



Building Structures and Materials DOA Aerospace Competencies

At Albatroz Engenharia, building Aerospace structures and materials competencies inside the Aeronautical Department of our DOA is a constant challenge. The Compliance Verification Engineers (CVE) take a relevant role in mentoring and providing guidance to the junior design engineers. Both roles always learn from each other. Want to know more about the core aerospace structures and materials competencies? Keep reading.

First, any DOA structural project begins with the analysis of the customer requirements, the constraints of the project and the aircraft or helicopter Type Certificate Data Sheet (TCDS).

After that, the CVE and the Head of Office of Airworthiness (HOA) can classify if the change is minor or major. If it is minor, the next step is to choose the applicable Certification Specifications (CS) requirements. Depending on whether the change is to be performed on a small aircraft (CS-23), large aircraft (CS-25), small helicopter (CS-27) or large helicopter (CS-29), the relevant applicable requirements related to structures and materials are chosen, to guide the demonstration of compliance.

Usually, the demonstration of compliance is necessary on most aircraft changes. It can be as simple as a statement or declaration (Means of Compliance 0) or a

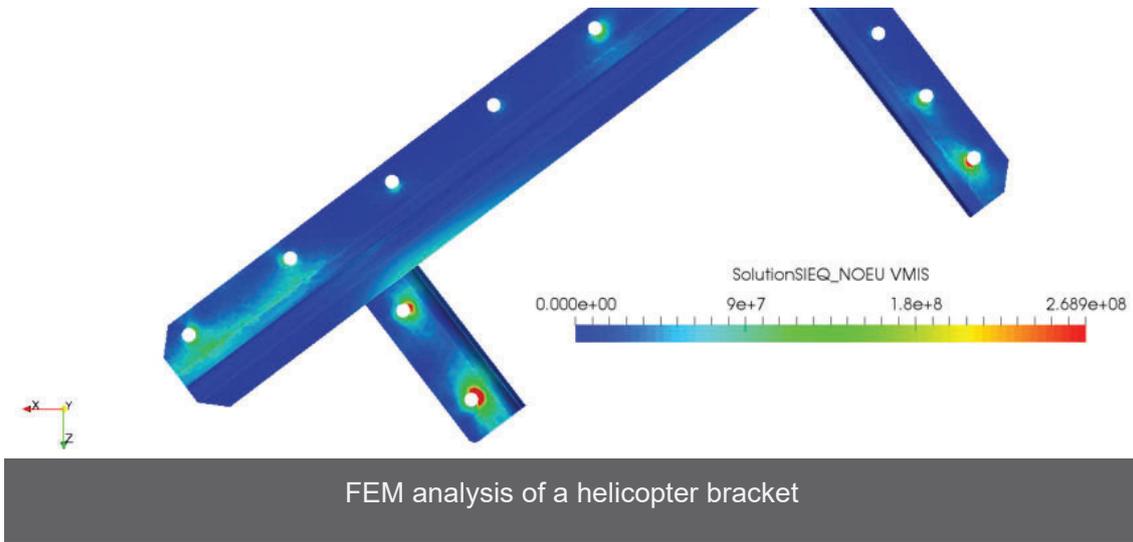
design review referring to a description or a drawing (Means of Compliance 1). However, in most cases, it is necessary a detailed analysis such as structural evaluations or electrical loads analysis (Means of Compliance 2). A safety assessment (Means of Compliance 3) may also be used to show compliance throughout a systematic evaluation of system hazards, failure modes and mitigation measures, if needed.

In more demanding changes, laboratory tests (Means of Compliance 4) or ground tests (Means of Compliance 5) and flight tests (Means of Compliance 6) may be necessary.

For instance, for a structures' CVE to evaluate a change, usually a stress analysis (Means of Compliance 2) is required with an analytical demonstration of connection failures modes such as: tear out, shear failure of fasteners, net tension and bearing. Most of the riveted or bolted connections on a change are analysed based on all these connection failure modes. Depending on the change, it may be necessary to calculate the margins of safety (MS) of the new structures and also confirm that the area of the helicopter or aircraft that is going to be changed still have positive MS in the fasteners.

If the geometry is complex, a Finite Element Method (FEM) analysis may be required. Usually, when FEM is used for compliance demonstration, it is necessary to validate the model with hand calculations and take special attention to the boundary conditions and check if the model constraints are as close as possible to the real situation.

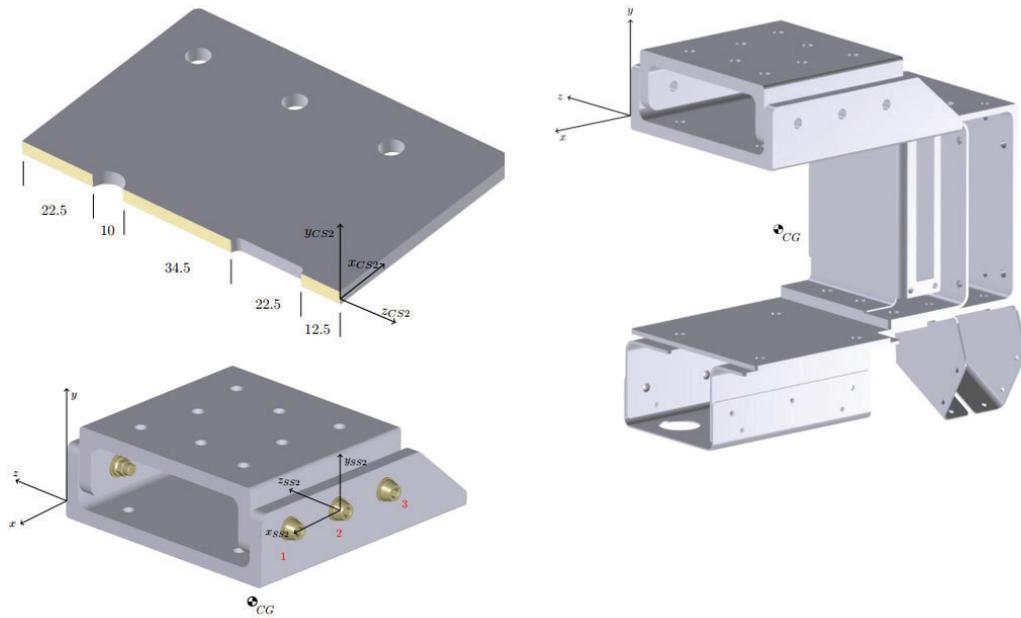
When selecting the FEM elements (shell, solid or beam) the design engineer should consider the degrees of freedom and characteristics of each element and node. Additionally, an adequate mesh type and size shall be used, and the accuracy of the results shall be demonstrated based on a mesh convergence study.



Besides the revision of all those topics, the Structures' CVE is also responsible to verify: the material selection, the surface treatment, and the surface finishing. These characteristics are relevant not only to guarantee static strength properties but also to guarantee that the fatigue lifetime of the components is according to the expectations.

If the part is made of sheet metal with any bending radius, it is also relevant to check if the bedding line is perpendicular to the direction of lamination and if the radius is adequate for the thickness and heat treatment of sheet metal used.

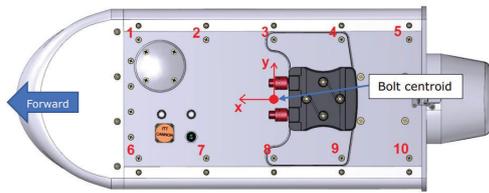
Dimensional tolerances must be precisely identified in the drawings, especially in critical components and in big assembly with several parts interfaces, sometimes a fraction of a millimeter can make the difference in accepting or rejecting a component.



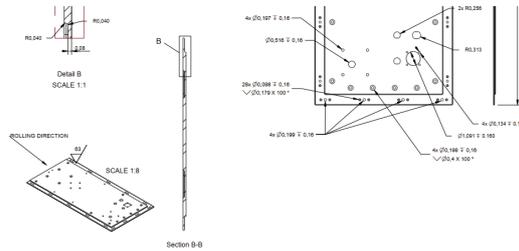
Preliminary design evaluation of a structural assembly

Finally, parts marking is also verified by the CVE, the Part Number and Serial Number (if applicable) shall be marked on each part to guarantee traceability and configuration control.

As shown in this article, the structures and materials competencies inside the DOA are vital to guarantee a good design and share knowledge with new design engineers. Creating a culture of sharing thoughts, experiences and ideas is important for the better achievement of customer needs keeping high quality standards.



Helix 300 bolt centroid used in the bolt connection assessment



Some details about the Helix 300 top plate design

For further information contact our commercial department: comercial@albatroz-eng.com or visit our website: www.albatroz-eng.com