

SUBJECT : **Flight crew alerting**
REQUIREMENTS incl. Amdt. : **CS 25.1322 at Amendment 13**
ASSOCIATED IM/AMC¹ : Yes / No
ADVISORY MATERIAL : **AMC 25.1322**

INTRODUCTORY NOTE:

The following Deviation has been classified as important and s such shall be subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) 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."

IDENTIFICATION OF ISSUE:

Gulfstream has applied for a Type Certificate for the new model GVII-G500. The CS 25.1322 at Amendment 13 is applicable to GVII-G500. CS 25.1322 was significantly modified at amendment 11. The regulatory material on Flight crew alerting 25.1322 is completely harmonized between FAA and EASA (same 14CFR 25.1322/CS 25.1322 and same AC 25.1322-1/AMC 25.1322).

A number of non-compliances to CS 25.1322 at Amendment 13 has been found and agreement made with Gulfstream to make the necessary design changes to make the GVII-G500 fully compliant. Since those design changes will be introduced after the issuance of the EASA Validating TC for the type, this Deviation is issued to record this and identify the mitigating factors to be put in place to ensure that the Type Certificate is compliant with the essential requirements for airworthiness in Annex II of the regulation (EU) 2018/1139.

Considering all the above, the following Deviation is proposed:

¹ In case of SC, the associated Interpretative Material and/or Acceptable Means of Compliance may be published for awareness only and they are not subject to public consultation.

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|  <p>EASA European Union Aviation Safety Agency</p> | <p>Deviation</p> | <p>Doc. No. :</p> <p>Issue : 1</p> <p>Date : 11 June 2019</p> <p>Proposed <input type="checkbox"/> Final <input checked="" type="checkbox"/></p> <p>Deadline for comments: 02 July 2019</p> |
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Deviation to CS 25.1322 Amendment 13

Deviation 1: Red Sensor Failure Flags (ATT, HDG, Red X on PFD speed/altitude/vs tape)

The design for TC is the following:

- These flags are correlated with their associated sensor failure CAS message (IRS Fail, ADS Fail) and cannot occur independently.
- The associated sensor fail CAS messages for each flag provides the alerting function, which includes a second attention getting sense.
- The associated sensor failure CAS messages are either cyan or amber depending on the remaining redundancy of the system (single or multiple sensors) and pilot action required on ground.
- The AFM corrective action for these flags is to observe the associated CAS message and perform the procedures for the associated CAS message.
- The use of Red colour for these flags appears as a heritage from the historical use of red instrument failure flags.
- Automatic reversion is used to manage these sensor failures when the aircraft is in the air. The presence of any of these red indications in flight requires a minimum of three failures and is therefore extremely improbable.

While compliance to 14CFR25.1322 has been found by FAA, EASA cannot validate this finding as part of the GVII-G500 validation project against:

- CS25.1322 (b): Those alerts do not necessitate immediate flight crew response and therefore must not be classified as Warning alerts.
- CS25.1322 (e)(1)(i): Not being warning alerts, red colour should not be used.

Deviation 2: Red Monitor Warning Function Failure Flags (Red X in CAS message window)

The design for TC is the following:

- This flag can only occur with a failure of both Monitor Warning Functions (MWFs). There is no associated action for a Red X in the CAS message window in flight.
- Automatic reversion from the selected MWF to the second MWF occurs both on the ground and in flight. Therefore the presence of a Red X in the CAS message window is remote since it requires a dual MWF failure.
- In any scenario other than a simultaneous failure of both MWFs, the Red X in the CAS window would be preceded by the single MWF 1-2 Fail CAS message. The MWF 1-2 Fail CAS message is amber on the ground and cyan in flight, and provides a second attention getting sense.
- The use of Red colour for these flags appears as a heritage from the historical use of red instrument failure flags.



While compliance to 14CFR25.1322 has been found by FAA, EASA cannot validate this finding as part of the GVII-G500 validation project against:

- CS25.1322 (b): This alert does not necessitate immediate flight crew response and therefore must not be classified as Warning alerts.
- CS25.1322 (e)(1)(i): Not being warning alerts, red colour should not be used.

Deviation 3: Lateral or Vertical Deviation Indicator Red Flags (Red X on CDI or VDI)

The design for TC is the following:

- These flags can only occur when NAV is the selected lateral guidance (green data) and data from the selected NAV receiver is not being received. This may be due to a failure of the NAV receiver or lack of received data due to aircraft positioning.
- In the case of failure of the NAV receiver, a cyan CAS will be present. The CAS provides the alerting function with secondary sense, with associated corrective action per the AFM.
- In the absence of a failure, the red X is simply due to aircraft positioning (the aircraft is not in a position to receive the signal on the tuned frequency). In this scenario, there is no corrective action beyond normal procedures for conducting an instrument approach using a ground based NAV receiver. The particular actions are to tune and identify the desired navigation receiver, and to position the aircraft as required to fly the approach. This is the minimum performance level required by trained and qualified crew. These normal instrument procedures are thoroughly trained during initial and recurrent training.
- The use of Red colour for these flags appears as a heritage from the historical use of red instrument failure flags.

While compliance to 14CFR25.1322 has been found by FAA, EASA cannot validate this finding as part of the GVII-G500 validation project against:

- CS25.1322 (b): This alert does not necessitate immediate flight crew response and therefore must not be classified as Warning alerts.
- CS25.1322 (e)(1)(i): Not being warning alerts, red colour should not be used.

Deviation 4: MWF Miscompare flag without second attention-getting cue and annunciation improperly classified

The design for TC is the following:

- This miscompare flag appears when the two MWFs have a miscompare on warning or caution messages.
- The applicant classified this alert as an Advisory alert and does not implement a second attention-getting cue.

While compliance to 14CFR25.1322 has been found by FAA, EASA cannot validate this finding as part of the GVII-G500 validation project against:

- CS25.1322 (b): This alert does necessitate immediate flight crew awareness and subsequent flight crew response and therefore must be classified as a Caution alert (and not as an advisory alert).
- CS25.1322 (c)(2):As a result of the misclassification of the alert (Not being classified as a Caution), a second attention-getting cue is not provided.

Deviation 5: GS/LOC Mismatch Flag without second attention-getting cue and annunciation improperly classified

The design for TC is the following:

- This mismatch flag LOC appears when the two localizers tuned at each pilot station deviate from each other by a given threshold.
- This mismatch flag GS appears when the two glideslope tuned at each pilot station deviate from each other by a given threshold.
- The applicant classified these alerts as Advisory alerts and does not implement a second attention-getting cue.

While compliance to 14CFR25.1322 has been found by FAA, EASA cannot validate this finding as part of the GVII-G500 validation project against:

- CS25.1322 (b): This alert does necessitate immediate flight crew awareness and subsequent flight crew response and therefore must be classified as a Caution alert (and not as an Advisory alert).
- CS25.1322 (c)(2): As a result of the misclassification of the alert (Not being classified as a Caution), a second attention-getting cue is not provided.

Deviation 6: FPV Mismatch annunciation improperly classified and Flag without second attention-getting cue:

The design for TC is the following:

- This flag is driven by a comparison of the flight path displayed on each PFD. When the comparator threshold is exceeded, the flag is posted on both PFDs in the primary field of view.
- FPV is a derived parameter from IRS and ADS data which themselves have monitoring and associated CAS.
- The applicant classified this alert as an Advisory alert and did not implement a second attention-getting cue.

While compliance to 14CFR25.1322 has been found by FAA, EASA cannot validate this finding as part of the GVII-G500 validation project against:

- CS25.1322 (b): This alert does necessitate immediate flight crew awareness and subsequent flight crew response and therefore must be classified as a Caution alert (and not as an Advisory alert).

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|  <p>EASA European Union Aviation Safety Agency</p> | <p>Deviation</p> | <p>Doc. No. :</p> <p>Issue : 1</p> <p>Date : 11 June 2019</p> <p>Proposed <input type="checkbox"/> Final <input checked="" type="checkbox"/></p> <p>Deadline for comments: 02 July 2019</p> |
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- CS25.1322 (c)(2): As a result of the misclassification of the alert (Not being classified as a Caution), a second attention-getting cue is not provided.

Deviation 7: RALT Miscompare annunciation improperly classified:

The design for TC is the following:

- This flag is driven by a comparison of the radio-altitude coming from the two radio-altimeters displayed on each PFD. When the comparator threshold is exceeded, the flag is posted on both PFDs in the primary field of view.
- The applicant classified this alert as an Advisory alert (with CAS message and single chime aural attention getting).

While compliance to 14CFR25.1322 has been found by FAA, EASA cannot validate this finding as part of the GVII-G500 validation project against:

- CS25.1322 (b): This alert does necessitate immediate flight crew awareness and subsequent flight crew response and therefore must be classified as a Caution alert (and not as an Advisory alert).
- CS25.1322 (e)(1)(ii): As a result of the misclassification of the alert (Advisory instead of Caution), the CAS message is depicted in cyan and not in amber as required for a Caution.

Mitigating Factors

EASA has determined the following mitigating factors for the acceptance of the identified deviations:

- A. The applicant shall address the deviations No. 1, 2 and 3 in the EASA AFMS, noting the Red Annunciations and Procedures
- B. The applicant shall address the deviations No. 4, 5, 6 and 7 in the EASA AFMS, noting the Amber Annunciations and Procedures
- C. The Applicant shall improve procedures in the AFM complemented by clear instructions so that FD and/or AP use in combination with wrong FPV are timely discontinued to avoid negative effects on a/c trajectory, to address Deviation No. 6
- D. The Applicant shall reinforce flight crew training in the OSD FCD to address Deviations 1 to 7, by emphasising the lack of second attention-getting cue and the AFM procedure for Deviation No. 6.
- E. The Applicant shall reinforce the experience requirements for pilots, introduced in the OSD FCD, by requiring experience from similar type of avionics with glass cockpit on the same class of aircraft and similar operations, as well as additional flight hours before starting the training, to address deviations 1 to 7.

For those reasons, EASA accepts the deviation **against CS 25.1322 at Amendment 13.**



Abbreviations

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| AP | Auto Pilot |
| ATT | Attitude |
| CAS | Crew Alerting System |
| FD | Flight Director |
| PFD | Primary Flight Display |
| FPV | Flight Path Vector |
| GS | Glide Slope |
| HDG | Heading |
| LOC | Localizer |
| MWF | Monitor Warning Function |
| RALT | Radar Altimeter |
| OSD | Operational Suitability Data |
| FCD | Flight Crew Data |