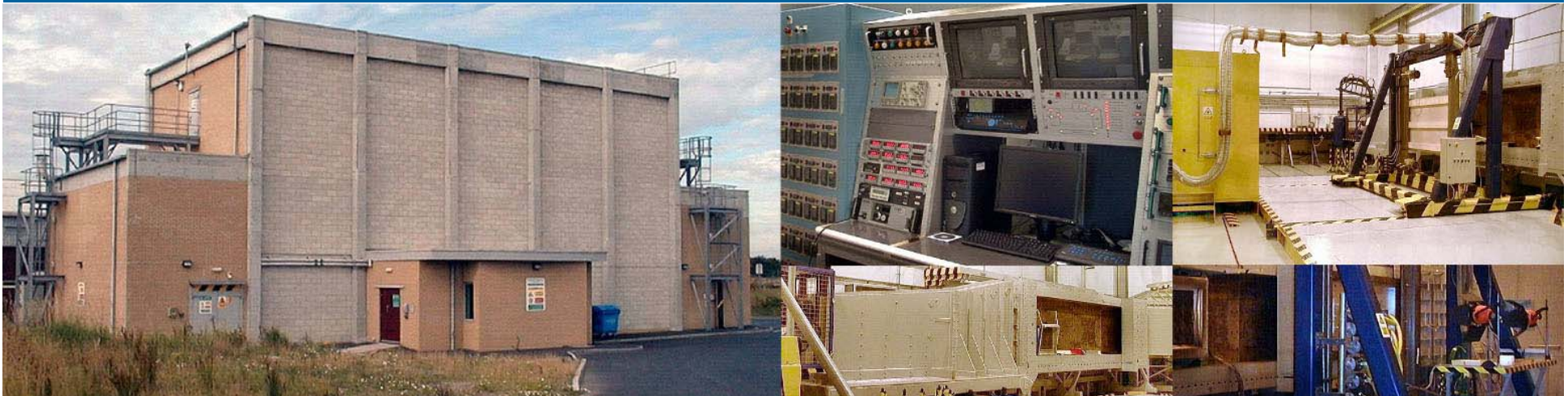


The Acoustic Fatigue Facility

Test Approach & Techniques

Andy Olsson, Acoustic Test Specialist, BEng., M.Phil.



The Facility

- Modular “box in a box” structure
- Purpose built to withstand internal noise levels of 154 dB within the test cell
- Access doors of 5.5m x 6m into facility with ‘Drive-in’ capability
- Test Cell of 20m x 9m x 7.15m is effectively a reverberation chamber capable of 154dB
- SWL 10 tonne overhead crane in Test Cell
- SWL 1.5 tonne mobile lifting and inspection platform
- High security and observation using remote recordable CCTV & PIR’s



Capabilities

- Noise duct designed to operate at noise simulations up to 175 dB
- Rapid thermal acoustic testing up to 800°C (1500 °F)
- Loads frame capable of applying 70 tonnes in-plane loading
- Static testing capability up to 5 tonnes for model validation
- Modal testing for model validation
- Impact testing capability for damage tolerance testing
- 70 channels of real time data acquisition
- Real time animation, time & frequency domain analysis



Progressive Wave Tube

- In house designed
- Achievable noise level of 175dB in the 1.2m x 0.3m x 4.4m working section.
- Low impedance horn with low cut off frequency of 30Hz.
- Anechoic termination / reverberation chamber has a maximum volume of 10m³.
- Modular system for easy adaptation to suit test requirements

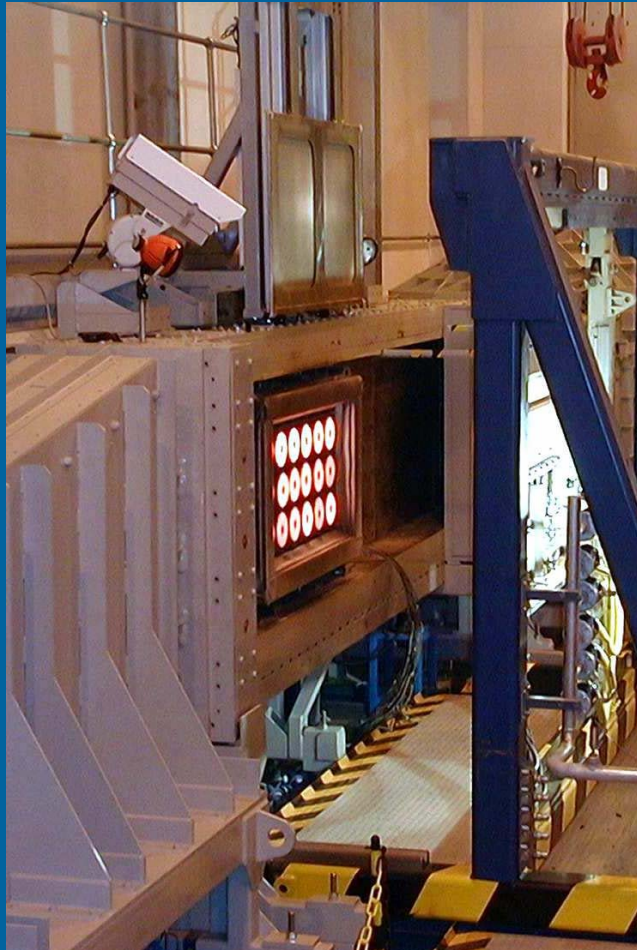


In Plane Loading



- Applied in-plane loads of up to 70 tonnes
- Maximum in-plane loading panel of 1.2m x 2.5m can be mounted in the loads frame
- Both tension and compressive loads can be applied
- Mobile loads frame for easy inspections
- Shear can be applied to multiple bay structure

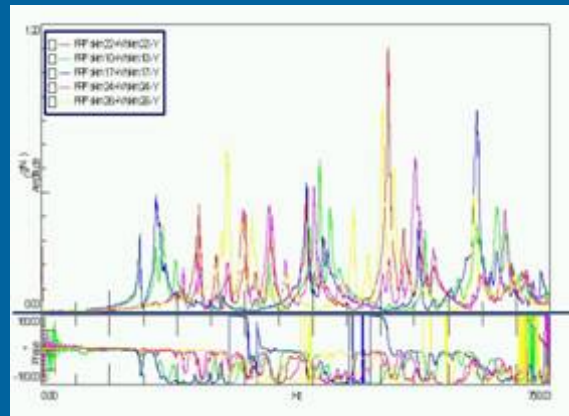
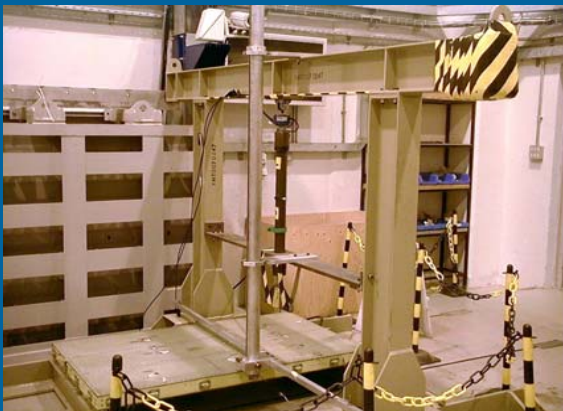
Heater & Controller



- Temperatures up to 800°C (1500 °F)
- Up to 40 heater elements rated at 8kW each mounted on a modular support structure
- Rapid temperature changes using a vertical 'gate' mechanism and air cooling
- Individual point control per element
- PID feedback inc. Cascade

Static, Modal and Impact

- Both static and Modal tests used to calibrate static model parameters.
- Strain & deflection results recorded during static.
- Modal parameters inc. damping found during modal test.
- Impact test (low or high energy) used to qualify damage tolerance.

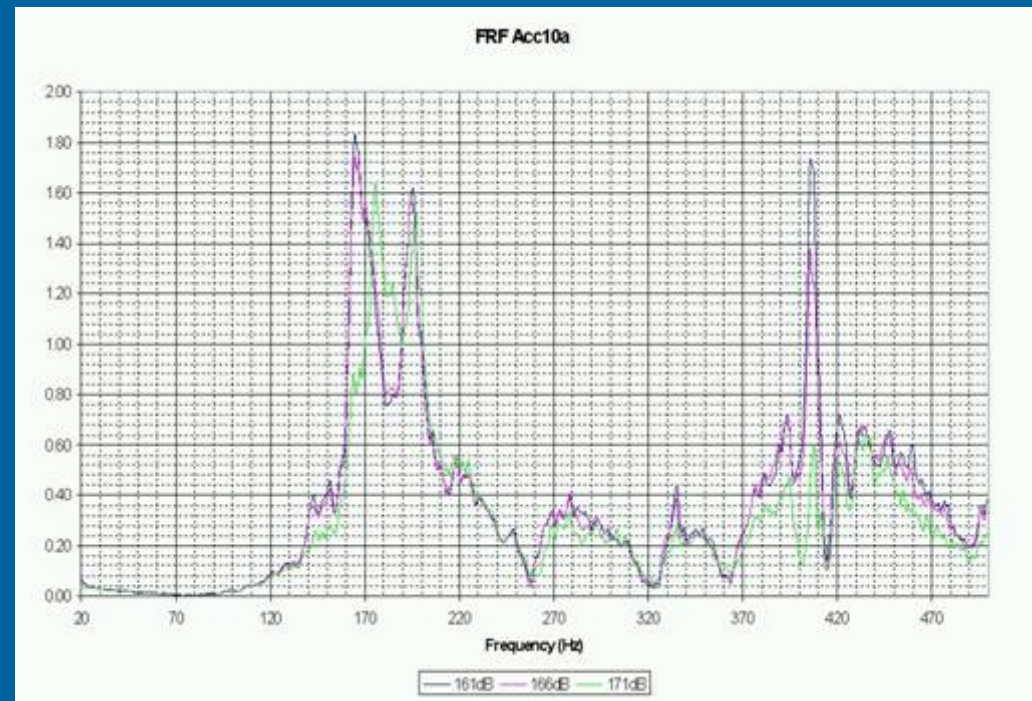


Test Approach – Customer Interface

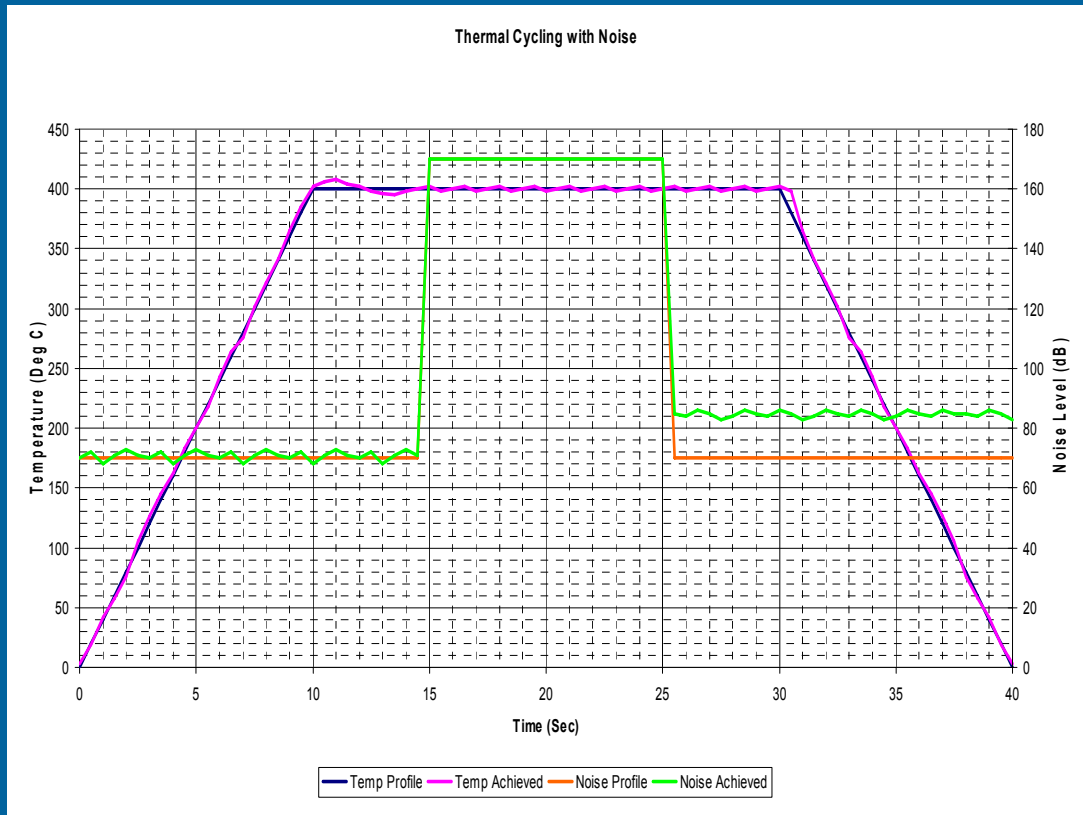
- Close liaison from initiation of test requirements
- Align testing capabilities with customer requirements
- Review testing methodologies against budgets & timescales
- ALL testing carried out & managed using ISO 9001 Quality Management and departmental quality processes (QPI 511).
- Project management, Engineering & Life Cycle Management used to review each stage of testing (design, test preparation, test, reporting etc.)
- Reviews attended by customer – ensures conformity with requirements and enables test requirements/techniques changes to be fully controlled.
- Test data can be aligned to specific formats to suit appropriate comparison to be made with any analytical results.

Recent Tests

- Non-Linearity
- Response confirmed at -15, -10, -5 & 0 dB test levels.
- Apparent damping seen as a stiffening of structure.
- Possible increase in modal frequencies and decrease in response amplitude.
- Results can be aligned to model to improve predictive methods.

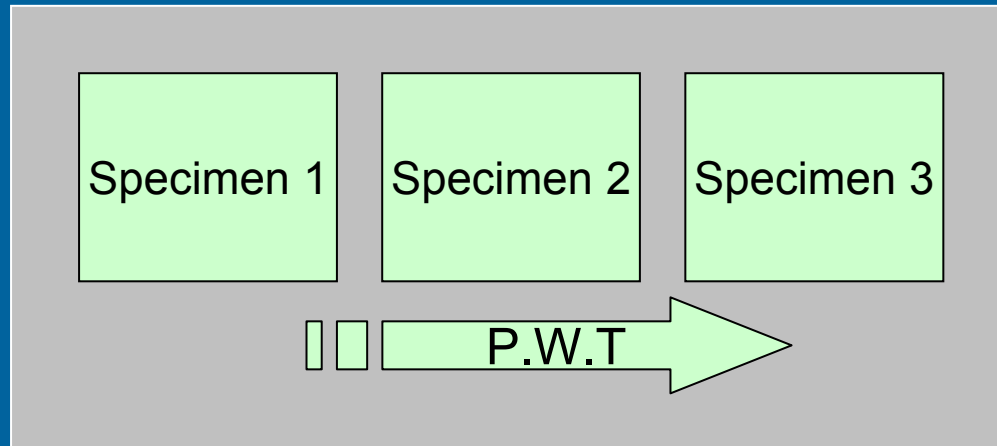


Recent Tests



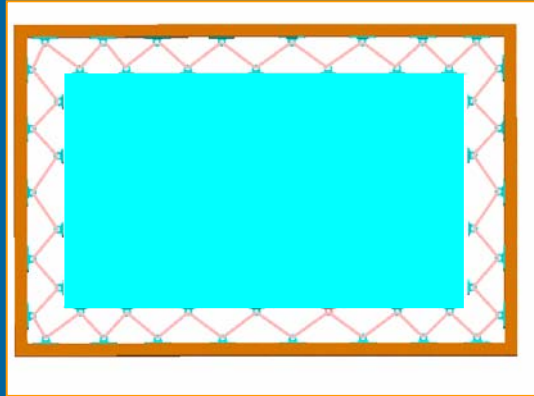
- Thermal Cycling
- 0-400°C
- With & without noise
- Rapid air cooling
- Digital video of each cycle
- Steady State testing to 800oC

Recent Tests

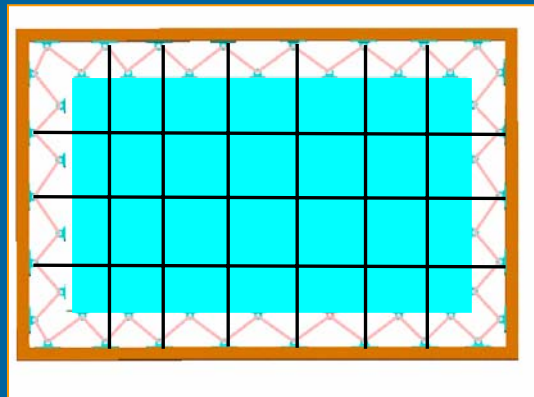


- Multi-Component test
- Differing gauge material matched to input noise level.
- Real time results can be compared directly.
- One test set up & single specimen can be removed if failure occurs without disrupting testing of the other two.

Recent Tests



- ‘Free-Free’ Testing
- Test article restrained with “bungee”
- Differing restraint methods can be used
- Minimises impact of full body modes as modal frequency was below input frequency.
- More representative of continuous type structure



Conclusions

- Purpose built facility
- Offering complete test solutions
- Consultation/Customer interface from test concept
- Response data analysed & formatted to customer requirements
- Technical support for design, manufacture & related structural testing
- Turn key system tests to large scale research & development programmes
- Testing to Def Stan and Mil Spec
- ISO 9001 & QPI 511 Quality Management
- Visitors & prospective customers most welcome



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