

# Common Vibration Test Snafus and How to Fix Them



- We have approximately 400 people on the webinar today. I fear that we won't be able to tackle all of your questions. Please feel free to type your questions in the chat area. We will try to cover as many as we can today. If we don't get to all of them, we will email out answers to all questions by next week.
- We are recording this webinar and will distribute it via email within the next week should you have an interest.
- Our marketing department will be conducting a short poll following the survey to ask about your top vibration testing challenges and snafus. Please take a moment to take the poll. We will distribute results to everyone who participates.



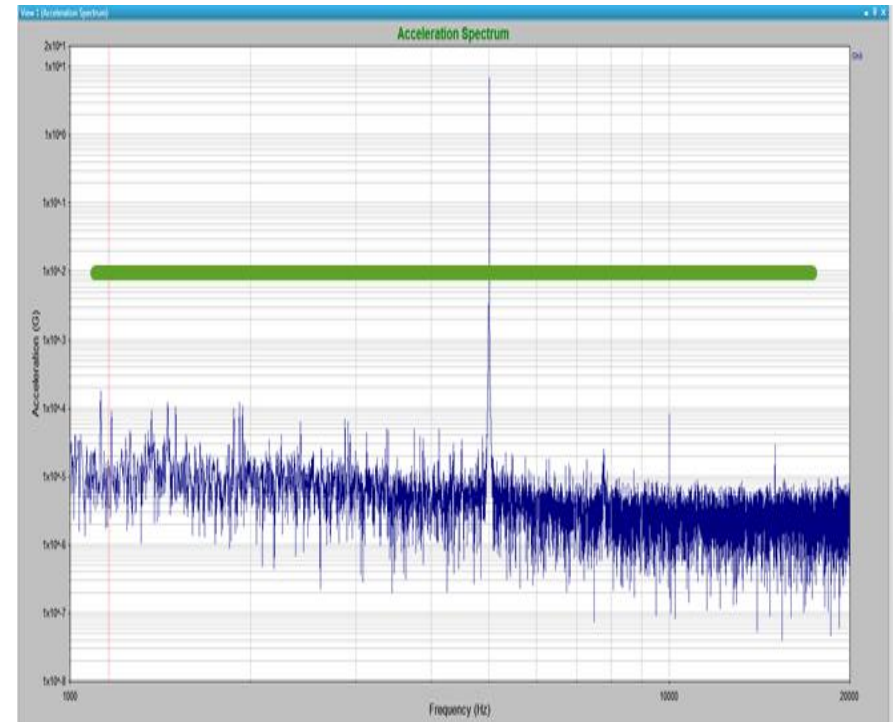
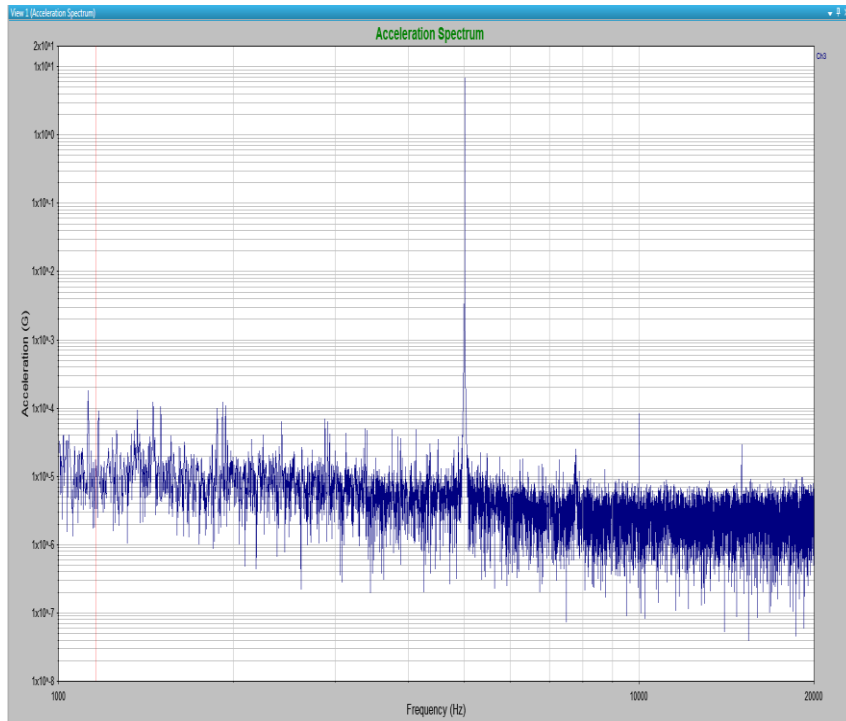
# Top 5 Snafus and Solutions

- #5 – Noise Floor Issues
- #4 –
- #3 –
- #2 –
- #1 –

# #5 – Noise Floor Issues

- **Problem**

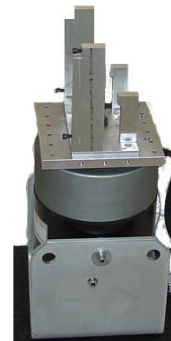
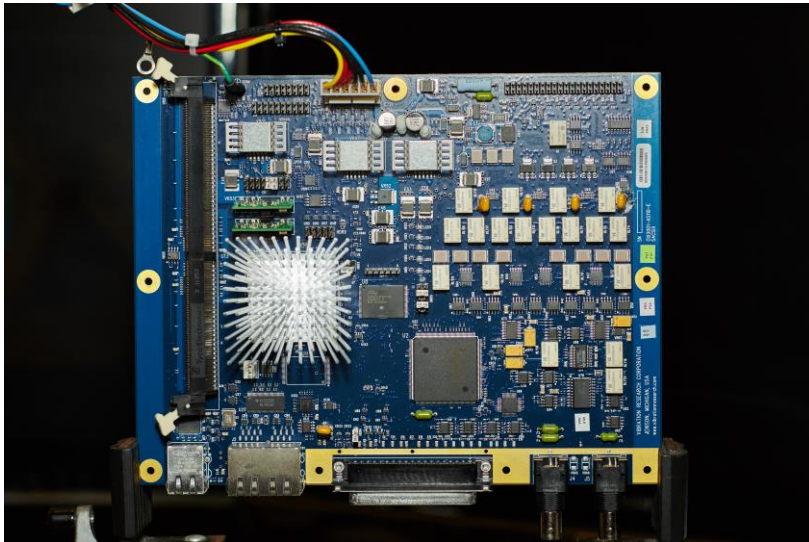
- Noise Floor too high for test specifications
- Ground loop issues



# #5 – Noise Floor Issues

- **Solution**

- Reduce noise floor if possible
  - Low current
  - High quality components
- Choose a different shaker system for this particular test
- Eliminate Ground loops
- Look at where and how grounds are connected.
- Webinar 201408: Ground Loop Issues.



# #5 – Noise Floor Issues

- **Search Vibration Research University**

- Resources – Experiments and Papers.
- Search for “ground” and “noise”.
- Much material here.



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# Top 5 Snafus and Solutions

- #5 – Noise Floor Issues
- #4 – Accelerometer Sensitivity Issues
- #3 –
- #2 –
- #1 –

# #4 – Accelerometer Sensitivity Issues

- **Problem**

- Accelerometer sensitivities incorrectly entered
- Accelerometer not powered or properly conditioned
- Wrong accelerometer used for the test
  - Too high mv/g sensitivity for high G levels. 100mv/g good for 50 g

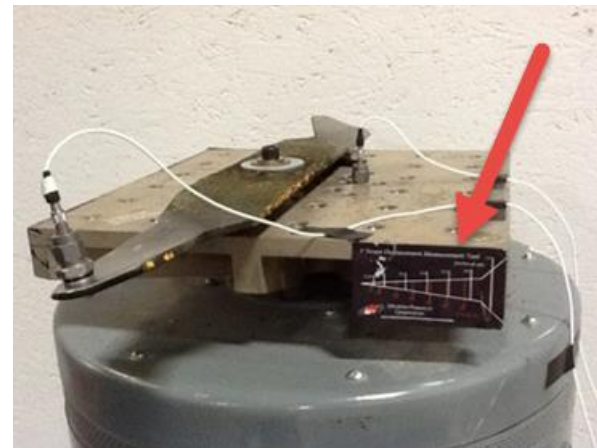




# #4 – Accelerometer Sensitivity Issues

- **Solution**

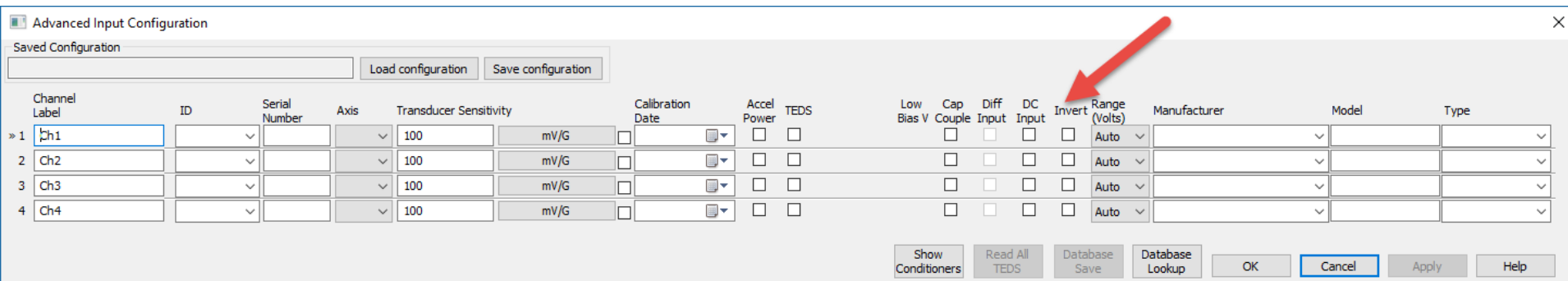
- Use TEDS
- Double Check input information
- Choose a different sensitivity accelerometer (10 mv/g)
- Look for “green ring” if constant current accelerometer
- Search VRU for “displacement wedge”
- e-mail VR for free displacement wedge stickers.



# #4 – Accelerometer Sensitivity Issues

- **Solution**

- Run system check
- Inverted trace? You can check the “invert” on sensitivity setup page



Advanced Input Configuration

Saved Configuration:

Channel Label	ID	Serial Number	Axis	Transducer Sensitivity	Calibration Date	Accel Power	TEDS	Low Bias V	Cap Couple	Diff Input	DC Input	Invert	Range (Volts)	Manufacturer	Model	Type
1 Ch1				100	mV/G			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Auto			
2 Ch2				100	mV/G			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Auto			
3 Ch3				100	mV/G			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Auto			
4 Ch4				100	mV/G			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Auto			

# Top 5 Snafus and Solutions

- #5 – Noise Floor Issues
- #4 – Accelerometer Sensitivity Issues
- #3 – Cabling Issues
- #2 –
- #1 –

# #3 – Cabling Issues

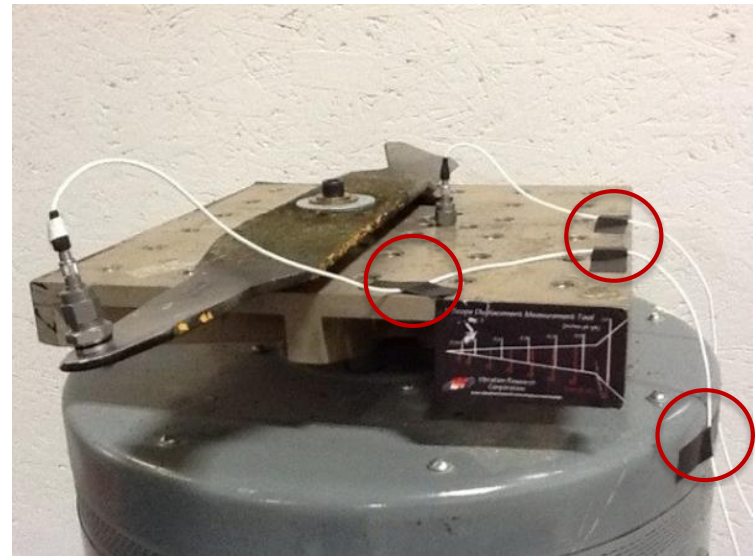
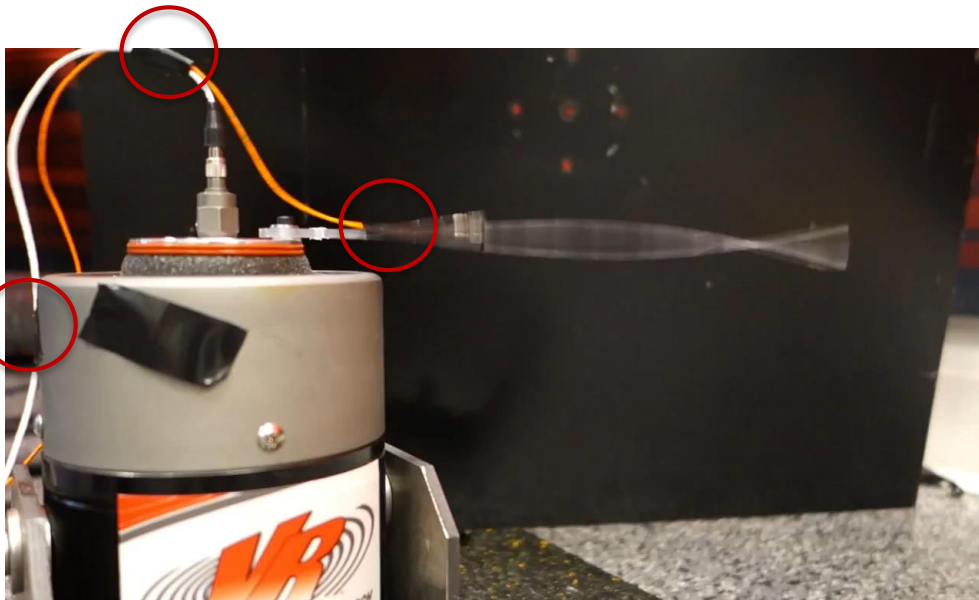
- **Problem**

- Cable not properly attached to accelerometer
- Look for “spiking” in the time domain (o-scope) display
- Caused by bad connections with a constant current sensor
- Noise from cable whip

# #3 – Cabling Issues

- **Solution**

- Tape down cables
- Attach cables tightly to accelerometer

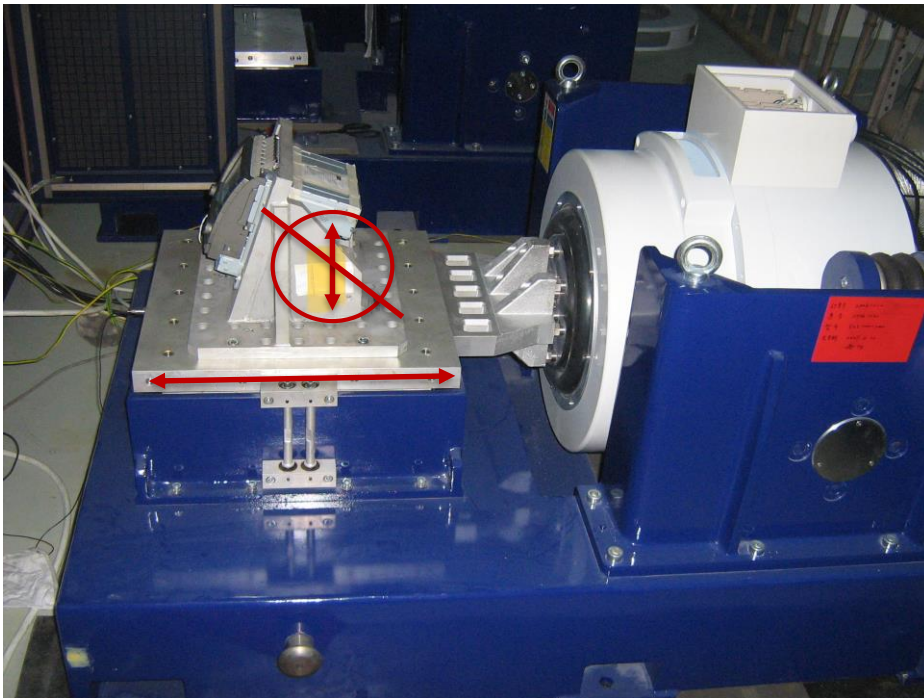


# Top 5 Snafus and Solutions

- #5 – Noise Floor Issues
- #4 – Accelerometer Sensitivity Issues
- #3 – Cabling Issues
- #2 – Accelerometer Mounting Issues
- #1 –

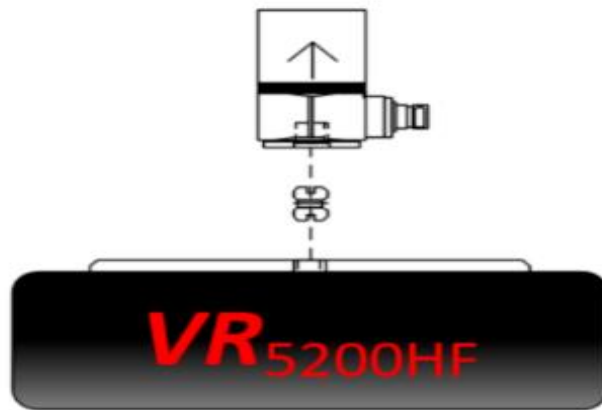
# #2 – Accelerometer Mounting Issues

- **Problem**
  - Mounted in wrong axis for vibration test
  - Not firmly mounted with glue or stud



## #2 – Accelerometer Mounting Issues

- **Solution**
  - Mount in correct axis
  - Use glue (with mounting base) or stud





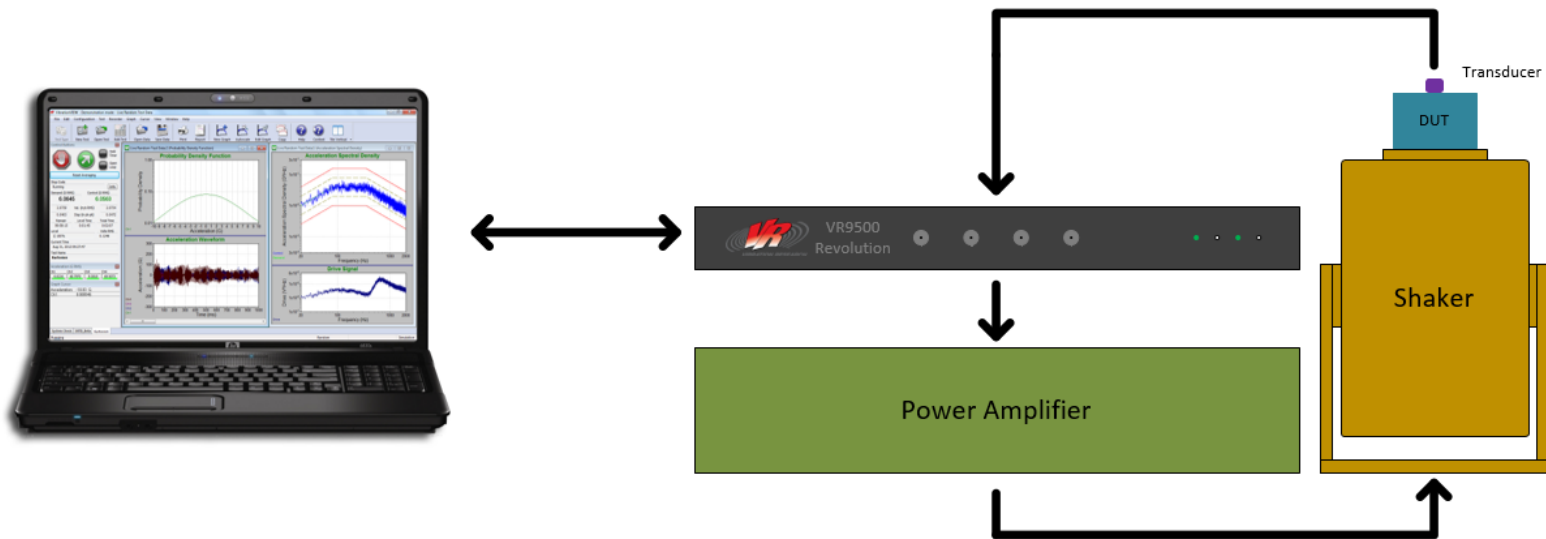
# Top 5 Snafus and Solutions

- #5 – Noise Floor Issues
- #4 – Accelerometer Sensitivity Issues
- #3 – Cabling Issues
- #2 – Accelerometer Mounting Issues
- #1 – Amplifier Issues

# #1 – Amplifier Issues

- **Problem**

- Gain cranked up!
- Gain dialed down or amplifier off!
- Amplifier Trips



# #1 – Amplifier Issues

- **Solution**
  - Turn Down the Gain!!
    - During test setup
  - Turn on Amplifier and Turn Up the Gain!
    - When ready to run the test
  - Choose powerful enough shaker system for test



# True!

## Stories from the Trenches

A favorite saying of mine:

- A test should be implemented like a street lamp: to **provide illumination**.
- Not like a drunkard uses a street lamp: to **provide support**.



# Stories from the Trenches

Before you run the test, ask yourself:  
*“why am I running this test”?*

1. The project is way behind schedule. It is on my checklist. **I need to pass this test.**
2. I need to **certify product survival** and prove it **exceeds expectations.**

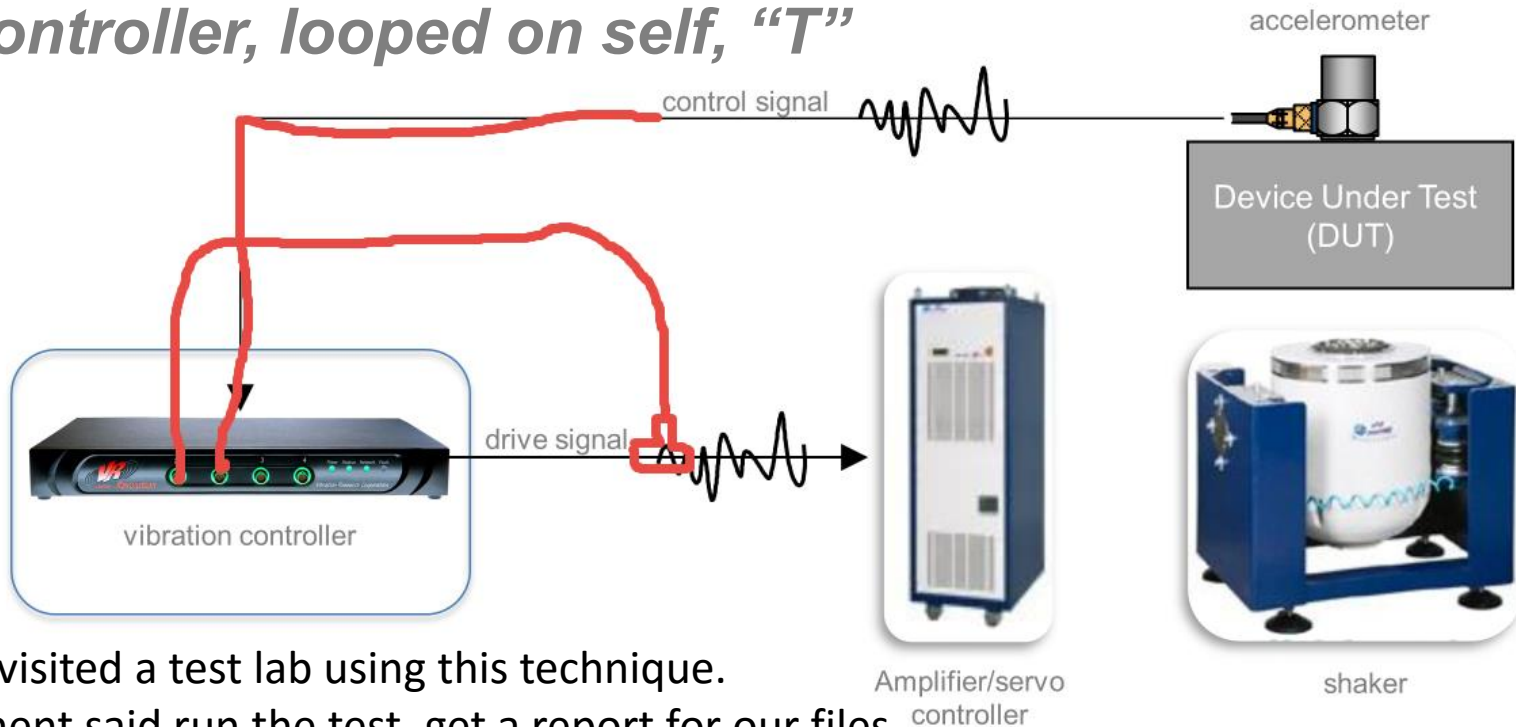
# Stories from the Trenches

- *Controller, looped on self, “T”*
- I just need to run the test, and produce the report



# Stories from the Trenches

- *Controller, looped on self, "T"*



I actually visited a test lab using this technique.

Management said run the test, get a report for our files.

Here is how he did it:

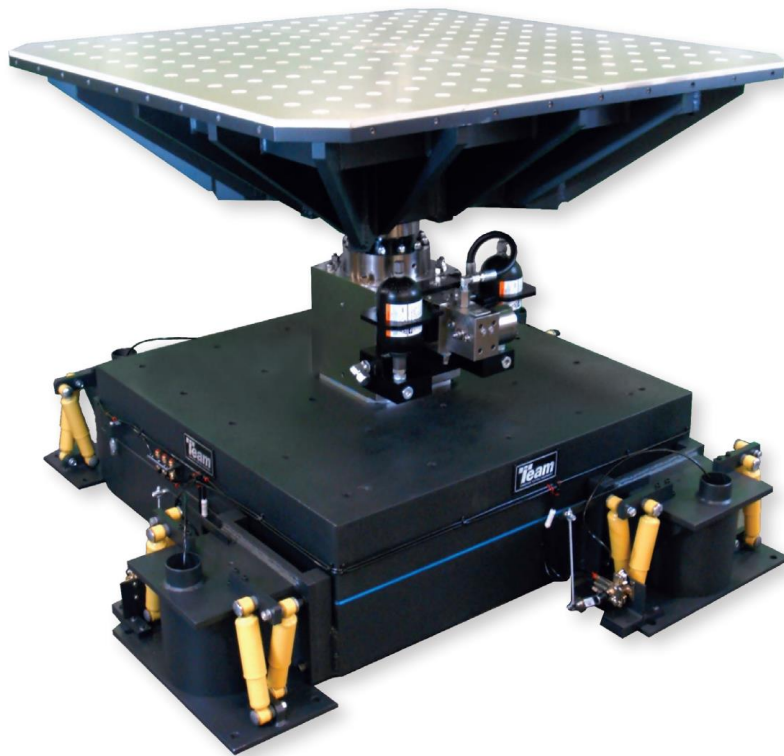
1. Run test with input to ch1 from the drive output.
2. Set amp gain so you get desired matching g rms on channel 2
3. Print your test results.

Sounds TERRIBLE but gives amazingly good test results.... On ANY fixture!

# Stories from the Trenches

- Sine sweep test to 500 Hz

I actually helped troubleshoot why the test used to run, and then quit working

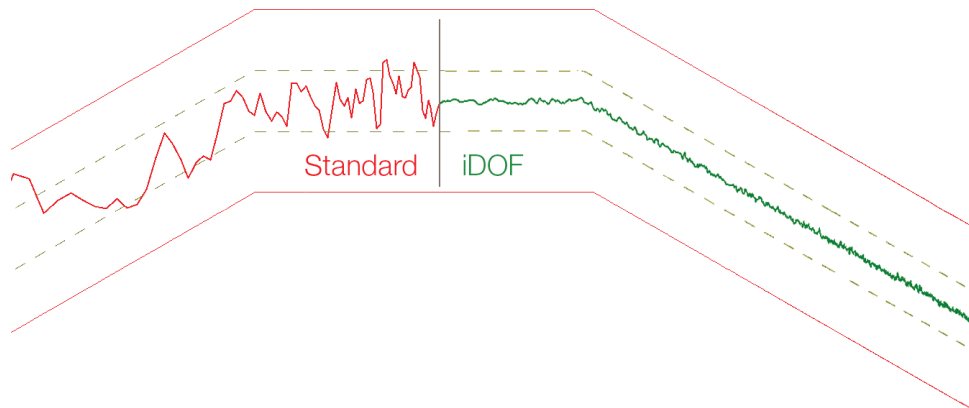


- Turn off the tracking filters, it might actually work!!
- Just kidding, you should always use tracking filters when running a sine test.



# Stories from the Trenches

- Random step change preserving smooth spectrum.
- If this happens, you know for sure the data is being *“recycled”*.
- Resonances may be stimulated while you are unaware.
- You need iDOF.

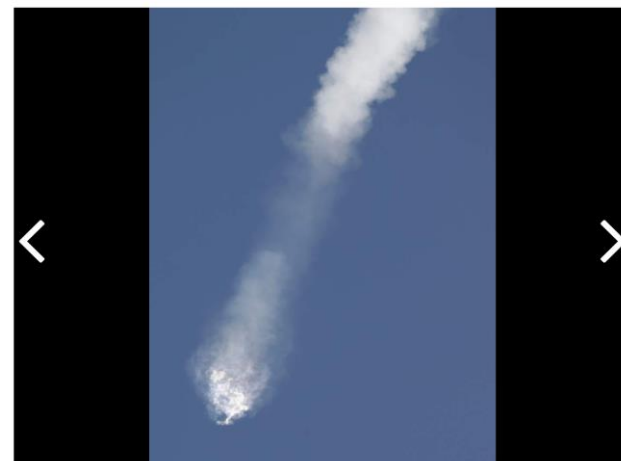


# Stories from the Trenches

- Is this why SpaceX failed in 2015?
- Maybe not, but it is possible!
- A strut designed for 10 times the needed strength failed during the launch
- Could have been over stressed during the final vib test. And nobody would know!

Preliminary analysis suggests the overpressure event in the upper stage liquid oxygen tank was initiated by a flawed piece of support hardware (a “strut”) inside the second stage. Several hundred struts fly on every Falcon 9 vehicle, with a cumulative flight history of several thousand. The strut that we believe failed was designed and material certified to handle 10,000 lbs of force, but failed at 2,000 lbs, a five-fold difference. Detailed close-out photos of stage construction show no visible flaws or damage of any kind.

SpaceX launch ends in failure as rocket breaks apart after liftoff

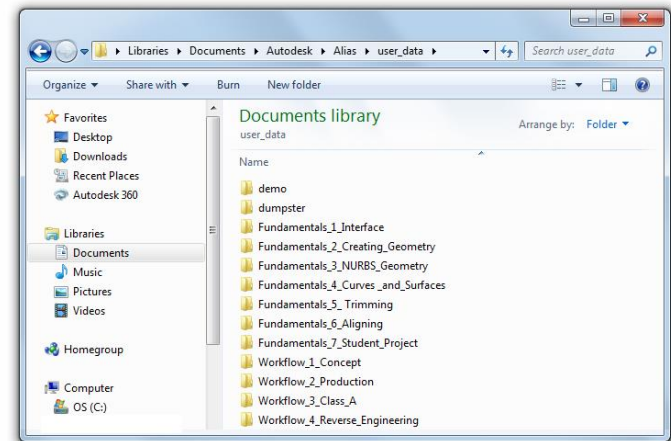


(4 of 6) The SpaceX Falcon 9 rocket and Dragon spacecraft breaks apart shortly after liftoff at the Cape Canaveral Air Force Station in Cape Canaveral, Fla., Sunday, June 28, 2015. The rocket was carrying supplies to the International Space Station. (AP Photo/John Raoux)

<http://www.spacex.com/news/2015/07/20/crs-7-investigation-update>

# Stories from the Trenches

- Accidental 10mV/g setting instead of 100 mV/g setting.
- Led to a question on our file storage structure. Wanted to know where the accel sensitivity was stored.
- **Customer wanted to “auto-generate” a report from a modified data file.**
- We said no, we do not give out this proprietary information.

A screenshot of a text file named 'StatisticsforNby.csv'. The file contains a grid of numerical data. The columns are labeled with values 0, 10, 20, 30, 40, 50, 60, and 70. The rows are labeled with dates and times, such as '3182 en. 03/31/2006, 96440, 9452, 31247, 3603, 1048086, 990158, 1815, 30.7, 3042, 905933, 34726'. The data values are integers, and the file appears to be a CSV format with commas as delimiters.

# Stories from the Trenches

- *Don't "fake" the test*



Home • Buffalo • Press Releases • 2013 • Rochester Man Pleads Guilty to Performing Phantom Testing on Military Radios and Sonobuoys

**Info** This is archived material from the Federal Bureau of Investigation (FBI) website. It may contain outdated information and links may no longer function.



## Rochester Man Pleads Guilty to Performing Phantom Testing on Military Radios and Sonobuoys

U.S. Attorney's Office  
December 18, 2013

Western District of New York  
(716) 843-5700

ROCHESTER, NY—U.S. Attorney William J. Hochul, Jr. announced today that ██████████ of Newark, New York, pleaded guilty before U.S. District Judge Frank P. Geraci to four counts of filing a filing a false statement with the United States government. Each count carries a maximum penalty of five years in prison and a \$250,000 fine.

During the investigation, special agents from the FBI and Army Criminal Investigation Division learned that ██████████ was both personally falsifying vibration graphs and directing other subordinates to do so. ██████████ would then print the false graph, or direct others to do so, and include this false document in the items history, thus proving that it was successfully tested, even though as he knew, the item was not properly tested. He referred to this process as “phantom vibe testing.”

As a result of the defendant's conduct, individual components had to be re-tested costing the Department of Defense \$299,094.00



# Stories from the Trenches

- *“Cleverly” fool the test equipment*
- Volkswagen diesel emissions test
- If the steering wheel does not move, put the engine in minimum emissions mode.



# Stories from the Trenches

- Samsung Note 7 battery disaster
- Lack of testing?



# ***Questions from last week's presentation:***

Question #1:

- Would a 10mV/g accel be appropriate for G values in a 0-10G, or would a 100 mV be more appropriate?

Question #2:

- If noise floor is present, would a 100 mV/g accel be more immune to noise floor than a 10 mV/g accel?

Question #3:

- When you heard "test this UUT to X G" would you assume that value is "peak", or "peak to peak"?

Question #4:

- We always turn up the gain to 100% on our amps. Are we taking life out of our amps?

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# Technologies-VR-Innovators



Ultimate Kurtosis Control puts acceleration peaks back into random vibration tests when the field environment is non-gaussian



Instant Degrees of Freedom (iDOF) prevents over or under random testing, and provides the smoothest control lines quickly

Vibration Research  
Opens

1995

2005

2010

2015



Field Data Replication (FDR) gives companies the ability to playback longer time history files than ever before



Fatigue Damage Spectrum (FDS) answers three questions: what test should I run, how long should I run it, and can I accelerate it

VR helps you make testing easy, honest, and repeatable with a proven track record of reliability and support



# Thank – you!

- Questions?
- Comments?