

## Cessna 175B Skylark, G-ARFL

<b>AAIB Bulletin No: 9/2004</b>	<b>Ref: EW/C2004/05/01</b>	<b>Category: 1.3</b>
<b>Aircraft Type and Registration:</b>	Cessna 175B Skylark, G-ARFL	
<b>No &amp; Type of Engines:</b>	1 Continental GO-300-D piston engine	
<b>Year of Manufacture:</b>	1960	
<b>Date &amp; Time (UTC):</b>	2 May 2004 at 1440 hrs	
<b>Location:</b>	Bridge Farm, Acle, Norfolk	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - 1 (Serious)	Passengers - N/A
<b>Nature of Damage:</b>	Substantial damage to airframe and engine	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	70 years	
<b>Commander's Flying Experience:</b>	235 hours (of which 70 were on type)	
	Last 90 days - 14 hours	
	Last 28 days - 10 hours	
<b>Information Source:</b>	AAIB Field Investigation	

### Synopsis

After a short local flight the pilot returned to his private airstrip and carried out an approach to grass Runway 34. As he crossed the threshold he considered that his airspeed was too high so he elected to carry out a go-around. Full nose up elevator trim was set and as go-around power was applied the aircraft's nose pitched up uncontrollably. At approximately forty feet, in a nose high attitude, the engine stopped and the aircraft stalled.

### History of the Flight

During refuelling, carried out approximately one week before the accident, the pilot (owner) of the aircraft noticed that although the rotary fuel selector was selected to both tanks, fuel was only being consumed from the right tank. He therefore only refuelled the right tank, which has a total capacity of 26 US gallons, with 40 litres of fuel and carried out a ground run with the left tank selected for some 15 minutes at 2,200 to 2,300 RPM. The engine behaved normally but it was not confirmed that fuel was being used from the left tank.

At 1245 hrs on the day of the accident the pilot departed his private strip at Acle, 10 nm east of Norwich, and flew to the gliding site at Tibenham arriving at 1308 hrs. An hour later the aircraft was flown on a 16 minute positioning flight to a private strip at Priory Farm, west of Tibenham. Both

sectors were uneventful and were flown with the fuel selector set to both tanks. At 1513 hrs the pilot departed Priory Farm to return home, following his normal procedure of flying with the fuel selector set to both tanks. At 1516 hrs, with the aircraft level at 1,700 feet in the cruise, the pilot selected the left tank. He joined overhead his private strip and let down to 1,000 feet into a right hand circuit to land on the short dry grass surface of Runway 34 (1,500 feet long by 75 feet wide). He completed his pre-landing checks on the downwind leg, turned onto the base leg, selected two stages of flap (20°), trimmed, set the engine power to 1,700 RPM and placed the carburettor heat to ON. He assessed that he was high as he completed his turn onto finals so selected the third stage of flap (30°) and applied full aft elevator trim to balance the elevator control forces. He continued the approach knowing that a go-around could be performed if the aircraft was not correctly positioned.

The aircraft crossed the runway threshold at the correct height at an IAS of 70 kt. Although positioned correctly the speed was too fast so the pilot applied full power and initiated a go-around. As he did so he had to apply a large push force on the control column to control the rapid nose up pitch rate. At this point the engine stopped and the stall warning sounded. The pilot applied full right aileron in order to avoid his property which, although he could not see due to the high nose attitude, he knew was to his left. The aircraft nose subsequently dropped and the aircraft struck the ground heavily in a right wing low, nose down attitude. It finally came to rest at an angle, against the corner of a hangar, with its left outer wing resting on the roof.

The pilot, who was wearing a safety harness with an upper body restraint, suffered serious injuries. He was however, able to switch off the electrical supply and vacate the aircraft through the right door that had sprung open in the accident; the left door having jammed. Two eye witnesses reported the accident and the emergency services were rapidly on the scene.

## **Aircraft operations**

### **Handling**

There are four stages of flap available on the aircraft, each of which represents 10°. During a go-around the increase in thrust combined with the flap position causes a significant nose-up pitching moment that needs to be anticipated in order to avoid over-pitching and significant loss of airspeed. The pilot had carried out go-around manoeuvres in training and was familiar with the nose up pitching moment and the amount of forward pressure required on the control column to control it. The go-around is easier to control if 30°, instead of 40°, of flap are used for the approach and for this reason the pilot always used 30° of flap for landing at his farm strip. Additionally, with only the pilot on board the aircraft's C of G is near the forward end of the C of G envelope. This can require full aft elevator trim in order to make the control column forces comfortable during an approach and landing.

### **Performance**

The Owners Manual for the Cessna 175 aircraft only details an approach speed with 40° of flap selected. In this configuration the approach speed is between 54 mph at 1,700 lbs AOW and 63 mph at 2,350 lbs AOW. The 'unfactored' Landing Distance from 50 feet at maximum AOW is 1,155 feet; of which 590 feet is the ground roll.

The aircraft is fitted with an audio stall warning horn that produces a steady note 5 to 10 mph above the stalling speed derived from a table in the Operators Manual. The table details the wings level stalling speeds for the aircraft as: 60 mph with the flaps up, 56 mph with the flaps at 20° and 51 mph with the flaps at 40°. The stall speed, with 30° of flap selected, at the aircraft's estimated landing weight, would have been 54 mph and the stall warning horn would have been expected to activate at between 59 and 64 mph.

## **Examination of the wreckage**

### **Preliminary examination in situ**

Downward displacement of the left wing root during the impact caused the inboard wing rib to obstruct the top edge of the left-hand cabin door, preventing it from opening by more than a centimetre or two. The right hand cabin door cleared its aperture freely, but was partially restricted in its range of movement by the ground. The cabin space was substantially intact with relatively little internal disruption. The pilot's seat was deformed downward and to the right, partially obstructing the fuel selector knob, which at the time of examination was set to the OFF position. Impact distortion of the bulkhead area had resulted in both control columns being displaced out of their normal orientation, and the central lower region of the instrument panel, in the vicinity of the engine controls, was similarly affected, albeit to a lesser extent.

At the time of examination, the pitch trim was set to full NOSE UP and the flap lever was set at the second stage position. The magneto and battery master switches were set to OFF. The throttle was fully forward, the primer was IN and locked and the mixture control was set to RICH. The carburettor heat control was in the COLD (fully-forward) position, but impact disturbance of the engine bulkhead meant that its "as found" position was unreliable.

The aircraft was recovered to the owner's hangar, where it was subject to detailed examination.

### **Detailed examination**

Visual inspection of the fuel tank contents, with the aircraft partially supported on a trestle in the hangar and in a slightly right wing low attitude, showed that the right hand tank was substantially full whereas the left tank contained relatively little fuel. The odour and colour of the fuel was consistent with aviation gasoline.

Inspection of the fuel system established that all pipework between the fuel tank outlets and the engine firewall was intact and that the connecting unions were secure and leak-free. The aluminium pipe passing through the left wing root was stretched and had become partially flattened as a result of downward displacement of the wing root during the impact, but the connection to the tank off-take port was secure and undamaged. The short length of rigid fuel pipe between the engine firewall and the inlet to the Gascolator filter, which was mounted just to the right of centre at the base of the engine firewall, had been crushed in the impact and was partially ruptured. The associated connecting unions, however, were secure and the pipe itself was free of obstruction. The flexible hose connecting the outlet from the Gascolator to the carburettor inlet was badly crushed; however, it did not leak. The impact-damaged Gascolator supply was disconnected from its union fitting on the bulkhead. Subsequently an unrestricted discharge of fuel was obtained when the fuel selector valve was selected to any of the three ON positions (BOTH, RIGHT and LEFT). In the case of the latter, this was achieved despite the (impact induced) partial flattening of the supply pipe in the left wing root.

The Gascolator (glass) filter bowl was devoid of fuel. However, with the aircraft resting on the ground in its post accident position, the lever operating the spring-loaded water drain valve would have been vulnerable to being pushed upward by the cowl into the OPEN position, thus draining the filter bowl. It was not possible, therefore, to determine whether the filter had been full at the time of impact. The filter element was free of obstruction.

A small amount of fuel was recovered from the flexible pipe between the Gascolator and the carburettor fuel inlet, but the carburettor itself contained only about 30% of the expected volume of fuel. Tests carried out subsequently have shown that if the carburettor had been full of fuel at the time of impact, its reduced contents cannot be explained by fuel draining out of the float chamber via the carburettor jet with the aircraft in its post impact nose-down, right wing low, attitude. (Loss of fuel via this route would have required a post-impact nose-down attitude approximately twice as steep as actually occurred). Although the fuel level in the float chamber was low, the accelerator pump chamber was charged sufficiently to allow the pump function and produce a good spray of fuel into

the choked tube. All jets were clear and there was no evidence of any contamination by water or solid matter. In summary, with the exception of the lower than expected float chamber contents, no defect or abnormality was found in the carburettor.

The hot-air box was wrenched off the carburettor inlet during the impact, and the 'diverter' flap operating cable had pulled from its attachments to the casing housing the end of the operating lever. A number of indentations were present on the exposed section of the inner section of operating cable, made by the pinching action of the clamp bolt, but it was not possible to determine with confidence which of these represented the cable's clamp setting at the time of impact.

With the magnetos switch in the cockpit selected to BOTH, a clearly defined spark was obtained from the impulse magneto when the propeller was 'hand-turned'. All spark plugs were clean, in good condition, and of normal appearance.

## **Analysis**

The condition of the propeller confirms that the engine was stopped when the aircraft struck the ground. The balance of evidence, from the post-accident examination, suggests strongly that the engine stopped because of a temporary or partial fuel starvation during the approach. This reduced the fuel level in the carburettor float chamber to a degree that left it incapable of supplying the required fuel mixture when power was applied for the attempted go-around. It was just sufficient however, to sustain the engine a low power on the approach. It appears that the throttle pump chamber remained charged with fuel. When the throttle was advanced to initiate the overshoot the resulting spray of fuel directly into the choke tube was sufficient to temporarily make up the deficit caused by the low level of fuel in the float chamber. Thereafter, however, the mixture was too lean to sustain the engine and it rapidly stopped. The fuel system supplying the carburettor was free of obstruction when examined after the accident and the reason for the low level of fuel in the carburettor could not be established.

Despite trying to anticipate the nose up pitching moment, the pilot was surprised by its rate and magnitude and thought he was making the necessary corrections. When the engine stopped the aircraft was at a steep climbing attitude, probably just above the stall speed. The loss of propeller wash over the elevator reduced the control effectiveness and the lack of thrust meant a rapid reduction in airspeed to below the stall. Application of right roll, to avoid buildings to the left of the runway resulted in the right wing dropping further as the aircraft stalled.