AAIB Bulletin No: 10/95 **Ref: EW/C95/6/2** **Category: 1.3**

Aircraft Type and Registration:	Morane Saulnier MS.880B Rallye Club, G-AYLE
No & Type of Engines:	1 Continental O-200-A piston engine
Year of Manufacture:	1967
Date & Time (UTC):	16 June 1995 at 1600 hrs
Location:	Dunkeswell Airfield, near Honiton, Devon
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - Serious Passengers - Fatal
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence (PPL) with Night Rating
Commander's Age:	57 years
Commander's Flying Experience:	138 hours (of which 11 were on type) Last 90 days - 1 hour Last 28 days - 0 hours
Information Source:	AAIB Field Investigation

History of the flight

On the morning of the day of the accident the pilot telephoned the proprietor of the Dunkeswell Air Centre, who was a fellow member of the group operating the aircraft known as 'the G-AYLE syndicate', to confirm that the aircraft was available for a local sightseeing flight that afternoon. When he arrived at the airfield, later in the day, the pilot was accompanied by two friends who were to fly with him. At approximately 1515 hrs the pilot alone entered the Devon School of Flying club house and spoke briefly to the Operations Manager. Information on the local weather and current Notices to Airmen (Notams) were available to the pilot in the club house. The club also maintained a booking out sheet for pilots to record details of their proposed flights. Completion of this information was not mandatory and there was no record entered by the pilot regarding the accident flight.

The Operations Manager observed the pilot carrying out his pre-flight checks of the aircraft which was parked approximately 100 metres away from the flying school on the grass adjacent to the airfield restaurant. At this time the pilot had been joined by his passengers. Some time later the pilot returned to the club house and asked for the aircraft to be refuelled. The pilot then pushed his aircraft to the

pumps and was joined by the Operations Manager who carried out the refuelling. The fuel delivery record sheet showed a fuel uplift of 25 litres (12.5 litres in each wing tank). Since the aircraft had landed from its previous flight with 20 litres of fuel remaining, the total fuel on board prior to the accident was 45 litres.

With the after-start sequence complete the aircraft taxied towards the intersection of Runways 18/36 but then returned to the threshold of Runway 23. An assistant at the flying school, who was manning the air/ground radio, heard the pilot of G-AYLE transmit "taxiing for 36". A minute later she heard a call that the aircraft was "changing because of the wind direction". Prior to departure witnesses heard the pre-takeoff power checks being conducted.

The actual weather conditions recorded at 1450 hrs UTC (10 minutes before the accident) by the meteorological observer manning the 24 hour weather observation post on Dunkeswell Airfield were: Wind 290°/09 kt (18 kt within the previous 10 minutes), visibility 28 km, temperature 15°C, dewpoint 09°C, relative humidity 67%, QFE 985 mbs QFF 1014.8 mbs, cloud $^{1}/_{8}$ cumulus at 2,000 feet and $^{7}/_{8}$ cirro-stratus at 25,000 feet.

The aircraft took off from Runway 23 and was seen climbing through 50 feet by a witness who was crossing the threshold of Runway 23. Another witness noticed that, as the aircraft reached approximately 100 feet above the runway, it was "going very slow (microlight speed), with the nose higher than normal; similar to the pitch attitude just before a stall.....it was holding the height, not climbing once it reached 100 to 150 feet above the ground". An eyewitness, who was on a tractor in field to right of extended centreline of Runway 23, saw the aircraft as it appeared above the tree line. He noticed that "It looked normal then two to three seconds later it veered to the left, dropped the left wing and dived behind the trees". The aircraft struck the ground, causing fatal injuries to the two passengers and serious injuries the pilot.

Moments after the accident, the flying school assistant received a telephone call from a witness near the accident site informing her that the aircraft had crashed in a nearby field. After a brief radio conversation with the school's Deputy Chief Flying Instructor, who was airborne at the time, she telephoned the emergency services. When the Operations Manager heard the news he and two other members of the club ran to the fire tender that was parked some 150 metres from the school. As they reached the crash site they were met by an instructor from the nearby microlight centre. Using a mobile phone he had also called the emergency services. As they approached the aircraft they saw that the canopy was missing and that the injured occupants were still in the wreckage. The pilot and passengers were left in position to await the arrival of the ambulance, for fear that moving them might cause further injuries. The ambulance and helicopter air ambulance arrived simultaneously at

1611 hrs. The pilot was transported by air ambulance to the Royal Devon and Exeter Hospital arriving at 1638 hrs. The two passengers had suffered fatal injuries. The post-mortem examination did not reveal any evidence of a pre-existing medical condition relevant to the accident. All injuries were consistent with severe deceleration suffered at impact.

Pilot background

The pilot had started his flying career in January 1974 on Cessna 150 aircraft and gained his PPL in May 1975 with a total experience of 49 hours. From 1975 until November 1985 he flew a further 98 hours. He did not fly again until January 1992 when he flew a Piper PA-28 to revalidate his PPL and completed 13 hours before his General Flight Test (GFT). His first flight in the Rallye (G-AYLE) was in June 1994 prior to joining the 'G-AYLE syndicate' in September 1994. Between that time and the accident flight he had flown 'G-AYLE' eleven times. Three of these flights were dual with the previous owner of the aircraft and involved circuit flying. The accident flight was the first time that he had flown the aircraft with three persons on board.

Aircraft operation

The 'G-AYLE syndicate' members used to meet occasionally to discuss the aircraft's operation and general management. During one of these meetings the group discussed climb-out techniques so that the pilot of the accident flight, who had a tendency to keep the nose of the aircraft too high during the initial climb-out phase, might be aware of this potentially poor technique. The previous owner of the aircraft stated that it "was very sluggish with three persons on board and had to be handled carefully during the climb once out of ground effect". Furthermore, a member of the syndicate who had experienced a 'power on' stall in this aircraft with the nose in a higher than normal attitude stated that the stall could be quite severe with an associated wing drop and substantial height loss. The normal takeoff technique, adopted for the aircraft's generally moderate performance, was to allow the aircraft to accelerate level in ground effect to a speed of 65 mph before attempting to climb. If this technique was not used the aircraft would not accelerate to climbing speed.

Aircraft Flight Manual

Weight and centre of gravity (C of G)

The aircraft has a Maximum Take-off Weight (MTOW) of 1,700 lb (770 kg) and is permitted to carry a total of four occupants with the combined weight of the rear seat passengers not exceeding 242 lb (110 kg). The aircraft's estimated weight at the time of the accident was some 8 lb below the MTOW and the C of G was within the prescribed operating envelope.

Stalling

In the Flight Manual section on 'Stalling' it is stated that the stall is very safe with small or nil longitudinal pitch down movement. The aircraft is perfectly controllable during the whole of the manoeuvre, but the pull stick force is somewhat high. (Pilots should avoid long descents in a stalled condition with the throttle closed and stick fully rearwards so as not to fatigue the structure). For stall recovery the power must not be applied until the aircraft has regained control at a speed of approximately 70 kt. The power off stalling speed at a weight of 1,700 lb with flaps down and wings level is 40 kt. With power on, the stalling speed is reduced by 4 to 5 kt.

Normal Takeoff

The Flight Manual details the technique to be used for a normal takeoff and climb. It advises that the flaps should normally be up but selected to the first notch on short fields. The throttle should be advanced slowly to full power and at 37 mph (32 kt) back pressure should be applied to the elevator control to raise the nosewheel. The aircraft will takeoff at 52 mph (45 kt). The normal initial climb up to 300 feet agl with the slats open is flown at 70 mph (59 kt) with full throttle giving an engine RPM of 2,550 ±50.

Pilot's own notes

The pilot carried with him in the cockpit handwritten notes concerning techniques to be used for normal and short field takeoffs. Under the heading 'Short takeoff and low level circuit' he had written the following:

> *'15° flap...2,000 Rev....nose wheel off 40 mph*
> *lift off 45 mph...climb 45 mph until obstruction clear*
> *low level circuit 75 - 80 mph...2,100 R...final turn 70 mph....20° Flap.....'.*

Examination of the wreckage

On site

The aircraft had crashed into a level grass field approximately 200 metres south west of the end of Runway 23. The only marks on the ground at the point of impact was a shallow crater made by the nosewheel and the underside of the nose, together with a single propeller blade slash. The disposition of the wreckage suggested that the aircraft had impacted on a ground track of about 190° magnetic whilst spinning to the left and with low forward speed. The aircraft had then bounced and continued

to rotate to the left through approximately 155° before coming to rest with its nose some 5 metres from the initial impact point on a heading of 035°. The main landing gear had not contacted the ground at the initial impact: consideration of the aircraft's geometry indicated that the pitch attitude must have been in excess of 30° nose down. Damage to the underside of the left wing leading edge indicated that this also had contacted the ground at the initial impact, although no marks were discernible due perhaps to the hardness of the ground.

The rear fuselage and empenage were virtually undamaged. The right wing was similarly undamaged, although the main spar had suffered an impact failure where it passed through the cabin. The canopy had broken into several pieces as a result of the disruption to the cabin during the impact. The nature of the damage to the latching mechanism indicated that the canopy had been closed at the time. Some leading edge damage to the propeller blades was noted, together with chordwise scoring which suggested at least some power existing at impact.

Airframe

The damage to the airframe was all consistent with the impact, with no evidence of structural failure prior to the accident. The aircraft had been in good condition for its age, although there was some exfoliation corrosion on the outboard riblets that supported the flap and aileron shrouds.

The flying controls had no signs of pre-impact failure or disconnection. The flaps were found at the takeoff setting, and the automatic leading edge slats were in the extended position. The latter deploy as a result of the aerodynamic forces generated on the surface of the slat, and these depend on the position of the stagnation point. Low airspeed or high angle of attack will cause the slats to extend. An interconnecting linkage protects against asymmetric deployment, and the teleflex-type cables employed were found to be intact. The slat tracks ran on rollers which were mounted in the wing leading edges. The outboard slat track on the left wing bore a roller imprint at the slats fully extended position. The right wing had not been subjected to an impact sufficiently severe to leave any imprint; however the right slat was found at its fully extended position.

The airspeed indicator had broken in the impact and was not capable of being tested. However the associated tubing that connected it to the pitot head (which had become detached from its mounting on the underside of the left wing during the impact) was found to be intact.

There was evidence that indicated that all three occupants' seat harnesses had been fastened at impact. The backs of the front seats were attached to a transom spar, located across the cabin, which was bolted to the canopy side rails. The shoulder harness inertia reels were attached to the underside of the spar which had failed at the side rail attachment bolts. This had allowed the seat backs to hinge forward during the impact, allowing the heads of both front seat occupants to strike the instrument panel.

Engine

The position of the throttle levers, of which there were two, together with their interconnecting linkage, indicated a low throttle setting at the time of the impact. The engine was stripped and examined. A check of the ignition timing found that both magnetos were synchronised and timed to within about 1° of the required setting. The magnetos, which were fitted with coils the latest standard were satisfactorily bench tested. The engine had operated for more than 2,460 hours (the same as the airframe), its overhaul life having been extended under the provisions of Airworthiness Notice No 35. Although it had never been overhauled, the cylinders and piston rings had been replaced in September 1990, at 2,178 engine hours. It was noted that the cylinders had chromed bores. Internally, the engine was in a generally good condition, with no evidence of lubrication problems. However, it was noted that there were orange coloured deposits on the surface of the exhaust valves of Nos 2 and 4 cylinders. This was indicative of high temperature operation, possibly as a result of a lean mixture being present in the combustion chambers. The top ring of the Nos 2 and 4 pistons had broken into two and six pieces respectively. The wear patterns on each of the ring fragments indicated that the broken condition had existed for some time, and hence was not an impact feature. There was little visible marking on the cylinder bores by these fractures due to the extreme hardness of the chromium plating. The reason for the broken rings was not established. The remaining rings on the affected pistons were intact and the general condition of all the pistons indicated that there had been no significant passage of combustion gases past the rings. It was concluded that the broken rings probably had no significant effect on cylinder compression.

One of the exhaust pipes, which had been slightly crushed in the impact, was found to have a split in it close to where it joined with the heater muff. The split was in a seam weld and the surfaces of the crack were covered with combustion products, indicating that the condition had existed prior to the accident. The total area of the crack was small and was unlikely to have affected engine performance but there may have been a potential for carbon monoxide poisoning. None was found in post-mortem examination of the occupants.

In summary, no defect in airworthiness was found which might have contributed to the accident.