



**TERMS OF REFERENCE**

**Task Nr:** E.004  
**Issue:** 1  
**Date:** 22 June 2011  
**Regulatory reference:**  
**Reference documents:** CS-E Engines

<p><b>1. Subject:</b> Engine Vibration</p>
<p><b>2. Problem / Statement of issue and justification; reason for regulatory evolution (regulatory tasks):</b></p> <p>CS-E.650 requires that each engine must undergo vibration surveys to demonstrate the satisfactory vibratory characteristics of "those components that may be subject to mechanically or aerodynamically induced vibratory excitations".</p> <p>As detailed in the existing AMC, it has generally been interpreted that demonstration of the engine's vibratory characteristics must be by full engine test. However, experience on recent certification projects has shown that the defined range of speeds may not be achievable during bench testing (particularly for the core spools of high bypass ratio engines) without placing the test engine in a highly unrepresentative condition. Furthermore, where new designs embody only small incremental changes relative to an already certificated product, other techniques (such as rig tests) may be more appropriate to demonstrate their susceptibility to vibratory forcing.</p> <p>In addition, Industry has been investing heavily in developing analytical methods that can predict a range of component behaviours, including fault conditions; these techniques are already capable of predicting certain vibratory characteristics both accurately and reliably. However, it is not clear how much reliance an applicant may place on such analyses to substantiate compliance with the safety objective.</p>
<p><b>3. Objective:</b></p> <p>Review and amend, as appropriate, CS-E.650 and associated AMC to clarify the safety objective and to detail acceptable means of compliance.</p>
<p><b>4. Specific tasks and interface issues (Deliverables):</b></p> <ol style="list-style-type: none"><li>1) Clarify the vibratory mechanisms and influencing factors to be considered when establishing safe vibratory characteristics.</li><li>2) Clarify the purpose of the survey extending 3% (and further 2% in case of a stress peak arising), beyond the maximum permissible speeds and outline acceptable means of compliance with this intent.</li><li>3) Provide more detailed advice about allowable test configurations.</li><li>4) Provide more detailed advice about means of compliance other than full engine test including (but not limited to) the use of analysis as evidence of compliance.</li><li>5) Clarify the relevance of high aerodynamic speeds (<math>N/\sqrt{T}</math>) to component response.</li></ol>

- 6) Clarify the definition of "maximum permitted corrected rotational speed".
- 7) Clarify the use of corrected speed versus mechanical speed assessments for the turbine core
- 8) Wherever possible, retain harmonisation with FAA requirements.

**5. Working Methods** (in addition to the applicable Agency procedures):  
Agency (using Stakeholder's Group (ShG))

**6. Time scale, milestones:**

NPA: 2012/Q2

Decision: 2013/Q3

**ANNEX 1****STAKEHOLDER GROUP COMPOSITION**

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TBD