European Aviation Safety Agency	**Certification Review Item**	**CRI C-xxx**
	[Aircraft] EASA Project No. xxxxxx **Structural Certification Criteria for Large Antenna Installations**	**Issue: xx** **Date: dd.mm.yyyy** **Page: 1 of 4** **Status: Open**

REQUIREMENTS: CS 25.23, 25.301, 25.305, 25.365, 25.571, 25.581, 25.603, 25.605, 25.609, 25.613, 25.629, 25.631, 25.841, 25.901, 25.1419, 25.1529, and Appendix H

ADVISORY MATERIAL: **---**

PRIMARY PANEL: 03 (Structures)
SECONDARY PANELS: ---

CATEGORY: Means of Compliance / Interpretative Material

Statement of Issue:

[Applicant] has applied for EASA approval of a Supplemental Type Certificate (STC) that includes installation of the structural mounting provisions and radome for a XXX installation. On similar projects, questions have been raised regarding the applicable structural requirements and acceptable means of compliance. The purpose of this CRI is to identify these requirements and provide a medium by which the compliance to these requirements is documented.

Discussion:

The consequences of loss of an antenna and/or radome become more significant with an increased size and weight of the antenna/radome installation. Therefore, past practice as applied to small antenna installations may not always be sufficient when applied to a large antenna installation. In fact, if loss of the antenna and/or radome is deemed catastrophic either due to decompression, or due to the antenna and/or radome striking the vertical or horizontal stabilizers, or for some other reason, then the structural certification criteria are more stringent. The XXX installation as proposed by the applicant is considered as a large antenna installation.

Note: The structural requirements outlined herein are based on the latest amendment of CS-25, which may have to be modified to be consistent with the agreed upon certification basis of this installation.

EASA Position dated dd.mm.yyyy:

EASA requests that the applicant provides the means of compliance for each of the regulations identified below.

CS 25.23 Load Distribution Limits
The effect of the antenna/radome installation on the weight, centre of gravity, and load distribution limits of the aeroplane must be considered. These changes must be documented in the weight and balance document as required by CS 25.29 and CS 25.1519.

CS 25.301(b) Flight Loads Validation
Methods used to determine load intensities and distribution must be validated by flight load measurement unless the methods used for determining those loading conditions are shown to be reliable, or conservative.

CS 25.305(e) Vibration and Buffeting
The effects of vibration and buffeting on the aeroplane must be considered, as well as on the antenna/radome installation itself. CS 25.251 also applies, and needs to be complied with.

CS 25.365(e) Pressurized Compartment Loads
Rapid pressurization of the antenna compartment (radome) must be considered as outlined in CS 25.365(e)(3) if loss of the radome/antenna could interfere with continued safe flight and landing. CS 25.365(e)(3) requires the consideration of "the maximum opening caused by aeroplane or equipment failures not shown to be extremely improbable."

EASA's interpretation of CS 25.365(e)(3) is that to address structural failures, the opening size resulting from a skin bay failure (bounded by two adjacent frames and two adjacent stringers) should generally be considered (i.e. is not extremely improbable) as a minimum opening size, unless a smaller opening can be justified based upon the maximum level of cracking that can be conservatively expected when a directed inspection for the structure under the radome exists in the ALS. (The assumed crack size and resulting opening should account for bulging affects and the possibility of missed opportunities for detection.) Failures to equipment and items such as seals should also be considered separately and in combination with structural failures as appropriate.

Consideration of CS 25.365(e)(1) is not required as the engine disintegration is assumed to adequately "vent" any remaining section of radome if the compartment beneath is penetrated. Application of the formula hole size requirement of CS 25.365(e)(2) is also not required, since, for the size of radome being considered, the majority of hole sizes up to the maximum stated in the formula will exceed the boundary of the antenna/radome. Furthermore, the potential for such large openings to create debris problems equivalent to or worse than the loss of the antenna alone supports the position that application of CS 25.365(e)(2) to such antenna would be beyond the accepted intent of the rule. Rather, the focus for compliance to the decompression requirement should be consideration of any airframe or equipment failures not shown to be extremely improbable, as explained above.

CS 25.571 Damage Tolerance and Fatigue Evaluation of Structure
A damage tolerance evaluation must be performed on any radome/antenna structure whose failure due to fatigue, corrosion or accidental damage could result in loss of the antenna/radome and subsequent tail strike, or other hazard such as rapid decompression of the aeroplane. Any inspection that is determined necessary as a result of this evaluation must be addressed as per CS 25.1529 and Appendix H.

CS 25.581 Lightning Strike
The antenna and radome installation must be designed such that the aeroplane is protected against catastrophic effects from lightning.

CS 25.603 Materials
Materials used must conform to approved specifications. The suitability of the material to withstand the operational environment (e.g. temperature and humidity) must be assessed.

CS 25.605 Fabrication Methods
The methods of fabrication used must produce a consistently sound structure. Each new fabrication method must be substantiated by a test program.

CS 25.609 Protection of Structure
Each part of the structure must be suitably protected against deterioration or loss of strength in service and must have provisions for ventilation and drainage where necessary for protection.

CS 25.613 Material Strength Properties and Design Values
Design values used to design the antenna/radome installation must be established on a statistical basis. The applicant must take into account the operational environmental conditions (e.g. temperature and humidity) when establishing design values.

CS 25.629 Aeroelastic Stability Requirements
The applicant must demonstrate by analysis and/or test that the aeroplane is free from aeroelastic instability with the antenna and radome installed. This may be accomplished by a comparative analysis showing that the aeroelastic stability of the aeroplane will be unaffected by the change. If the antenna/radome installation is not conformal to the fuselage, such as an antenna/radome mounted above the fuselage, the installation itself must also comply with CS 25.629.

CS 25.631 Bird Strike
The applicant must show that a bird strike on the antenna/radome, including attachments, will not prevent continued safe flight and landing. This includes consideration of parts that may separate from the aeroplane. This requirement need not be considered if it can be demonstrated that a bird cannot strike the antenna/radome, including attachments, within the normal flight envelope.

CS 25.841 Cabin Pressurization
Certain aeroplanes approved for operation at high altitude (above 41.000 ft) have Special Conditions addressing pressurization. For these aeroplanes, the requirements defined in the Special Condition apply to any modification of the pressure vessel.

CS 25.901(c) Sustained Engine Imbalance
The applicant may need to consider the effects of sustained engine imbalance (windmilling) if the antenna/radome design is such that it would be susceptible to structural failure due to vibration. It must be shown that the resulting vibration will not cause a structural failure of the antenna/radome installation that would result in a foreseeable hazard, either at the point of failure or downstream.
AMC 25-24 provides further guidance on this subject.

CS 25.1419 Icing
Ice shedding from the antenna/radome installation should be considered. It must be shown that such shedding and the resulting damage to other parts of the aeroplane does not interfere with continued safe flight and landing.

CS 25.1529 & Appendix H Instructions for Continued Airworthiness
The applicant must demonstrate compliance by developing an appropriate maintenance and inspection program.

Airworthiness Directives
The applicant should address any Airworthiness Directive(s) applicable to the area of the antenna/radome installation.

[Applicant] Position:

Conclusion:

PCM Signature
Date: