ACCIDENT

Aircraft Type and Registration:	Jodel D18, G-BWVV
No & Type of Engines:	1 Volkswagen 1834 piston engine
Year of Manufacture:	1997
Date & Time (UTC):	26 June 2011 at 1534 hrs
Location:	North Coates Airfield, Lincolnshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Serious) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	52 years
Commander's Flying Experience:	385 hours (of which 4 were on type) Last 90 days - 9 hours Last 28 days - 4 hours
Information Source:	AAIB Field Investigation

Synopsis

The pilot was returning to land at his home airfield because of a rough running engine. He was poorly positioned for his first approach so he went around and flew a circuit at low level. While attempting to line up on final approach the aircraft stalled and spun into the ground. The pilot was injured but was able to evacuate the aircraft unassisted. He had little experience on type and it is probable that he mistakenly operated the choke instead of the carburettor heat causing the fuel / air mixture to become too rich.

History of the flight

The pilot arrived at North Coates in the early afternoon and prepared his aircraft for flight. He refuelled the front tank to full with AVGAS, from a container he had brought with him to the airfield. He also had a conversation with another pilot discussing the aircraft's fuel selector, its orientation and which end was the pointer; the other pilot offered to fly with him as he seemed a little unsure about the selector, but this offer was not taken up.

The pilot booked out for a local flight and noted that the aircraft's endurance was 3½ hours. The aircraft was not equipped with an electric starter so he hand swung the propeller and the engine started immediately. He successfully carried out a radio check, on the North Coates frequency of 120.15 MHz. After takeoff from Runway 23 he turned to the left and flew to the south. At 1405 hrs he made a radio call to Humberside on

frequency 119.125 MHz. ATC answered the call but the pilot did not receive the reply. Over the next five minutes he made five further attempts to contact Humberside. Then, at 1417 hrs, he tried again and this time established two-way contact. He reported that he was en route from North Coates to Boston at 3,000 ft amsl and that the aircraft was not fitted with a transponder. At 1430 hrs he gave a position report overhead St Leonards and was asked to report at Boston. The next contact from the aircraft was at 1513 hrs when he advised that he was abeam Alford at 2,800 ft and planning to route north across the River Humber to Beverly before returning to North Coates.

At 1527 hrs the pilot was flying northbound at 2,800 ft when he noticed that the engine was running roughly. The Humberside controller then contacted the pilot and requested his current position. The pilot advised the controller that he was returning to North Coates and the controller asked him to confirm that he was about three miles from there. The pilot confirmed that and was given the North Coates frequency. This R/T exchange lasted 24 seconds. The pilot then changed frequency and made a radio call to North Coates but did not receive a reply.

The pilot reported that the aircraft dropped a wing and descended rapidly. He managed to recover, by using opposite rudder and stick neutral, and levelled out at 400 ft amsl. He then flew a wide left-hand circuit for Runway 23, crossing the coast and flying over the shore in case the engine stopped. In the later stages of the final approach he realised he was too high and could not land safely. He flew along the runway at about 200 ft aal and entered a close-in low-level circuit. The engine continued to run roughly and he pumped the throttle in an attempt to keep it running.

Witnesses on the ground saw the aircraft carry out the low-level circuit and noted that the aircraft was flying relatively slowly and wobbling. They watched it turn onto a close-in base leg and turn left towards the runway crossing the extended centreline. It continued turning left re-crossing the runway centreline, turned right, climbed a little and stalled. Some of the witnesses heard the engine power increase then decrease. The aircraft recovered briefly into a climb, before stalling again and, from a height of approximately 50 ft it entered an incipient spin and impacted the ground.

The pilot suffered face, head and neck injuries in the accident but nevertheless was able to extricate himself from the wreckage unaided and move away to a safe distance. Bystanders ran to assist and gave first aid until an ambulance arrived.

Airfield information

North Coates Airfield is located close to the coast in north-east Lincolnshire. Grass Runway 23 / 05 is 650 m long and 20 m wide. The airfield elevation is 17 ft amsl and the circuit height is 500 ft aal. The extended final approach for Runway 23 is over the sea.

Meteorological information

When the aircraft departed from North Coates the weather conditions were fine with a surface wind from 210°M to 220°M at 10 kt. By the time the pilot returned, the wind had changed to a more southerly direction of 170°M at 10 to 15 kt. The 1102 hrs TAF for Humberside, 15 nm to the west-north-west, showed the forecast surface wind was from 180°M at 10 kt. The 1520 hrs METAR for Humberside was surface wind from 180°M at 10 kt, varying between 150°M and 210°M, visibility more than 10 km, scattered clouds at 3,500 ft, temperature 28°C, dewpoint 18°C and pressure 1018 HPa.

The surface weather conditions were unusually warm. However, the Met Office examined the data from radiosonde ascents in the area and estimated that at 3,000 ft the air temperature was 15°C, the dew point was 11°C and the relative humidity was 75%. There was therefore a notably steep temperature gradient above ground level, suggesting that the warm surface temperature was largely due to surface heating.

Reference to the Civil Aviation Authority Carburettor Icing Prediction Chart, published in Safety Sense Leaflet No 14 shows that, in the prevailing conditions, serious carburettor icing was possible at descent power but, if the 3,000 ft temperatures are plotted, serious carburettor icing was possible at any power setting.

Pilot information

The pilot started his flying on microlight aircraft and qualified for a PPL Microlight (restricted) in January 2005. He acquired his own aircraft, a Rans S6, in November 2004. In April 2005, whilst flying the Rans, he was involved in an accident which destroyed the aircraft, although he was uninjured. After that he converted his licence to an NPPL with Simple Single Engine Aircraft (SSEA) rating. He recorded, in a new logbook, that he had 185 hours of microlight flight time and he commenced training for a NPPL in January 2006. His training was carried out in a Cessna 150 aircraft and was completed in March 2007. In October 2008 he bought a Piper PA-38 Tomahawk aircraft and then, in April 2009, a Piper Cherokee 140. At the beginning of June 2011 he bought G-BWVV, having sold the Tomahawk in 2009 and the Cherokee in March 2011.

The pilot had not flown a tailwheel aircraft before so he was required to carry out differences training with an instructor before he could fly solo in G-BWVV. It is left to the instructor to decide on the appropriate course content as there is no specific syllabus for this training.

On 7 June 2011 he started his differences training at North Coates. The instructor reported that during this session general handling familiarisation was carried out in the local area and some time was spent teaching the pilot to sideslip the aircraft. The instructor thought this was important because G-BWVV was not fitted with flaps. They then returned to the circuit for takeoff and landing practice. At the time however, there was a crosswind on Runway 23, making it difficult to carry out the training, so after one hour the session was ended. On 9 June 2011 a further one and a half hours of intensive takeoff and landing training was carried out. The surface wind was calm and both runways were used. Each landing was to a full stop. After this session the instructor signed the pilot's logbook confirming that the tailwheel conversion was complete, although he considered that the pilot would not be able to cope with a crosswind landing. They discussed this and made a verbal agreement that the pilot should get some solo practice, without any crosswind, and then fly more dual circuits in a crosswind. The accident flight was the pilot's first solo flight since the dual training.

Description and history of the aircraft

The aircraft is an established homebuilt deign which is constructed of wood with a fabric covering. It was operated on an LAA Permit to Fly and featured side-by-side seating for two people. The aircraft was fitted with a tailwheel landing gear.

The engine was derived from a Volkswagen four cylinder air-cooled car engine. The engine was fitted with carburettor heat and a choke to provide mixture enrichment for cold starting. The controls for these were mounted either side of the throttle control knob in the cockpit, see Figure 1.

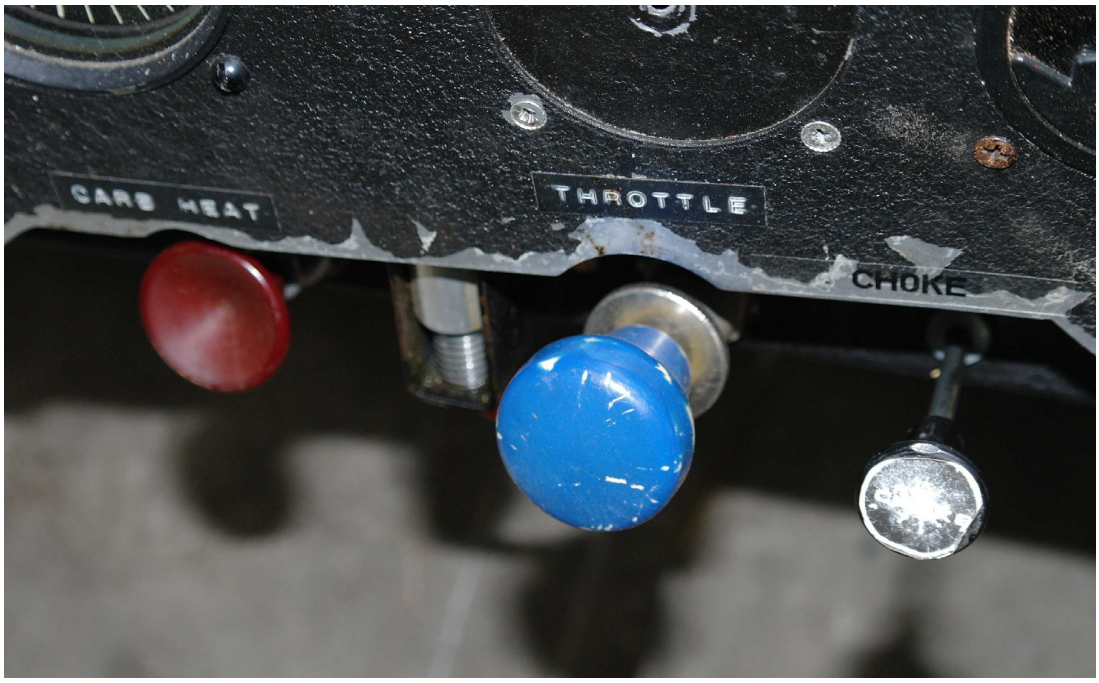

Figure 1

Detail of engine controls in cockpit shown in the 'as found' position

Fuel was contained in two fuel tanks, each fitted with its own filler cap and vent. The 35 litre forward tank was located between the firewall and the instrument panel. The 30 litre rear tank was located behind the rear cockpit bulkhead. Fuel from each tank was fed to a selector valve located under the front tank to allow the pilot to select the fuel supply to the engine from either tank. The forward tank was normally used for takeoff and landing. From the selector valve the fuel passed through a gascolator and an engine-driven pump before reaching the carburettor.

G-BWVV was completed in 1996 and operated by the builder until 2003 during which time it flew approximately 255 hours. Ownership then passed to a new owner and during his conversion training the aircraft was damaged in a takeoff accident, see AAIB report EW/G2003/04/15 published in the July 2003 Bulletin. The aircraft was repaired and flew again in 2006. The second owner then flew it until 2009 completing a further 65 hours. The aircraft was returned to flying condition in 2011 when it was sold to the third and current owner.

The pilot bought the aircraft at the beginning of June 2011. The most recent Permit to Fly check flight was carried out in August 2010. It was recorded that the stall occurred at 48 kt IAS together with notes that there was some pre-stall buffet and a wing drop to the right at the stall.

The airspeed indicator had a V_{NE} marked at 132 kt as required by the LAA Type Acceptance Data Sheet. No other speeds were marked nor required to be marked on the instrument (shown in Figure 2). The aircraft was not equipped with a stall warning system. The pilot did not have any formal handbook for the aircraft but he had some handwritten notes regarding approach speeds and other data which he carried with him in flight. These notes cited a stall speed of 46 kt, a best angle glide speed of 60 kt and a final approach speed of 65 kt.

Figure 2

Airspeed indicator

Examination of the accident site

The accident site was in a field close to the extended centre line of Runway 23 and approximately 150 m short of the threshold; the soil was dry and compact and therefore quite hard. Evidence indicates that the aircraft was descending in a steep right wing-down and nose-low attitude whilst rotating to the right at a low forward speed. The all-moving tailplane was in the full aircraft nose-up position. The right wingtip struck the ground first causing the right wing to fail and the fuselage to separate from the wing structure. From initial ground contact to the time the aircraft had come to rest, it had turned through approximately 180 degrees. There was no fire.

Initial examination of the wreckage

All parts of the aircraft were at the accident site indicating that nothing had detached from the aircraft in flight. The flying controls were examined and all were found correctly connected and there was no sign of any restriction. The engine and firewall/instrument panel were detached from the fuselage, but the disruption between the firewall and the engine was limited. The throttle control was found in the fully forward (full power) position, the carburettor heat was in the fully forward (cold) position and the choke control was in the fully out (starting) position. Due to the limited deformation in this area it is most likely these were the positions at the time of the impact. Fuel had been leaking from the aircraft due to impact damage but members of the flying club managed to save sufficient fuel from both the front and rear fuel tanks to rule out fuel exhaustion. The fuel selector had been moved in an attempt to stop the fuel leakage but, before this was done, the position of the selector was noted and marked.

The lap straps of the pilot's harness had pulled away from their mounts and both sides of the lap strap were attached to the buckle. The removable part of the lap strap was attached to one of the buckle slots meant for the shoulder harness, see Figure 3. The pilot's shoulder straps and their mounting point were undamaged and were found separate from the lap strap and buckle.

The wreckage was recovered to the AAIB facilities for a more detailed examination.

Figure 3

Close up of pilot's harness lap strap and buckle

Detailed examination of the wreckage

The pilot reported that the engine had started to run roughly and therefore the investigation focused on the engine and its ancillary systems.

Fuel system

Approximately 15 litres of fuel had been recovered from the front fuel tank which appeared to be a mixture of AVGAS and MOGAS and approximately 10 litres of AVGAS was recovered from the rear tank. The fuel system was checked and apart from the accident damage no defects were found. Fuel was present in the gascolator, the engine fuel feed pipe, engine-driven pump and carburettor float bowl. There was a small quantity of fine debris in the carburettor float bowl but the jet appeared clear. There was also some debris in the gascolator bowl but this was separated from the engine by the filter screen in the gascolater. The engine driven pump operated normally.

Fuel selector

The fuel selector had been replaced by the pilot prior to this flight and it appeared to have been correctly installed and was working normally. Although the work was recorded in the aircraft log book, it had not been cleared by an appropriately qualified LAA inspector as required.

Engine

It was not possible to conduct a test run of the engine due to damage sustained to the mounting points. The engine was inspected and no pre-accident defects were identified. It turned over normally by hand and all four cylinders had good compression.

Analysis of photographs taken at the time of the accident show the engine was rotating at approximately 2,000 rpm at impact.

Ignition system

The two magnetos were removed so they could be tested on a bench rig; both operated normally. It was not possible to test the wiring to the magneto switches on the instrument panel as it had been disrupted in the impact and subsequent recovery. Inspection of the wiring did not identify any pre-accident defects. Both magneto switches were found in the ON position.

Radio

The active frequency selected on the radio was 121.15 MHz with a standby of 119.12 MHz (Humberside).

Engine controls and indications

It was noted that although the carburettor heat control and the choke control knobs were of slightly different diameters they were very similar in shape and different in colour, see Figure 1. The carburettor heat control had a long travel and a feature that allowed it to be locked by twisting its knob through 90 degrees. The choke control had a much shorter travel and could not be locked out. The pilot reported after the accident that he had used the carburettor heat control several times during the flight. He commented that the quarter turn locking out mechanism had not always worked.

The engine rpm gauge was two inches in diameter and had a small scale which covered an arc of approximately 90º of which approximately 45º covered the normal operating range of 800 to 3300 rpm, see Figure 4.

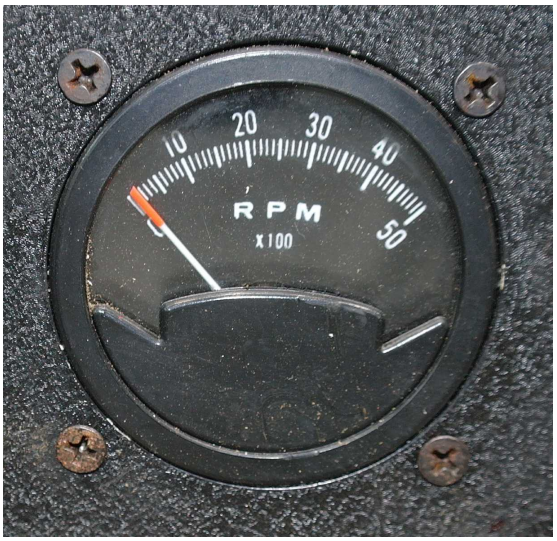

Figure 4
Rpm gauge

Fuel selector valve

The fuel selector operating lever had a small pointer on the opposite side to the operating handle, see Figure 5. The selected position was indicated by a placard on the instrument panel, see Figure 6.

Analysis

The pilot reported that the engine had started to run roughly while he was on a cross-country flight. He could not recall exactly his last action before the rough running started.

The aircraft appeared to be in good condition and no defects were found with the engine or its ancillaries that would cause it to run roughly.

The rpm gauge had only a small scale making it more difficult to determine any rpm drop during either magneto or carburettor heat checks. Discussions with other pilots who had flown the aircraft revealed that it needed frequent applications of carburettor heat and that the rpm drop, when it was selected during the pre-takeoff checks, was more noticeable aurally than on the rpm gauge. A larger scale may have given a clearer indication of the effect of using carburettor heat.

The fuel selector and its placard made it difficult to confirm which tank had actually been selected and the pilot had discussed the fuel selector indication at length with another pilot prior to his departure. The placard is also misleading in that there is only one detented position for the front tank and one for the rear tank and not an arc of 90º as indicated.

Figure 5
Fuel selector in OFF position

Figure 6
Fuel selector placard

CS-VLA is a design code for similar size aircraft[1] and it states in CS-VLA778 (g) (ii), for mechanical fuel selectors:

> *'The position indicator pointer must be located at the part of the handle that is the maximum dimension of the handle measured from the centre of rotation'*

The fuel selector in G-BWVV used the small pointer opposite the much larger handle to indicate the selected position, see Figure 5. Instructions for other homebuilt aircraft using similar selector valves recommend filing off the small pointer and using the large handle as the indicator to avoid any confusion.

There are several possible reasons for the initial rough running. One is that it was caused by a fuel selection change by the pilot, whereby he unintentionally selected the fuel to OFF. The selected position was not easy to determine and he had been uncertain before the flight about the indications. However, the engine continued to run throughout the rest of the flight so this seems unlikely. It is also possible, given the atmospheric conditions which were conducive to serious carburettor icing at any power setting, that the engine suffered carburettor icing.

A more likely reason is that the pilot mistakenly selected the choke control when attempting to use the carburettor heat, while carrying out a routine check for icing. The carburettor heat control and choke controls fitted to G-BWVV were of a similar shape and the choke control was found in the fully out (starting) position after the accident. The carburettor heat control is dark red in colour. Red is more usually associated with the mixture control and although a mixture control was not fitted to this aircraft, the pilot would have used one on previous aircraft he flew. This may have diverted his attention to the other similarly shaped, but black coloured, choke control instead of the carburettor heat control. In the fully out (starting) position, extra fuel is introduced into the inlet manifold to provide a rich mixture. Pulling the choke control fully out with the engine operating at its normal temperature would cause rough running and a loss of power due to the over rich mixture.

Whatever the original cause of the rough running, the choke control was found to be fully out after the accident. The design of the control is such that it is not likely to have moved during the accident. Thus, at some time during the flight, it is likely that the pilot inadvertently applied choke to the engine causing it to run roughly.

The engine started to run roughly when the aircraft was at 2,800 ft amsl. At the time the pilot was contacted by Humberside ATC, asking for a position update, he had already decided to return to North Coates to land. He reported to them that he was returning to North Coates but he did not mention an engine problem. He was advised to change frequency and noted afterwards that although he had done so, he had not received any response. The reason for this was that the selected frequency was 121.15 MHz instead of the North Coates frequency of 120.15 MHz. It appears that while he was engaged on making these radio transmissions the airspeed reduced and shortly afterwards the aircraft stalled, losing some 2,400 ft before control was regained.

The pilot's use of rudder when the wing dropped during the stall probably prevented a spin from developing but the aircraft would not have recovered until the angle of attack was reduced. A standard stall recovery would have prevented such a significant loss of height.

Footnote

[1] Although CS-VLA is not directly applicable to this aircraft, the guidance it contains is considered to reflect best practice for this size of aircraft.

The aircraft recovered at 400 ft aal and the pilot joined the circuit from a wide downwind position. He was not in a position to land safely on the first approach so he repositioned for a second attempt. The aircraft was now at about 200 ft aal and he was unable to climb. He flew a close-in circuit pattern but the southerly wind would have tended to tighten the circuit and in particular the base leg. Thus, when he attempted to turn onto final approach he flew through the runway centreline. He then attempted to turn back towards the runway, but the turn was tight and at a very low level. The bank angle increased and the aircraft stalled. He made a partial recovery but the aircraft stalled again and spun into the ground.

Survivability

The pilot reported that, with the shoulder straps fastened, he was unable to reach all the controls properly and as a result he flew with just the lap strap fastened. During the impact his shoulders were not restrained and he was therefore thrown forward through the top of the canopy, striking his head on the ground. He was very fortunate not to suffer more serious injuries from either the ground impact or as he recoiled back through the shattered canopy. The lap strap attachment fittings broke away from the structure during the break-up sequence.

Conclusions

The engine was operating at a reduced power, probably because the choke was pulled out and the mixture was too rich. The pilot continued to try to land at North Coates Airfield but ended up flying a low-level circuit. The aircraft stalled while he was attempting to line up on final approach having flown through the extended runway centreline. The aircraft had no stall warning system and little natural buffet to warn of the approaching stall.

A lack of familiarity with the aircraft and an attempted approach at an unfamiliar circuit height in crosswind conditions were all circumstances which contributed to the accident. Although the pilot had undergone some tailwheel differences training this did not cover all aspects of operating the aircraft.

Safety action

The LAA intend to highlight the learning points from this accident to their members via their magazine. This will include the importance of having clear and unambiguous markings on all controls and selectors, always correctly fitting and adjusting the seat harness provided and the importance of becoming fully familiar with the operation and function of all controls in an aircraft before attempting a flight.

Each homebuilt aircraft is an individual aircraft and therefore potentially different, even from others of a similar design. These types of aircraft may have handling characteristics that require different skills to larger factory built aircraft. The LAA has identified that there is an increased risk of accidents in homebuilt aircraft during a pilot's first few hours on type. The LAA run a Pilot Coaching Scheme for its members whereby they can fly with experienced instructors to provide conversion training to different types of aircraft.