

Socata TB10 (Tobago), G-BKTY

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Aircraft Type and Registration:	Socata TB10 (Tobago), G-BKTY	
No & Type of Engines:	1 Lycoming 0-360-A1AD piston engine	
Year of Manufacture:	1983	
Date & Time (UTC):	27 April 2001 at 1525 hrs	
Location:	Sherburn Airfield, Yorkshire	
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 Pilots Licence	
Commander's Age:	69 years	
Commander's Flying Experience:	690 hours (of which 420 were on type)	
	Last 90 days - 5 hours	
	Last 28 days - 3 hours	
Information Source:	Field Investigation	

History of the flight

The pilot/owner had arrived at Sherburn airfield early in the afternoon in order to collect his aircraft which had been at the airfield for one week whilst a new intercom unit was fitted. He intended to fly from Sherburn to Crossland Moor airfield, near Huddersfield, where the aircraft was normally kept. The pilot inspected the newly installed intercom unit and then completed the external pre-flight checks. Upon collecting the aircraft the owner found that an engineer was re-attaching with glue the plastic knob of the flap selector switch which protrudes from the centre console. It was also found that the towing arm was on the rear seat of the cockpit, and so it was removed and stowed in the baggage compartment the access to which was on the left side of the aircraft just behind the wing trailing edge. After consulting the meteorological information the pilot decided that he required refuelling prior to his departure. He therefore removed the towing arm from the

baggage compartment and connected it to the nosewheel. The airfield refueller assisted the pilot in manoeuvring the aircraft over to the fuel pumps where 20 litres of fuel (10 litres per side) were loaded into the fuel tanks as instructed by the pilot. The refueller noted that prior to refuelling there was already fuel in both tanks, enough to fully cover the floor of the tanks, but he did not know the total fuel contents. After refuelling the pilot secured both fuel tank caps and the aircraft was pushed back into a parking slot clear of the fuel pumps. The refueller then removed the towing arm from the nose-wheel and handed it to the pilot. He went to the flight operations centre to record the amount of fuel dispensed to the aircraft. No one saw the towing arm being stowed but it was found in the baggage bay after the accident. At about 1515 hrs the pilot entered his aircraft via the left door and shortly afterwards started the engine. After a brief period of time, sufficient for him to have completed his after start checks, he commenced taxiing. He was guided past other parked aircraft by the refueller who was on the right side of the aircraft during these manoeuvres and was thus unable to see the baggage compartment door.

The aircraft taxied to the threshold of Runway 19 and commenced the take off. During the initial stage of the take off roll three witnesses, at separate locations, noted that there was a large hole in the left fuselage just behind the wing trailing edge and all deduced that the baggage compartment door was either open or was missing. One of these witnesses was the Chief Flying Instructor (CFI) who was in the flying club operations room. He monitored the take off run and once the aircraft was airborne he informed the pilot, via the radio, that the baggage door appeared to be open. The pilot replied that he was unaware of any problem but would return to land at Sherburn. The aircraft then immediately commenced a turn to the right. The CFI estimated that this turn was initiated at a height of about 500 feet agl and that during the turn the aircraft descended to approximately 250 feet agl. A number of witnesses described the turn as unusually steep; it was estimated to be about 40° angle of bank and the aircraft turned through 180°. The aircraft appeared to be fully under control whilst on the downwind leg, however, it remained at a low altitude and tracked very close to the landing runway. The aircraft was also reported to be flying very slowly but it would have been difficult for witnesses to judge both speed and altitude accurately since it was unusual for an aircraft to be observed flying so low and close to the runway.

As the aircraft approached a position abeam the threshold of Runway 19 it started a right turn. As it did so the angle of bank rapidly increased to an estimated 80° and the nose slowly pitched up. A number of witnesses recalled hearing the engine noise increasing rapidly to a high level as if the pilot had suddenly applied full power. At this point the CFI activated the crash alarm because he believed that the aircraft was now in an unrecoverable situation. The aircraft was seen to strike the ground vertically and a fire started almost immediately. The two airfield fire and rescue vehicles arrived at the accident site within 2 minutes and commenced fire-fighting operations with a 250 litre foam dispenser and a number of portable fire extinguishers. The fire was quickly brought under control.

The pilot received fatal injuries in the impact. A post mortem examination did not reveal any evidence of pre existing disease which may have caused or contributed to the cause of the accident.

Meteorological conditions

The synoptic situation indicated that an unstable westerly airflow covered the area with attendant heavy showers, conditions were good outside of these showers. The reported conditions at the time of the accident were: surface wind 280°/6-8 kt, visibility greater than 10 km, cloudbase 1,500-2,000 feet with showers in the vicinity but not over the airfield.

Pilot's experience

The pilot had commenced flying training in the Royal Air Force in 1953. He had completed 145 hours of training by 1954 but did no more flying until 1992 when he gained his civilian Private Pilots Licence. In the following year an IMC rating was added to the licence. At the time of the accident the pilot had a total of 690 hours flying experience of which 420 hours were on Socata TB10 aircraft. Most of his flying since then had been on G-BKTY and since the beginning of October 2000 he had recorded 9 hours 30 minutes flying.

Aircraft information

The Socata TB10 Tobago is a conventional, single-engine, low-wing monoplane aircraft of all metal construction. The tricycle-type landing gear is non-retractable. The flying controls are manually operated via control rods. The flaps are electrically operated by a motor, which drives a screw jack connected to a torque tube. The two-bladed propeller is of the variable pitch type. The aircraft was equipped with a single-axis autopilot that provided heading hold and navigation capabilities through a controller driving a servo connected to the aileron controls.

Wreckage and impact information

Ground impact marks produced by the aircraft nose, the leading edges of the wings, and the main landing gear tyres indicated that the aircraft had struck the ground on a heading of approximately 180°(M), in a wings level and near vertical pitch attitude. Propeller slash marks in the ground indicated that the engine was developing power at the time of impact. The nose section of the aircraft was destroyed and the wings severely damaged by the impact. Fuel from the ruptured wing fuel tanks had ignited immediately. The propeller, which had separated from the crankshaft, and numerous pieces of canopy glass were found in the impact crater. The engine was found 2 metres from the impact crater. The main part of the aircraft was thrown backwards and slid over the ground for approximately 15 metres on a bearing of 010° before coming to rest. The aircraft was destroyed in the ground fire. A search of the area under the flight path did not locate any objects which could have fallen from the aircraft. It was possible to establish that all of the flight control surfaces had been attached to the airframe and that the flight control operating rods and trim cables were connected to the control surfaces at the time of impact.

Examination of the engine on site did not reveal any signs of a catastrophic engine failure. All of the ancillary components were still attached with the exception of the carburettor and air pump which were torn off by the impact.

The baggage door was found still attached to the fuselage with its hinges intact. The door was in the open position and the upper part of the door was embedded in the ground. The fuselage area around the door had been destroyed by fire, but the door itself had sustained only minor fire damage having been partly shielded by elements of the fuselage after the ground impact. The lock was undamaged and was found in the unlocked detent. The aircraft's towing arm was found in the baggage compartment area.

Detailed wreckage examination

The flight control mechanisms in the cockpit area and fuselage were severely disrupted by the impact and post-crash fire, however no evidence of pre-impact failure was found. The flap drive

screw jack was found in the fully retracted position, corresponding to the flaps 'up' position. There was no evidence of pre-impact failure of the flap control mechanism. The knob of the flap selection lever, which was re-attached before the flight, could not be identified, having been consumed in the post accident fire. The aircraft instruments were completely destroyed by the fire and therefore did not provide any useful data.

The examination of the engine showed no external evidence of failure. The engine accessories were all attached, with the exception of the carburettor and air pump, which had broken off in the impact. The magnetos were still attached to the mounting pad, but had suffered impact damage to the casing and the internal components, so it was not possible to test them. The propeller governor was still attached to the mounting pad and appeared undamaged. The spark plugs and rear accessories were removed from the engine and internal drive train continuity including the accessory drive train was confirmed by rotating the crankshaft by hand. Compression was confirmed on all four cylinders. Laboratory analysis of a fuel sample taken from the bulk storage tank from which the aircraft was fuelled prior to flight showed that the fuel complied with the specifications for AVGAS 100LL, was free from contamination and therefore fit for use.

Baggage door

The baggage door on the TB10 is hinged at the bottom, with the lock mounted at the top. The centre of gravity of the door is such that the door falls open under its own weight when it is unlocked.

The baggage door on another TB10 based at Sherburn-in-Elmet was examined in order to establish whether it was possible for a locked baggage door to come open. The lock on that aircraft was found to be so badly worn that the key could be withdrawn from the lock barrel with the lock in any position. By comparison, on an unworn lock, the key can only be withdrawn from the barrel if the lock is in the fully locked or unlocked position. These positions are detented, so that the locking lever cannot move from the locked or unlocked detent without the key being inserted. It was demonstrated that on a badly worn lock, the key could be rotated to a position such that the locking lever was only just holding the door closed and that the key could be removed and the door would remain closed. By tapping on the fuselage to simulate airframe vibration, the door could then be made to pop open. The fact that the lock on G-BKTY was found in the unlocked detent would however, appear to rule out this possibility. In addition, persons familiar with G-BKTY stated that the baggage door required a positive effort to hold the door closed in order to lock it. It is therefore unlikely, but not impossible, that the pilot could have only partially locked the door prior to take off.

It is difficult to see how the pilot could have overlooked an open baggage door. The baggage door on the TB10 is located immediately behind the pilot's entry door and the pilot would have passed it in gaining entry to the aircraft. The baggage door key was found on the same key ring as the ignition key. If he had left the key in the lock and entered the aircraft with the intention of flight, he would not have been able to start the aircraft and his error would have been obvious. Anecdotal information brought to light a case of another TB10 pilot who had attempted to take off with the baggage door open, but who was prevented from doing so by ground crew who had become aware of the problem. Thus it remains a possibility that the baggage door had not been closed after the towing arm had been placed in the baggage compartment.

Aircraft controllability

The effect of the open baggage door on the controllability of the aircraft was considered. The aircraft manufacturer had not conducted any flight testing with the baggage door open but was of the opinion that the open door would have had little effect on the controllability of the aircraft. This seems reasonable as the baggage door is relatively small, lies parallel to the direction of the airflow when in the open position and is located a long way forward of and below the horizontal stabiliser. The pilot was unaware that the door was open until he was advised of the fact by ATC, which indicates that the aircraft handling had not been significantly affected up to that point. However, it could not be ruled out that the open door might have had a marginal effect on the controllability of the aircraft during turning manoeuvres. It is possible that any such effects might be more pronounced in steep turns, which the pilot was seen to perform in his attempt to return to land.

The autopilot

The possibility of an autopilot failure resulting in an uncommanded aileron input was considered, but was thought to have been unlikely for several reasons. Firstly, it is not normal procedure to use this type of autopilot for take-off, approach or landing and so it probably would have been switched off. Secondly, the rate of roll applied by the autopilot is relatively low, so that the pilot has time to intervene should the autopilot experience a runaway. The design of the autopilot system is such that the pilot can easily override the autopilot actuator using a small amount of force on the control wheel. Finally, had there been an autopilot runaway, the behaviour of the aircraft in roll would have appeared erratic due to the pilot's attempts to correct for the uncommanded roll. Witnesses did not report seeing any such motions.

Conclusions

From the available evidence it is clear that the baggage door was open in flight. It was not possible to conclude how the baggage door had come to be open, nor what the effects of the open baggage door on the aircraft handling might have been. No evidence was found of any failure of the engine or airframe systems that could account for the manoeuvres which the aircraft performed prior to the crash.

The take off and subsequent flight on the downwind leg suggest that the aircraft was under full control at this stage, although its altitude and positioning whilst downwind were most unusual. The position at which the final turn was initiated was also unusual in that it would have required extreme manoeuvring from this point in order to land the aircraft successfully on the runway. Such an extreme manoeuvre was then observed. Under normal circumstances the first stage of flap should have been deployed but this was not done. Even if the recently re-attached plastic knob had come off, flap operation would still have been possible using the spindle of the flap switch. The investigation was unable to assess the possible contribution of the open baggage door upon the pilot's ability to maintain control of the aircraft during this manoeuvre. However, the pilot's decision to return immediately to land in order to rectify the problem undoubtedly increased his workload. Moreover, his problems may have been compounded if he had allowed the open baggage door to distract him from the essential task of flying the aircraft. Despite the lack of evidence of any pre existing disease found at autopsy, the possibility of some form of incapacitation cannot be entirely discounted.