

Druine D.31 Turbulent, G-BIVZ

AAIB Bulletin No: 2/99 Ref: EW/C98/8/2 Category: 1.3

Aircraft Type and Registration: Druine D.31 Turbulent, G-BIVZ

No & Type of Engines: 1 Ardem 4CO2 Mk 4 piston engine

Year of Manufacture: 1992

Date & Time (UTC): 9 August 1998 at 1435 hrs

Location: Swanton Morley Airfield, Norfolk

Type of Flight: Private (Display)

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 with display authorisation

Commander's Age: 40 years

Commander's Flying Experience: 784 hours (of which 219 were on type)

Last 90 days - 43 hours

Last 28 days - 25 hours

Information Source: AAIB Field Investigation

History of the flight

Background

The pilot had been involved in formation display flying for a least four years before the accident. He had flown nine display flights in Turbulent aircraft in 1998 with four of these flights on the

weekend before the accident. In all the displays he had flown in the No 3 position on the left wing of the leader in a 'Box 4' formation.

At 0930 hrs, on the day of the accident, the pilots assembled at their home base of Headcorn airfield in Kent to prepare for their planned display at Swanton Morley, Norfolk. They were joined by the pilot of a Stampe aircraft who was to perform a solo aerobatic display at the same location. They prepared their aircraft and departed from Headcorn 35 minutes later for an uneventful flight to Norfolk. As they proceeded north, in a loose box formation, the weather improved from low stratus to give unlimited visibility and warm temperatures. Witnesses at the airfield described the weather as clear blue sky with good visibility and a moderate north north-easterly wind. The formation arrived at Swanton Morley at 1155 hrs.

On arrival the pilots met their ground crew and attended a display briefing given by the display director. Timings for the display were discussed and agreed. The 'Turbulent' team were given two display slots, one at 1330 hrs for 10 minutes followed by a further display at 1430 hrs for 15 minutes.

The display

Following a successful display at 1330 hrs the team were given a second briefing by the team leader again 'walked through' their routine. This second routine involved a formation take off, various formation changes, followed by a 'Prince of Wales' break leading into four opposition fly pasts flown by the two 'wing men' (No 2 and No 3). These opposition manoeuvres involved the aircraft passing, at approximately 3 to 5 feet agl, under bunting suspended between two poles. Whilst the wing men performed their opposition runs the other two aircraft (No 1 and No 4) were to perform a tail-chase overhead. The team were then to form into a line astern formation and carry out balloon bursting fly pasts. After four runs the team were to rejoin and carry out another 'Prince of Wales' break, fly past waving to the crowd, and land. The balloon bursting phase of the display was later replaced with the Stampe aircraft joining the final formation for the 'break' and landing. The team had flown this formation on a number of occasions and had included it in their display the previous weekend.

The accident

The formation took off as planned at 1430 hrs entering the display with general formation flying consisting of a box four, line astern and back to box four for the 'Prince of Wales' break. The display proceeded as planned with the Stampe taking off under the display ready to join up during the tail-chase. When the 'Prince of Wales' break was complete, the leader and No 4 started their

tail-chase together with the Stampe. The other two aeroplanes (No 2 and No 3) were seen by the leader, during his tail-chase, to pass under the bunting at least once. He then saw two or three airfield fire appliances racing across the grass towards the eastern end of the airfield. There were many eye witnesses to the accident. Those with an uninterrupted view all saw G-BIVZ pass close to the poles and the bunting stretched between them at a height estimated to be about 20 feet agl. It then dipped its right wing, on passing the poles, before flying towards the eastern end of the airfield. At that point the aircraft turned to the left initially, banked at approximately 45°, before reversing its turn and pulling up into a steep climbing turn to the right. It pulled up to approximately 100 to 150 feet and into a steep 'wing-over' to the right. Nearing the vertical its forward momentum diminished, the nose dropped through the horizon and the right wing 'tucked under'. The aircraft then accelerated before impacting with the ground in a nose down attitude. Several witnesses described the aircraft as 'stalling' before entering the near vertical descent into the ground.

The formation had been flying 'non-radio', hence the leader had not heard anything over the RT and so looked across to see where the appliances were going. He saw that the bunting support poles, which had been held by the ground crew, were on the ground and initially thought that one of the aircraft had hit the poles. He then looked further to the east and saw the No 3 aircraft, G-BIVZ, inverted on the edge of the airfield.

One witness described seeing a 4 to 5 second burst of white smoke emanating from the engine as the aircraft reached the near vertical. He went on to state that within 2 to 3 seconds of this happening the engine gave a short spluttering sound, a further small cloud of white smoke was then seen, as the aircraft pitched nose down the engine noise stopped. Other witnesses, who remembered hearing the engine, described it as performing normally. The presence of white smoke emanating from the nose of the aircraft is common to this engine type when abrupt manoeuvres are carried out due to oil entering the engine breather system. This can be reduced by the fitting of a baffle plate in the engine but this modification was not fitted on this aircraft.

Some witnesses described seeing a small white coloured object floating from the sky in the vicinity of the aircraft. One witness described it as 'white in colour - something like a floor tile'. The aircraft was light blue in colour and examination of the wreckage showed that nothing had detached from it prior to impact. An extensive search of the area revealed that there were numerous discarded expanded polystyrene meal cartons on the ground which could have been lifted into the air by the moderate wind present at the time.

Post accident

The leader landed immediately, vacated his aircraft, and ran to meet the display director who had witnessed the accident. The other aircraft followed the leader in to land, thinking that he had an

engine problem for they were unaware that there had been an accident. The pilot of the No 2 aircraft, who had also seen the accident landed as close as he could to the accident scene in an attempt to render assistance. The emergency services were on scene almost immediately, but the pilot had suffered fatal injuries in the impact. Post mortem examination of the pilot did not reveal any condition which may have caused or contributed to the accident.

Pilots notes

Handling notes for the Turbulent aircraft, issued by the Tiger club, include the following section on stalling.

'In level flight, with a full load and with power off the aircraft will stall at 33 kt. The stall is gentle but there is no warning. One wing may eventually drop if the aircraft is held in the stall, but owing to the fixed slots on the outer leading edges of the wings, ailerons remain fully effective after the stall. Recovery is immediate as soon as back pressure is relaxed and full power applied.

Great caution is necessary in steep and maximum rate turns as the speed drops off very quickly and induces a stall without warning.'

Engineering examination

The accident site was in a fenced off area of young trees, approximately 40 cm tall, which was inside the north eastern boundary of the airfield. The initial ground impact was by the aircraft's right wing tip whilst it was in a steep bank to the right and descending. Following this initial impact the aircraft rotated about its vertical axis, as if attempting to cartwheel, and came to an abrupt halt when the left wing struck the ground.

Examination of the ground impact marks indicated that the aircraft was on a heading of 160°, pitched nose down by about 20° and banked to the right by about 60°. It had a high rate of descent and was travelling at approximately 50 mph. Evidence from the propeller blades and their degree of

break-up indicated that the were rotating at impact and being driven by the engine at low power. The aircraft's fuel tank was approximately half full at impact. There was no post impact fire.

A detailed examination of the aircraft wreckage did not reveal any fault that would have caused or contributed to the accident. All the flying control systems were intact and showed no evidence of any control failure or restriction. The aircraft had not collided with or struck anything prior to the initial ground impact. The engine was taken to an approved overhaul organisation and a strip examination carried out. Although the general condition of the engine was found to be poor there was no evidence of any failure that would have caused the engine to fail or lose power.

Conclusion

The evidence indicates that the aircraft was airworthy and the engine capable of delivering power up to the point of impact. The type of manoeuvre flown by the pilot, a reversed turn and wing-over, probably required more power than was available if flying speed was not be lost. This characteristic of Turbulent aircraft is generally well recognised by their pilots but, tragically in this case the pilot may have been more concerned with his correct positioning for the fly past than with proper energy management of a low powered aircraft.