ACCIDENT

Aircraft Type and Registration:	Beagle B121 Series 1 Pup, G-AXPM
No & Type of Engines:	1 Continental Motors Corp O-200-A piston engine
Year of Manufacture:	1969
Date & Time (UTC):	22 April 2011 at 1504 hrs
Location:	Panshanger Aerodrome, Hertfordshire
Type of Flight:	Private
Persons on Board:	Crew - None Passengers - None
Injuries:	Crew - N/A Passengers - NA
Nature of Damage:	Propeller, landing gear and wings damaged, engine shock loaded and wingtip of parked aircraft damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	62 years
Commander's Flying Experience:	681 hours (of which 377 were on type) Last 90 days - 7 hours Last 28 days - 6 hours
Information Source:	AAIB Field Investigation

Synopsis

Following a 50-hour check, the aircraft's ignition switch was left in the RIGHT position, with no key in the switch, due to the use of an incorrect key. During the next pre-flight inspection the pilot perceived that the ignition switch was in the OFF position. As he turned the propeller by hand, as required by the aircraft's EXTERNAL INSPECTION checklist, the engine started and ran at full power. The aircraft broke free of its tie-downs, struck a parked aircraft and crashed into an earth embankment. Safety action has been taken concerning the content of the aircraft's flight manual and service manual checklists.

History of the event

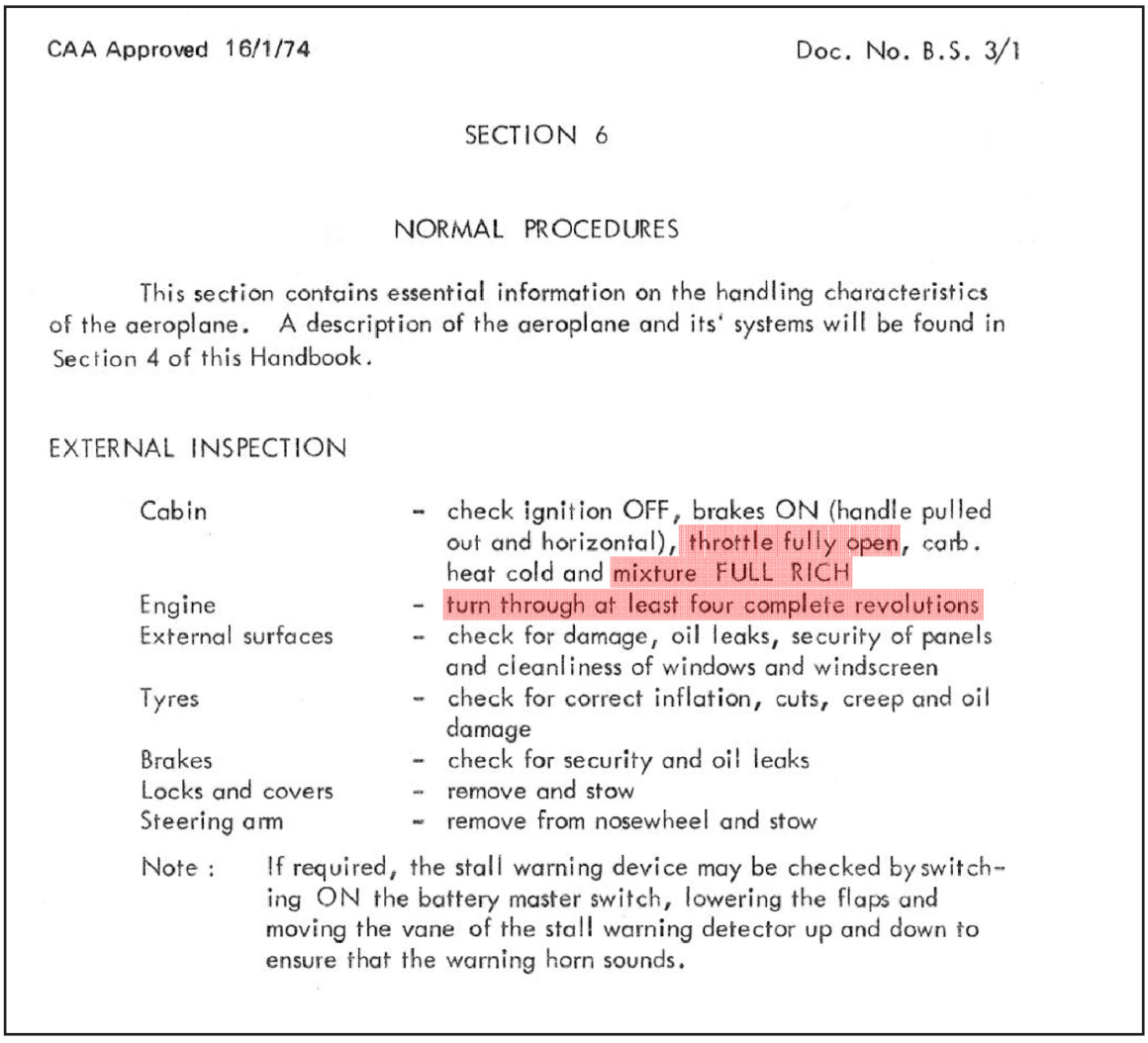
The aircraft had undergone a 50-hour maintenance check on the day preceding the accident. As the aircraft's maintenance organisation could not locate the ignition key for the aircraft, the engineer performing the inspection used another key, from a selection of spare keys that he kept. The 50-hour check included an engine ground run. After the ground run, the engineer withdrew the ignition key from the ignition switch whilst the switch was still in the RIGHT magneto position.

The following day the pilot arrived at the aircraft with the intention of making a local flight. The aircraft was parked on a hardstanding, secured by tie-downs to hard points under both the left and right wings. After removing

the wheel chocks, fuselage cover and pitot tube cover, the pilot proceeded to follow the pre-flight inspection tasks as set out in the aircraft's approved flight manual EXTERNAL INSPECTION checklist (Figure 1):

The pilot looked through the aircraft's left cabin door at the ignition switch, saw that no key was present in the switch and perceived that the switch was in the OFF position. He then proceeded to check that the aircraft's parking brake was set to ON, carburettor heat set to COLD, the throttle set fully OPEN and the mixture was set to FULL RICH. The pilot then turned the engine through by hand. He did this by standing beside the propeller, facing rearwards on the right side of the aircraft, and pulling the propeller downwards with his right hand.

On the second propeller rotation, the engine fired and immediately ran at full power. As the pilot dived for cover beneath the right wing, the aircraft broke free from both of its wing tie-downs and accelerated away, in a westerly direction. After clipping the left wingtip of a parked Cessna 310, the aircraft crashed into an earth embankment approximately 200 m from its parking position, and came to rest nose-down in a ditch. It



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SECTION 6

NORMAL PROCEDURES

This section contains essential information on the handling characteristics of the aeroplane. A description of the aeroplane and its' systems will be found in Section 4 of this Handbook.

EXTERNAL INSPECTION

Cabin	-	check ignition OFF, brakes ON (handle pulled out and horizontal), throttle fully open, carb. heat cold and mixture FULL RICH
Engine	-	turn through at least four complete revolutions
External surfaces	-	check for damage, oil leaks, security of panels and cleanliness of windows and windscreen
Tyres	-	check for correct inflation, cuts, creep and oil damage
Brakes	-	check for security and oil leaks
Locks and covers	-	remove and stow
Steering arm	-	remove from nosewheel and stow

Note : If required, the stall warning device may be checked by switching ON the battery master switch, lowering the flaps and moving the vane of the stall warning detector up and down to ensure that the warning horn sounds.

Figure 1

Beagle B121 Pup Series 1 EXTERNAL INSPECTION checklist (AAIB highlights)

sustained significant damage to its propeller, landing gear and wings in the accident.

The pilot did not receive any injuries. Following the accident, he took photographs of the ignition switch in an undisturbed state and also after he had used his own key to turn the ignition switch to the OFF position (Figure 2).

Inspection of the ignition switch

The ignition switch was recovered from the aircraft for further inspection, in addition to the key used by the maintenance engineer who completed the 50-hour check, and the owner's ignition key. It was found that by using the maintenance engineer's key, it was possible both to rotate the ignition switch fully, and also to withdraw the key from the switch with the switch in any of the OFF, RIGHT, LEFT or BOTH positions.

When the pilot's ignition key was tested in the switch, it was also possible to rotate the switch fully, but it was only possible to withdraw the key from the switch in the OFF position, which is the design intent.

The ignition switch was disassembled for further inspection and no internal faults were discovered.

Aircraft information

The Beagle B121 Pup Series 1 is a low-wing monoplane, powered by a single Continental O-200-A piston engine. It was certified in the United Kingdom in March 1968, to BCAR Section K airworthiness requirements. There are currently 54 Beagle B121 Pup aircraft on the UK register, and most of these aircraft entered service between 1967 and 1970. Later Series 2 and 3 of Beagle B121 Pup are similar in most respects to the Series 1, apart from the type of engine installed. All series of the aircraft are equipped with an electric starter motor, and it is usual to start the engine using this.

The current version of the EXTERNAL INSPECTION checklist for the Beagle B121 Pup Series 1, contained in section six of the approved flight manual, (document B. S. 3/1, Figure 1), was last revised in January 1974. The current revisions of the flight manuals for Series 2 and 3 of Beagle B121 Pup also contain similar EXTERNAL INSPECTION checklist instructions.

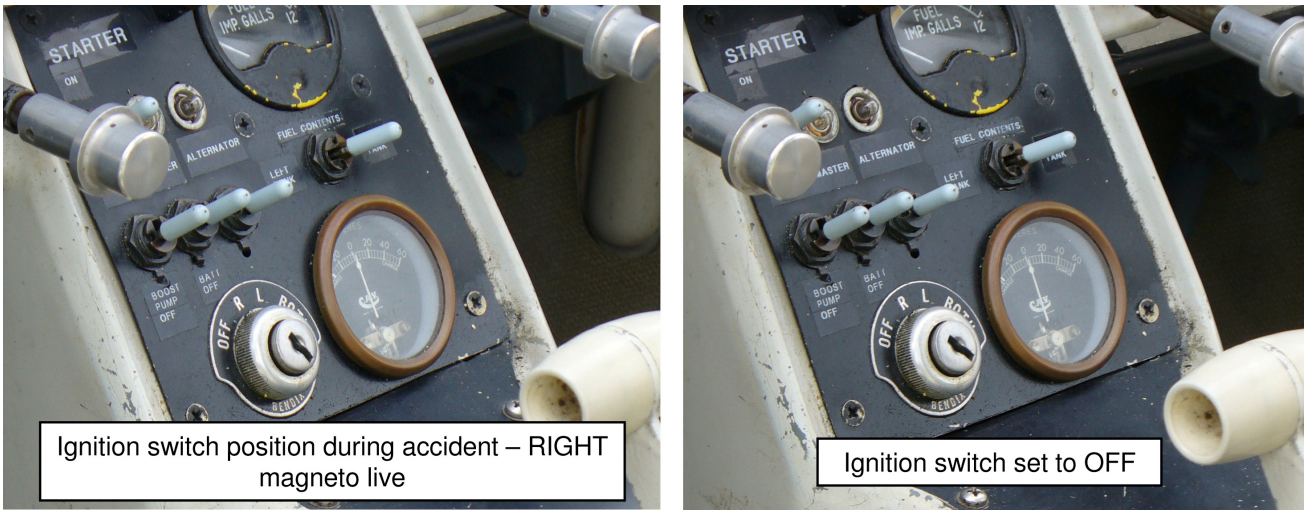

Figure 2

Ignition switch positions during and after the accident

The service manual applicable to all series of the aircraft (document 121/02/3-68) was last amended, to A.L. 10, in June 1969. The service manual PRE-START CHECKS checklist contains similar instructions to the flight manual in relation to turning the propeller by hand, with the mixture set to FULL RICH and the throttle set fully OPEN.

Airworthiness control of the Beagle B121 Pup

All series of Beagle B121 Pup aircraft are currently classified by the EASA as 'Orphan Aircraft', as they are not supported by a Type Certificate holder with a valid Design Organisation Approval. The Type Certificate for these aircraft has therefore been replaced by an EASA Specific Airworthiness Specification, and they are individually issued with an EASA Restricted Certificate of Airworthiness. Due to its orphan aircraft status, any continued airworthiness actions deemed necessary for the Beagle B121 Pup aircraft are directly controlled by the EASA.

Lack of previous occurrences

The AAIB's records were checked for previous occurrences of uncommanded engine starts on Beagle B121 Pup aircraft, but none were recorded. A commercially available pilot's checklist for the aircraft was purchased, to compare against the aircraft's approved flight manual. The commercial checklist's EXTERNAL CHECKS did not contain any instructions relating to setting the aircraft's throttle or mixture controls, nor did it require the propeller to be rotated by hand.

Two other pilots who were familiar with the Beagle B121 Pup were consulted in regard to their pre-flight inspection procedures for this aircraft type. Both pilots confirmed that during pre-flight inspections of the aircraft, they set the mixture to IDLE CUT-OFF and the throttle to CLOSED.

Analysis

The accident occurred because the propeller was rotated whilst the right magneto was live, despite no key being present in the ignition switch. When the pilot visually checked the ignition switch by looking into the cockpit from the left cabin door, he confirmed that no key was in the switch but parallax error made it difficult to differentiate between the RIGHT and OFF switch positions. In addition, the lack of a key in the switch reinforced the pilot's perception that the switch was in the OFF position, as this is what he had become accustomed to expect during seven year's ownership of the aircraft.

The aircraft's EXTERNAL INSPECTION checklist required that the pilot configured the aircraft in a state in which the engine would start, and run at full power, if for any reason the propeller was rotated whilst ignition system was live. In this respect, the checklist design was a dormant failure. It required a single breach of the only available defence – reliance on the ignition system being OFF – to create the dangerous situation where the engine would start, and run at full power, after being turned over by hand.

The cause of the ignition being left in a live condition in the accident was the use of an incorrect key by the maintenance engineer sustituting for the correct key. However, a similar hazardous condition could have arisen in the case of a broken magneto primary lead, or an internal electrical fault in a magneto.

It is likely that the lack of previous similar accidents is partially due to the use of commercially available checklists that do not contain pre-flight inspection tasks that place the engine in a configuration to start, when rotated by hand, in the event of a live ignition system.

Safety action

Following the discovery of deficiencies in the aircraft's EXTERNAL INSPECTION checklist, the UK support organisation for the aircraft prepared suitable amendments to the approved flight manuals for all series of Beagle B121 Pup. These were submitted to the EASA using the Form 36 procedure (*Application for Approval of a Stand-Alone or Minor Change Related Revision of Flight Manual*), and were accepted. The revised flight manual pages were promulgated to aircraft owners in September 2011. Amendments to the aircraft's service manual PRE-START CHECKS are currently in the process of being approved by the CAA.