No: 11/90 **Ref: EW/C1173** **Category: 1c**

Aircraft Type and Registration:	Rans Coyote S5, G-MWEJ	
No & Type of Engines:	1 Rotax 447 piston engine	
Year of Manufacture:	1990	
Date and Time (UTC):	25 July 1990 at 1922 hrs	
Location:	Near Garstang, Lancashire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - Fatal	Passengers - N/A
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	38 years	
Commander's Total Flying Experience:	In excess of 900 hours (of which 6 hours were on type)	
Information Source:	AAIB Field Investigation	

History of the flight

The Rans Coyote is an American designed aircraft which is approved for operations in the United Kingdom by the Popular Flying Association (PFA). G-MWEJ was purchased in kit form from the UK distributor by the deceased pilot and a colleague. Construction commenced in October 1989 and was completed in March 1990. Following inspection by a PFA inspector a Certificate of Fitness for Flight, valid for one month, was granted by the PFA for flight test purposes. The first test flight took place on 7 April 1990 and following successful completion of the flight test programme a Permit to Fly was applied for.

On 21 July 1990 the co-owner flew the aircraft to a local beach with the intention of practicing steep approaches and spot landings. This exercise was observed from the ground by the pilot and a friend who had taken part in the flight test programme. During this exercise the co-owner noted that she was unable to flare the aircraft properly for landing because of a restriction to the aft movement of the control column. She landed on the beach and the aircraft was then flown by the pilot who had flown the aircraft during the test programme. He confirmed the reported problem and on inspection noted that when the control column was moved slowly, the symptoms noted in the air could be reproduced on the ground. Rapid movement of the control column however did not result in a restriction. It was

also noted that towards the forward end of its travel, movement of the control column resulted in downward bending of the elevator push-pull rod, causing it to jam in the bearing which supported the push-pull rod in its outer tube. The aircraft was subsequently flown back to its base without incident. The aircraft was not flown again until the accident flight.

On 25 July 1990 the pilot, who was very experienced on microlight aircraft, arrived at the flying site where G-MWEJ was kept, at about 1900 hrs. On arrival he asked two other pilots if they had any ½ in. inside diameter steel tube, about 12 inches long. He told one of the pilots that he was not happy with the way that the aircraft was flaring and reportedly stated: 'I want to put it back the way it was'. The tube that he was trying to obtain matched the specification of that used in the unauthorised link in the elevator control system. However, neither pilot had any tube and the (now deceased) pilot was then seen to go to G-MWEJ and spend some time working in the area of the control column.

G-MWEJ was subsequently seen to take-off in a northerly direction at about 1920 hrs. The weather was fine with a light wind. A witness observed that the take-off appeared to use an excessive amount of runway. Once airborne, the aircraft was seen to climb at a lower rate than normal and then to commence a slow turn onto an easterly heading, climbing to about 200 feet. During this period the engine sounded normal. The aircraft was next seen at 1922 hrs by several eye-witnesses, some 2 miles to the east at about 200 feet and flying steadily in an easterly direction. The balance of evidence suggested that G-MWEJ had been flying at reduced power before it suddenly pitched nose-down into a vertical dive and impacted on a golf course. There was no fire but the pilot was killed instantly by the impact.

Examination of the wreckage showed that the aircraft had struck the ground in a vertical attitude with a significant amount of negative 'G' force imposed on the structure. The pitch control mechanism had broken in the impact while the stick was in the fully forward position. There was evidence that the aluminium push-pull rod (see the attached diagram) had failed in bending before impact, presumably due to pilot-induced forces. The steel connecting link was found to be 8 inches long (between centres). The correct dimension for this link was 9 1/4 inches. There was also evidence that the PVC bushes in which the push-pull rod ran had been lubricated with mineral oil, and that the rod had been tight within the forward bearing.

The co-owner of the aircraft stated that during construction the control column was found to be well forward of the neutral position, when the elevator was neutral, but that this problem was cured before inspection by the nominated PFA inspector. She also stated that she was unaware of any modification to the flying control system subsequent to inspection by the PFA inspector. The PFA inspector however, stated that at the time of his inspection prior to the first flight, the elevator control system was to the approved design.

The effect of shortening the connecting link to 8 inches was investigated. The link normally makes a 30° (approx) angle with the push-pull rod, resulting in half of the forces in the system acting at 90° to the desired direction of motion. By shortening the link, this angle was increased so raising these

adverse forces by about 25% and decreasing the desired, 'end-to-end', forces by about 10%. In a trial carried out by the UK agent for Rans, a system fitted with an 8 inch link suffered permanant deformation of the push-pull rod with an applied stick force of 70 lb. The Joint Aviation Requirements Very Light Aeroplanes (JAR-VLA) schedule calls for a stick force of about 100 lb without failure. This is a similar requirement to that contained in BCAR section S. The aircraft was cleared by the PFA using the VLA schedule as a basis, but this apparently did not mean that it necessarily had to meet the schedule in every respect.

Several S4 and S5 aircraft have been examined in the course of this investigation and as a result the AAIB have informed the CAA and the PFA that the original unmodified design of the pitch control system appears inadequate. In particular, the system is subject to large deflections if the loads within it increase for any reason, and it is considered that these distortions can lead to jamming.

From the trial carried out by the agent it appears that the system can jam if slight distortion is introduced into the aluminium push-pull rod. During the investigation it has been suggested that this distortion could have occurred while the aircraft was being boarded at some time as it is necessary to move the column forward and it is possible to place weight on the mechanism. The push-pull tube is at its most vulnerable with the column fully forward. The PFA have required a modification which relieves the push-pull rod of any adverse loads which might be generated as a result of either slight distortion or of friction in the system. This modification has been agreed by the manufacturer and introduced on aircraft in the USA, as well as to UK aircraft.

RANS COYOTE pitch control mechanism.

Shown with control column fully forward, with maximum overhang of the push-pull rod.

Not to Scale.