NOTES ON SHOCK TESTING OF ISOLATED AVIONICS COMPONENTS

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September 1, 2005

Isolated avionics components may have an unexpectedly poor performance in high-amplitude shock transmissibility tests.

Assume that there are no spurious electrical effects in the accelerometer data.

Here are six possible causes, some of which may be interrelated:

1. The isolators may have "bottomed out." Simple hand calculations formulas for evaluating this possibility are given in Reference 1.

2. The isolators may have had some non-linearity other than bottoming out.

3. There are rocking modes which were unaccounted for in the hand calculations. These would usually occur at low frequencies, below say 100 Hz. See Reference 1. Furthermore, some of the modes may have coupled translation and rotation.

4. The component has lightly-damped, high frequency structural modes. These modes would not have been accounted for if the component were modeled as a simple spring-mass system.

5. The poor performance is due the mechanical impedance interaction between the component and the test fixture. The fixture should be rigid.

6. Standing waves are forming in the isolators themselves. The natural frequency of an individual isolator is seldom calculated since the isolator is usually treated as a "mass-less spring." This standing wave effect is similar to "spring surge" which may occur in automobile engine valve springs operating at or above redline RPM speeds. Elastomeric isolators should have sufficient damping to attenuate this effect, however.

Reference

1. T. Irvine, Avionics Isolation Design Guidelines, Vibrationdata, 2005.