

Aircraft Type and Registration:	Beech Bonanza C35, N60256	
No & Type of Engines:	1 Continental E180-11 piston engine	
Year of Manufacture:	1951	
Date & Time (UTC):	28 January 2005 at 1437 hrs	
Location:	Southend Airport, Essex	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Propeller, main and nose gear doors and nose gear assembly	
Commander's Licence:	See below	
Commander's Age:	71 years	
Commander's Flying Experience:	2,471 hours (of which 310 were on type) Last 90 days - 4 hours Last 28 days - 3 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by AAIB	

History of the flight

The aircraft was being flown by its owner to assess the effects of adjustments which had been carried out during recent maintenance action, including a check of the landing gear warning system. The flight test proved that the landing gear warning horn, which indicates that the landing gear is not down below a certain throttle position, was sounding at too high a throttle setting. Correctly adjusted, the aural warning would sound when the throttle was retarded below a setting equivalent to a manifold pressure of 12 inches Hg, but on the test flight this figure was approximately 18 inches Hg, having remained substantially unchanged after the adjustments.

The pilot had limited time available for the flight due to other activities later in the day, and it was only 10 minutes after takeoff that the pilot called Southend for instructions to rejoin the circuit. The weather at the time was showery, with a moderate and gusty surface wind. Southend Airport's ATIS reported the surface wind from 360°(M) at 11 kt, with a few clouds at 500 feet, scattered clouds at

1,300 feet and broken cloud cover at 3,000 feet; the visibility was 8,000 metres in light rain. When the aircraft was stabilised on the final approach to Runway 06, the Tower controller reported the wind as being from 350°(M) at 8 kt, gusting to 31 kt and, as the aircraft approached the runway threshold it was reported as 020°(M) at 13 kt gusting to 30 kt. The pilot reported later that the approach was very difficult in the wind conditions, which were close to the aircraft's limits. In view of the weather conditions and time pressure, the pilot flew the approach faster than the recommended speed and delayed selection of full flap until just before touchdown.

Runway 06 at Southend Airport has a threshold displaced by about 180 metres due to a public road and church spire adjacent to the beginning of the actual runway length. The pilot intended to touchdown some 40 metres before the displaced threshold but was not sure of the actual achieved touch down point. Once the aircraft had landed, and still with some difficulty in controlling the aircraft, the pilot intended to raise the flaps with a view to 'dumping' lift and increase the chance of vacating the runway at the next exit. However, he inadvertently selected the landing gear to UP and the gear started to retract. Realising his mistake, the pilot reselected the landing gear DOWN, but the aircraft's landing gear had partially retracted and the aircraft slid to a halt on the downwind side of the runway, about 340 metres from the displaced threshold markings. The aircraft sustained damage to the inner main landing gear doors, the nose gear doors, nose gear leg assembly and propeller.

The Tower controller's view of the accident was hampered by rain on the windows, and partially obstructed by buildings and parked aircraft. A CCTV camera covered the undershoot area, but this too was affected by moisture on the lens. The controller was aware of the aircraft during the landing; it appeared to be in a normal attitude but he could not determine whether the aircraft was on or just above the runway, nor whether the landing gear was down or not. However, he did see the right wing start to drop as the aircraft settled on to the partially extended gear and he activated the crash alarm.

Later examination of the runway revealed propeller strike marks situated on the runway centreline, starting about 105 metres from the aircraft's final position. The distance between strike marks indicated that the aircraft was travelling at about 30 kt when the propeller first contacted the runway surface.

Pilot's licence

The pilot held a UK Private Pilot's Licence, issued in 1977, and was the holder of a FAA Private Pilot's Licence, issued in 1986 on the basis of the continuing validity of his UK licence. The pilot had believed that his class rating for Group A aircraft (now Single Engine Piston - Land) could be revalidated on a self-certification basis, which he had done each year in his flying log book. His log book entries had not been certified by a CAA authorised examiner, nor had he complied with the revised requirements of JAR-FCL which were introduced in 1999, and his class rating was therefore invalid.

Description of the landing gear

The retractable landing gear is connected to an actuator which is driven by an electric motor. The landing gear doors are automatically actuated when the landing gear is extending or retracting. The inboard main landing gear doors, which are connected to the retract gearbox, are closed when the gear is in the extended or retracted position. During the extension sequence, the main legs start to lower when the inner doors are approximately half way open, and the doors start closing again just before the legs are fully extended. During retraction, the inner doors open to allow the main legs to retract, and begin to close again when the main legs are about 30 degrees from the fully retracted position. A landing gear safety switch is incorporated into the gear UP circuit and closes when the strut approaches full extension; its function is to guard against inadvertent UP selection whilst on the ground. A landing gear warning horn alerts the pilot to a 'gear not down' situation at low throttle settings, or to the fact that the landing gear is selected UP with the aircraft on the ground.

Aircraft examination

The aircraft was examined in situ by personnel from the aircraft's maintenance company and later underwent functional tests under the AAIB supervision. The aircraft came to a stop with the main gear wheels resting on top of the inner gear doors. Whilst the inner gear doors had suffered considerable abrasion damage, there was no damage to either gear leg, nor signs of distress on the main wheel tyres. The circuit breaker protecting the system had 'popped'.

The aircraft was placed on jacks to allow the landing gear safety switch to be tested. Located on the right hand strut, the switch should close the UP circuit when the landing gear strut is $\frac{3}{4}$ inch from the fully extended position. With the strut extending, the switch was found to operate $\frac{1}{8}$ inch before the normal setting of $\frac{3}{4}$ inch. A normal retraction sequence was initiated, which was successful. The safety switch was then placed into an "on ground" condition and an attempt made to raise the landing gear. The gear drive motor did not operate, confirming the integrity of the safety system.

Recorded information

The R/T exchanges between the pilot and the tower controller were recorded and available for replay. At the time of the accident, a five second transmission is made by the pilot, in which the landing gear warning horn can be heard clearly. Prior to this, at about 1 minute 45 seconds prior to the accident, the pilot transmits that he is on finals and the warning horn can be heard in this transmission also. However, there are two further exchanges with ATC regarding the wind, at about 90 seconds and 30 seconds prior to the accident, in which the warning is absent.

Analysis

The accident occurred when the pilot inadvertently selected the landing gear UP after landing. The aircraft examination confirmed that the landing gear system and associated warning were fully serviceable. Although the landing gear safety switch was slightly out of adjustment, with the effect that the UP circuit could be closed at a slightly reduced strut extension, the discrepancy is minimal and unlikely to be a significant factor in the accident. The nature of damage to the inner gear doors and lack of damage to the main gear legs or tyres suggested either that an extension sequence had been initiated late in the landing manoeuvre or that the aircraft was at least partially airborne when the retraction sequence commenced, and that the aircraft subsequently sank down onto the retracting gear.

The pilot was certain that the gear was selected DOWN for the approach and the absence of a gear warning horn on the two transmissions immediately before landing supports this. With the landing gear warning horn switch incorrectly set closer to a cruise power setting, it is very unlikely that the warning would not be sounding during an approach with the gear retracted. However, the possibility exists that the warning may have been intermittent due to occasional high power demands in the gusty conditions and the short sampling rate provided by the brief transmissions.

The pilot initially believed that his inadvertent gear up selection was made at quite a low speed, and the aircraft was certainly at a relatively low speed when the propeller contacted the runway. He had intended to raise the flaps, which were controlled by a switch similar to that which operated the landing gear, and made a simple error in his switch selection. The pilot thought that this may have been influenced by the fact that he had been exercising the gear during the flight, though he would also have been operating the flap switch just before the accident. He subsequently considered it possible that the erroneous selection had occurred earlier in the landing phase, possibly whilst the aircraft was still partially airborne, or whilst he was holding full left aileron which may have unloaded the right main gear which contained the safety switch.