

AAIB Bulletin No: 10/94

Ref: EW/G94/05/23

Category: 1.3

Aircraft Type and Registration: Pierre Robin HR100/210 Safari II, G-BDMB

No & Type of Engines: 1 Continental IO-360-H piston engine

Year of Manufacture: 1976

Date & Time (UTC): 27 May 1994 at 1740 hrs

Location: Exeter Airport, Devon

Type of Flight: Private

Persons on Board: Crew - 1 Passengers - 1

Injuries: Crew - Minor Passengers - Minor

Nature of Damage: Damaged beyond economic repair

Commander's Licence: Private Pilot's Licence with IMC and Night Rating

Commander's Age: 64 years

Commander's Flying Experience: 960 hours (664 of which were on type)
Last 90 days - 17 hours
Last 28 days - 14 hours

Information Source: Aircraft Accident Report Form submitted by the pilot

The aircraft was en route from Swindon to Exeter. The pilot made his initial contact with Exeter ATC as he passed Merryfield at an altitude of 2,500 feet. He was instructed to report 'airfield in sight' and remain clear Runway 26 extended centreline due to an inbound Shorts 360 aircraft that was about to commence an ILS approach. The pilot descended to 2,000 feet (QFE) and arranged his flight so as to position wide at the start of the downwind right-hand leg for Runway 26 and remained clear, north of the airfield. As he reached abeam the 26 threshold he reported visual with the other traffic and was 'cleared to join right base for Runway 26 number two to the 360, and report finals'. The aircraft was approximately north abeam the threshold as the 360 landed and the pilot reported finals at 1.25 to 1.5 nm as the 360 cleared the runway after its landing run.

The weather at the time was fine with a visibility of 25 km scattered cloud at 3,500 feet, broken cloud at 4,800 feet, temperature of +10°C and a surface wind of 170°/02 kt.

The approach was flown at an IAS of 80 kt with full flap selected. On short finals the aircraft experienced an increase in descent rate but this was countered by an application of power to maintain

80 kt and the correct approach path. Moments later at an approximate height of 100 to 150 feet agl the pilot reported that the aircraft wings rocked followed immediately by the right wing dropping and the nose going down. The aircraft did not respond to any control inputs, descended rapidly and hit a substantial hedge with the right wing. The impact forced the aircraft into a wings level attitude as it slid approximately 40 metres and came to rest with the nose in the airfield perimeter fence. The pilot and passenger who were wearing full harnesses vacated the wreckage through the normal exit sustaining only minor injuries.

The pilot assessed the cause of the accident as being due to wake turbulence even though the estimated separation between aircraft was 3.25 nm and 2 minutes 30 seconds. He also commented that he and the passenger were saved from more serious injury by the wearing of a full harness and the fact that the right wing and hedge absorbed a considerable amount of impact energy. Inspection of the aircraft controls did not reveal any malfunction.

The CAA issued, on 16 December 1993, a UK Aeronautical Information Circular (AIC 178/1993 (pink 95)) detailing the dangers associated with turbulence caused by aircraft wake vortices. The circular re-states the aircraft weight categories and separation standards which came into effect on 4 January 1982. It also gives the general warning on wake vortex characteristics and illustrates a number of suggested wake vortex avoidance techniques, together with details of the research programme being conducted into wake turbulence problems. Relevant extracts are reproduced below:

The UK conforms to the ICAO requirements for Wake Vortex Weight and Separation Criteria but with certain modifications to the weight and spacing relationship which experience has shown to be advisable for the safety of operations at UK aerodromes. The following table indicates the weight parameters:

Category	ICAO and Flight Plan	UK
Heavy (H)	136,000 kg or greater	136,000 or greater
Medium (M)	Less than 136,000 kg and more than 7,000 kg	Less than 136,000 kg and more than 40,000 kg
Small (S) (UK only)	-----	40,000 kg or less and more than 17,000 kg
Light (L)	7,000 kg or less	17,000 kg or less

(Note: A Shorts 360 aircraft (MTWA 12,300 kg) would be classed as Medium (M) under the ICAO classification and Light (L) in the UK. A Robin HR100/210 is classified as Light (L))

For the purposes of separation in the approach and departure phases within the UK and regardless of the weight category as entered on the flight plan, aircraft 40,000 kg or less and more than 17,000 kg will be treated as Small (S) and aircraft of 17,000 kg or less MTWA will be treated as Light (L)

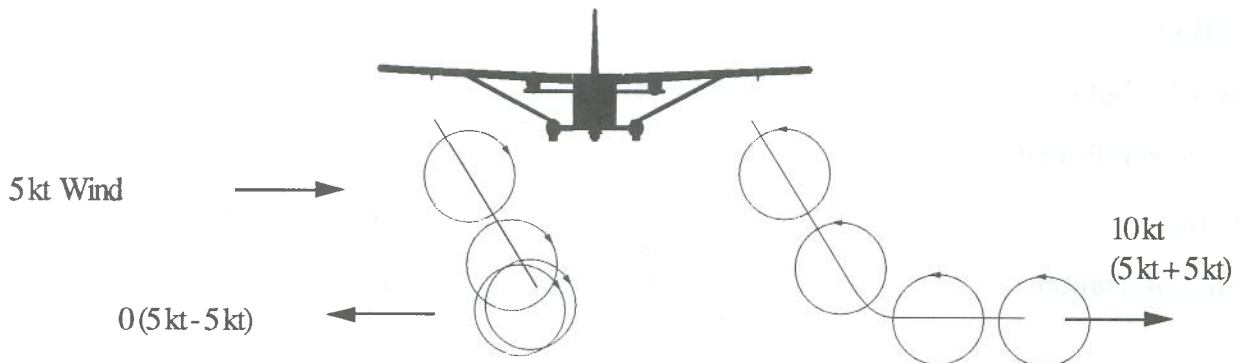
The following table details the Wake Turbulence Spacing Minima for the Final Approach Phase:

Leading Aircraft	Following Aircraft	Separation Minima Distance and Time Equivalent			
		ICAO		UK	
		nm	min	nm	min
Heavy	Heavy	4	----	4	2
Heavy	Medium	5	2	5	3
Heavy	Small	NA	NA	6	3
Heavy	Light	6	3	8	4
Medium	Heavy	3	----	*	*
Medium	Medium	3	----	3	2
Medium	Small	NA	NA	4	2
Medium	Light	5	3	6	3
Small	Heavy	NA	NA	*	*
Small	Medium	NA	NA	3	2
Small	Small	NA	NA	3	2
Small	Light	NA	NA	4	2
Light	Heavy	3	----	*	*
Light	Medium	3	----	*	*
Light	Small	NA	NA	*	*
Light	Light	3	----	*	*
These minima to be applied when an aircraft is operating directly behind another aircraft and when crossing behind at the same altitude or less than 1,000 ft below.					
* Separation for wake vortex reasons alone is not necessary					

It must be emphasised that the separation minima stated in the circular cannot entirely remove the possibility of a wake turbulence encounter. The objectives of the minima are to reduce the possibility of a vortex wake encounter to an acceptably low level, and to minimise the magnitude of the upset when an encounter does occur.

Care should always be taken when following any substantially heavier aircraft, especially in conditions of light winds. The majority of serious incidents, close to the ground, occur when winds are light.

Vortices will move outwards at the rate of 5 kt in still air. The diagram below shows vortex movement near the ground in a light crosswind, viewed from behind the generating aircraft.



During the investigation into this accident the AAIB asked the CAA (NATS) to comment on the differences between the ICAO and CAA requirements for aircraft separation for wake turbulence avoidance. CAA (NATS) explained that the decision to deviate from the ICAO guidelines (which were only an estimate) and change the boundary of the LIGHT group was taken because of a disproportionate number of wake vortex encounters, including one of particular severity, to executive jets which have a MTOW of around 11,000 kg. The intention of the change was to provide these types of aircraft with increased spacing when following larger aircraft. At the time of the change there were no incidents in the CAA Wake Vortex database when a LIGHT aircraft was following another LIGHT. Furthermore, since that time there has been only one incident where a helicopter was positioned too close to another light aircraft. Regarding the separation between aircraft in the LIGHT group, ICAO do not recommend any wake vortex spacing (other than a minimum of 3 nm radar separation) between these aircraft, a policy which is followed in the UK.

CAA (NATS) stress the point made in the AIC 178/1993 para 2.12.1 which points out that the separations do not and have never claimed to have removed all chances of Wake Vortex encounter. The separations are an attempt to mitigate the dangers by allowing sufficient time for the Vortex to collapse or move away from the runway.