

**Comment Response Document
Engine Alliance GP7200
Equivalent Safety Finding ESF1
CS-E 790(a)(1) “Ingestion of Large Hailstones”**

Commentor:	UK CAA
Paragraph:	EASA position
Comment:	<p>The EASA position states that the safety objective of CS-E 790(a)(1) is comparable to CS E 800 “Bird Strike and Ingestion” and therefore that the provision of CS-E 800(f)(1), to allow evidence other than engine tests, should be admissible for showing compliance with CS-E 790(a)(1).</p> <p>It is not clear that sufficient justification has been presented in this ESF to explain why CS-E 800(f)(1) can be read across to CS-E 790(a)(1). If this was the intention of the authors of the CS-E requirements, we would have expected CS-E 790 to have been revised accordingly with its own equivalent to 800(f)(1) but was not. One could equally conclude that the absence of an equivalent to 800(f)(1) in CS-E 790 is deliberate and that alternative means of compliance to engine testing are not admissible.</p>
Justification:	
Proposed Text: (if applicable)	N/A
EASA Response:	<p>Other than referring to the intention of the authors of CS-E, the commenters do not offer a justification for their comment. EASA justification is as follow:</p> <p>CS-E 790(a)(1) requires that “<i>The ingestion of large hailstones ..., with the Engine at Maximum Continuous power/ thrust, must not cause unacceptable mechanical damage or unacceptable power or thrust loss after the ingestion, or require the Engine to be shut down</i>”.</p> <p>Two effects of the large hailstone ingestion should be considered: the mechanical damage due to the kinetic energy of the ice, and the ingestion by the engine of the corresponding mass of ice or water.</p> <ol style="list-style-type: none"> 1. Power or thrust loss caused by the ingestion of ice or water: Ingestion of large hailstones does not adequately assess the effect of ice or water ingestion on the engine. This is actually evaluated by testing in accordance with CS-E 790(a)(2). Compared with CS-E 790(a)(1), much more liquid water and ice are ingested during testing in accordance with CS-E 790(a)(2). This ESF concerns only CS-E 790(a)(1). The engine will be fully tested in accordance with CS-E 790(a)(2) and no equivalent safety finding is necessary to demonstrate the engine capability to ingest water or ice. 2. Power or thrust loss, or necessity to shut down the engine, because of mechanical damage: The safety objective in term of mechanical damage is comparable with the one of CS-E 800. Means of compliance other than complete engine test are accepted for CS-E 800, it is therefore reasonable to also accept these other means of compliance for CS-E 790(a)(1). Before publication, the ESF document will be revised to mention that, in such a case, the content of CS-E 800(f)(1), and related AMC, need to be taken into consideration when using these other means of compliance for CS-E 790(a)(1).