

Vibration & Shock testing in the Aerospace Industry

AdvEnSys (Advanced Engineering Systems) introduction

AdvEnSys has been created with the target of offering to the technical community the extensive experience in Environmental Testing Training, Project Management and Technical Consultancy of its management. It comprises, among others, related aspects as required standards deep analysis, laboratory design, equipment market survey and technical-economical proposal evaluation, RFQ generation, project execution, acceptance testing protocol (ATP's) writing, and order fulfillment management.



Training course overview

Participants in this training are engineers and facility operators involved in design, analysis and verification of vibration and shock environments in spacecraft industry. These seminars try to provide technical advisory information, recommendations, and good practices to all spacecraft and payload developers, therefore, maximising the effectiveness of their vibration and shock testing programmes at qualification, acceptance and protoflight levels. This seminar is oriented to:

- Engineers who are either new to the field of vibration testing, or already experienced but who want to consolidate and broaden their knowledge.
- NPD, I&TE, OT&E, and T&E test and evaluation engineers.
- Research and development, System Integration, Validation and Quality departments.
- Testing Laboratories offering service to Space related companies.



Training course structure and key aspects

This 4-day open course in live webinar format, is split in four modules of four hours effective duration each with a 15' coffee break. Attendees can choose to join one or more modules, but such assistance will require knowledge of the previous levels. The training covers from the basic laboratory simulation models or the testing equipment to generate these vibrations, to complex concepts in Random or SRS vibration, or procedures to develop your own tailored standards.

To achieve the purpose of the course and make it interactive, we have chosen the virtual classroom format where the speaker gives a live presentation, and it is possible and desirable for students to ask questions. We will use one of the usual commercial software solutions for this type of remote training (Microsoft Teams®). The course will run from 9:00 to 13:15 CET with the following contents:

Module I – Core

- What do we mean by vibration? Where do we find vibrations in the real world?
- Fundamentals:
 - Sine vibration. Frequency, displacement, velocity, and acceleration.
 - Resonance Search, Track and Dwell. Transmissibility plot.
 - Random vibration. PSD
 - Classical Shock Testing.
- Different types of vibration test systems.
- Vibration servo controllers and sensors.

Module II - Core

- Advanced programming of sine and random testing.
- Other testing modes; Sine on Random; Random on Random; Multi-sine test.
- Control strategies.
- Vibration testing laboratory lay-out tips, servicing, and calibration.
- Fixtures characterization.
- Comprehensive discussion of electrodynamic shakers; Armatures, power amplifiers, isolation systems, slip tables, head expanders, ...

Module III Space - Specialised

- Random statistical parameters; Kurtosis, degrees of freedom, average, confidence level, statistical accuracy, ...
- Vibration testing in Aerospace industry; Qualification, Acceptance & Protoflight Testing.
- Time Waveform Replication, Iteration vs adaptive control.
- Vibration Single axis vibration vs multiaxis vibration. MIMO controllers.

Module IV Space - Specialised

- Shock Response Spectrum (SRS); Pyroshock testing
- Quasi-static testing: Sine burst
- Vibroacoustic testing; RATF & DFAN chambers.
- How to build up your own standard. Field data logging; averaging technics P95/50 & P99/90; testing time compression, Miner's rule; FDS Fatigue Damage Spectrum.

Training course formats

Type of training	Open courses	In-company courses
Topics addressed	Fixed agenda in modules	Customized agenda; flexible duration
On-line live webinar	✓	✓
Classroom seminar	✓	✓
Specialized lectures	✓	✓
Optional hands-on sessions	✓	✓

Jose Luis Lopez - Founder short profile



Aeronautical engineering background with 30-year experience in high added value products and solutions into International Markets. Main markets covered during his professional career are Industrial, Academic and Research Centers, Test Houses, Military, Aeronautic/aerospace and Automotive.

Direct training activities to companies or in collaboration with public and private organizations, to provide Environmental Testing (vibration, climate, packaging...) training courses to multiple entities in Spain, Europe and Middle East.

Fields of expertise

AdvEnSys can provide the following training courses:

- Vibration. Basic concepts; vibration technologies; single axis or multi axis testing; shock, SRS, pyrotechnic, ...
- Climate. Temperature, humidity, corrosion, altitude, vacuum, solar radiation, HALT / HAST, ...
- Transport simulation, packaging testing, drop, compression, dangerous goods, environment data gathering, ...
- Specific standards MIL-STD 810H CHG_1; DEF-STAN 0035 Part 3; RTCA DO160G; IEC 60068-2-XX; NASA-STD-7003A, ECSS-E-ST-10-03-Rev.1, ...

Spanish Committee Member of the following International Technical Committees:

- IEC/TC 104.- Environmental Conditions classification and Methods of Test.
- ISO/TC 51.- Pallets for unit load method of material handling.
- ISO/TC 122.- Packaging.