



Fabreeka Soft Support System for Ground Vibration Testing



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TABLE OF CONTENTS

What is the Fabreeka Soft
Support System? 03

How is the Fabreeka Soft
Support System Changing
Aircraft Testing? 04

Examples of Real-world
Applications. 05

Innovative Solutions for the
Future of Aircraft Testing. 06

Learn More About Us. 07

What is a Fabreeka Soft Support System?

Fabreeka's [Soft Support System](#) (SSS) supports ground vibration testing (GVT) for aircraft manufacturers from around the world. The purpose of the SSS is to isolate aircraft for GVT. During GVT, aircraft manufacturers and engineers measure (as accurately as possible) the natural frequencies, their associated mode shapes, and modal damping values of aircraft, often for a variety of loading conditions and configuration changes.

This data is necessary during the [Federal Aviation Administration](#) certification process of a new or modified aircraft to ensure the aircraft is structurally stable. Together, manufacturers and engineers use the data from GVT to validate flight control responses, structural frequency functions, and any flight anomalies. For example, if an airplane hits turbulence amid a flight, GVT testing will help ensure that the aircraft is strong enough that it will not fail.

During GVT of an aircraft, the modal testing requires the simulation of a free-free boundary condition, like that of a regular flight operation. To achieve this environment, Fabreeka works with structural and dynamic testing groups of aircraft manufacturers to design the required SSS for testing.

The SSS includes a minimum of three low frequency, pneumatic isolators that support and float the aircraft at its jacking joints. The system also includes a pneumatic control panel, height indicator panel, leveling valves, and several standard safety features to not only make the system reliable but also safe to use during GVT testing.

Before ground vibration testing, Fabreeka's soft support system lifts the aircraft on the designated support point joints utilizing its mechanical jacks. Once the aircraft is off the ground, the landing gear can retract. For safety purposes, the jack system can lower the aircraft closer to the ground to a predetermined height. Once the aircraft is at the proper elevation and level, the air chamber is pressurized to lift the aircraft on the air column. Now, the aircraft is decoupled from the ground and ready for GVT.

Key Take Aways:

Fabreeka's SSS supports ground vibration testing for manufacturers around the world.

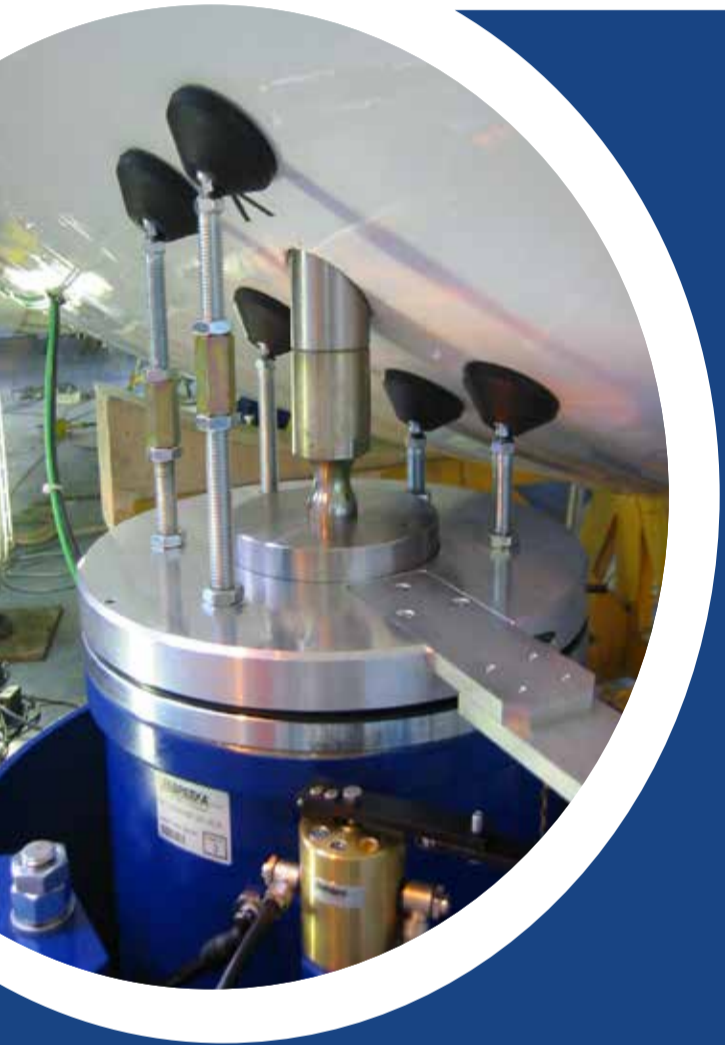
Data collected during GVT is used to ensure an aircraft is structurally stable.

The SSS isolates the aircraft to simulate a free-free testing environment.

The system is made up of pneumatic isolators, mechanical jacks, and a control panel that supports and float the aircraft.



How is Fabreeka's SSS Changing Aircraft Testing?



Professionals can save time and money during GVT by using a Fabreeka custom SSS. Traditional methods — such as testing with bungee cords — are very time-consuming. Bungee methods require adjustments and reconfigurations for every load condition, which adds both time and cost to testing. Also, older systems may require dangerous critical lifts where cranes must lift the plane for the isolators to be installed under the aircraft.

However, with [Fabreeka's Precision Aire™ Leveling PAL Isolators](#), there is no critical lift needed. The isolators, jacking system, and control cabinet all work together to move the aircraft to its proper position. The SSS has both vertical and horizontal isolation capabilities.

Picture on the left: The Fabreeka isolator is shown supporting the landing gear of the aircraft.

Picture on the right: A Fabreeka isolator supports and floats the aircraft during GVT using the jack support points on the landing gear.

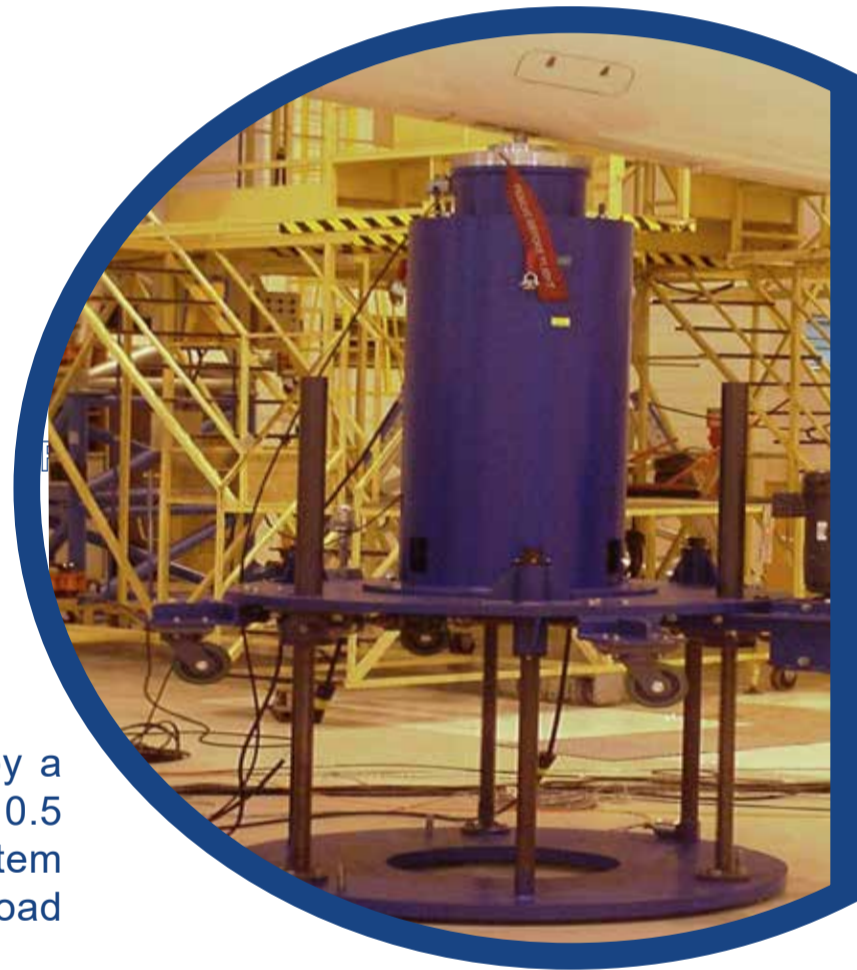


Also, the system features a control cabinet that runs the power, regulator system, and jacking. The control cabinet features digital gauges that display the operating pressure of each isolator. Also, some controls are built into the cabinet to raise and lower the system. For extra safety precaution, there are position limit alarms for both the jacks and pistons, hard stops for the jacks, relief valves for pressure, and an emergency stop for the entire system. The cabinet may connect external hardware such as beacons for additional safety.

Real-world application of Fabreeka's Soft Support System

In 2004, Embraer a Brazilian aerospace company, had to certify their new 190 aircraft that required structural and dynamic testing. As the aircraft underwent ground vibration testing, the 190 aircraft was supported by a Fabreeka SSS. The isolation system enabled the 111-thousand-pound (55.5 ton) aircraft to float to obtain accurate results.

The body (also known as the fuselage) of the 190 aircraft was supported by a PAL 133-60P pneumatic isolator (shown right). This custom-designed isolator from the engineers at Fabreeka was designed to achieve lower natural horizontal and vertical frequencies (0.7Hz vertical and 0.5Hz horizontal). The system was made custom as standard PAL isolators have vertical natural frequencies from 1.5 to 2.7 Hz and horizontal natural frequencies from 3.0 to 4.5 Hz.



The aircraft was supported under the right and left wings by a PAL 416-60P isolator with a frequency of 0.7 Hz vertical and 0.5 Hz horizontal. Each PAL Isolator is a part of a three-point system with an integrated level-control valve that functions as a load sensor and height control sensor.

The pneumatic control cabinet (shown left) indicates the required pressure needed to lift each isolator. This unit helps efficiently control the jacking process by raising the isolator off their jack points either simultaneously or individually. With gauges integrated to monitor the vertical position of each isolator, the working pressure is displayed on the cabinet. As well, various safety features are integrated into the control cabinet to allow for safe testing.

Additional Real World Applications

2014

Engineers at Fabreeka worked with an Italian aircraft manufacturer in designing a soft support system for ground vibration testing. The system included one PAL 255/133-60P isolator and two PAL 416/255-60P isolators. In addition, a pneumatic control panel, height indicator panel, and leveling valves were installed.

2017

Fabreeka worked with a Swedish aerospace company during ground vibration testing. One PAL 55/36-60P isolator and two PAL 416-60P isolators were installed in addition to common features of the SSS.

Innovative solutions for the future of aircraft testing

With the experience of over 100 years of development history, Fabreeka guarantees their customers the rapid availability of a globally unique product portfolio.

After 20 years of designing, testing, and implementing soft support systems, Fabreeka can ensure their system will lead to customer satisfaction. Gone are the days of dangerous critical lifts and readjustments to isolate an aircraft for testing. With Fabreeka's soft support system, ground vibration testing is guaranteed to be both safe and efficient.

At Fabreeka, our commitment is to do it right the first time, every time. That is why our engineers take the time to work with testing groups on the design of the system depending on the specifications of the project. From there, the work has only begun. We make it a point to be there throughout the process – from design reviews, supervision of installation, training of the system on-site, and everything in between. It is our hope, that we can continue working together on innovative solutions for the future of aircraft testing.



Fabreeka engineers have the expertise and knowledge to design the soft support system to meet project requirements.

- Naji Hajje, Quality Manager,
Fabreeka International

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1-800-322-7352 or 781-341-3655

Info@Fabreeka.com

www.fabreeka.com

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