PCB PIEZOTRONICS
AN AMPHENOL COMPANY

## Case Study

# How Low Outgassing Accelerometers Facilitate Thermal Vacuum Testing and Permanent Satellite Installation

Meeting NASA Requirements for the Suomi National Polar-Orbiting Partnership (NPP) Satellite

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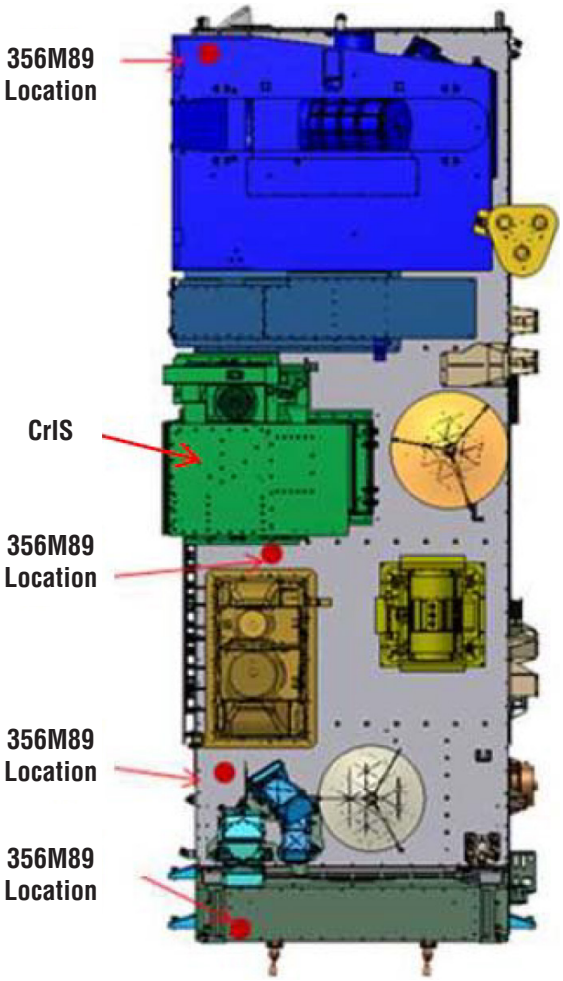
## PREPARING SUOMI NPP FOR THE DEMANDS OF SPACE

Before launch, spacecraft and satellites must undergo rigorous ground testing to verify their ability to survive the extreme conditions of space. For NASA's Suomi National Polar-orbiting Partnership (NPP) Satellite, this included comprehensive vibration testing within a thermal vacuum chamber designed to simulate the harsh environment of orbit. To ensure the integrity of sensitive instruments and protect mission performance, every material and component introduced into the chamber, including accelerometers used for vibration data collection, had to meet strict contamination control requirements.

## TESTING OBSTACLES

Ground vibration testing for the Suomi NPP Satellite presented several key technical challenges. The satellite's complex structure—including the spacecraft, scientific instruments, and associated ground support systems—required extreme care to avoid contamination during thermal vacuum testing. All materials exposed to the chamber were required to meet an outgassing rate of less than $1\times10^{-12}$gm/cm²-s at +30 °C to prevent surface contamination that could compromise instrument performance.

Once the spacecraft was assembled, installed sensors would become inaccessible, making long-term reliability and stable performance under random vibration, swept sine, and shock conditions critical. Limited installation space further required compact, rugged sensor designs that would not interfere with other spacecraft systems.




## PCB SOLUTION

PCB Model 356M98 was chosen for its proven low outgassing performance and rugged design. Ten accelerometers were selected, along with compatible low outgassing cables and hermetic feed-through connectors. The accelerometers are hermetically sealed and constructed with welded titanium housings, glass-to-metal seals, and low outgassing cable insulation. Testing in accordance with NASA RP-1124 and ASTM E595 ensured that all components met strict total mass loss (TML) and collected volatile condensable material (CVCM) thresholds.

Before installation, the sensors were cleaned with isopropyl alcohol and then subjected to a bake-out process to eliminate residual contaminants. Nine of the ten accelerometers were installed directly on the Suomi NPP Satellite to detect and analyze any operational vibration that might interfere with the Cross-track Infrared Sounder (CrIS) instrument during its thermal vacuum operational checkout. Cross-track Infrared Sounder (CrIS) instrument during its thermal vacuum operational checkout.

**LOW OUTGASSING TRIAXIAL ACCELEROMETER**
MODEL 356M98

## RESULTS

By selecting and qualifying low outgassing accelerometers, the customer successfully protected critical spacecraft components from contamination during thermal vacuum testing. PCB Model 356M98 sensors provided stable, accurate measurements under extreme conditions and remained permanently installed within the spacecraft, eliminating the need for maintenance or reinstallation after integration.

## THE PCB ADVANTAGE IN THERMAL VACUUM TESTING

| Testing Challenge | PCB Model 356M98 Solution |
|---|---|
| Contamination risk from sensor outgassing | Fully protects sensitive instruments by meeting NASA RP-1124 and ASTM E595 low outgassing standards |
| Reliable data collection in extreme conditions | Shear-mode piezoelectric element delivers stable measurements under random vibration, shock, and thermal stress |
| Long-term reliability after spacecraft integration | Ensures maintenance-free installation with hermetically sealed titanium construction |
| Installation in tight or critical areas | Simplifies integration with compact, lightweight sensor design |

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CS-05-0525