

Wireless Inclinometer Calibration System



Digital-Communication
Technology Upgrades

A special system was fabricated to properly calibrate the wireless inclinometer, a new device that will measure the Orbiter's hang angle. The wireless inclinometer has a unique design and method of attachment to the Orbiter that will improve the accuracy of the measurements, as well as the safety and ease of the operation. The system properly calibrates the four attached inclinometers, in both the horizontal and vertical axes, without needing to remove any of the component parts.

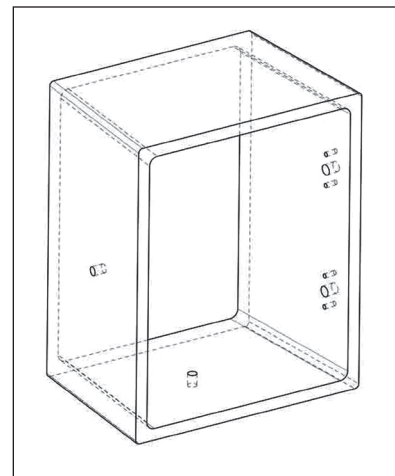
The Wireless Inclinometer Calibration System combines (1) a calibration fixture that emulates the point of attachment to the Orbiter in both the horizontal and vertical axes and the measurement surfaces, (2) an application-specific software program that accepts calibration data such as dates, zero functions, or offsets and tables, and (3) a wireless interface module that enables the wireless inclinometer to communicate with a calibration PC.

The stainless-steel mounting fixture emulates a mount to the Orbiter ground support equipment (GSE) door frame on the aft fuselage compartment. This design accounts for the 8-degree offset from the fuselage parallel to the Orbiter when the inclinometer is mounted in the horizontal position. The outside walls of the fixture can accommodate mounting to the Calibration Laboratory measurement tilt table in the proper axes, and the open-box design is self-supporting both in the upright position (equivalent to Orbiter horizontal) and when rotated 90 degrees (Orbiter in the vertical position). The mounting location side of the fixture is designed to ensure that the inner walls and the outer walls are parallel. The opposite wall of the fixture is characterized to account for the 8-degree (plus/minus the fabrication offset) difference between the mounting edge and the centerline of the Orbiter to the mounting wall. The wall adjacent to the mounting wall is characterized as 90 degrees (plus/minus the fabrication offset) off the mounting wall. The wall opposite the mounting wall has the outside surface as flat as possible. Since it is impossible to fabricate a perfect fixture, the device lends itself to characterization of known values.

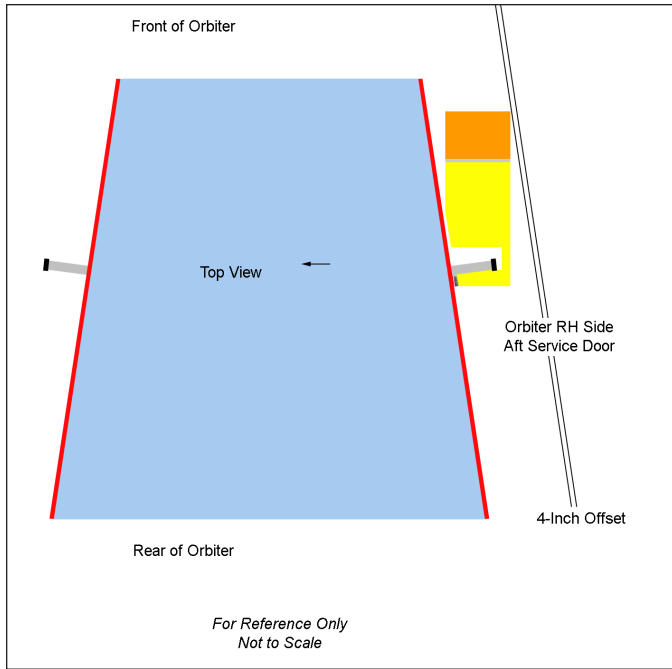
The software application consists of a LabVIEW runtime program with a user-friendly interface for a desktop or laptop in a Windows XP environment. The operator can download previous calibration data and upload new calibration dates, special notes, and offsets. Both old and new data can be saved in text format for use in spreadsheets. In addition, the software attempts to find coefficients that will convert the readings from the sensor into values that will match the real angle values. The operator can choose the number of coefficients to be used.

The wireless interface module is powered directly from the PC or desktop USB port. Wireless communication permits the entire remote wireless inclinometer to be calibrated as a unit.

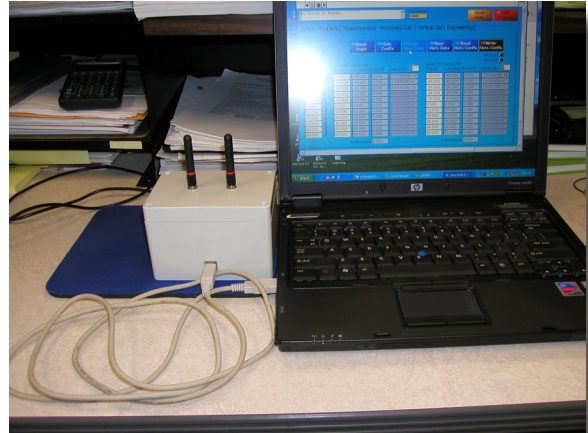
Though the wireless inclinometer calibration system was designed exclusively to support Orbiter processing operations, the system requires only minor hardware and software modifications to be ready for aircraft, military, industrial and construction applications. The benefits are much simpler calibration procedures, more reliable measurements, and lower maintenance costs.



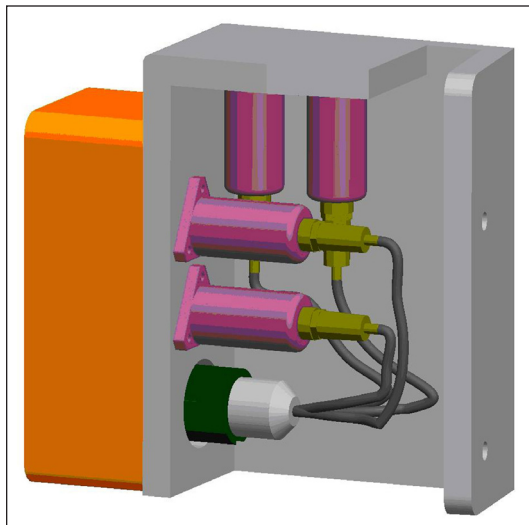
Calibration fixture.



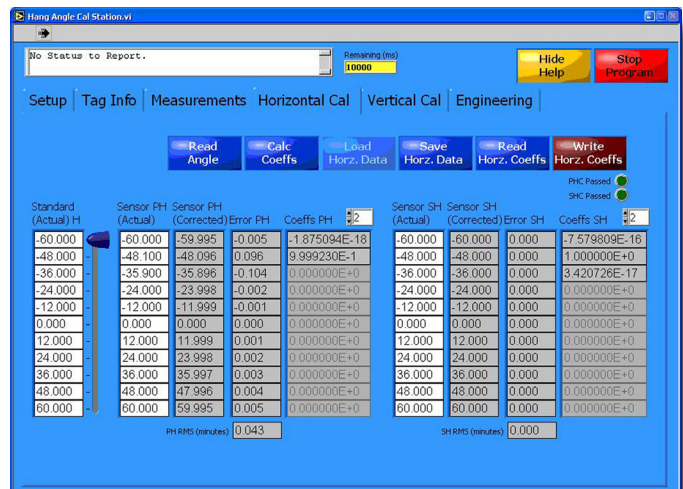
Mounting location and critical dimensions.



Calibration system interface module.



Wireless inclinometer concept.



Application software.