

## Soft Support System for Ground Vibration Testing on a F35 Fighter Aircraft



The Lockheed Martin F-35 Lightning II is a fifth-generation, single-seat, single-engine stealth multirole fighter, that can perform close air support, tactical bombing, and air defense missions. The F-35 has three different models; one is a conventional takeoff and landing variant, the second is a short take off and vertical-landing variant, and the third is a carrier-based variant.

The F-35 is descended from the X-35, the product of the Joint Strike Fighter (JSF) program. Its development is being principally funded by the United States, with the United Kingdom and other partner governments providing additional funding. It is being designed and built by an aerospace industry team led by Lockheed Martin with Northrop Grumman and BAE Systems as major partners. Demonstrator aircraft flew in 2000, with the first flight on 15 December 2006.



Lockheed Martin has recently begun the certification process for their new F35 Lightning II fighter aircraft. The F35 program requires structural and dynamic testing as part of the certification process.

This dynamic testing (modal analysis) is performed in a GVT (Ground Vibration Test), which requires mounting the aircraft using a Fabreeka Soft Support System (SSS). This mounting simulates the “Free-Free” condition during regular flight operation.



The SSS includes three (3) low frequency, pneumatic isolators with self levelling electromechanical servo valves, and an electric driven spindle jacking system, which allows jacking the aircraft from the floor and retract the landing gear to simulate real flight conditions. Above photo shows the arrangement of the SSS using 3 isolators, with the landing gear being retracted.







The SSS for the F35 Lightning II aircraft consists of two (2) PAL255/133-XXP pendulum isolators, and one (1) PAL416/255-XXP pendulum isolator, all isolators located on a electrically driven, mechanical spindle jacking system. The isolators can support and lift 18.000 Kg (PAL416) and 11.500 kg (PAL255). The vertical and horizontal natural frequencies are 0.5 Hz – 0.7 Hz both vertical and horizontal with offering reasonable damping and giving the activated system a brilliant mechanical and dynamic stability.

Due to the large variety in load conditions, a major requirement to the isolation system was a wide load span per isolator, enabling Lockheed Martin to use the SSS with the need of an isolator exchange. Both isolator types offer an internal mechanism which allows switching the effective load bearing area of the isolators, resulting in nearly constant natural frequencies over a wide load range.



An electrical / pneumatic control unit is an integral part of the complete SSS unit. From this unit the jacking process is controlled (either all 3 jacks simultaneously or each jack individual for aircraft levelling). Gauges are integrated to monitor the actual vertical position of each jack, the actual working pressure is displayed and allows the calculation of the weight distribution of the aircraft during GVT.

Furthermore various safety features can be found which allow the system to operate in a very safe manner (as is standard in the aircraft industry).