No: 11/86 **Ref: 1c**

Aircraft type and registration:	Socata Rallye 180-GT MS 893E G-BFMS
No & Type of engines:	One Lycoming 0-360-A3A piston engine
Year of Manufacture:	1978
Date and time (UTC):	11 October 1986 at 1000 hrs
Location:	Barton Airfield, Manchester
Type of flight:	Aerial work
Persons on board:	Crew — 1 Passengers — None
Injuries:	Crew — 1 (fatal) Passengers — N/A
Nature of damage:	Aircraft destroyed
Commander's Licence:	Senior Commercial Pilot's Licence
Commander's Age:	42 years
Commander's Total Flying Experience:	1436 hours (of which approximately 500 were on type)
Information Source:	AIB Field Investigation

Aerial banner towing

The purpose of the flight was to carry out advertising, using an aerial towed banner. For this operation the aircraft equipment typically comprises a 17 feet long tow-rope, attached to a release hook on the tail-cone of the aircraft. On the end of this rope is a three-pronged grapple hook. Prior to take-off, the grapple is retained by a 'bomb-release' unit, situated under the centre fuselage just aft of the wing trailing edges. The rope is held in three folds along the fuselage keel by a series of Terry clips between the tail cone and the 'bomb-release' unit.

After take-off, and within the airfield boundary, the pilot releases the grapple which then drags the rope free and streams behind the aircraft. With the grapple so deployed, the aircraft makes an approach to the banner pick-up system.

The pick-up system comprises two vertical 7 feet tall poles, situated 15 feet apart, between which is suspended the forward portion of the lead-line to the banner. The banner, attached to this line, is laid along the ground ahead (upwind) of the poles with its trailing edge furthest up wind.

The aircraft, with the grapple hook 4 or 5 feet below, then makes a nearly flat approach upwind at 70 knots and a height which will allow the hook to engage the banner lead-line. Having achieved a successful snatch, initially no drag is felt as only the lead-line to the banner is being lifted off the ground. During this period, the aircraft is put into a very steep full power climb followed, as the banner itself 'peels' off the ground, by a rapid return to level flight in order to accelerate the aircraft. When the banner is fully airborne, the climb is resumed and the task of advertising carried out. Following completion of the task, the banner is released from the tail hook, over the airfield, and the aircraft makes a normal landing.

History of the flight

There was no wind and the aircraft took off from runway 27. The banner was laid out along runway 14, such that the aircraft would make an approach to the pick-up point in that direction.

After take-off, whilst climbing through about 50 feet agl, the pilot released the grapple and continued the climbing turn to align the aircraft for the banner pick-up.

Following deployment of the grapple, the pilot most unusually made the transmission "Is my hook deployed?" and received the reply from his colleague, positioned some 30 feet from the banner, "Affirm, your hook is deployed". The colleague stated that, from this position, the grapple was visible but the tow line was not. He further stated that, immediately following deployment, the grapple swung or sprung forwards to a point vertically level with and slightly aft of the tailplane. He did not see where the grapple went from that position, except that he could then see it trailing, apparently normally, behind the aircraft. At no time during the deployment, or subsequently during the run-in to the pick-up, did the grapple touch the ground.

Following a normal approach, the pick-up was successfully achieved and the aircraft rotated up into a rapid climb. Accounts as to whether this manoeuvre was accompanied by the application of full engine power vary. However, subsequent examination of the tachometer and ground marks suggest that full power was achieved.

As the banner began to 'peel' off the ground, the pilot pushed the nose of the aircraft down, in order to let the speed build up again. The airspeed at this time is normally very low and something approaching full down elevator is needed to achieve the manoeuvre. Following this, instead of arresting the nose-down pitching movement as the aircraft regained level flight, the nose continued downwards and the aircraft flew into the ground, killing the pilot. There was no fire.

Initial examination of the wreckage showed a portion of the tow-rope lying across the upper surface of the right tailplane, with the tow-rope attachment rings still in the vicinity of the tail hook. Areas of damage were found on the leading edge of the tailplane and the trailing edge of the balance tab, clearly indicating that the tow-rope had, whilst still attached to the tail hook, prevented the elevator from moving upwards. This damage, together with that sustained by the elevator and its control rod, showed that considerable force had been applied by the rope. Furthermore, the flightpath of the aircraft during the last seconds of flight clearly indicated continuous down-deflection of the elevator.

In this aircraft, the inertia reels for the shoulder harnesses of the front seat occupants are mounted on a transverse beam behind the seats. It could be seen that this beam had failed, during the impact sequence, at its attachment to the left sidewall of the fuselage, behind the pilot. It is noteworthy that, although the beam itself is a substantial hollow extrusion, of rectangular cross-section, it is attached to the sidewall of the fuselage by three vertical bolts, the holes for which are located, through only the bottom side of the beam, 5 mm from its end. The pathologist's report of the post-mortem examination states that the death of the pilot resulted primarily from head injuries and indicated no medical cause for the accident.