

Structural Breadboard Testing



What Is Structural Breadboard Testing?

Structural breadboard testing is a vital part of validating the [structural integrity](#) and **performance of space hardware** during its development phase. It allows manufacturers to determine **key parameters of full-scale structures** in a reduced, cost-effective format, enabling iterative testing and refinement before moving to final design or production. It forms an important component of our [testing services for space applications](#).

What Are Structural Breadboards?

In structural testing, a **breadboard is an early-stage prototype** or physical model of a spacecraft or its components, designed to evaluate its **structural integrity and mechanical performance**. Structural breadboards are built to represent the overall **dimensions, materials, and mechanical interfaces** of the final design. However, they may simplify or exclude non-critical details, for example they may be built flat instead of curved.

This approach enables **multiple iterations** of testing variations or the testing of a certain representative area from a full-scale specimen. Due to the specific focus, **it can be tested at lower cost** and with **shorter turnaround times** compared to a complete full-scale specimen testing.

By focusing on **fundamental structural elements** like welded or riveted joints, stringer runouts or window cut-outs, breadboards allow engineers to **detect potential weaknesses early** in the design phase. In this way, breadboards serve as **essential intermediate test platforms**, bridging the gap between **theoretical design calculations** and the final hardware's qualification and/or certification.

What Structural Breadboards Testing Services Do We Offer for Space Applications?

At **Arplus+ Laboratories**, we provide **comprehensive breadboard testing services** that help validate your space hardware's **structural integrity** and **performance** before committing to full-scale production. Our capabilities include:

- **Static Testing:** We verify structural functionality and performance under controlled load conditions, ensuring that your design can withstand both expected and off-nominal loading scenarios.
- **Stiffness Assessments:** By applying predefined load cases, we evaluate the stiffness of the entire specimen or at specific locations relative to each other and compare them to the design requirements that have to be met.
- **Limit and Ultimate Load Testing:** We push your breadboard to its calculated loading conditions, ensuring that it can sustain the design loads without irreversible damage in the later produced flight hardware.
- **Rupture Load Testing:** In worst-case scenarios, we identify the exact loading and deformations conditions on the path to failure and at the level at the structure fails, providing valuable data for design optimizations and material selections.
- **Uncertainty Assessments:** We offer a dedicated uncertainty assessment to understand the quality of testing from single sensors influences - like force - or the uncertainty influences of multiple sensors to calculated parameters, like stiffnesses.

To gather precise, **high-fidelity data**, we employ a range of **advanced instrumentation**, including **strain gauges**, **displacement sensors**, and **Digital Image Correlation (DIC) systems**. Through multiple load cases—such as commissioning, stiffness evaluation, ultimate load application, and rupture assessment—we deliver robust, **actionable insights** into your breadboard's structural characteristics.

What Are the Benefits of Structural Breadboards Testing?

Adopting a **breadboard testing approach** to space hardware offers a variety of **advantages** to manufacturers, integrators, and space agencies:

- **Cost Efficiency:** Detecting and addressing issues during the breadboard testing phase is less costly than finding them during the later stages of development or even after launch.
- **Early Risk Mitigation:** By focusing on critical details such as joints, cut-outs, and interfaces, potential design flaws can be identified and corrected before investing in final hardware production.
- **Accelerated Design Iteration:** Rapid and frequent testing cycles enable developers to refine their designs quickly, streamlining the development process and improving final product quality.

- **Improved Reliability:** It increases confidence in system reliability by thoroughly testing critical components and interfaces.
- **Enhanced Data Quality:** Instrumentation-rich breadboard tests offer detailed insight into material behavior and structural responses, informing more accurate predictions for final full-scale hardware.
- **Informed Decision-Making:** Data gathered from breadboard testing supports informed decisions regarding materials, manufacturing methods, and design modifications, ultimately improving reliability and mission success.

Why Choose Applus+ Laboratories for Structural Breadboards Testing for Space Applications?

When you partner with [Applus+ Laboratories](#), you benefit from a wealth of experience, advanced testing capabilities, and a commitment to excellence:

- **Specialised Expertise:** Our engineering teams have deep experience in structural testing for the space industry. We not only provide data but also guide you through the interpretation and application of results.
- **Customised Solutions:** We design bespoke test concepts, load introduction elements, and specialized tooling to address your specific requirements, whether you're examining unique interfaces or complex geometries.
- **State-of-the-Art Instrumentation:** Our instrumentation setups—from strain gauges to DIC systems—ensure accurate, high-resolution measurements, enabling robust validation of your breadboard's structural integrity.
- **Proven Track Record:** With a history of successful collaborations across European launcher programs and space missions, such as Vega-C and Ariane 6, we bring a strong reputation for reliability, quality, and timely delivery.
- **End-to-End Support:** From concept development and finite element analysis (FEA) to the execution of test programs and final certification, Applus+ Laboratories provides comprehensive support that streamlines your path to qualification and mission-readiness.

By choosing **Applus+ Laboratories**, you secure a **dedicated testing partner** who understands the **complexities of space structures**, offers **agile breadboard testing services**, and delivers **reliable, data-driven insights** that enable **informed decision-making** and enhance your mission's prospects for success.