

MIL-STD-810 Vibration Performance Analysis



3-slot 1/2 ATR Conduction Cooled Chassis

Quasi-Static Accelerated Loading Analysis

Material Yield to Failure Identification

100Hz

Simulation accuracy to real

About Our Partner

Elma Electronic is a leader in open standards based modular enclosures, backplanes and sub-system assemblies and integration. They are a leader in component architectures such as OpenVPX, CompactPCI, AdvancedTCA and SOSA.

Elma offer close relationships to customers and partners with a history of deep technical expertise and precision engineering.

Checking for Quality

Elma are globally appreciated as a source of highly reliable and functional equipment. A measure of their quality is the deployment their products receive, many of which are flight critical airborne applications installed by leading Prime contractors.

Elma were contracted to deliver a rugged ATR chassis to one of these Prime contractors. As **part of flight certification Elma were required to perform a shock and vibration simulation** analysing limits greater than that which it saw during qualification test. This verified the product's safety and flight worthiness, while informing the design team of the margins to failure.

Finding Niche Expertise

In order to ensure the highest level of engineering appli-

cation was applied to this request, Elma **needed high quality expertise to correctly replicate the ATR unit in its extended environment.**

Providing it is done correctly, the most effective way of identifying possible modes of failure is through high accuracy simulation. While Elma have outstanding expertise in the design and manufacture of these rugged units, their expertise in assembly and rugged test could not showcase all failure modes or predict margins to safety in all eventualities. They **recognised swiftly that the impact of incorrectly interpreting this data would have knock-on effects with their client** and sought to mediate a solution with a trusted partner.

Elma needed a partner who could hit the ground running with a **deep understanding of MIL-STD-810 Shock & Vibration principles and Defence standard Fatigue & Failure calculations.** Learning these complex standards and methods from scratch would have caused undue stress and workload on both Elma and the customer.

It was important for Elma to find a partner they could trust to openly represent the high standards Elma themselves maintain, and ensure their stature with their customer is only increases throughout the project duration.



Entropy Headquarters
Silverstone Innovation Centre
Technology Park, Silverstone,
United Kingdom, NN12 8GX

Contact:
T: +44 (0) 1327 760 021
E: info@engineeringentropy.co.uk
www.engineeringentropy.co.uk

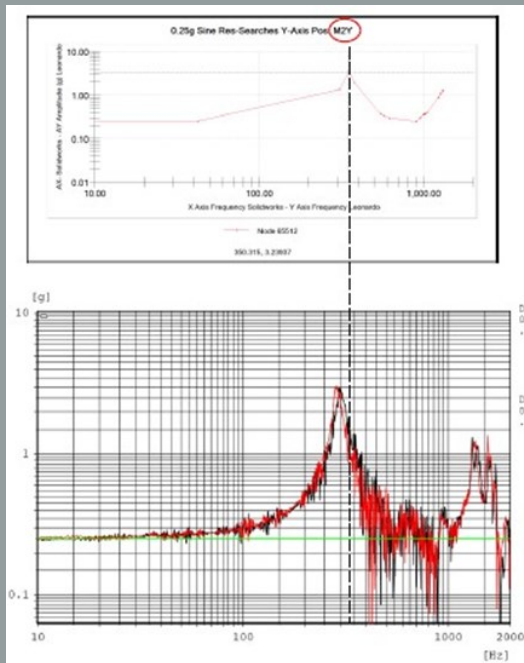
Entropy Expertise

With our extensive expertise in bringing rugged systems to market, **Entropy offered Elma a simple turnkey option to bring new expertise into their development team.** We were able to minimise the amount of time Elma spent managing the project, by **directly interfacing with their customer, suppling high class information and leading design reviews in a professional manner.**

Elma clearly identified the chassis system that was under test and were able to define the environmental conditions to be examined from within MIL-STD-810. With this information available, we could build up a highly representative model.

Creating a Complex Model

As a new partner, we wanted to show that the simulation process we undertake was valid. As Elma had extensive testing data for the frequency response of their unit, we were able to generate a complex model of their system to show veracity of the natural response mechanisms of the unit with a pseudo-static analysis. **Our model gave accuracy within**



A comparison of real test response against simulated load response showing high levels of data correlation. Running these type of studies validate the quality of the simulation work done.



A deformed results plot showing accelerated loading of the unit in the XY (traverse) plane.

100Hz of resonant response, showcasing the potential of using good FEA solutions in place of much early-stage testing. Some diversion from real is acknowledged due to lack of cable geometry.

While an excellent engineering exercise, this pseudo-static model is unnecessary for extracting material loading and the process amended as such:

1. Import complex model into static analysis with **accurate ARINC404A hold down hook boundary conditions implemented.** This is highly critical and small errors in input may throw results widely off
2. Implement Miles' equations allowing **interpretation of extended environmental conditions into an equivalent static loading analysis.**
3. Exporting and analysis of results **identified areas of critical margin, and areas for improvement**, such as possible geometry changes or reduction of areas of high loading.

Achieving Flight

Entropy were able to provide Elma's Prime Customer with **clear, comprehensive and accurate FEA data to support flight worthiness certification** in the form of frequent review calls and a professional report. With receipt of this data, and through clear communication of our findings, Elma and Entropy were able to convey sufficient confidence to the experienced engineers at the Prime Customer, **without which the project delivery would have been at risk.**