled piston engine giving 116 BHP at 2,800 RPM which drives a two bladed fixed pitch propeller. To enable control of the engine, using the left hand from either seated position, two throttle levers are provided, one at the centre and the other to the left of the cockpit. These are interconnected by a layshaft and move in sympathy with each other.

The fuel system on the T67B includes a single fuel tank, which forms part of the forward fuselage and is located between the cockpit and the engine firewall. The tank is constructed of GRP and has a capacity of 117 litres (25.7 gall imp) of which 112.5 litres (24.7 gall imp) is useable. This aircraft was not fitted with either an 'inverted' fuel or oil system.

The flying controls are conventional. The ailerons and elevator are operated by two interconnected control columns, which are connected to the flight control surfaces via push rods, pivot points and quadrants. The rudder is controlled by cables running from torque shafts in the cockpit to a quadrant in the tail and is operated by foot pedal mechanisms. As the seats are fixed, each of the four rudder pedals is individually adjustable to one of four positions. Elevator trim is also cable operated from a manual trim wheel, situated between the two seats, to a trim tab on the right elevator. The flaps are manually operated by a three-position lever located between the seats. This lever locks in each position and is released by operating a spring loaded plunger on the end of the lever.

**Accident Site**

G-BLTV had crashed in a slightly sloping, recently harvested field. The compact nature of the accident site, and the associated ground marks under the wreckage, indicated that it had struck the

ground in a near horizontal attitude, on a heading of 280°M, with little forward speed. This indicated that the aircraft had been in a near vertical descent prior to the impact. There was no evidence from the distribution of the wreckage of any rotation (yaw) of the aircraft at the time of impact.

Impact forces had ruptured the fuel tank from underneath and to the sides; the fuel subsequently released had then ignited. Due to the wind, the fire was blown across the wreckage destroying the cockpit, main fuselage, right tailplane, most of the right wing and the rudder. The left wing, the outer sections of the right wing and the left tailplane were not damaged by fire.

The force of the impact had caused the left and right ailerons to become detached. The right aileron was found lying beside the right tail plane and had extensively burnt. Below the right wing tip was a ground mark, which indicated that this tip had impacted the ground. Moreover, the wing tip had grass and mud stuck to its underside. As the tip was found several inches off the ground, this indicated that the wing had flexed downwards during the impact and then, with the resultant upward motion, thrown the aileron up and back towards the rear of the aircraft. The left aileron was still attached to its control push rod but had become detached from its attachment points in the wing. The left wing showed gross distortion to its upper surface which was aligned with the main wing spar. This was consistent with the spar being forced upwards against the wing skin on impact. Additionally, when the aircraft was moved there was a long shallow transverse ground mark, aligned with the main spar. There was also a shallow ground mark aligned with, and just in front of, the leading edge of the left wing. The right flap had been completely burnt through and the left flap had burnt at its inner section close to the fuselage. As a result, the flap control push rods had become detached from the surfaces.

The tail bumper had left a deep impression in the ground as a result of the impact. The bumper was located 40 cm to the right of the hole, indicating a bounce to the right after impact. This was corroborated by the wing tip ground mark mentioned above being 35 cm aft of the final position of the right wing tip.

Both main landing gears were fractured and bent backwards under the wing. The nose gear had also been forced backwards during the impact, indicating that the aircraft had a small amount of forward energy at impact.

The engine had broken away from the engine mount and was found lying forward of, and in line with, this mount on the firewall. The propeller blades were at the 1 and 7 o'clock positions with the lower blade having dug straight into the ground. There was little damage to the blades except for bending on the lower blade due to the inertial force of the engine pushing forward against it once it had entered the ground. This indicated that the engine was either at a very low RPM, and had stopped as the lower blade entered the ground, or that it had stopped in flight prior to the impact.

Both pilots were wearing five point harnesses, which were both still engaged in their respective locking mechanisms. In addition, the canopy had disintegrated on impact and the canopy frame was found locked in the forward (closed) position.

**Detailed Wreckage Examination**

The aircraft was recovered to the AAIB at Farnborough for a detailed examination. As the engine may have stopped in flight, a detailed strip examination was carried out. No pre-existing defects or faults were found. The carburettor was also examined. Despite the heat of the fire and the impact, it was possible to ascertain that, at the time of impact, the carburettor heat mechanism had been set at 'Hot' and, from witness marks on the butterfly valve, that the throttle was at idle power. Examination of the cockpit levers also revealed that the mixture had been set to 'Rich'. All the engine controls were found to be continuous.

Due to the intensity of the fire, most of the aluminium push rods for the flying control systems had melted, and thus it was not possible to be certain if there had been any defects in these systems prior to the impact. Despite this, some 60% of the systems were available for examination and this revealed that all damage seen had resulted from the impact and subsequent fire. No evidence was

found in the recovered remains of the elevator system to explain the slight stiffness experienced by the pilot who flew G-BLTV prior to the accident flight.

The flap operating linkage to both the left and right wing was found to be continuous to the push rods connections to the respective flaps, but here the fire had destroyed their physical attachment to both flaps. The flap lever was found locked in the UP position.

The elevator trim system was also found to be continuous, but the fire had destroyed the elevator trim tab itself. Measurements at the manual trim wheel indicated that the trim had been set to slightly nose up.

The rudder cables were found still attached to the aft rudder quadrant but, due to the fire, their attachments to the rudder pedal layshaft had melted. The left rudder cable was found broken at a point where the cables ran through fairleads on a rear fuselage frame, but the fracture was consistent with impact forces. The right rudder pedals were found in a position that would suggest full right rudder was being applied at impact. The left rudder pedals were found at the neutral position but, following the break in the cable, springs within the system had naturally returned the pedals to this position. It was possible that the pedals had been free to move following the impact, before they were affected by the fire. The rudder pedal adjustments were found with the right set of pedals both set at the furthest forward (number 1) position and the left set of pedals with the outboard pedal at number 3 and the inboard at the furthest aft position (number 4). However, it could not be determined whether the pedal settings had changed as a result of impact forces.

Due to the fire it was not possible to ascertain if there had been any restrictions of the rudder cables or pedals prior to the impact. No 'loose articles' were found in the wreckage but the extent of the fire was such that possibility of a jam or restriction of the rudder control system from such an article could not be discounted. The only items that are normally kept in the aircraft, but which could not be accounted for, were the fuel water test strainer and a fire extinguisher, which was normally mounted on the cockpit aft bulkhead.

**Maintenance History**

According to the aircraft's current logbook, G-BLTV had completed a total of 3,599 hours up to 28 October 2002. The logbook also revealed that the aircraft had not been flown for a prolonged period between 28 February 2002 and 12 October 2002 and that the Certificate of Airworthiness (CoA) had expired on the 9 March 2002. An annual inspection and renewal of the CoA was then completed at Wellesbourne Mountford in the period between July 2002 and October 2002. Following this, the first CoA test flight was carried out on 12 October 2002, followed by a second on 15 October 2002. The CoA was re-issued on the 18 October 2002. The Certificate of Maintenance Review (CMR) was completed on the 22 October 2002, as was the final Certificate of Release to Service (CRS). The company which had maintained the aircraft has recently ceased trading and, despite extensive enquires, the aircraft's earlier log books were not recovered.

**Rudder system related issues**

Since the Slingsby T67 Firefly has been in service, several Service Bulletins (SB) have been issued in relation to its rudder control system.

SB No 15 was issued in 1987 and highlighted *'....the possibility of the left hand rudder pedal fouling the fuselage plastic trim panel'.* This SB required an inspection, prior to the next flight, for specified minimum clearances between the pedal, trim and turnbuckle bolts whilst applying a sideways force to the pedal. If the clearance was in excess of 10 mm then the trim was to be inspected for correct installation and for distortion. A clearance of less than 10 mm required the incorporation of a modification which included packing of the rudder pedal.

SB No 83 issued in March 1996 highlighted *'...a potential foul between the No.2 pedal (left hand pilots inbd pedal) inboard pivot bolt tail and head of nosewheel steering rod arm attachment bolt.*

*This foul is to be found at extreme forward pedal adjustment with full rudder deflection...'.* Rectification of the problem was accomplished through the incorporation of a modification.

Modification M576 was issued in 1994 and was applicable to all T67s that were 'post mod M95'. This included G-BLTV. The modification was introduced *'.....to prevent a possible foul between port inner pedal (No.2 position) and nosewheel steering arm, at extreme rudder deflection with the pedal adjusted full forward'.* It required that a chamfer should be applied to the pedal assembly and was to be completed at the next 150 hours service check.

As the early logbooks for the aircraft were not recovered, it was not possible to confirm if the above mentioned SBs and modification had been carried out on G-BLTV. However, they were all mandated by the CAA and the CoA, CMR and CRS should not have been issued without evidence of their incorporation.

**Medical information**

The post mortem examination of the pilots revealed no evidence of any disease, alcohol, drugs or any toxic substance, which could have caused or contributed to the accident. The Pathologist's report revealed that both pilots had died instantly, from multiple injuries resulting from a severe vertical force, and the severity of these injuries precluded any determination of which pilot might have been controlling the aircraft at the time of the impact. It was established that the instructor had been seated in the left seat and the student instructor in the right seat

**Operational aspects**

During scheduled maintenance, G-BLTV had been weighed at Wellesbourne Mountford on 11 October 2002. Using details from this, and known weights of the pilots and fuel, calculations show that the aircraft was 4 kg under the MTOW on departure from Oxford on the accident flight. The CG position was also within the required limits.

The aircraft was flown on a test flight on 12 October 2002 at a similar weight and CG position to that on the accident flight. During this flight, two spins were carried out in each direction. Each spin was entered at 5,000 feet amsl and comprised two turns before recovery; total height loss on each spin was 1,000 feet. The flight was completed with all results being within the allowable tolerances except that the climb rate, at 518 fpm, was some 46 fpm below the schedule requirement. A further test flight was carried out on 15 October 2002 when the required minimum climb rate was achieved.

The aircraft was cleared for certain aerobatic manoeuvres, including intentional spinning, up to its MTWA. The following information was included in the Pilot's Notes for the aircraft:

*'3.7 ERECT SPIN RECOVERY*

*Standard Recovery Technique*

*Close the throttle.*

*Raise the flaps.*

*Check direction of spin on the turn co-ordinator.*

*Apply full rudder to oppose the indicated direction of turn.*

*Hold ailerons firmly neutral.*

*Move control column progressively forward until spin stops.*

*Centralise rudder.*

*Level the wings with aileron.*

*Recover from the dive.*

*WARNING*

*WITH C OF G AT REARWARD LIMIT THE PILOT MUST BE PREPARED TO MOVE CONTROL COLUMN FULLY FORWARD TO RECOVER FROM SPIN*

*3.7.1 Incorrect Recovery*

*A high rotation rate spin may occur if the correct recovery procedure is not followed, particularly if the control column is moved forward, partially or fully, BEFORE the application of full anti-spin rudder. Such out-of-sequence control actions will delay recovery and increase the height loss. If the aircraft has not recovered within 2 complete rotations after application of full anti-spin rudder and fully forward control column, the following procedure may be used to expedite recovery.*

*a. Check that FULL anti-spin rudder is applied.*

*b. Move the control column FULLY AFT - then SLOWLY FORWARD until the spin stops.*

*c. Centralise the controls and recover to level flight (observing the "g" limitations).*

*7.2.9 Erect Spinning*

*Entry Height The height loss is about 250 ft per turn and recovery takes about 500 ft. These height losses may vary, dependent on how many turns of the spin are done and how prompt and correct the recovery action is. They may be used as a basis for planning recovery which should be complete by 1500 ft above ground level. It is recommended that inexperienced pilots allow a further 1000 ft to the entry height. Thus the entry height for a 4 turn spin for an inexperienced pilot should be:*

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| *turns 4 x 250* | *1000 ft* |
| *Recovery* | *500 ft* |
| *Min Height* | *1500 ft* |
| *Safety Allowance* | *1000 ft* |
| *[Minimum entry height]* | *4000 ft above ground level.'* |

Full spin training is only conducted during aerobatic courses and Flying Instructor courses. For PPL courses, the requirement is for stall/spin awareness and avoidance training.

The FIC organisation at Oxford had issued 'Flight Check Lists' for appropriate aircraft to their pilots. Within the Slingsby Flight Check List, was an entry dealing with 'Erect Spin Entry Height'. This detailed the height loss as 250 feet per turn, the recovery height allowance as 500 feet and that the recovery should be complete by 3,000 feet agl. It also included an example calculation for a 4 turn spin showing the entry height as 4,500 feet agl.

Radar information on the aircraft was provided by National Air Traffic Services Ltd (NATS), based on a radar sited at London (Heathrow). With no height encoding operating from the aircraft's transponder, the height of the aircraft at the entry to the spin could not be determined. The first radar return was identified about 3 nm north west of Oxford Aerodrome at 1333 hrs. The radar data indicated that G-BLTV continued on a north westerly heading until 1342 hrs, when it initiated a left turn through 360°, before taking up a north easterly heading towards Banbury. Then, at 1346 hrs at a position to the west of Banbury, G-BLTV completed another left turn through 360° before heading north west for just over a minute. It then turned to the right towards Banbury and the last radar data point, at 1350 hrs, showed the aircraft to be about 0.5 km north of the accident site. During the recording, there was no evidence of any extreme manoeuvring by the aircraft.

Neither pilot was wearing a parachute for the accident flight. Within the UK, there are no legal requirements for pilots of powered aircraft to wear parachutes. General Aviation Safety Sense Leaflet No 19, dealing with 'Aerobatics', refers to parachutes in the section on 'Personal Equipment and Clothing', where '*the following option is strongly recommended: A parachute, if worn, should be*

*comfortable and well fitting with surplus webbing tucked away before flight. It should be maintained in accordance with manufacturer's recommendations. Know how to use it, after all, you may only need it once!'*

The British Gliding Association provides more detailed advice to glider pilots and consider that parachutes are personal equipment and not part of the aircraft. The Association recommends that parachutes should be worn on all flights, but requires them to be worn for any flights entering cloud.

When the T67A was first produced, it was subjected to extensive spinning trials by both Slingsby and the CAA, in 1982, and these were considered satisfactory. Following the introduction of the T67B, further satisfactory spinning trials were completed in 1984. During these trials, it was noted that the application of engine power, even up to full power, made very little difference to the spin characteristics. The aircraft was also spun with the engine completely stopped and no difficulties were experienced; the rate of rotation, height loss and recovery remained unchanged. Additionally, the aircraft exhibited little change in spinning characteristics with flap selected.

Records were reviewed for previous spinning accidents involving T67 aircraft; approximately 200 T67 aircraft have been manufactured. From 1985 to 1996, the CAA had eight reported occurrences where pilots of T67 aircraft had encountered difficulties in recovering from spins. Of these, the following two were accidents and were investigated by the AAIB : T67C, G-BLRE on 20 November 1988 (AAIB Bulletin 3/89); T67M, G-BUUH on 12 July 1995 (AAIB Bulletin 10/95). No evidence of any pre-impact failure or malfunction of the aircraft was found by any of these accident investigations. Investigation of the earlier incidents resulted in Service Bulletins and modifications to the aircraft (detailed in the '*Rudder system related issues'* paragraph of this report).

**Discussion**

This investigation indicated that the two pilots had briefed for the spinning flight. Furthermore, the amount of fuel they decided to uplift, to remain within the allowable weight limits, showed a correct and responsible attitude. Both pilots had experienced spinning before and were not apparently apprehensive. The instructor was the only one to have previously flown a T67 aircraft; perusal of the instructor's flying log book indicated that the B model was the variant that he had flown most frequently.

The format of the flight could not be determined exactly. However, considering the experience of the two pilots, it is highly likely that the instructor would firstly review the standard pre-spinning checks before demonstrating a full spin. Part of these checks would have been a comprehensive visual check of the surrounding area to confirm that it was clear of other aircraft. The radar recording indicated that two 360° turns had been made and that the aircraft only entered one spin. Therefore, the commander was probably the pilot handling the controls during the spin.

Radar data indicated that the aircraft entered the spin while heading north-east. This would be at variance with one witness who thought that the aircraft was pointing in her direction (south-west). However, she stated that the right wing of the aircraft went down and that the aircraft started rotating counter clockwise. Visual determination of an aircraft direction, from a head on or tail on location, is very difficult and the counter clockwise turn direction reported by this witness would only be consistent with the left wing going down, ie with the aircraft heading away from the witness. All the witnesses considered that the spin continued, with minor variations, until the aircraft disappeared behind some trees, and all commented that the engine noise seemed to stop just prior to the spin. This apparent loss of engine noise could simply have been the throttle being retarded before the spin but the possibility that the engine had stopped at this time, or during the subsequent spin, could not be discounted.

Examination of the wreckage revealed no pre-impact failures or obvious malfunctions with the aircraft, although the damage from the fire precluded confirmation that none were present. It was determined that the engine was either at a low power setting or had stopped. Additionally, some pieces of equipment thought to have been on the aircraft, ie, the fuel strainer and the fire extinguisher, could not be found. As the fuel strainer was probably destroyed in the fire, the possibility that this, as

a loose article, had caused a control restriction could not be completely discounted. However, had the fire extinguisher been loose and causing a restriction or jam, then it is highly likely that evidence of such an article would have been found in the wreckage. As no such evidence was found, then it was considered unlikely that the fire extinguisher had interfered with the controls.

The characteristics of the wreckage indicated that the aircraft was in a nose level (flat) attitude, had a high vertical rate of descent, little forward movement and no horizontal rotation (yawing) when it hit the ground. The essential components of a spin are that the aircraft's wings are stalled and that yaw and/or roll is present. Impact marks from a fully developed spin would show a high vertical rate of descent, little forward movement and horizontal rotation. Recovery from a spin is achieved by stopping the rotation movement and unstalling the wings. The impact marks made by G-BLTV indicated that the rotational movement had stopped but that the aircraft wings were stalled at the time of ground impact. Although there were no witnesses to the last portion of the descent, it was likely that the aircraft was recovering from the spin but with insufficient height to complete a full recovery.

Witness evidence was that the entry to the spin was at a reasonable height. This is supported by evidence of the commander's responsible approach to the flight and would indicate that he had complied with the advice in the aircraft checklist and entered the spin at around 4,500 to 5,000 feet agl. There would have been no reason to continue beyond about four turns before recovery and, thus, it would be expected that he would have initiated the recovery at a minimum of 3,500 feet agl. Evidence from the recent flight tests indicated that satisfactory spin recoveries had been carried out from both directions. Also, the aircraft had been subjected to some uneventful aerobatics on the morning of the accident, all of which indicated that prior to the last flight, the aircraft had been serviceable. Therefore, a failure to recover from the spin in time was most likely to have resulted from either a control malfunction, a distraction or inappropriate control inputs.

It is highly unlikely that an experienced pilot and instructor would have applied an inappropriate control input during a briefed and demonstrated manoeuvre. A control malfunction could have resulted in a failure to recover and this factor could not be completely discounted. However, evidence from the impact site indicated that the aircraft was in the process of recovering from the spin as it crashed. This would suggest that any control malfunction was temporary and would point towards a control restriction as a more likely possibility; this could have been caused by a loose article, although no evidence of such an article was found. One other contributing factor could have been an engine stoppage during the spin. This would not have precluded a recovery but could have been a distraction which diverted the pilot's attention at a critical time.

**Safety Recommendations**

Regardless of the reason for the failure to recover, the pilots, with no parachutes, had little option but to remain with the aircraft. Had parachutes been worn, an additional height check would have been made and, if the aircraft had not recovered by that specific height, the crew could have abandoned the aircraft. This option is available to Royal Air Force pilots, who always wear parachutes in aircraft capable of aerobatics. These aircraft are usually fitted with jettisonable canopies. The situation is somewhat different in a civilian environment with a much greater diversity of aircraft and equipment. Some of these aircraft, although cleared for spinning, would be difficult to egress in an emergency. At present, the CAA approach to the use of parachutes in aerobatic aircraft is restricted to a recommendation within Safety Sense Leaflet No. 19. The British Gliding Association are able to take a more positive approach to the subject, as nearly all gliders are configured with jettisonable canopies. It is considered that it would be appropriate for the CAA to review their approach to the use of parachutes in aircraft used in General Aviation, particularly those that may be used for spining training, with the aim of providing more comprehensive and positive advice to pilots.

It is therefore recommended that:

**Safety Recommendation 2003-76**

The Civil Aviation Authority should conduct a review of the present advice regarding the use of parachutes in GA type aircraft, particularly those used for spining training, with the aim of providing more comprehensive and rigorous advice to pilots.

**Conclusion**

The aircraft crashed following an apparent delay in recovery from a planned spinning manoeuvre. No definite reason for this failure to recover in time could be identified. However, it is possible that either a loose article or distraction may have been a contributory factor. Neither pilot was wearing a parachute, which eliminated any option they may have had for abandoning the aircraft.