New type of permanent Camposites / Aluminum joint for Aircraft

Graduate

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Introduction: This thesis explores the design, analysis, and testing of a new aluminum-to-composite permanent joint for aerospace applications. The proposed solution utilizes standard, low-cost solid Monel rivets combined with washers to distribute loads more evenly and minimize damage to carbon fiber composite materials.
The primary target is to replace more expensive and labor-intensive solutions, such as blind bolts or Hi-Lite fasteners, with a joint that offers comparable mechanical performance, easier installation, and lower cost per piece.

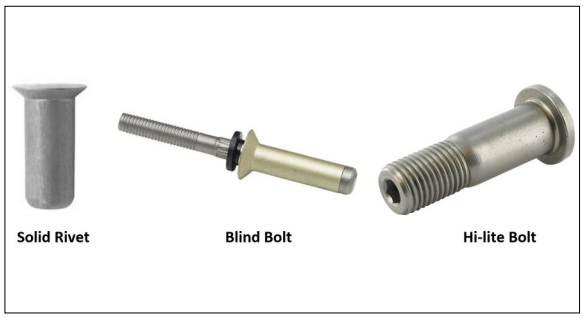
Approach: The proposed joint uses standard solid rivets in combination with specially selected washers to better distribute loads and minimize damage to the composite material. Extensive testing was carried out to assess the mechanical behavior of different configurations, with particular attention to how the washer's geometry affects overall joint performance.

The study revealed that the balance between stiffness and flexibility plays a key role in the joint's effectiveness. Some configurations led to localized stress concentrations, while others provided a more favorable load distribution and damage tolerance.

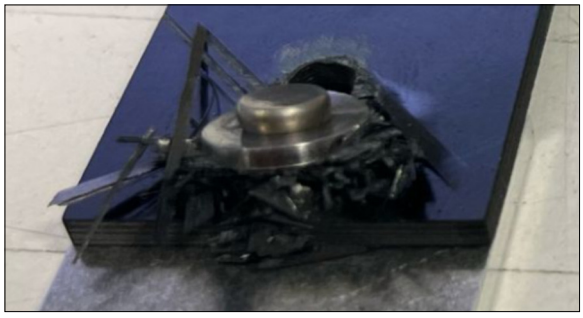
An important finding was the influence of the joint design on failure behavior. Certain configurations promoted early, visible signs of damage on the composite side, which can be advantageous for maintenance and safety monitoring.

Result: Overall, the work demonstrates that a carefully optimized washer design can significantly enhance joint performance while keeping manufacturing and installation simple and cost-efficient. The proposed solution is especially well-suited for applications subjected to low to moderate mechanical loads, offering a promising alternative for selected aerospace use cases.

Types of rivets tested
Own presentment



Specimen failure (Static test)
Own presentment



Static tests procedure
Own presentment

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Subject Area
Plastics Technology, Simulation Technology