Comment Response Document
(SC E-02 - Airworthiness Standard for CS-22H AMT Olympus HP Turbojet Engine to be operated in powered sailplanes)

Commentor:	UK CAA
Para:	Discussion
Comment:	While there is a general statement that those paragraphs which are applicable for turbine engines as well as for piston engines remain applicable, it is not clear in the CRI precisely which paragraphs of the original CS22 are retained. In order to clarify the requirements applicable to turbine engines, we suggest that one of the following formats is used: Option 1) All requirements applicable to turbine engines are included in a new standalone subpart H-T, i.e. the retained requirements of CS 22 Subpart H are added to the requirements in the CRI. It is then clear whether subpart H or subpart H-T is applicable to a particular aircraft/engine configuration. Option 2) The turbine engine requirements are incorporated in the existing Subpart H requirements and additional paragraphs are identified as being applicable to turbine engines. This is similar to the format already used in CS23 e.g. CS23.903b) or e). This option would also simplify the requirement as the piston engine wording would not need to be duplicated in the turbine engine requirement as has occurred in paragraphs such as CS22T.1825 **(SC3)**.
EASA Response	Accepted, it will be clearly identified which paragraphs of the existing CS-22 Subpart H are also applicable to turbine engines.

Commentor:	UK CAA
Para:	Additional – Safety Analysis
Comment:	While piston engines generally fail in a benign manner, gas turbine designs exhibit a number of failure modes which may result in hazardous effects at the aircraft level. Depending on the specifics of the design, such failures may include non-containment of high energy debris in the event of rotor failure, combustion case failure leading to uncontrolled fire, axial ejection of rotors, over speed, over temperature, inability to control thrust level etc. In order to identify all of the significant failures associated with this design, it is proposed that a safety analysis be required to at least identify hazardous failure modes and detail the actions required to limit their probability of occurrence to levels acceptable to EASA, where necessary. The analysis may lead to identification of particular parts which must have prescribed limitations applied (e.g. manufacturing controls, inspections, additional maintenance, life limitation etc) in order to meet required levels of integrity and may identify particular instrumentation required to satisfactorily control the engine.
EASA Response	Accepted, the proposed text will be added to the Special Condition. The hazardous failure modes will be addressed in the frame of a FMEA.

Commentor:	UK CAA
Para:	Additional – Provision of Instruments
Comment:	The provision of instruments for CS22 aircraft is currently covered by requirements in CS22.1305 in Sub Part F. These provisions have, however, been developed for piston engines and are not appropriate for an engine of this type. The special conditions developed for this engine therefore must ensure that sufficient information is provided to the airframe designer to ensure safe operation of a gas turbine unit, to allow modification of the requirements of subpart F when the engine comes to be installed.
EASA Response	Noted, necessary instrumentation will be co-ordinated with the airframer under the existing provisions of CS 22.1805.

Commentor:	UK CAA
Para:	Discussion
Comment:	As indicated in the comment above, this Special Condition seems to have been restricted to amendment of Subpart H of CS22. As a result engine certification requirements only have been considered. In order to be able to certify a turbine engined aircraft to CS22, a number of requirements in the basic code such as flight, engine mount, engine instrument requirements and Appendix I for Self Sustaining Powered Sailplanes would also need to be revised. Additional requirements would also be needed to address starting (use of gas) and fire protection. It is recommended that the whole of CS22 is reviewed and changes to the requirements to address turbine engined aircraft are added to the Special Condition.
EASA Response	The comment may be valid but its content is outside of the scope of the engine certification. This comment will be transferred to the Rulemaking Directorate in order to be considered at a later Rulemaking Activity. For installation of the engine, a new SC on the airframe applicant will need to be developed.

Commentor:	UK CAA
Para:	SC13 CS22T.1859 **(SC13)**
Comment:	This paragraph allows for containment of either the largest blade section as defined in CS22T-1860(c)(1) **(SC14)** or hub fragments as specified in 22T-1860(c)(2) **(SC14)**, but does not define when either case must be considered. This could lead to the applicant electing to carry out the lower energy test case, on the basis that it is the easiest to satisfy, but this should not be the intent of the SC. If it is concluded from the safety analysis (see comment above) that the probability of rotor burst is such that it cannot be discounted, then it is the higher energy hub test which needs to be performed to demonstrate containment. If it is shown to the satisfaction of EASA that measures are put in place to ensure the integrity of high energy rotor parts and therefore make the failure of these parts sufficiently remote that they do not need to be considered, then the blade containment test may be performed.
EASA Response	Accepted, the SC will be changed in order to require the rotor burst test as the most severe condition.

Commentor:	UK CAA
Para:	Additional – Continued Rotation
Comment:	Continued rotation following engine shutdown (either planned or unplanned) should be covered by the requirements, unless it can be shown that continued rotation is not possible following shutdown.
EASA Response	Accepted, text as proposed will be added.

Commentor:	UK CAA
Para:	SC14 CS22T.1860 **(SC14)**
Comment:	It is proposed that the definitions of "critical rotor" and "non-critical rotor" are added, since these are not defined at present
EASA Response	Accepted, will be added

Commentor:	UK CAA
Para:	Additional - Overspeed and Overtemperature testing
Comment:	If it is elected not to demonstrate rotor containment in CS22T-1860 **(SC14)**, then it is proposed that some reserve over maximum operating condition is demonstrated, in terms of both overspeed and overtemperature to show that hazardous failure will not occur up to these conditions. This is standard in other gas turbine designs.
EASA Response	SC will be modified to require Rotor Containment, see **SC13** CS22T.1859

Commentor:	UK CAA
Para:	CS 22.1823
Comment:	This paragraph should be amended to specifically require that engine seizure and blade-off loads are included in the engine mounting loads specified.
EASA Response	Accepted, will be added.

Commentor:	UK CAA
Para:	SC4 Engine Control System
Comment:	The reference to "radio magnetic interference" is not consistent with other codes for engines, and the SC does not cater for the possibility of lightning in the area in which the aircraft is operating.
EASA Response	Currently there are no specific sailplane requirements existing, normally flights in conditions conducive to lightning strikes must be avoided (AFM) and a general consideration of radio magnetic interference is given in CS 22.1301(a), (b). Therefore it seems not to be appropriate to impose a requirement at engine level that's not covered at the airframe level.

Commentor:	UK CAA
Para:	CS22.1808
Comment:	The word "Thrust" should be added to title of this paragraph, for consistency with terminology in the SC raised for this project.
EASA Response	Accepted, "Thrust will be added"

Commentor:	UK CAA
Para:	SC10 Endurance test
Comment:	Sequence 6 of table; should refer to power/thrust
EASA Response	Accepted

Commentor:	UK CAA
Para:	SC1, last bullet point
Comment:	- Typographical error
EASA Response	Noted

Commentor:	AMT Netherlands b.v.
Para:	CS-22T.1858 **(SC12)** - Cyclic Endurance Test
Comment:	(a) Subsequent some questions regarding this subparagraph are summarized: - depending on the results of the tests prescribed in CS22T.1843 **(SC8)** ... - How does the request of this subparagraph depend on the results of the tests prescribed in CS 22T.1843 **(SC8)**? - In which case are additional tests necessary? - may be conducted in a cell of a powered sailplane and consists of ground and flight tests ... - What is the motivation to combine engine tests with flight tests and to perform additional tests on a powered sailplane? - Is it usual to request flight tests within an engine certification? - temperatures are summery (at least 30°C on the ground) ... - What is the motivation to request this temperature? - Aren't the relevant flight envelope temperatures requested by paragraph CS 22T.1803 **(SC2)**? (b) This subparagraph seems to describe the same idea as subparagraph (a).
EASA Response	Agreed, as being the case for all other engine certification projects, there should not a flight testing requirement be created. In addition there seems to be no benefit for determining the engine vibration characteristics based on the proposed flight testing. Therefore this requirement will be deleted. The provision of 22T.1843(b) **(SC8)** in the case of any peak indication seem to be sufficient to demonstrate engine integrity.

Commentor:	EASA, P. Lair
Para:	Special Condition Layout
Comment:	The layout of the CRI-T1 and the included Special Conditions, i.e. display of newly introduced CS-22 Subpart H paragraphs may prejudice the result of a possible later rulemaking process. Therefore it is proposed to delete all such reference and issue the Special Condition strictly project specific.
EASA Response	Agreed.