ACCIDENT

Aircraft Type and Registration:	Thruster T600N 450, G-CBIO
No & Type of Engines:	1 Jabiru Aircraft Pty 2200A piston engine
Year of Manufacture:	2002
Date & Time (UTC):	17 January 2012 at 1150 hrs
Location:	Near Compton Abbas Airfield, Dorset
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Fuselage tube, nose pod and nose landing gear leg, empennage, right wing, propeller and engine damaged
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	63 years
Commander's Flying Experience:	269 hours (of which 47 were on type) Last 90 days - 5 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further inquiries by the AAIB

Synopsis

Following a reduction in engine power due to carburettor icing, the pilot made a forced landing in a field during which the aircraft turned over. The aircraft's carburettor heat system had been modified in an unapproved manner, rendering the aircraft more susceptible to carburettor icing. Two safety actions are being implemented as a result of this accident.

History of the flight

The aircraft was flying from Sandown Airfield to Compton Abbas. After cruising at 1,700 ft amsl, the pilot applied carburettor heat, reduced power to 2,000 rpm and commenced a descent to position the aircraft on the downwind leg for Runway 08 at Compton Abbas. At 1,400 ft amsl (600 ft aal) he tried to open the throttle to level off, but found that although the throttle lever moved, the engine power did not respond. He retarded the throttle slightly, which reduced the engine rpm, but when he tried to open the throttle again the engine power still did not increase. At this point the aircraft was approximately 1 nm north east of Compton Abbas Airfield and, deciding that he was too low to reach the runway, the pilot transmitted a MAYDAY message and selected a field to land in. After touching down the aircraft rapidly decelerated due to soft ground conditions and turned over, coming to rest inverted (Figure 1). Both occupants were uninjured and were able to vacate the aircraft without difficulty.

Figure 1
G-CBIO following the accident

Meteorology

An aftercast was provided by the Met Office for the Compton Abbas area at the time the accident occurred. It estimated that, at 1,700 ft altitude, the air temperature was +2°C and the dewpoint was +1°C. These conditions were conducive to serious carburettor ice formation at any power setting (Figure 2).

Aircraft inspection

Shortly after the accident the pilot moved the throttle control forwards to the OPEN position and observed that the Bowden-type throttle cable formed a bow between the throttle lever and the point where the cable entered the fixed outer sheath, indicating resistance in the throttle control circuit.

The aircraft was recovered from the field three hours after the accident by an aircraft maintenance engineer familiar with the aircraft type. He noted that the throttle butterfly spindle was free to rotate and the throttle cable between the throttle lever and the butterfly spindle was mechanically intact, and moved freely within the outer sheath.

Carburettor heat system

The aircraft was fitted with a carburettor heat system comprising an electrically heated jacket fitted to the inlet throat of the carburettor body, Figure 3(a). This differed from the production standard carburettor heat system installed when the aircraft was manufactured in 2002, in which hot engine oil is circulated through a hollow jacket attached to the exit throat of the carburettor body, in close proximity to the throttle butterfly Figure 3(b).

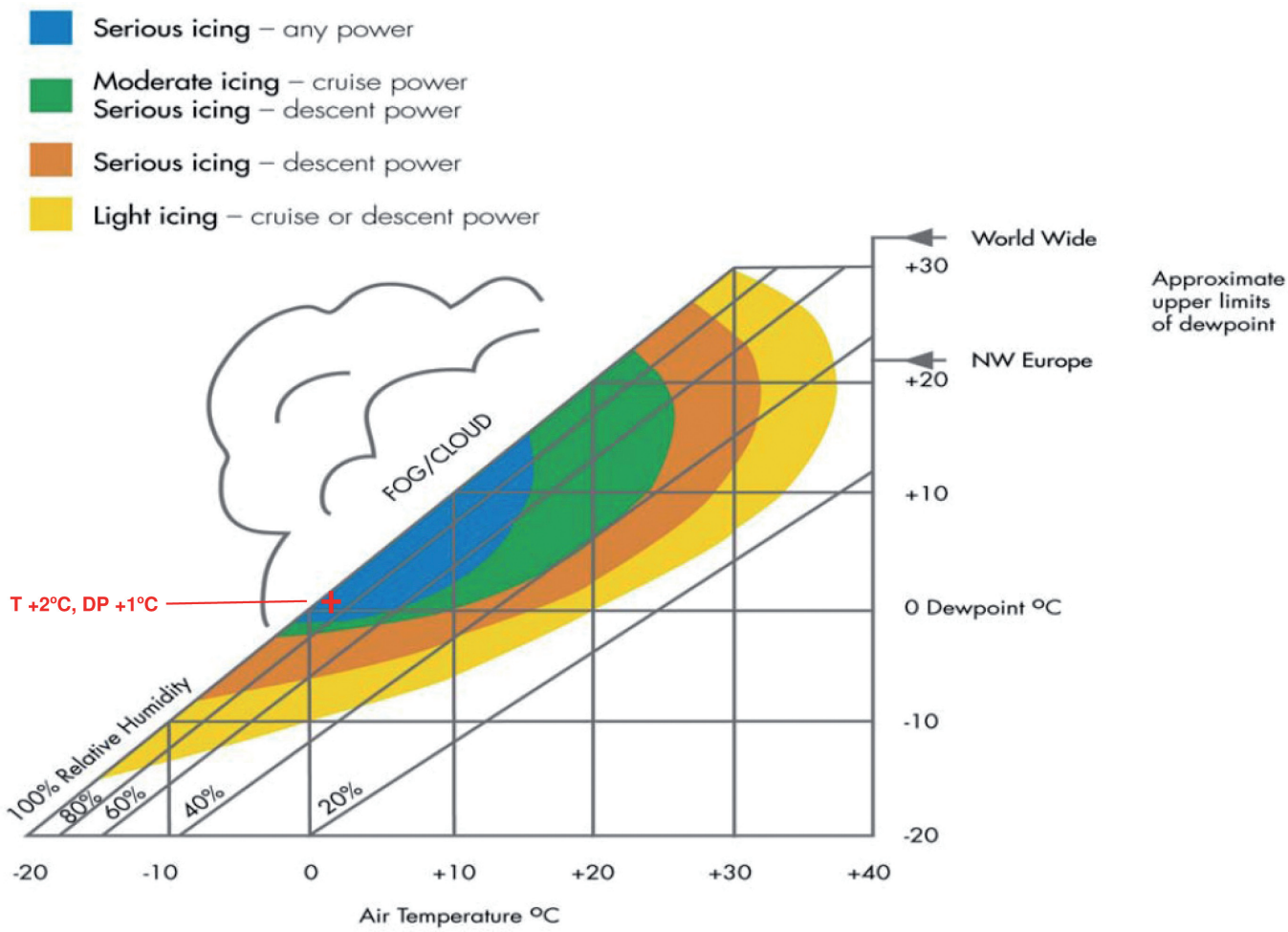


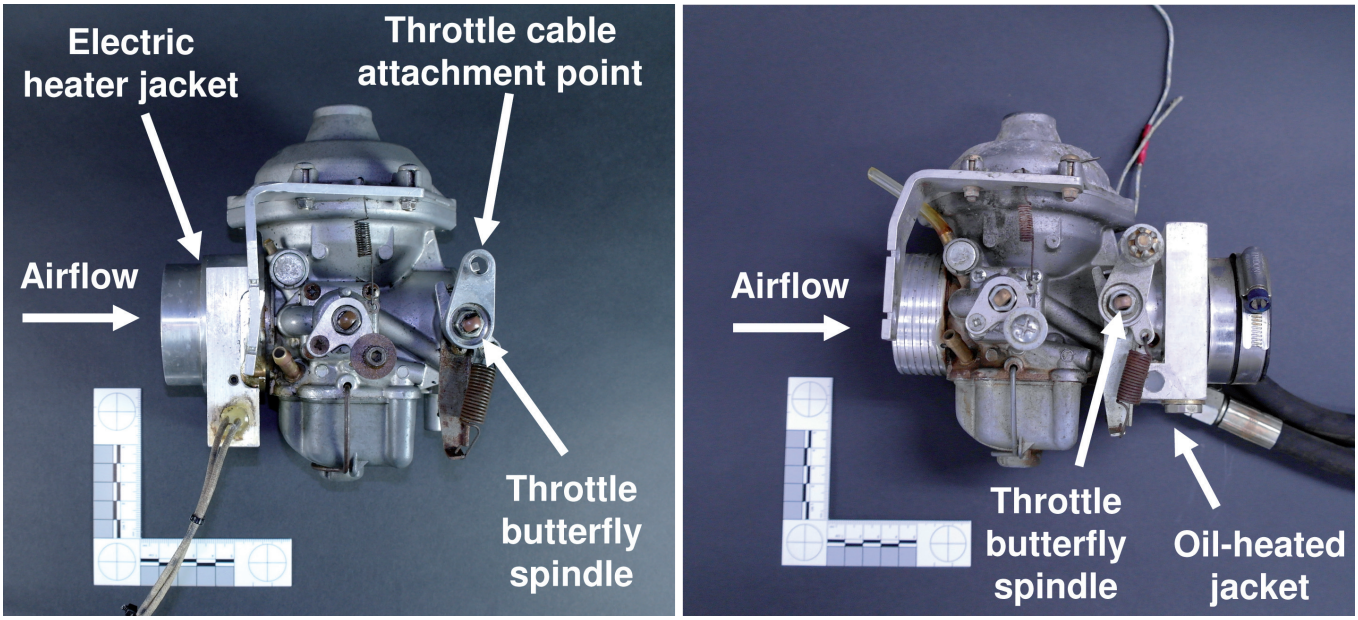
Figure 2

Carburettor icing chart

The ability of the electric heater jacket to warm the carburettor throttle butterfly valve was tested by cooling the entire carburettor in a refrigerator to 1ºC and applying 12 Volts to the heater jacket electrical terminals. Thermocouples were attached to the electric heater jacket and the butterfly valve, allowing the temperature of both components to be monitored. The results showed that after three minutes of heat application, the heater jacket had reached a temperature of 30ºC, whereas the butterfly valve temperature has risen by only 1ºC, to 2ºC. After six minutes the heater jacket had reached 45ºC and the butterfly valve temperature had risen to just 6ºC. The test was performed in static airflow conditions and without fuel evaporation from the carburettor jet, both would cause a large cooling effect at flight conditions. Therefore the butterfly valve's small temperature rise measured during the test would be very significantly reduced in the conditions encountered during the accident flight.

Aircraft records

The aircraft manufacturer confirmed that when the aircraft was built in 2002, the carburettor had been fitted with a production standard oil-heated jacket mounted downstream of the carburettor body, directly adjacent to the throttle butterfly valve. The engine fitted to G-CBIO at the time of the accident was confirmed, by



(a) G-CBIO carburettor heat configuration (b) Production configuration

Figure 3

Modified and production configuration carburettor heat arrangements

engine serial number, to be the same engine installed at the original build date. No details of the approved carburettor heat system were contained in either the aircraft maintenance manual or the CAA-issued Microlight Type Approval Data Sheet (TADS) for the Thruster T600N 450.

The aircraft logbook contained an entry in December 2003 stating that an electric carburettor heat system had been installed, although no additional details or part numbers were recorded, nor was the reason for the change in carburettor heat system. As the Thruster T600N 450 is a CAA Type Approved microlight, modifications to the aircraft may only be approved by either the aircraft manufacturer or the BMAA. Both organisations confirmed that, in relation to alteration of the carburettor heat system on G-CBIO, no such modification approval had been sought or granted.

The aircraft had undergone a total of seven 'permit to fly' maintenance inspections following modification of the carburettor heat system. The aircraft records did not contain any written findings regarding this non-conformance with the aircraft's production standard configuration.

Airworthiness requirements

The aircraft was approved to BCAR Section S airworthiness requirements, which do not contain any specific requirements relating to either engine reliability or induction system ice protection systems. Therefore the installation of the production-standard oil jacket carburettor heater was an enhancement of the aircraft over and above BCAR Section S requirements. A survey of AAIB accident records for Jabiru 2200A-powered Thruster T600N aircraft over a 10-year period between 2002 and 2012 revealed only one other accident in which carburettor icing may have been a factor. The UK fleet of this mark of Thruster aircraft currently stands at 64 and the low incidence of previous carburettor icing accidents suggests that the production-standard

carburettor heating system is effective in preventing serious carburettor ice formation.

Discussion

The cause of the reduction in available engine power in G-CBIO was probably due to the formation of ice within the carburettor, restricting the opening movement of the throttle butterfly valve. The possibility that water may have been present in the throttle control Bowden cable which subsequently froze during flight, replicating the reported throttle symptoms, was considered unlikely due to the air temperature being above 0ºC at the aircraft's operating altitude. By the time the pilot had recognised the power loss, the aircraft was too far away from the runway to allow a landing at Compton Abbas Airfield, resulting in a forced landing. Pilots are reminded that the presence of carburettor icing may become evident when power changes are made, particularly a reduction in power. In conditions where carburettor icing is likely, it is advisable to make power reductions at locations and heights from which a successful forced landing may be made.

The vulnerability of the carburettor to icing was significantly increased by the installation of an unapproved electrical carburettor heat system. Testing conducted by the AAIB demonstrated that this unapproved system was unlikely to be effective at melting ice within the carburettor.

The aircraft had undergone seven 'permit to fly' maintenance inspections between installation of the electric carburettor heat system and the accident flight and the non-conformity remained undetected during this period. Neither the TADS nor the aircraft maintenance manual contained details of the production standard system and therefore the only remaining safety barrier in place was the Thruster T600N 450 type-specific knowledge of the BMAA inspectors conducting the annual inspections. Thus, in this instance, the presence of a carburettor heat system (of an unapproved and inappropriate type) combined with the lack of available technical information may be considered to have been a contributory factor in the resulting accident.

Safety actions

The BMAA will issue a defect alert to their inspectors to highlight the issue of unapproved modifications in general, and remind inspectors of the approved type of Thruster T600N 450 carburettor heat system. The aircraft manufacturer will also amend the Thruster T600N 450 TADS to include details of the approved carburettor heat system on this aircraft.