

## **Proposed Temporary Deviation on fuel gauging system of Hélicoptères Guimbal Cabri G2 when using automotive unleaded gasoline.**

### **Introductory note:**

The hereby presented Temporary Deviation has been classified as important and as such shall be subject to public consultation, in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) of which states: "2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

### **STATEMENT OF ISSUE:**

Hélicoptères Guimbal (HG) has applied to EASA for certification of a Major Change of its Cabri G2 helicopter type, relating to introduction of alternate fuel in addition to the initially approved fuel AVGAS 100LL (ASTM D910 rev.A). The proposed alternate fuels are:

- AVGAS UL91 (ASTM D7547)
- Automotive unleaded gasoline (EN228 or ASTM D4814) with the following limitations, as per Operator's manual associated to HG engine STC n° EASA.E.S.01001:
  - Minimum octane: 98 ((RON  $\geq$  98 and MON  $\geq$  87) or AKI  $\geq$  93)
  - Zero content of alcohols.

The Cabri G2 fuel gauging system is of capacitive type, this latest is sensitive to the fuel relative permittivity. The sensitivity affects the accuracy of the fuel quantity reading that requires a full calibration. AVGAS 91UL is covered by the initial compliance demonstration activities performed with AVGAS 100LL fuel quantity calibration that considered a fuel relative permittivity of 2.

The above certification hypothesis is not valid for the automotive unleaded gasoline ("MOGAS") that can have a relative permittivity different from that of AVGAS. In-service experience in General Aviation has demonstrated that the indicated fuel amount could significantly differ from the actual fuel amount. When fuelling with AVGAS 100LL after basic calibration with MOGAS, the indicated fuel amount was found lower than the actual amount in tanks. Investigation revealed that fuelling with MOGAS after a basic calibration with AVGAS 100LL, the indicated fuel amount is higher than the actual fuel amount in the tanks. In both situations the intended function requirement are not met and in the latest the consequences prompted EASA to release an Airworthiness Directive (EASA\_AD\_2011-0021\_1).

As both fuels (AVGAS and MOGAS) are intended to be certified onto the Cabri G2, including in mixed quantities, the Cabri G2 fuel quantity measurement system shall be capable to perform its intended function, to allow a quick, accurate and true reading (including the "zero" of unusable) for the fuels, and any combination of them, thus showing compliance with requirements of CS 27.1301 and CS 27.1337(b)(1).

As the initial design proposed by HG will not allow compliance with these requirements when using MOGAS or fuel mix, HG has been required to modify it and, pending the modification, HG has defined the following compensating factors allowing the Agency to grant HG a time-limited deviation of 18 months:

- A placard in the cabin allows the pilot to directly convert fuel gauge indication to actual fuel quantity, with the same non usable fuel considerations as initial Cabri G2 certification. The placard shows corrections as a function of percentage of automotive gasoline in AVGAS.  
The pilot has then quick access to actual fuel quantity throughout the flight, whatever the fuel mix he is using.
- This placard is implemented through flight manual conditional pages.
- These pages also include emergency procedures and normal procedures highlighting two points:
  - 1) Use of the fuel gauge correction placard throughout the flight for fuel management.

- 2) Low fuel light is an independent indication that is not dependent on fuel type. It should therefore be used as a safety feature by using it as a warning light instead of caution light.