**ACCIDENT**

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| **Aircraft Type and Registration:** | Rans S6-ES Coyote II, G-CCNB |
| **No & Type of Engines:** | 1 Rotax 582-48 piston engine |
| **Year of Manufacture:** | 2004 |
| **Date & Time (UTC):** | 28 March 2005 at 1530 hrs |
| **Location:** | Weston Park near Shifnal, Shropshire |
| **Type of Flight:** | Private |
| **Persons on Board:** | Crew - 1 Passengers - 1 |
| **Injuries:** | Crew - 1 (Minor) Passengers - 1 (Minor)<br>Public - 1 (Serious) |
| **Nature of Damage:** | Substantial aircraft damage plus minor damage to two vehicles |
| **Commander's Licence:** | Private Pilot's Licence |
| **Commander's Age:** | 44 years |
| **Commander's Flying Experience:** | 109 hours (of which 9 were on type)<br>Last 90 days - 3 hours<br>Last 28 days - 2 hours |
| **Information Source:** | AAIB Field Investigation |

**Synopsis**

During a go-around, the aircraft stalled and crashed into two parked motor caravans, seriously injuring the owner of one of them. Investigations revealed that the pilot, who had qualified and trained on flex-wing aircraft, had not received adequate training to fly a three-axis aircraft, and was not in current flying practice. The approach had been flown towards rising ground and an illusory visual horizon was a contributory factor. The aircraft was overweight at the time of the accident and its elevators were incorrectly rigged. Pilot training requirements did not differentiate between control system types and so safety recommendations were made to address this aspect.

**History of flight**

A 'Festival of Transport', attended by several thousand people, was taking place in the grounds of Weston Park, a country house. The Festival activity included Microlight flying and static displays of aircraft. A landing area, some 680 m by 100 m was in use (see Figure 1).

The pilot flew a flapless approach with the intention of landing in a north-easterly direction. He reported that the approach was normal, but that he saw a flex-wing microlight manoeuvring on the western side of the landing area, and was concerned that it might infringe the landing area. As the approach continued, he saw a three-axis microlight aircraft taxi onto the opposite end

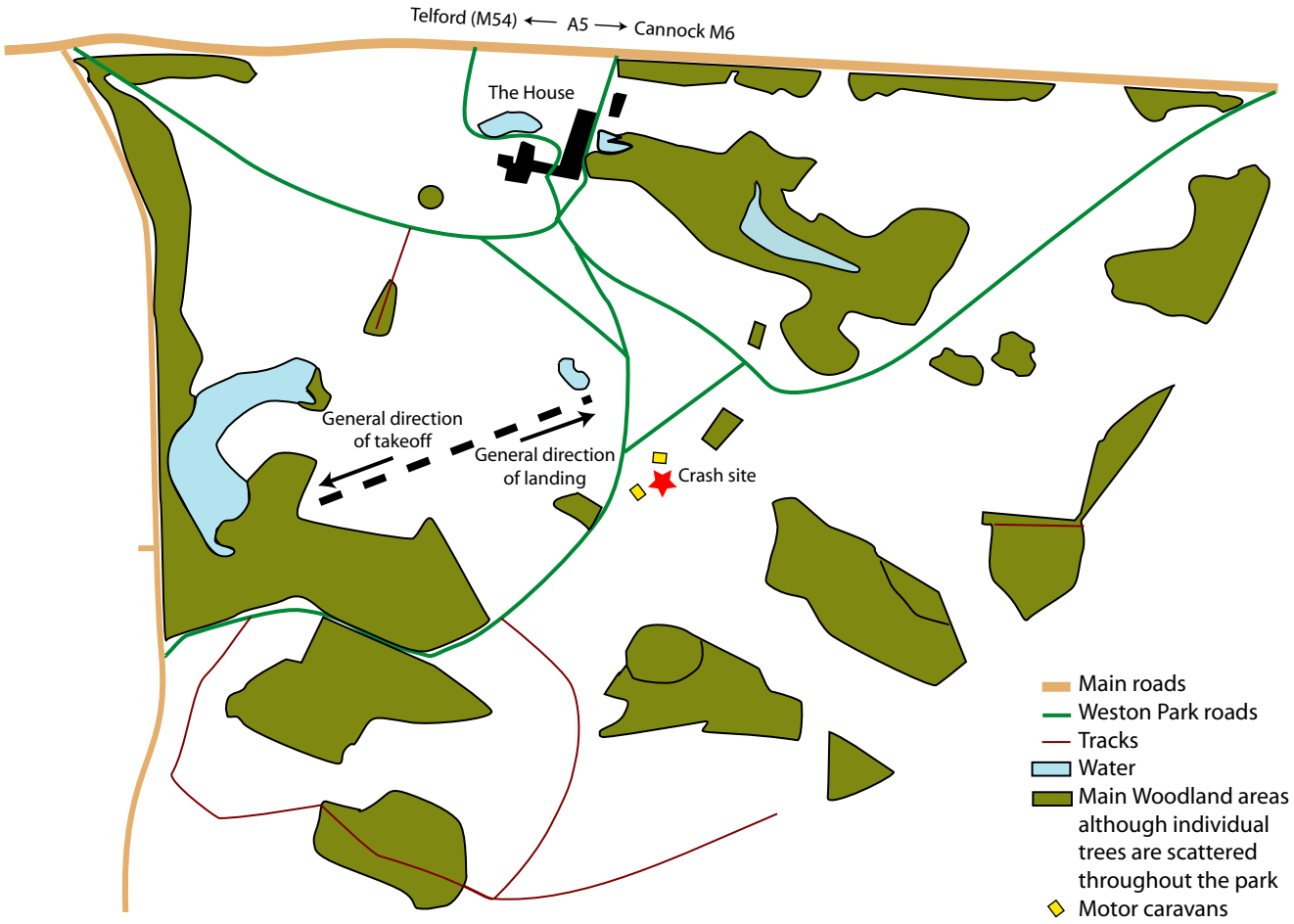


**Figure 1**

Weston Park

of the landing area, and he judged that this aircraft might shortly commence a takeoff. The pilot decided that it was unsafe to continue the approach so he applied full power and pitched the aircraft nose-up to go around. Shortly after he commenced the go-around, the left wing dropped suddenly. The pilot used aileron and rudder to re-establish wings-level flight but very soon afterwards, the right wing dropped, and despite full control inputs to regain normal flight, the aircraft continued to roll to the right and pitch down. The pilot saw a clear area some distance ahead and attempted to raise the aircraft's nose in order to reach it.

The aircraft struck the ground immediately between two motor caravans and hit them both with its wings. An awning was attached to the left side of the motor caravan struck by the left wing and the owner of the motor caravan was sitting immediately adjacent to the awning. After striking the vehicle's front bumper, the aircraft destroyed the awning and struck the owner, causing serious injuries to his head, chest, and ankle. The aircraft sustained substantial damage and came to rest erect, some 30 m beyond the position of its initial simultaneous collision with the ground and the motor caravans, having yawed left through some 200º. The pilot and passenger, who had both been wearing lap straps and diagonal harnesses,

exited the aircraft without difficulty. Fire crews, some of whom had been exhibiting appliances at the Festival, attended the scene and assisted in providing first aid and containing spilt fuel from the aircraft.

**Aircraft information**

The Rans S6-ES Coyote II is a home-built, two-seat, strut braced high-wing monoplane constructed primarily of aluminium and steel tubing covered with sailcloth. The accident pilot purchased the completed aircraft in October 2004. He was not the constructor and the aircraft was first registered in September 2003. The aircraft type has conventional, three-axis flying controls and trailing-edge flaps which have four settings, from fully up, to 43º in the fully down position. The fuel system comprises two 34 litre (9 USG) tanks, one in each wing, with fuel being gravity fed to the engine. The feed pipes from both fuel tanks are joined via a tee-piece, the outlet of which feeds the engine, so that it receives fuel from both tanks. The fuel supply to the engine may be isolated via a shutoff valve located in the cockpit.

The aircraft was equipped with a 65-horsepower, two cylinder, two-stroke engine driving a two-bladed fixed pitch wooden propeller through a reduction gearbox. The flight instrumentation included airspeed, vertical speed and turn/slip indicators, with additional displays for engine parameters, such as engine rpm. Pitot pressure is sensed by a probe mounted in the left wing leading edge, with pressure being transmitted to the airspeed indicator via polyurethane tubing. The tubing should be attached to the probe with a ratchet-type plastic hose-securing clamp. On the ground the probe may be partially retracted manually to reduce the likelihood of it being damaged whilst the aircraft is parked.

**Landing area and accident site**

The landing area was a reasonably smooth grass area clear of trees and other obstructions, within the parkland of the Estate. The area had been used for occasional flying operations for many years. The landing area had a significant slope, with the south-western end some 39 ft lower than the north-eastern end. This slope dictated that landings were commonly conducted in a north-easterly direction, and takeoffs were in a reciprocal direction.

Around the landing area were displays of vintage vehicles, an ‘auto-jumble’, an arena in which various activities took place, and other attractions. Caravans and motor caravans were parked around the site, a number of these being present throughout the weekend of the Festival. Approximately 4,000 people visited the Festival each day.

The accident site shown in Figure 2 was to the east of the north-eastern end of the landing area. From the ground impact marks it was deduced that the aircraft contacted the ground out of control, in a slightly nose-down pitch attitude. It passed between two motor caravans, parked approximately 19 ft apart, colliding with an awning attached to the left vehicle and striking the owner of the vehicle. The nose and left main landing gear were torn off during the ground slide.

The aircraft’s left wing struck and damaged the bumper of the motor caravan on its left. Smear marks of black plastic from the bumper were visible on the leading edge of the left wing and the wing leading edge tube was deformed over a spanwise distance of about 6 ft, approximating to the width of the vehicle. The roof of the right motor caravan exhibited damage consistent with it having been struck by the right wing. From


**Figure 2**

Crash Site

measurements of the impact marks on the vehicles, it was deduced that the aircraft was in a 10º to 15º left wing low orientation when it struck the vehicles.

Evidence was found of propeller rotation and engine power at impact, including propeller strike marks in the soil and corresponding mud spattering on the side of the right motor caravan. Both propeller blades had broken off near their roots and fabric from the awning had become tightly wrapped around the propeller drive shaft. A significant quantity of fuel had leaked onto the ground and in excess of 20 litres of fuel were drained from the aircraft prior to it being recovered.

**Aircraft examination**

The flight controls and engine controls were found to be intact and appeared to operate correctly when checked at the accident site. The flaps were in the fully retracted position, corresponding to the flap selector lever's position.

On further examination, it was established that the elevators had been incorrectly rigged during construction of the aircraft, such that the elevator range of travel was 25º up and 34º down, instead of 30º up and 20º down as specified in the aircraft build instructions. When reviewed, the elevator rigging instructions were found to be ambiguous and open to misinterpretation.

After installing a new propeller, the engine was test run several times using the fuel recovered from the aircraft. It developed significant power and showed no signs of hesitation, even with rapid movements of the throttle control.

The polyurethane pitot pressure sense pipe was found disconnected from the pitot probe and the pipe was kinked at a point 55 mm from the end. Tests showed that a considerable amount of energy was required to produce a kink in the pipe, given its flexibility and even folding the pipe over double on itself did not cause it to kink. It was noted that the pipe had been secured to the probe using wirelocking around the circumference of the pipe, instead of a hose clamp as specified in the aircraft build instructions. Notwithstanding this deviation from the standard, when tested, the wirelocking held the pipe on the pitot probe with a reasonable degree of security. The greater portion of the pitot probe was missing, having broken off in the impact with the bumper of the left-hand vehicle. Calibration checks of the airspeed and vertical speed indicators proved acceptable.

**Types of microlight aircraft**

Microlight aircraft are categorised by their control system, which is either 'flex-wing' or 'three-axis'. Flex-wing aircraft typically have a one-piece wing or 'sail', from which a pod is suspended. The pod accommodates the pilot and, in some cases, passenger. These aircraft are flown by weight-shift, with the pilot applying a force on a control bar to shift the weight of the pod relative to the wing. The pilot has no control of the aircraft in yaw. Three-axis aircraft are flown with a control column, which provides control in pitch and roll, and rudder pedals, providing control in yaw.

The fundamental differences between weight shift and three-axis control systems are the diametrically opposed control movements for pitch and roll and the provision or otherwise of yaw control using pedals.

**The pilot's experience**

The pilot gained a Private Pilot's Licence, endorsed *'(Aeroplane) (Microlight only)'* (PPL(M)), in 2002 after training in flex-wing aircraft. He stated that he undertook five hours conversion training in 2002 with a local flying instructor in order to fly three-axis aircraft. His log book showed 90 minutes of this training in late 2002. The flying instructor who undertook this training recorded 75 minutes of training on a three-axis Spectrum aircraft.

**Pilot training requirements**

A holder of a PPL (M) is entitled to fly any microlight aircraft, regardless of the control system. The current CAA *'Licensing, Administration and Standardisation Operating Requirements and Safety'* (LASORS) document is the official source of pilot licensing information for holders of PPL(M) licences, and it makes no mention of different control systems.

Civil Aviation Publication CAP53 (which was the equivalent document until superseded by LASORS in 2002) stated:

> *'Microlight pilots converting from weight shift to 3-axis control systems, or the reverse, not having gained at least 1 hour PIC gained prior to 1 July 1993 in an aircraft having the appropriate control system, should undertake adequate conversion training and pass the Additional Control System Test (ACST) conducted by an appropriately qualified microlight examiner.'*

The use of the word 'should' in this context indicates that this was a recommendation, not a requirement.

Pilots learning to fly microlight aircraft are no longer able to obtain PPL(M) licences, as the National Private

Pilot's Licence (Microlight) (NPPL(M)) has replaced the PPL(M). The British Microlight Aircraft Association (BMAA) oversees training and testing for the issue of a NPPL(M). The BMAA Instructor and Examiner Guide stated:

> *'Microlight pilots completing a course of NPPL (M) training and subsequently granted a NPPL (M) may only fly aircraft with the same control system (ie weightshift or 3-axis) as used during the course. Appropriate Control System Differences Training with a Flight Instructor must be completed in order to fly a microlight aircraft with the alternate form of control system.*
>
> *'Both the BMAA and the CAA strongly recommend that PPL M and PPL SEP Holders undergo Control System Differences Training as well.'*

**Meteorology**

An aftercast supplied by the Meteorological Office indicated that an area of low pressure to the west of the British Isles was feeding a light, dry, south to south-easterly airflow over the Midlands. The aftercast indicated that there was haze at the accident site, with visibility between 8 and 12 km, a mean sea level pressure of 1012 mb, no cloud below 3,000 ft, and a variable, mainly south-easterly, wind at 3 kt. The temperature was 12°C and the dewpoint 5°C, giving a relative humidity of 62%.

An experienced microlight pilot and instructor who flew into the Festival at about midday and remained until after the accident stated that he assessed the weather conditions during the day using his experience, and the surface wind by observing the windsock. He stated that the wind was light throughout the period, not exceeding 5 kt, and that about the time of the accident the wind was from the north-west.

**Illusory horizon**

The significant slope of the landing area caused the visual horizon to appear above the local horizontal when viewed from the south-western end of the area. This aspect would, for a period, present a false or illusory horizon to a pilot going around from low height in the north-easterly direction because the visible horizon would be above the true horizon. Mature tall trees just beyond the end of the landing area, some 177 ft higher than the lower end of the landing area, could add to the illusion.

Where an illusory horizon is present, the pilot must use skill and judgement to fly the aircraft accurately with reference to the local horizontal ignoring the illusory horizon. If the aircraft is flown by reference to an illusory horizon, the nose will be pitched higher than is desired. Where the angle between the local horizontal and the perceived horizon is more than a few degrees, the pilot may unwittingly pitch the nose up too far, possibly placing the aircraft in a condition approaching the stall.

**Stalling - general principles**

As an aircraft enters a stall, one wing may drop; that is, the aircraft may suddenly roll, without any control input having been made by the pilot. In most cases, the aircraft nose pitches down at the same time. The approach to the stall usually occurs whilst the pilot is applying rearward pressure on the control column, and is typically identified by a high nose attitude and buffeting felt through the airframe and flight controls.

When a wing drops, the pilot may apply rudder and aileron control in an attempt to regain wings-level flight, but this in turn requires more lift from the down-going wing and may cause it to stall more deeply. Typically, this causes the aircraft to roll further in the direction opposite to the control input.

Various factors affect the rapidity of onset of the stall, and the nature of entry into a stall. Generally, stalls at high power have a more rapid onset than stalls at low power.

**Stalling - the accident aircraft**

The Rans S6 Build Manual[1] stated *'Stalls have a warning buffet due to turbulent air from the wing root flowing over the elevator'*.

An experienced Rans pilot had flown the aircraft a shortly before the accident. He commented that the aircraft did not unstick during takeoff as he expected, and when he attempted to stall the aircraft, it did not decelerate as he expected. He reported that he *'could not get the nose into an attitude in which it would stall'* and that the aircraft *'would not stall'*. He did not attempt a stall with full power selected. He explained that other Rans aircraft he had flown stalled easily, with clear pre-stall buffet, and that the stall was often accompanied by a wing-drop.

G-CCNB held a current Permit to Fly, which was valid until 7 June 2005. It had flown less than 35 hours since construction. Before the Permit was issued, the aircraft was test flown by a pilot approved by the Popular Flying Association. The test flight was completed on 28 May 2004. No significant handling issues were noted and stall testing at the maximum gross weight gave a power-off, flaps-up stall speed of 44 mph, with the onset of buffet occurring at 48 mph. A slight right wing-drop was observed at the stall, but this was not considered to be abnormal.

**Footnote**

[1] There was no Operating Manual for the aircraft, but information regarding operation and flying technique was included in the Build Manual.

At the time of the accident, the aircraft's weight was approximately 465 kg whereas the maximum approved gross weight of the aircraft was 450 kg. Post-flight calculations showed that the centre of gravity was in the middle of the allowable range.

**Organisation of the flying activity**

The estate at Weston Park was managed by a Limited Company on behalf of the owners, an Educational Trust. The Festival organisers had a commercial agreement with Limited Company to use the park land. A considerable number of years before, the same Festival organisers had arranged flying displays at the site, with appropriate permissions from the CAA.

The Festival organisers had been approached some years before the accident by a local microlight pilot who had asked whether it would be possible to display some microlight aircraft at the annual Festival. He was permitted to do so along with some of his acquaintances. Over a period of years, this activity had expanded to include flying from the site.

The accident pilot, other pilots who attended the Festival and a manager of the Limited Company all referred to this individual as the organiser of the flying activity. When interviewed, this individual denied that he was an organiser of the flying activity, but stated that he willingly communicated details of the show to local microlight pilots. He spoke to people who attended the show about the flying activity, including providing details of the customary procedures for the flying operations. Prior to the Festival, he had placed a windsock adjacent to the landing area, and had pegged down a wire fence, which crossed the landing area.

A letter sent some weeks before the accident from the Festival organiser to this individual stated, (inter alia):

*'I hope that we can look forward to your company at the forthcoming Midlands Festival of Transport. I am enclosing some passes and posters… everything remains the same, same positions etc; I have told a few people who plan to fly in to contact you nearer the time for final instructions. I'm sure there will be some who just "arrive" as well. Don't forget to invite as many of your acquaintances as possible'.*

**The Rules of the Air and the Air Navigation Order**

Rule 5(1)(d)(i) of the Rules of the Air Regulations 1996 (valid at the time but since amended) stated:

*'an aircraft shall not fly over, or within 1000 metres of, any assembly in the open air of more than 1000 persons assembled for the purpose of witnessing or participating in any organised event, except with the permission in writing of the Authority and in accordance with any conditions therein specified and with the consent in writing of the organisers of the event'.*

In this context *'the Authority'* was the CAA.

Flying displays are formally regulated by the CAA and stringent requirements are in place to ensure public safety at such events. Article 129 of the Air Navigation Order defined a flying display as follows:

*'Flying display' means any flying activity deliberately performed for the purpose of providing an exhibition or entertainment at an advertised event open to the public'.*

Although flying activities were an attraction at the Festival, and publicity material featured an image of a flex-wing microlight, the organisers did not believe that the flying activity constituted a 'flying display'. Moreover, all parties concerned with the organisation of the event confirmed that they had not sought permission from the Authority.

**Previous recommendation**

AAIB Safety Recommendation 98-62, made following a fatal accident to a Kolb Twinstar Mk III Microlight aircraft in July 1998, stated:

*'This accident may have resulted from a loss of control by the pilot. The pilot had no training and limited experience on the type of aircraft control system that he was using. Given the fundamental differences between weight shift and 3-axis control systems, notably the diametrically opposed control movements for pitch and roll, it is recommended that the CAA should consider making the guidance contained in CAP53… a mandatory requirement.'*

Initially the Authority took the view that Alternate Control System training should be made mandatory for pilots of microlight aeroplanes converting from weight shift to 3-axis control or vice-versa but ultimately it did not accept the recommendation. The Authority stated that mandating the guidance contained in CAP 53 was not justified because examination of the pilot's flying experience demonstrated that he was fully competent with the control of the aircraft throughout its flight envelope.

**Analysis**

The flight progressed normally until the approach to the landing area, when the pilot perceived that another aircraft was lining up on the landing area to take off, and decided it was not safe to land. He executed a go-around,

during which one wing, and then the other dropped; the aircraft went out of control and lost height rapidly. The loss of height and the wing drop were entirely consistent with a stall.

The pilot held a valid Private Pilot's Licence, gained following a course of training on flex-wing microlight aircraft. However, he was inexperienced, both in terms of his total flying experience and his experience on three-axis types. He had not undertaken any training on the Rans S6, and the 'three-axis' training he had undertaken with a Flying Instructor had taken place on a different type of three-axis aircraft. Moreover, it took place more than two years before the accident flight. The pilot had flown the accident aircraft for fewer than 9 hours, and had only flown 3 hours in the 90 days preceding the accident. As such, he was neither in current flying practise, nor trained to fly the aircraft.

Flex-wing and three-axis aircraft have very different flying control systems. The control inputs are diametrically opposed in pitch and roll, and a pilot who transitions from flex-wing to three-axis controls must also develop the new skill in controlling an aircraft in yaw. It is possible, therefore, that inappropriate control of the aircraft in yaw may have contributed to the wing drop as the aircraft stalled immediately before the accident.

The position of the false horizon, perceived by the pilot at the time of the go-around, may have caused him to pitch the aircraft higher than normal thus allowing the airspeed to decay to that approaching the stall. This illusion is considered to have contributed to the inappropriate handling of the aircraft during the go-around.

The incorrect rigging of the elevator made the aircraft difficult to stall, and this was reflected in the account of the experienced Rans pilot who flew the aircraft. This 'unwillingness' to stall might have imbued the owner with confidence that the aircraft was docile at low speed, and that it was unlikely to stall.

It is possible that the pitot pressure sense pipe could have become detached from the probe prior to the accident flight. Had this been the case, the pilot would not have had any air speed indication. However, given the kink in the pipe and the obvious severity of the impact of the left wing with the vehicle bumper which damaged the pitot probe, it seems more likely that the pipe became disconnected as a result of the accident.

**Safety Recommendations**

Only by consistently demonstrating the necessary skills can a pilot be assessed as being competent to operate an aircraft. Therefore, it may be argued that both training and testing should be required before microlight pilots are permitted to fly unsupervised in an aircraft with an unfamiliar control system. Consequently, the following Safety Recommendation was made:

**Safety Recommendation 2005-128**

The Civil Aviation Authority should require holders of the Private Pilots Licence (Aeroplane) (Microlights) converting from weight shift to three-axis control systems, or the reverse, to undertake adequate conversion training and pass a Flight Test conducted by an appropriately qualified microlight pilot examiner.

During the course of the investigation, it became apparent that the requirements placed upon the holder of an NPPL(M) are contained only within the BMAA's Instructor and Examiner Guide. This guide is effectively an internal document within the BMAA and has no mandatory effect. Therefore, the following Safety Recommendation was made:

**Safety Recommendation 2005-129**

The Civil Aviation Authority should mandate the arrangements for grant of National Private Pilots Licence (Microlights) qualifications which are presently published in the British Microlight Aircraft Association's Instructor and Examiner Guide and incorporate them into LASORS.

Taking into consideration the BMAA's present requirements regarding Control System Differences Training, together with the remarks about demonstration of skills above, the following Safety Recommendation was made:

**Safety Recommendation 2005-130**

The Civil Aviation Authority should mandate that, where holders of an NPPL(M) are required to undertake Control System Differences Training in accordance with the Air Navigation Order 2005, they should also be required to demonstrate an adequate level of flying skill on an aircraft possessing the previously unfamiliar control system before flying unsupervised in an aircraft with such a control system.

**Advice to show organisers**

Although in this case the serious injuries to the motor caravan owner were caused by the aircraft's crash, light aircraft accidents rarely injure third parties. However, aviation legislation has many purposes including the protection of the public from accidental injury or death as a consequence of flying activities. Given the provisions of the Rules of the Air and the Air Navigation Order, it would have been reasonable to expect the organisers of the Festival to seek advice and perhaps permission from the CAA for the flying activity. Had an application been made for the flying activity to be a 'flying display' (given that the definition of 'flying display' would appear to encompass the flying activity at the Festival), it is possible that efforts to minimise the hazard to the public might have prevented injury to the owner of the motor caravan.