

Vibration testing

bulky versus compact products

NPI Services / Product validation Group

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Why vibration testing

- Look for mechanical **resonances**

 - **Vibration Swept Sine (S):**

 - Weak mechanical points
 - Root cause analysis of vibration damage

- Simulation real environment:

 - **Vibration Swept Sine (S):**

 - Propeller and turbojet Aircrafts
 - Helicopters
 - Mechanical cracks

 - **Vibration Random (R)**

 - Vibration is not related to a driving stimulus frequency
 - Motor noise
 - Vibration due to Transportation
(wheels over a road)

 - **Shock**

 - accidental abuse (drop,...)
 - normal operational environments of ground vehicles, aircraft
 - handling of equipment (Medical)

Vibration test equipment at product validation

- (Electrodynamic) shaker (LDS V895-440) / ground plane: 50 x 50 cm
- Slip table
- Amplifier
- 4 input Oros controller (now 8 input controller datagraphics)
- measurement Accelerometers
- Fixture (**R&D responsibility**)
 - Stiff
 - "No or limited" resonances in frequency

range



Product Range of Barcoviev

Visualisation solutions:

- Mostly display like
- Not heavier than 40 kg
- Ground surface not wider than 50 cm
- Each product has it's own test fixture to secure the EUT



Aerospace



- Cockpit displays such as video display units, smart display units, multi-purpose control display units, electronic flight instrument systems and electronic flight bags
 - Used to display critical flight data aboard more than 100 civil and military airplanes and helicopters

Defense



Rugged visualization solutions, including flat panel displays, graphics controllers, consoles and workstations, recording solutions and rugged computers

Medical Imaging



Medical grade displays

Diagnostic displays (2MP – 3MP)

Mammography displays (5MP)

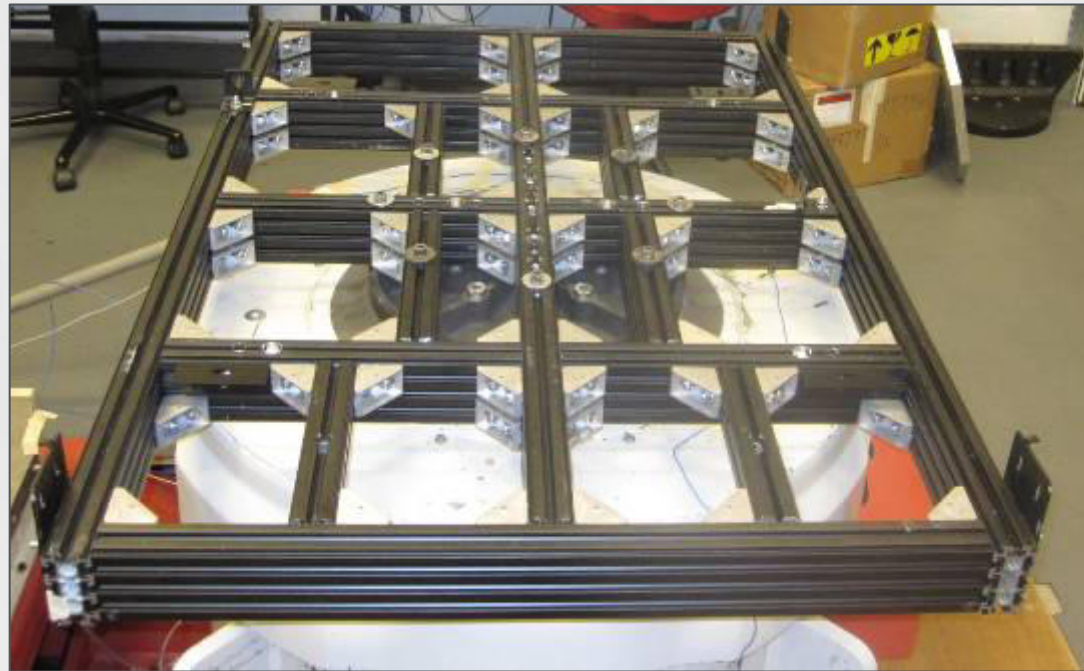
Surgical displays (High definition quality)

Clinical Review displays (1MP – 2MP)

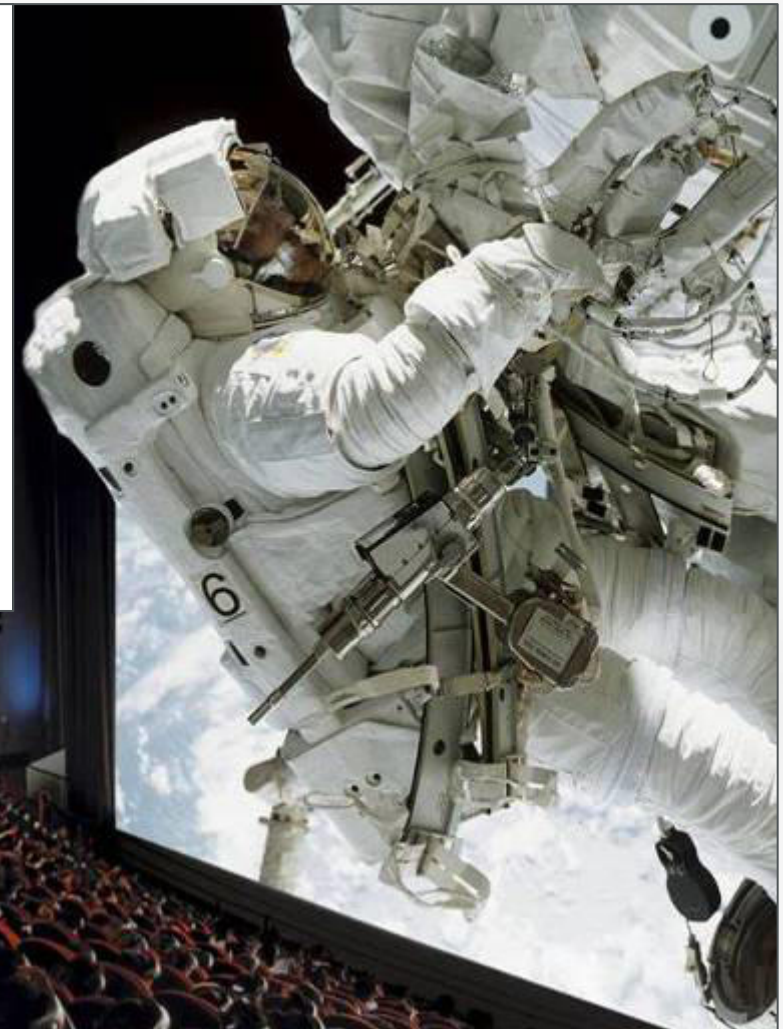
Product Range of Barco Media & Entertainment

Visualisation solutions:

- Mostly bulky projectors for cinema, simulators & rear projection
- Heavier than 100 kg
- Ground surface wider than 50 cm
- Adjustable test fixture to secure various projector sizes made of an assembly of extrusions bolted together



Digital Cinema



Monitoring & control of Infrastructure & utilities



Rear-projected, networked visualization platform provides operators with all key information of a facility and/or distribution network at a glance

Energy, power, water distribution

Oil & gas production and distribution

Events



Full range of LED, lighting, projection and control equipment offering unlimited creativity and flexibility to the rental and staging industries

Try to test this!



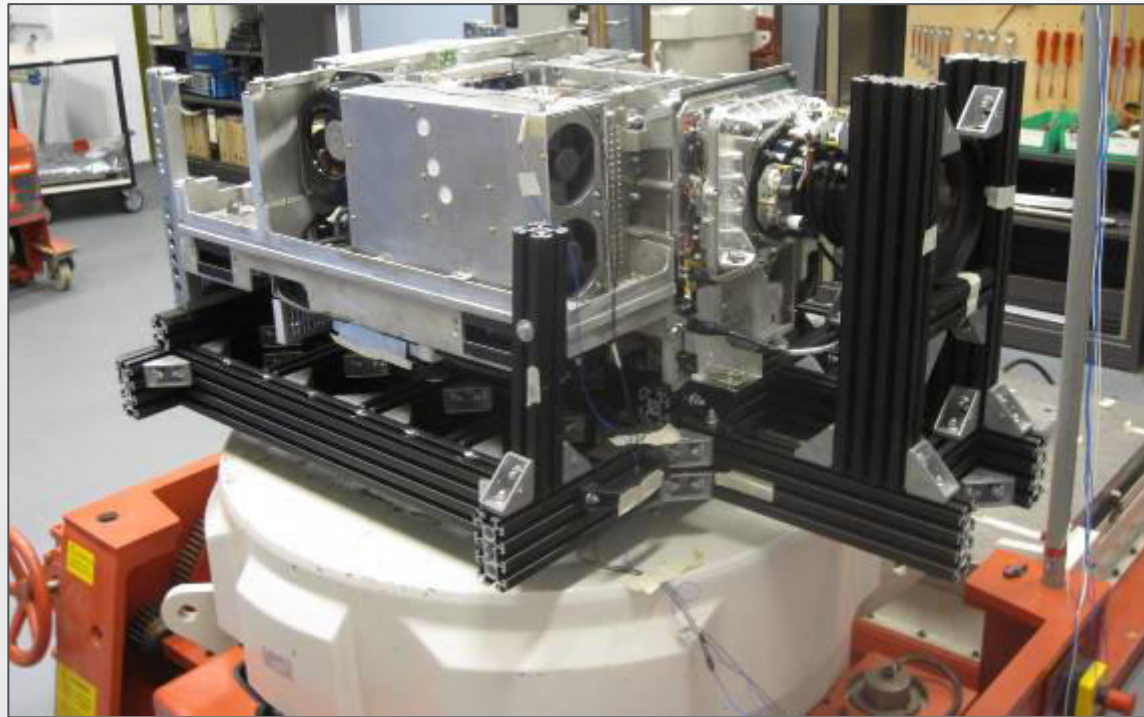
Ground plane / centre of gravity

- **armature out of balance** ⇒ Damaging the vibration table

Fixture

- **Inducing resonances in both EUT & vibration table**
 - ⇒ Damaging the vibration table
 - ⇒ Overtesting EUT

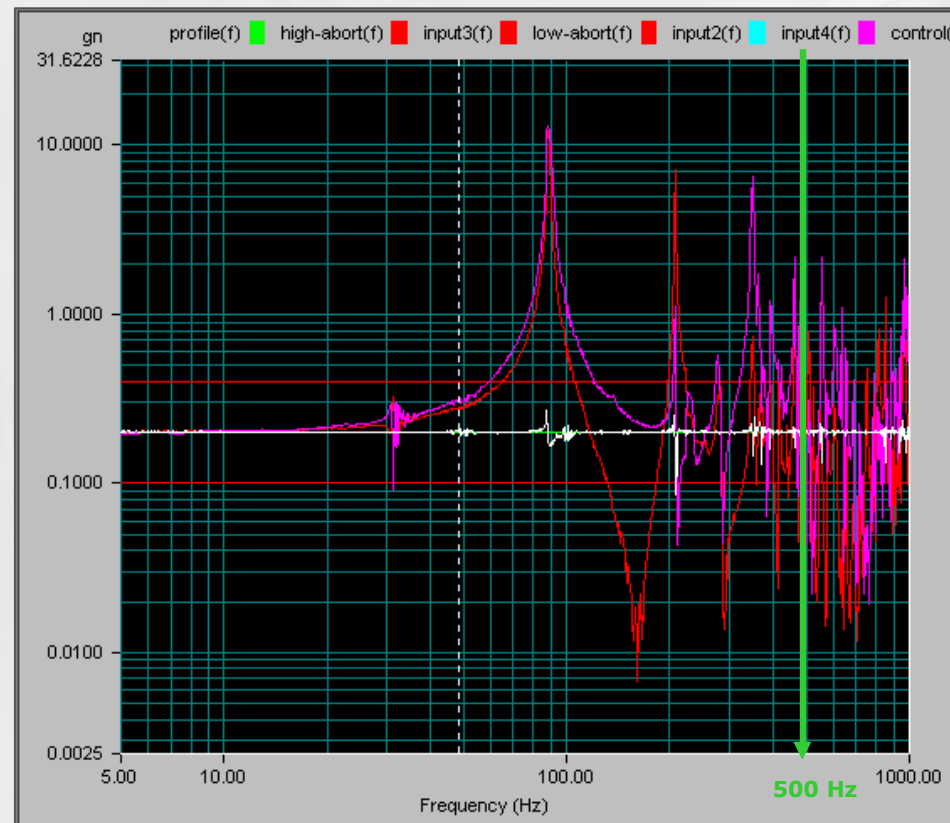
How we started testing media & entertaining products



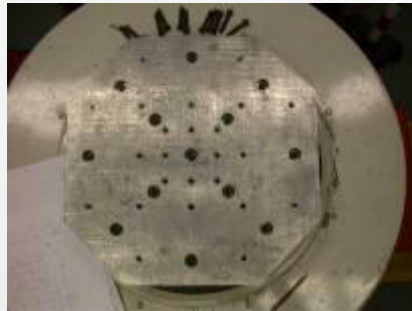
- Enforce test jigs
- Ensure that the center of gravity is in the center of the vibration table
- Prove to R&D that even with an improved fixture, there are still resonances induced in the frequency span of interest

Problems with the fixture: to big & to weak

- Input : 0.2g sinus, 5 to 1000 Hz.(white line)
- Control1: On attachment point of projector (purple line)
- Control2: On corner of fixture (red line)
 - at 90 Hz resonance of factor 60!! (0,2 to 12g)
 - at 150 Hz damping of >10
 - at $f > 200$ Hz the fixture "sings"



Action 1 to be taken: enlarge vibration ground plane



0,5 x 0,5m



1,2 x 1,2 m

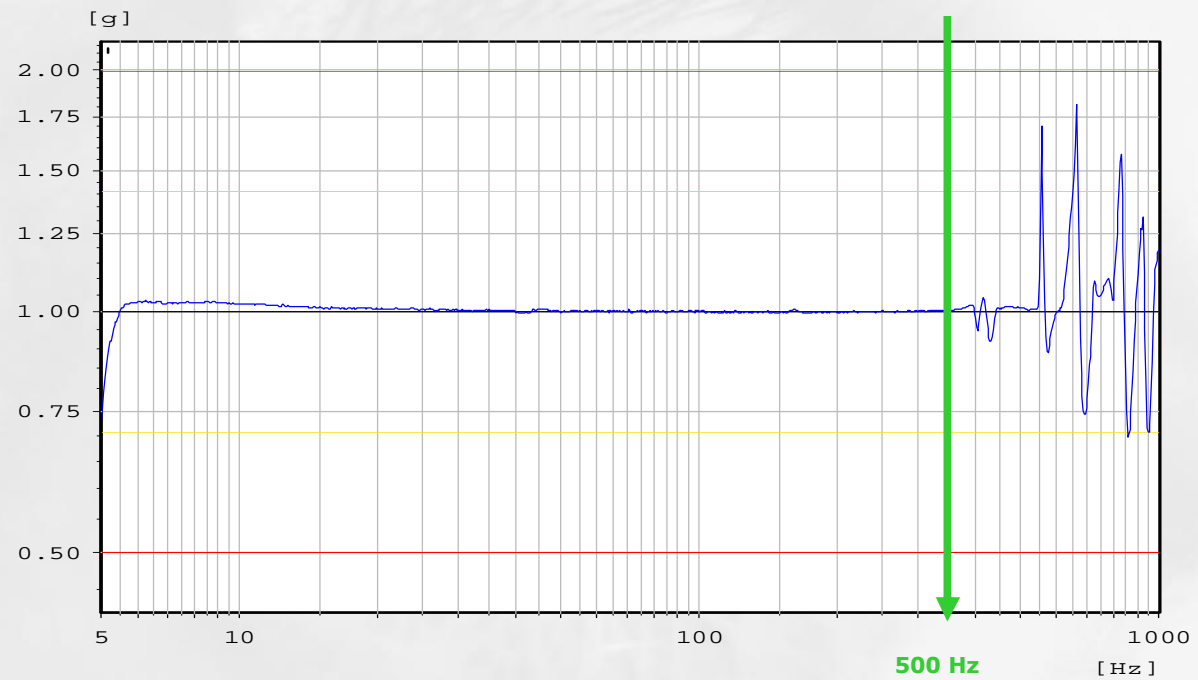
Buy head expander



Resonance pattern with head expander

Sine

Control channel



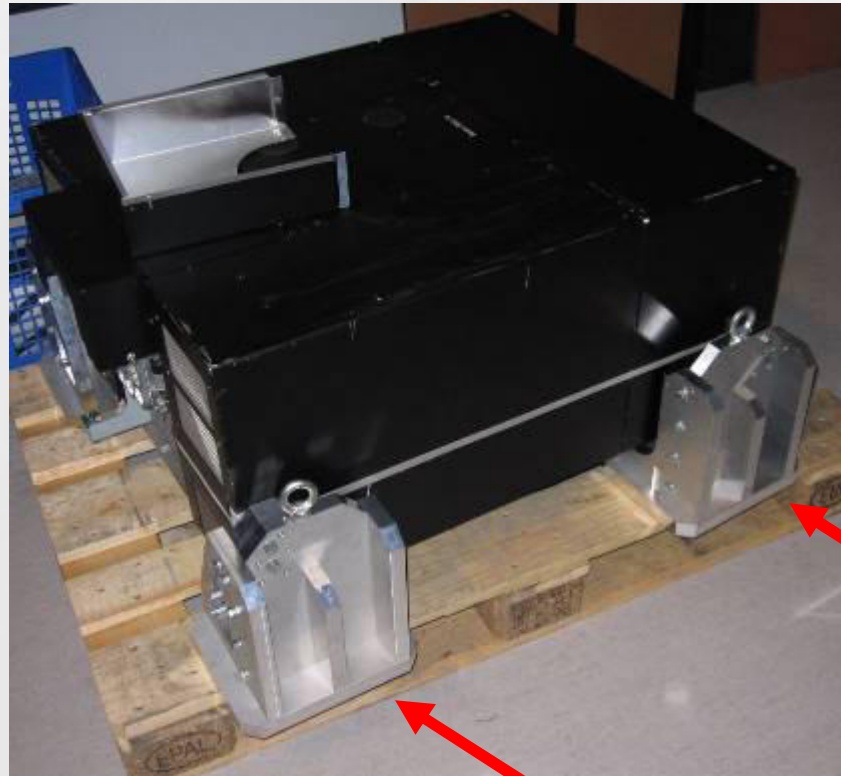
Rept. :XXXX

Annex XXX

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Action 2 to be taken: change vibration fixture

It took us 3 years, proof of resonances while testing various projectors & an internal organised course on the importance of rigid fixtures to convince R&D to redesign the fixtures to our specs



The go-getter wins!