Skyranger 912(1), G-CBWL

AAIB Bulletin No: 11/2004	Ref: EW/C2003/07/01	Category: 1.4
Aircraft Type and Registration:	Skyranger 912(1), G-CBWL	
No & Type of Engines:	Rotax 912 - UL DCDI piston engine	
Year of Manufacture:	2002	
Date & Time (UTC):	8 July 2003 at 1140 hrs	
Location:	Barton Airfield, Manchester	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Serious)	Passengers - N/A
Nature of Damage:	Left wing damaged. Forward fuselage disrupted. Engine shock loaded	
Commander's Licence:	Private Pilot's Licence (Aeroplanes) (Microlight only)	
Commander's Age:	60 years	
Commander's Flying Experience:	75 hours (of which 15 were on type)	
	Last 90 days - 11 hours	
	Last 28 days - 4 hours	
Information Source:	AAIB Field Investigation	

Synopsis

Just after takeoff, at an estimated height of 40 feet, the aircraft was seen to roll to the left. The bank continued to increase to the point where the nose dropped and the aircraft descended and struck the ground in a steeply banked, nose down attitude. The aircraft came rapidly to a halt with the pilot trapped in the wreckage having suffered serious injuries. An engineering investigation revealed that the aileron cables had been rigged in the reverse sense to normal.

History of the flight

The pilot commenced microlight flying training in 2001 and, on completion of his PPL, he purchased the accident aircraft, a microlight with 3-axis control, in kit form. He constructed the aircraft in about five months and, in February 2003, it was issued with a Permit to Fly. Once the aircraft had been completed it was kept in a trailer at the pilot's home and it was normal practice to rig the aircraft on arrival at the departure airfield. In general terms, the rigging process consisted of attaching each wing to the fuselage, fitting the wing struts and connecting the flight controls. The pilot did not use a checklist for the process but he had developed a logical procedure that he used each time he rigged the aircraft.

On the day of the accident, the pilot and a neighbour had agreed to go for a local sightseeing flight from Barton Airfield. The neighbour had flown with the pilot twice previously and was sufficiently familiar with the rigging process to provide the pilot with assistance. On arrival at Barton Airfield, the pilot and his neighbour unloaded the aircraft from the trailer and set about the rigging process which normally took about 45 minutes. The rigging was proceeding normally but, as the pilot was connecting the flight controls, he was interrupted and had to return to the task after a few minutes delay. Subsequently, he had some difficulty in making the flight control connections and had to disconnect, reconnect and wire lock a turnbuckle.

On completion of the rigging it was the pilot's normal practice to carry out a walk around inspection and to check the flight controls from the cockpit. On this occasion, just as he was entering the cockpit, having completed the walk around, he was interrupted for a second time and could not recall carrying out the planned check from the cockpit.

The pilot had adjusted the engine's slow running since his previous flight and he therefore decided to check the engine on a short solo flight before departing on the sightseeing flight with his neighbour. At about 1135 hrs the aircraft taxied for Runway 27 and, at the holding point the pilot carried out the pre-takeoff vital actions which included a check of the flight controls. He recalled checking visually that the controls moved in response to his control inputs, but he did not check that the ailerons moved in the correct sense.[1]

As the aircraft lined up for takeoff ATC gave the surface wind as 280°/13 kt. The first part of the takeoff proceeded uneventfully but, just after becoming airborne, the pilot applied a small amount of right rudder to establish a ground track along the runway centreline. Shortly thereafter he recalled making a correction for a slight bank with the ailerons but instead of reducing, the bank increased. Witnesses on the ground recalled seeing a slight left bank develop which smoothly and rapidly increased until the nose dropped and the aircraft descended and struck the ground. The aircraft came to a halt quickly and the pilot was trapped in the wreckage having suffered severe injuries.

Aircraft description

The Skyranger aircraft is a two seat high winged three-axis microlight aeroplane, powered by a four cylinder four-stroke liquid/air cooled engine driving a three bladed tractor propeller, Figure 1. It was designed in France, manufactured in the Ukraine and certified in the United Kingdom to the requirements of British Civil Airworthiness Requirements (BCAR) Section S, Issue 2. To date, some 500 kits have been manufactured with more than 100 going to the UK market. The aircraft is predominately constructed of pin-jointed straight aluminium tubes covered with a pre-sewn polyester fabric skin. Conventional flying control surfaces are connected by cables to a single central control stick and dual rudder pedals and a two stage flap system is operated via aluminium rods from a lever mounted between the two seats. The fixed tricycle landing gear has nose wheel steering, operated by movement of the rudder pedals, and the main wheels are fitted with hand operated hydraulic disc brakes.

Figure 1 Skyranger Aircraft

[1] The recommended pre-take-off checklist published for the Skyranger, section 4.4 of the Operators Manual, includes the following, which is reportedly typical of the checklist contents for microlight aircraft that are routinely rigged and de-rigged.

C – Controls

Check controls for full and free movement. (Note, a kneeboard worn on the pilot's right leg may give control restrictions)

Check visually that the controls are moving in the correct sense.

Skyranger aircraft

The aeroplane is designed in a way that allows for easy dismantling, for stowage in a small area or trailer, and easy re-assembly, prior to flight.

Accident site and impact parameters

The accident site was approximately 140 metres to the south of Runway 27, on the eastern edge of Runway 20, on an open, flat and unobstructed grass area of the airfield.

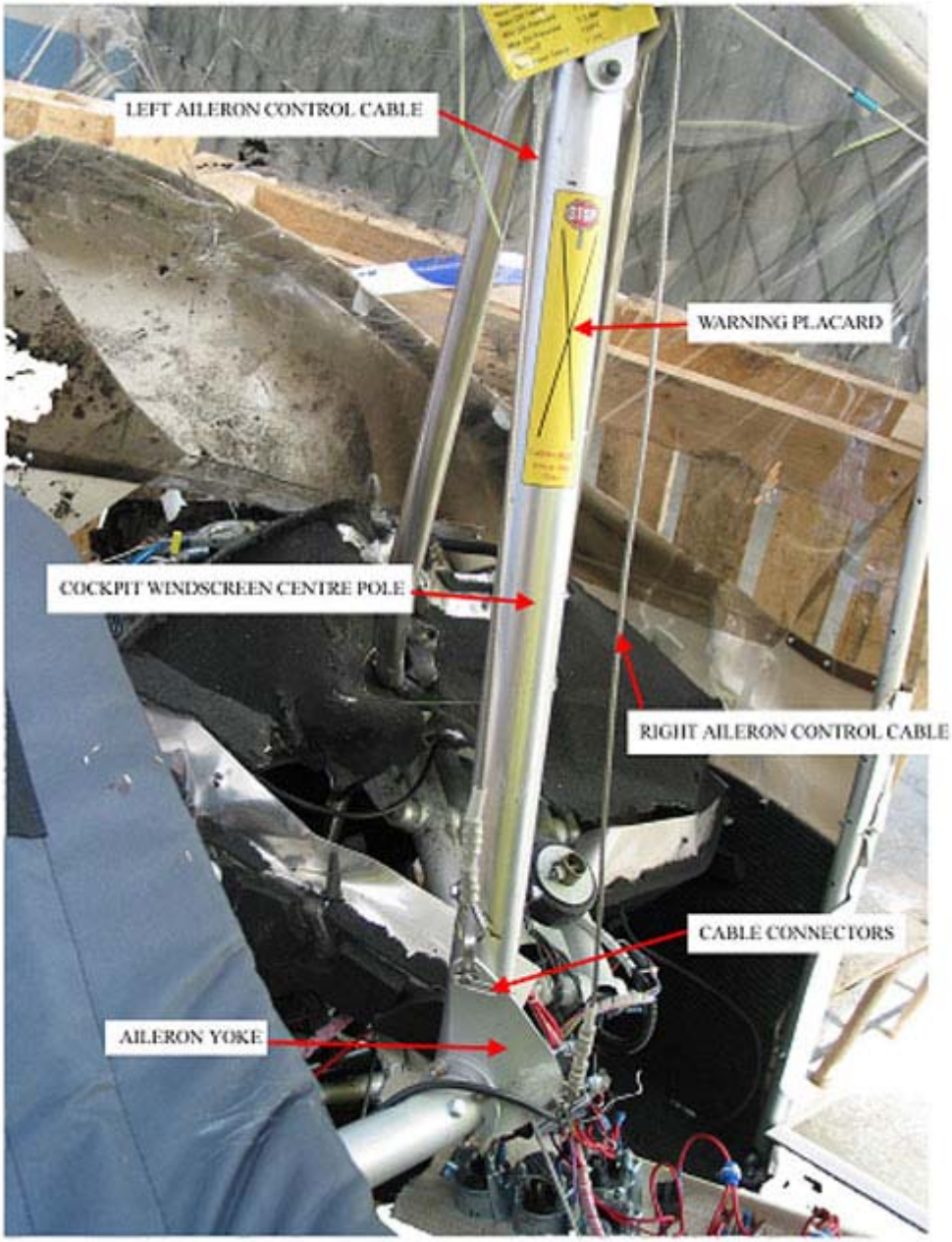
Examination of the wreckage and the accident site showed that the aircraft impacted the ground on a heading of about 140°M and banked to the left by approximately 70°, whilst turning to the left and with the nose pitched down approximately 40°. The main force of the impact was taken by the majority of the left wing, the nose landing gear and the forward lower fuselage. Evidence of damage from the propeller indicated that it was being driven at low power by the engine at the moment of impact.

Wreckage examination

Examination of the microlight's wreckage found no evidence of pre-impact damage or failure that could have contributed to the accident. However, during the examination it was found that the aileron control cables had been incorrectly connected to the aileron yoke on the control stick, Figure 2.

Figure 2 Photograph showing incorrect connection of aileron cables to the yoke

Figure 2



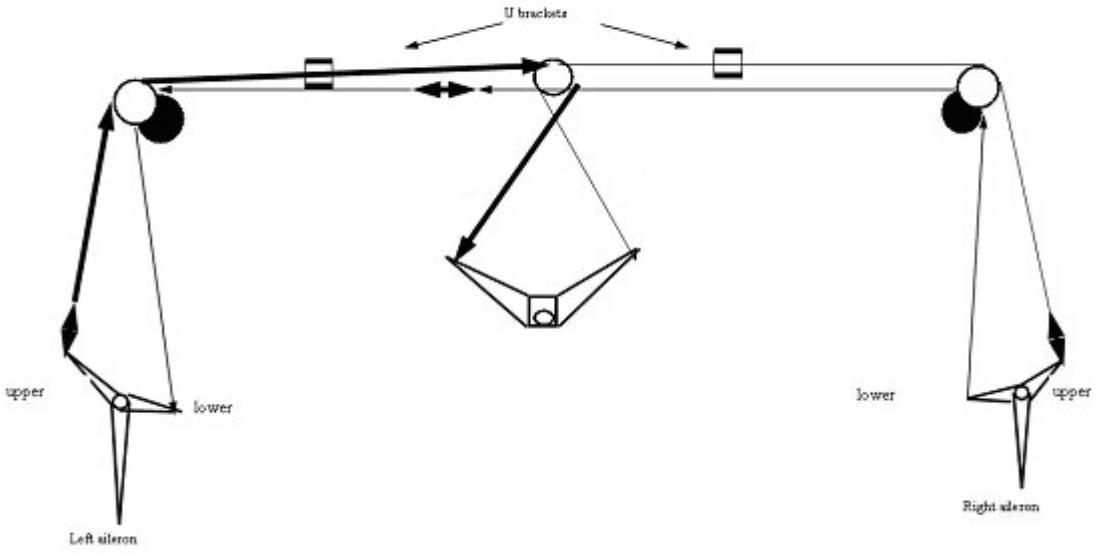
Aileron control cables cross connected to the aileron yoke on the accident aircraft

When the aileron cables are correctly fitted they cross over each other so that the left aileron cable is connected to the right-hand side of the aileron yoke and the right cable to the left-hand side of the aileron yoke, Figure 3. This area is hidden from view by the instrument panel.

Figure 3 Diagram of aileron control system cable

Figure 3

Diagram of aileron control system cable routing indicating cable crossover between aileron yoke and pulleys at top of cockpit windscreen centre pole



(Diagram courtsey of the UK Agent)

It was noted that the connections at the ends of the two aileron cables were physically identical and that there were no identification markings or colour coding on the cables or on the aileron yoke. However, a large placard was present, attached to the cockpit windscreen centre pole, which displayed a warning regarding the correct fitting of the aileron cables, Figure 2. It was also noted that all the flight control cable connectors in the aircraft were identical to those fitted to the aileron cables and that none of them displayed any markings or colour coding intended to minimise the possibility of incorrect connection. The aileron connections are comprised of a shackle, looped through the eye formed at the end of the control cable, which connects to the aileron yoke via a clevis pin. This is retained by a safety pin.

British Civil Airworthiness Requirements (BCAR), Section S

BCAR Section S, paragraph 685 (d) states:

> *'Each element of the flight control system must have design features, or must be distinctively and permanently marked, to minimise the possibility of incorrect assembly that could result in malfunctioning of the control system.'*

This statement is reproduced in the Joint Aviation Requirements for Very Light Aeroplanes (JAR-VLA) paragraph 685 (d).

Examination of other microlight aircraft types

During the course of this investigation a number of other microlight types that had been certified to BCAR's Section S were examined, with particular reference to their flying control systems. It was found that where markings had been applied to the flying control wires, they took the form of colour coding. In all cases where such coding had been applied it was found to be very small in size, over time had become faded and dirty, making it extremely difficult to distinguish and, in some cases, had come away altogether. It was also noted that in most cases, the flying control cable connectors were of an identical type which could make accidental cross connection possible.

It was noted that some Skyranger aircraft owners had installed a hinged panel in the horizontal top surface of the instrument panel to facilitate easier access to the control stick aileron yoke when connecting the aileron control cables.

National Private Pilot's Licence (NPPL) colour perception requirements

With the introduction of the NPPL in the UK a significant number of microlight pilots are now flying with this Licence and it is likely that this number will increase. Part of the appeal of the NPPL is the more relaxed medical standard required to obtain and maintain this Licence, compared with the JAA Class 2 Medical standard. The eyesight colour perception (colour blindness) requirements of the NPPL are those defined by the Driving and Vehicle Licensing Authority's (DVLA) medical requirements for Group 1 and 2 drivers. There are no minimum colour perception standards stated within these DVLA requirements which, in practice, means that pilots with defective colour perception are able to obtain and maintain an NPPL medical certificate.

Safety actions taken

The UK agent for the Skyranger identified early on in its introduction in to the UK that there was a possibility that the aileron control cables could be cross connected during the aircraft's assembly. As a result, and in consultation with the aircraft's manufacturer and the British Microlight Aircraft Association (BMAA), the agent designed and produced the warning placard shown in Figure 2. Following this accident, the UK agent, again in consultation with the aircraft manufacturer and the BMAA, designed and produced a modification to the aileron control cable end fittings that mechanically prevents inadvertent cross connection of the cables to the aileron yoke on the control stick. This modification is supplied with new aircraft kits, and is available as an optional modification for existing aircraft.

Safety Recommendations

The BMAA advise that 'normal' practice in the operation of microlights is that the person carrying out the rigging, usually the owner or the pilot, would make an initial check of the aircraft and this should include the correct operation of the flying controls. Following this, a second check should be conducted by either another qualified pilot or by a BMAA inspector. This procedure is similar to that used with PFA Permit-to-Fly aircraft. In the case of an aircraft designed to be rigged and de-rigged on a regular basis, the connection of the flight controls is either automatic, as is the case with many sailplanes, or is designed to be easily accomplished in a foolproof manner, usually by the pilot.

Prior to the accident flight, the pilot became distracted during the rigging process and failed to notice the error in the aileron control cables connections, despite experiencing difficulty in actually making the connection. Also, although during the pre-takeoff control checks, he checked that the ailerons moved in response to control inputs, he did not check that the ailerons moved in the correct sense, and thus missed a final opportunity to avoid the accident. Despite the recent modifications introduced on new build Skyrangers to prevent cross connection, it is apparent that the same problem could occur on other de-riggable types of microlight aircraft, particularly where a colour coding method is solely used to comply with BCAR Section S in order to minimise the possibility of cross connection of flight controls. The following Safety Recommendations are therefore made.

Safety Recommendation 2004-48

It is recommended that the PFA and the BMAA ensure that as aircraft, which are certificated to the requirements of BCAR Section S, continue in service, no degradation of any distinctive markings applied to flight control systems connections intended to minimise the possibility of cross connection of flight controls during the aircraft rigging process, occurs.

Safety Recommendation 2004-49

It is recommended that the Civil Aviation Authority, in conjunction with the to British Civil Airworthiness Requirements (BCAR) Section S steering group, amend the requirements so that all elements of the flight control systems of new aircraft types certified to BCAR Section S rely solely upon design features in order to prevent flying control cables or rods being cross connected during the aircraft rigging process.