

Ground Vibration Testing Solution for Aircraft Manufacturer

Submitted by [VTI Instruments](#)

With more than 37.5 million commercial flights per year, aviation manufacturers are always pushing to increase the safety, efficiency, and comfort of their aircraft. To achieve the desired results, these manufacturers are continuously testing and improving their designs.

Completing these tests in-flight can be very expensive, dangerous, and often time consuming - leading manufacturers to complete these tests on the ground. Ground vibration test (GVT) systems allow for the testing of aeroplastic and aeroservoelastic stability of aircraft. The data collected is used to validate vibration, flight control models, detect structural flaws, and allow for the resolution of in-flight aeroelastic related abnormalities and troubleshoot flight control dynamic problems.

In November 2013, when an international aircraft manufacturer needed to complete their ground vibration testing, VTI Instruments was able to provide a high precision measurement solution.

The Challenge

The customer required their new system to have dynamic signal analyzers with a 24-bit ADC, minimum of 400 channels, TEDS reading capability with a turn-key software, MAYA HTT's I-DEAS test software integration capability, and custom interconnects that would interface with their existing connectors. Incorporating I-DEAS into the solution was essential as the software makes changing between acquisition and analysis mode simple, and is capable of performing modal analysis efficiently with many of its useful tools.

The Solution

Prior to seeking the solution for their requirements, the customer's GVT team was familiar with VTI's VT143x digitizer product line and MAYA's I-DEAS software as they were already using both for their GVT solution. Having used this combination of hardware and software for many years, the customer was aware of the reliability of both companies' products as well as their excellent support. Furthermore, the decision-making process was made easier with VTI's willingness and flexibility to provide the complete solution that included all the hardware, software, interconnects, and the system integration service with MAYA's I-DEAS software.

The hardware solution was consisted of:

- 3 x CT-400 13-slot chassis
- 3 x VXI-MXI-2 mainframe extenders
- 25 x VT1436 digitizer cards
- E8491B Firewire slot-0 controller

- Interconnects between the VT1436 front panel connectors and the connectors on the back of the system racks.

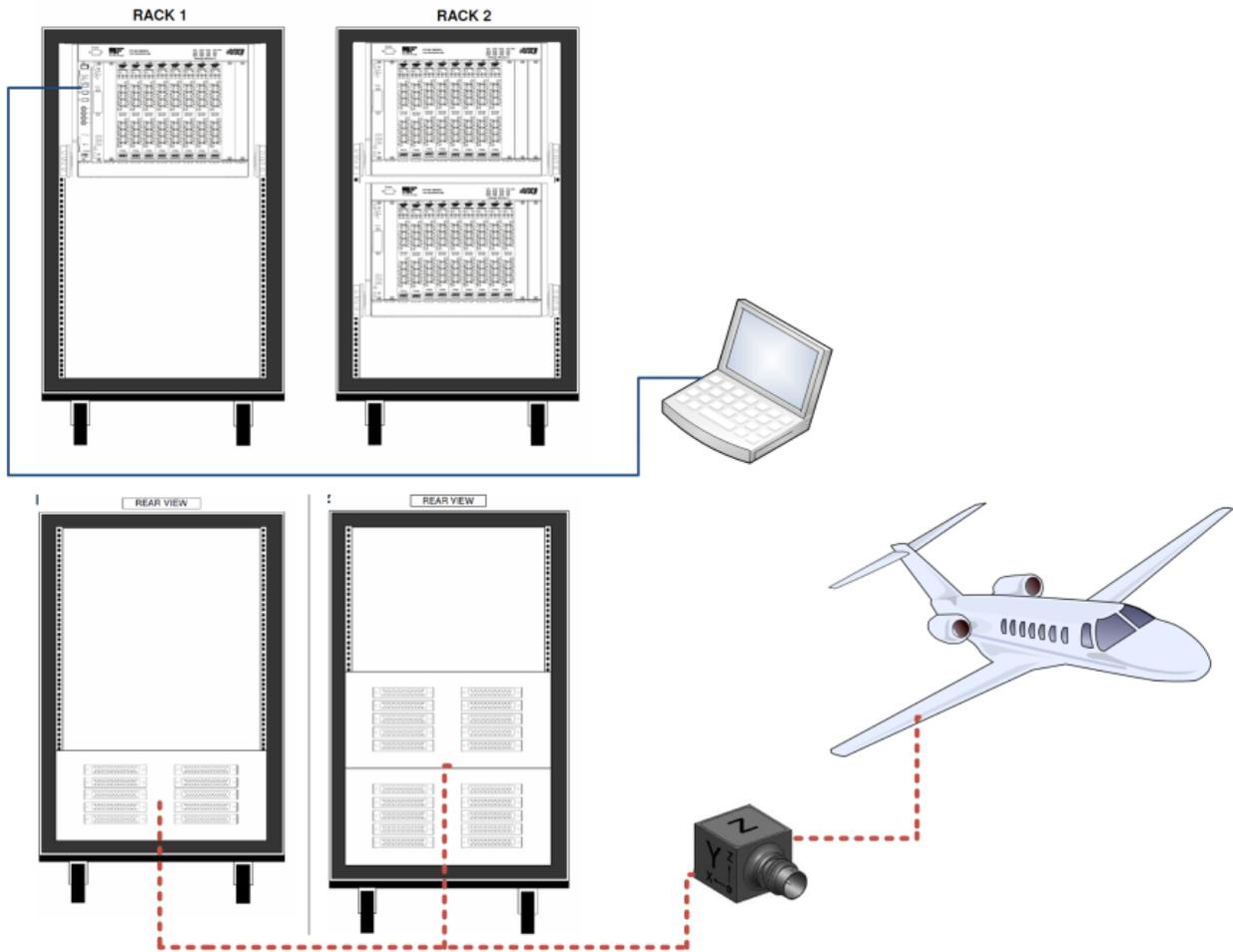
The VT1436 is a 16-channel 102.4kSa/s 24-bit digitizer plus DSP with built-in IEPE conditioning, and it's widely used in the test industry for its high-performance capabilities.

The VT1436 is capable of using low sensitivity transducers with the 100 mV input range. Moreover, having an on-board user-programmable DSP gives a great advantage for the total system performance. Compared to the VT1432A cards that our customer had previously used, the VT1436 modules are more precise with a higher bit resolution ADC and have twice the sampling rate as well as the built-in IEPE conditioning. The VT1436 has a 24-bit ADC with the resolution of 2^{24} (16,777,216), while the VT1432A has a 16-bit ADC with the resolution of 2^{16} (65,536). The VXI-MXI-2 mainframe extenders were used to connect the three chassis together as one system, and the E8491B Firewire slot-0 controller was used to interface with the host PC. The TEDS reader software was developed to read the binary sensor information using the driver API and decode it to display the TEDS information such as sensor manufacturer, model name, serial number, and the sensor specifications. Combining VTI's low-risk, high performance hardware solution with MAYA's industry-leading I-DEAS software, our customer believed that it fit their requirements better than any other proposed systems from other manufacturers.



Fig. 1 – VT1436

Having provided test solutions to virtually all major aircraft manufacturers for many years, VTI Instruments had a proven solution that fit the customer's GVT requirements as well as the extensive experience that they could rely on. By trusting VTI's demonstrated ability to deliver a high precision system, it provided less risk in the customer's project schedule and lower overall cost. This opportunity was successful and beneficial to both companies and helped establishing a good relationship between the two companies.



NI-DAQmx 2.1 - NI LOCAL I/O Tools ADMINISTRATION

Channel Table Spreadsheet

File Edit Options Window Help

Complete

Transducers

#	Serial Number	Manufacturer	Model	Description	Input Mode	Data Type	Type Qualifier	Length (in Bits)	Polar. (in Bits)	Temp. (in Bits)	Units Label	Sensitivity (per Bit)	IS
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													

General Settings

Property	Value
Input Module ID	VT1405, VT1415/16
Input Module Description	4-to-16 channel module, 51.2 kHz
Measurement Settings	
Number of References	1
Number of Responses	16

Channels

#	Channel Name	Enabled	Type	Status	Level Meter	Input Range	Auto Range	Nodes	Direction	Description	Data Type	Sampling Type	Coupling	Sensitivity (per Bit)	Sensitivity (per g)	Scale (Gain)	Units	Units	Shut Down
1	RAC_1	OK	Reference	OK		0.1 V	OK	1	Y+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
2	RAC_2	OK	Response	OK		0.1 V	OK	1	Y+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
3	RAC_3	OK	Response	OK		0.1 V	OK	1	Y+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
4	RAC_4	OK	Response	OK		1 V	OK	1	Z+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
5	RAC_5	OK	Response	OK		1 V	OK	2	X+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
6	RAC_6	OK	Response	OK		1 V	OK	2	Y+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
7	RAC_7	OK	Response	OK		1 V	OK	2	Z+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
8	RAC_8	OK	Response	OK		1 V	OK	3	X+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
9	RAC_9	OK	Response	OK		1 V	OK	3	Y+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
10	RAC_10	OK	Response	OK		1 V	OK	3	Z+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
11	RAC_11	OK	Response	OK		1 V	OK	4	X+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
12	RAC_12	OK	Response	OK		1 V	OK	4	Y+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
13	RAC_13	OK	Response	OK		1 V	OK	4	Z+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
14	RAC_14	OK	Response	OK		1 V	OK	5	X+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
15	RAC_15	OK	Response	OK		1 V	OK	5	Y+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			
16	RAC_16	OK	Response	OK		1 V	OK	5	Z+	Acceleration	Dynamic	AC with EP	2000 mV/Bit	4.00000e-1	1.00V	000...			

Start System Administrator

Start Average Response

Start

08:24 05/04/2014

