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ELECTRONIC FLIGHT INFORMATION SYSTEMS

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## 1. Introduction

Electronic Flight Information Systems (EFIS) are electronic instruments that incorporate multiple flight, navigation or powerplant instruments. They are often described as ‘glass cockpits’. BCAR Section S issue 5 introduced a number of new airworthiness requirements aimed specifically at EFIS. This document describes and interprets these requirements to aid BMAA members modifying their aircraft to install an EFIS (and writing a compliance report to accompany a modification application)<sup>1</sup>.

This document is based on the assumption that, following instrument loss, microlight aircraft can be flown and landed reasonably safely using only external cues, and without requiring exceptional piloting skills. If, for a particular type, this assumption is not considered entirely true, backup instruments should be considered<sup>2</sup> (irrespective of whether an EFIS is fitted or not).

## 2. Requirements introduced in BCAR Section S issue 5

The following requirements – specific to EFIS – were introduced in BCAR Section S issue 5. There follows the BMAA interpretation of these requirements.

### 2.1. Requirements

#### S 1301 Function and Installation

c) Where a single electronic display unit is used to show some or all of the required flight and navigation and powerplant instrument parameters required by BCAR S 1303 and S 1305, the following apply (See AMC S 1301 c.):

- 1) the required instruments parameters must be displayed to the pilot at all times;
- 2) the display must be capable of continuous reliable operation for a minimum of 20 minutes after failure of the electrical generating system;
- 3) if a stall warning device is fitted in accordance with S 207 b), it must be independent of the electronic display; and
- 4) failure of one sensor must not adversely affect the display of other parameters which are independent of that sensor.

#### AMC S 1301 c)

Where a single electronic display unit is used to show some or all of the required flight and navigation and powerplant instrument parameters required by BCAR S 1303 and S 1305, the reliability of the single electronic display should be shown to be at least equivalent to traditional instruments.

#### S 1557 Miscellaneous markings and placards

g) **Electronic displays.** Where a single electronic display unit is used to show instruments required by BCAR S 1303 and 1305, a placard instructing the pilot to land as soon as practicable in the event of electronic display failure must be plainly visible to the pilot.

#### S 1583 Operating limitations

h) **Electronic displays.** Where a single electronic display unit is used to show instruments required by BCAR S 1303 and 1305, an instruction to land as soon as practicable in the event of instrument failure must be furnished.

### 2.2. BMAA interpretation

**S 1301 c) 1).** Screens intended to be displayed during flight must contain the required instruments as listed in the TADS/HADS for the type<sup>3</sup>. It is not necessarily feasible for all screens to contain the required instruments (e.g. configuration screens). In this case the pilot must familiarise himself with the instrument before flight so that he only selects screens intended for use in flight and can easily return to a default screen.

**S 1301 c) 2).** The aircraft must be fitted with a charging indicator (e.g. warning light, voltmeter or ammeter) so that the pilot is warned if the electrical generating system fails and can turn off any unnecessary electrical consumers. The time till EFIS failure can then be calculated from the remaining electrical consumption and the capacity of the aircraft’s battery. The charging indicator may be part of the EFIS.

**S 1301 c) 3).** Self-explanatory. Only applies if a stall warning device is required for the type.

**S 1301 c) 4).** Self-explanatory.

**AMC S 1301 c).** Traditional microlight instruments are not certified and do not have to show any particular level of reliability rendering it impossible to demonstrate compliance with this requirement! Nonetheless EFIS should be

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<sup>1</sup> This document does not discuss all requirements applicable when installing an EFIS; only those requirements specific to EFIS.

<sup>2</sup> In particular a backup ASI on an aircraft where controlling speed satisfactorily on approach would otherwise be difficult, and a (non-electronic) slip-ball on 3-axis control aircraft with low directional stability and/or significant adverse yaw.

<sup>3</sup> Not permanently displaying certain required engine parameters may be acceptable as long as a clear warning is given if a limit is breached. The BMAA must be consulted, and an equivalent level of safety demonstrated. The difficulty is that any trend in the parameter is not communicated to the pilot.

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installed in accordance with the EFIS manufacturer's advice and operated within any limitations specified by the EFIS manufacturer.

*S 1557 g).* Self-explanatory.

*S 1583 h).* Self-explanatory. Refers to operating limitations contained in the Pilot's Handbook.

### 3. Configuration

Many EFIS are configurable. EFIS may be configured without explicit modification approval from the BMAA. However the configured instrument must comply with the following requirements or the Permit to Fly is invalidated. For genuinely user-configurable<sup>4</sup> EFIS these requirements must be appended to the aircraft's Pilot's Handbook.

*S 1301 c) 1), S 1303 & S 1305.* Screens intended to be displayed during flight must contain the required instruments as defined in the TADS/HADS for the type.

*S 1323.* The air speed indicator must at least cover the range  $V_{S0}$  to 1.05 times  $V_{NE}$ . Powerplant instruments must at least cover the allowable operating range.

*S 1541 c) & S 1581 c).* Air speed and powerplant instruments: must be displayed in the same units as corresponding limitations are placarded.

*S 1545.* Air speed indication: speed ranges  $V_{S0}$ - $V_{FE}$  and  $>V_{NE}$  must be clearly marked white and red respectively, e.g. with coloured lines or sectors<sup>5</sup>.

*S 1549.* Powerplant instruments: maximum and, if applicable, minimum safe operating limits must be marked with a clear warning, e.g. a red line or red sector, or clear visual or audible alarm.

Advice must be taken from the BMAA if the displayed air speed is to be corrected for position errors. This is to ensure that there is no confusion between Indicated Air Speeds and Calibrated Air Speeds.

### 4. Operating limitations

#### 4.1. Placards

The following placard must be fitted.

*IN CASE OF DISPLAY FAILURE LAND AS SOON AS PRACTICABLE*

#### 4.2. Pilot's Handbook

The EFIS operator's manual must be appended to the Pilot's Handbook.

The Pilot's Handbook must be supplemented with the following. The 'general operation' section is required for all EFIS-equipped aircraft. The 'user configuration' section is only required for aircraft equipped with genuinely user-configurable<sup>4</sup> EFIS.

##### *General operation*

- *The instrument must be operated to the EFIS operator's manual.*
- *The pilot must familiarise himself with the instrument before flight – in particular to ensure he only selects screens intended for use in flight and can easily return to a default screen.*
- *In the event of display failure the pilot should land as soon as is practicable.*

##### *User configuration – the aircraft's Permit to Fly is invalidated if these guidelines are not adhered to.*

- *Screens intended to be displayed during flight must contain the required instruments as defined in the TADS/HADS for the type.*
- *The air speed indicator must at least cover the range  $V_{S0}$  to 1.05 times  $V_{NE}$ . Powerplant instruments must at least cover the allowable operating range.*
- *Air speed and powerplant instruments: must be displayed in the same units as corresponding limitations are placarded.*
- *Air speed indication: speed ranges  $V_{S0}$ - $V_{FE}$  and  $>V_{NE}$  must be clearly marked white and red respectively, e.g. with coloured lines or sectors.*
- *Powerplant instruments: maximum and, if applicable, minimum safe operating limits must be marked with a clear warning, e.g. a red line or red sector, or clear visual or audible alarm.*
- *Advice must be taken from the BMAA if the displayed air speed is to be corrected for position errors (to ensure that there is no confusion between Indicated Air Speeds and Calibrated Air Speeds).*

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<sup>4</sup> For example an EFIS that can be configured installed in the aircraft using the buttons on the front face.

<sup>5</sup> If this is not possible alternative markings may be acceptable if an equivalent level of safety can be demonstrated. The BMAA must be consulted.