

VIBRATION REDUCTION IN ISC PERISCOPE

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Goals

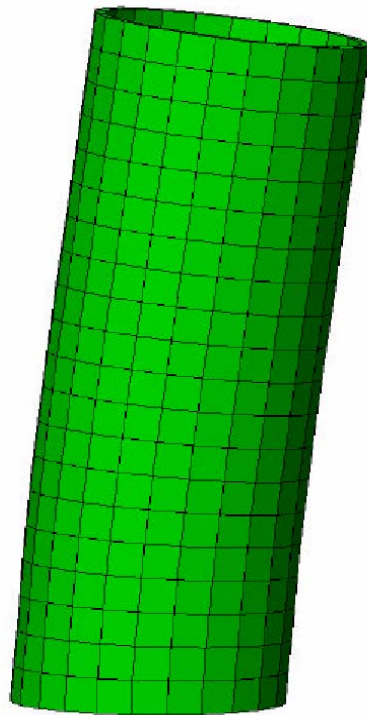
- Increase first mode by a factor of 3 (140 to 420 hz)
- Reduce acoustic coupling by a factor of 10
- Eliminate dog clamps used to hold periscope to ISC table
- Reduce table skin rocking which is amplified by the lever arm of the periscopes

Design Process

- Start with simple structural shape
 - Allows easy calculation of attainable natural frequencies
 - Inexpensive, easy to obtain and modify
- Make modifications to basic shape which have minimal effect on first modal frequency
 - Each modification checked with FEA
- Consult the experts
 - Professor Samir Nayfer MIT Department of Mechanical Eng. consulted on acoustic damping

Analysis of Basic Shape

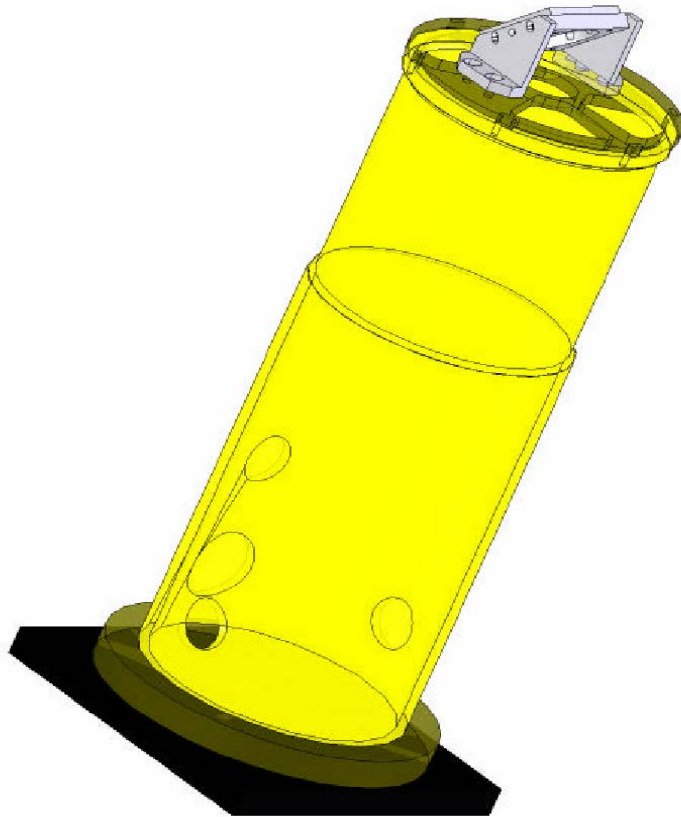
- 8.0" dia. x .322 wall pipe



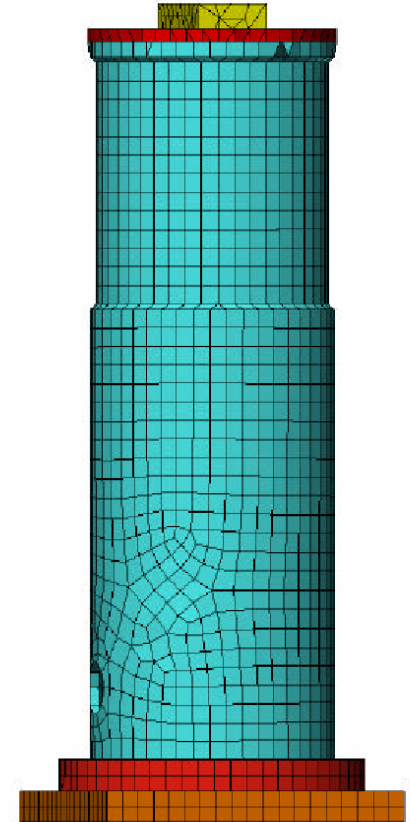
Mode: 1 of 5
Frequency: 554.968 cycles/s
Maximum Value: Not Available
Minimum Value: Not Available

- Added mirror, mount, and top plate
- Removed mass in upper 1/3 of tube to compensate for added weight
- Added access holes
- Added welded base to tube and ability to rotate assembly

Periscope Design

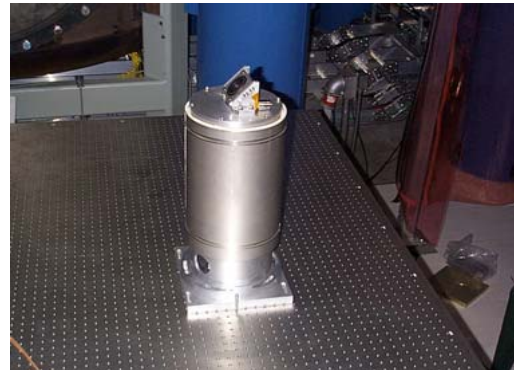


Mode: 1 of 5
Frequency: 491.772 cycles/s
Maximum Value: Not Available
Minimum Value: Not Available



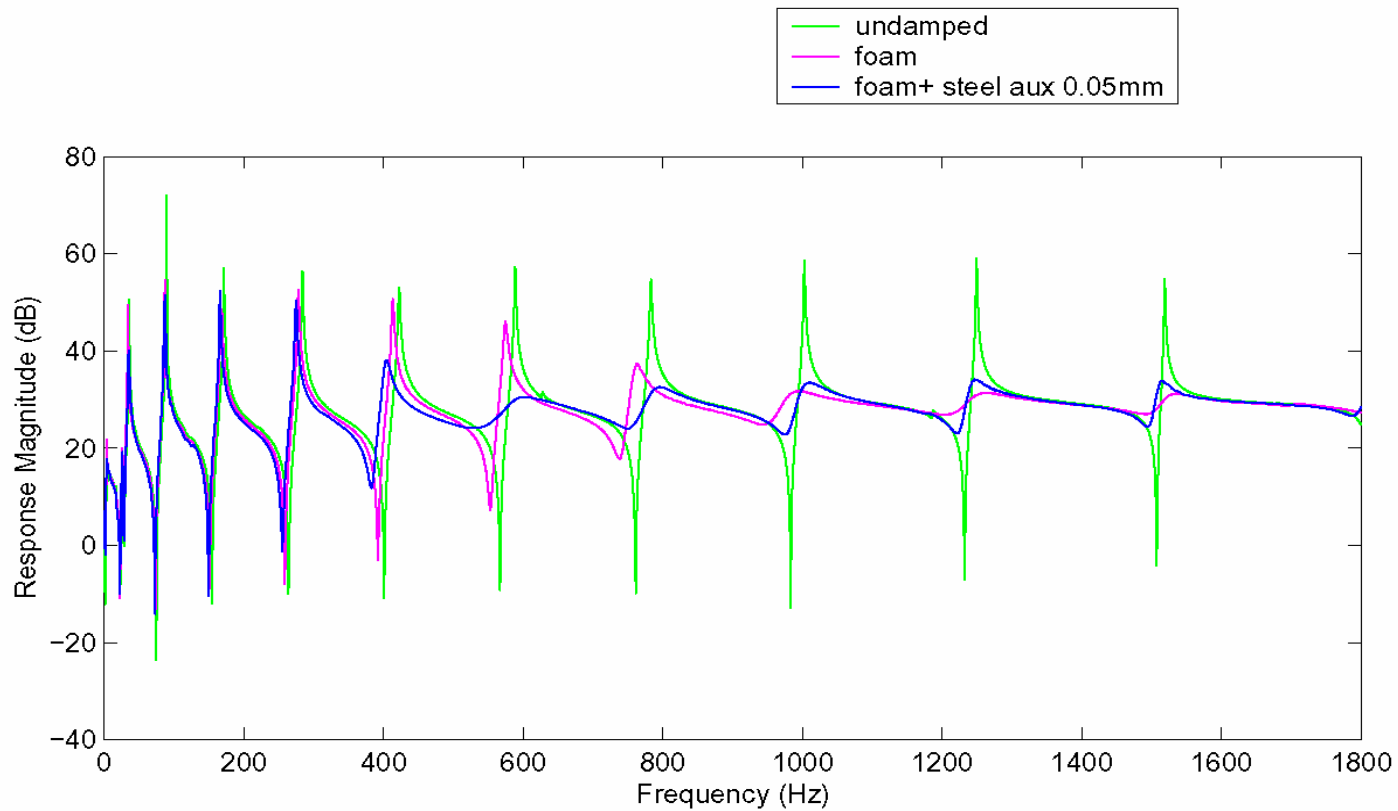
Acoustic Damping

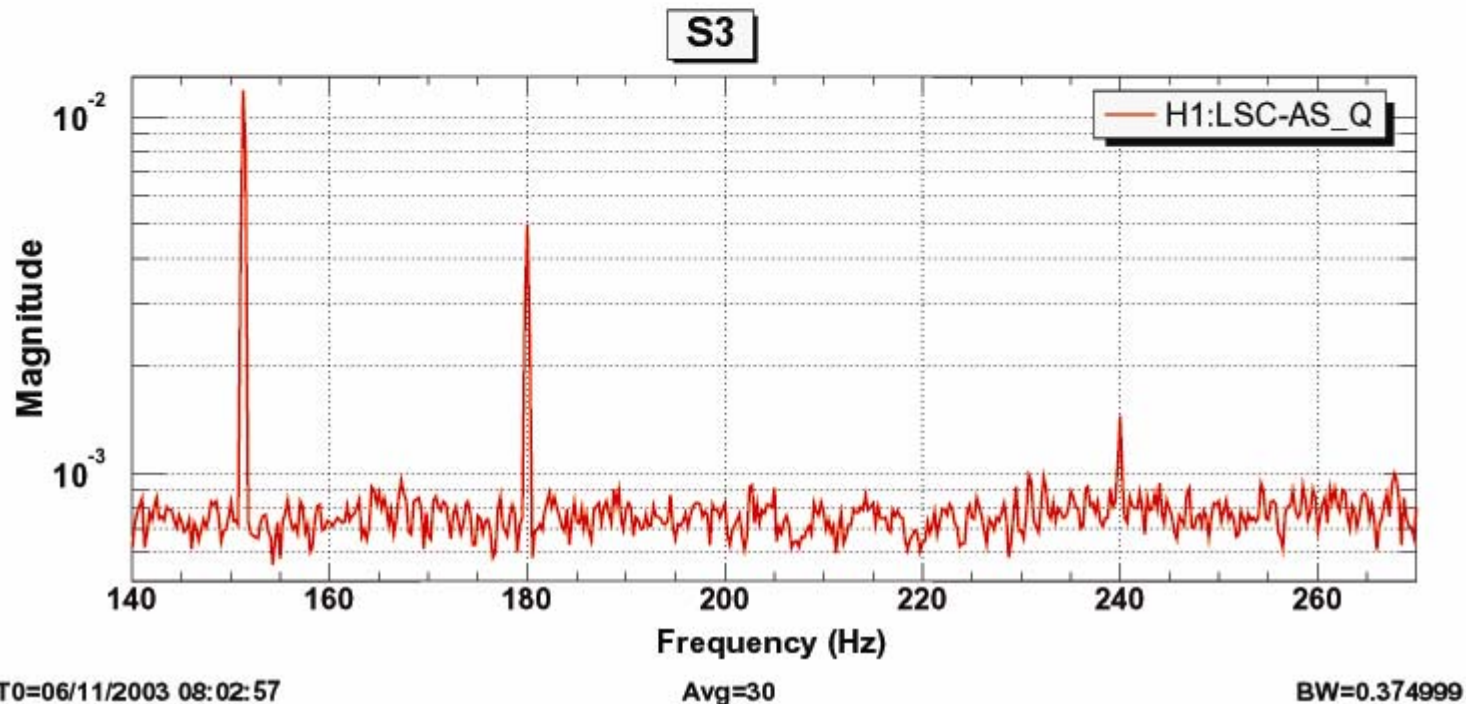
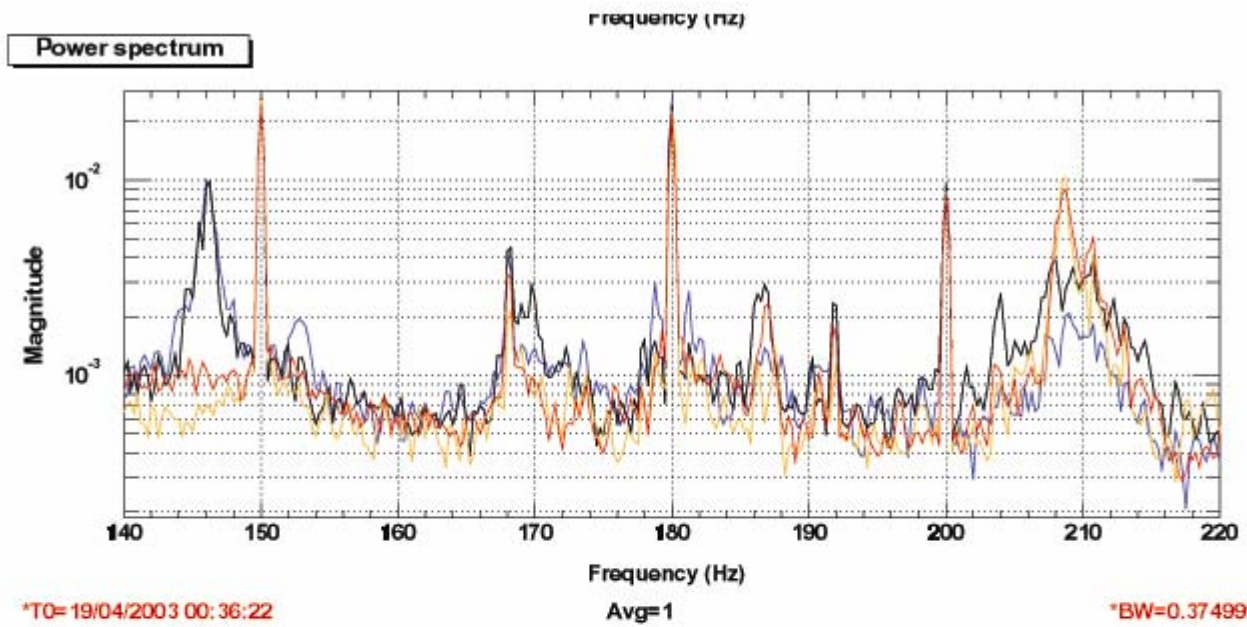
- Recent work by Professor Samir and Graduate student Kripa Varanasi at MIT saw a 10 X reduction in noise above 400 hz
- Optimum damping occurred using Isodamp acoustic foam EAR C3201-25 with .05 mm stainless steel jacket
- K.K. Varanasi and S.A. Nayfeh, 2003, "Vibration Damping by Coupling to Lossy Low-Wave-Speed Media". In *Smart Structures and Materials 2003: Damping and Isolation*, SPIE 03, Agnes and Wang Eds.



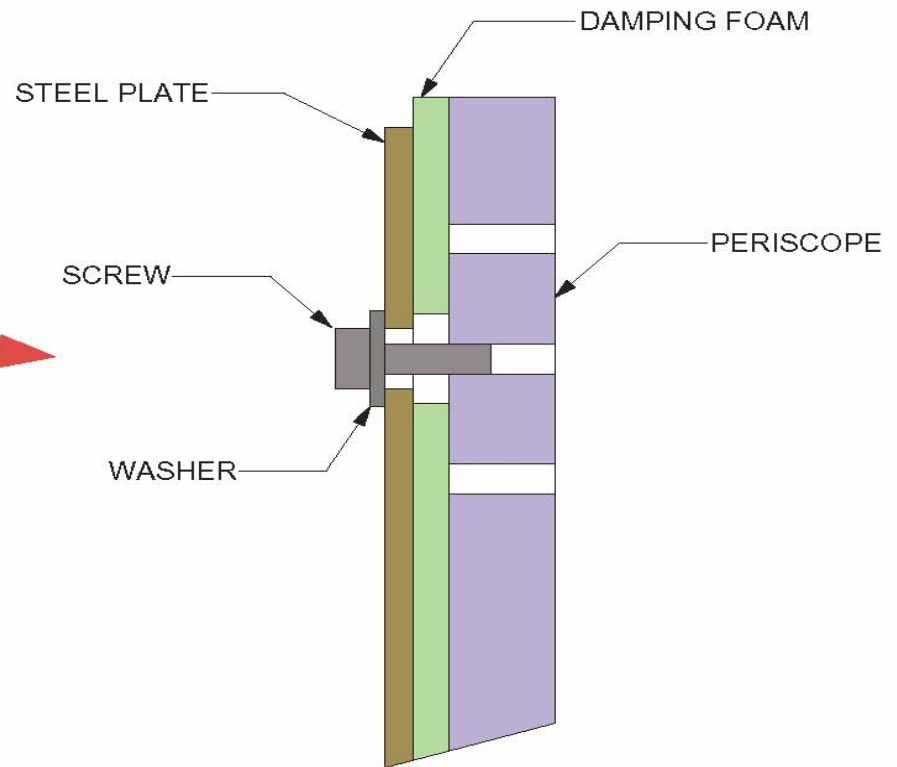
Acoustic Damping

steel layer 1.2% of beam mass



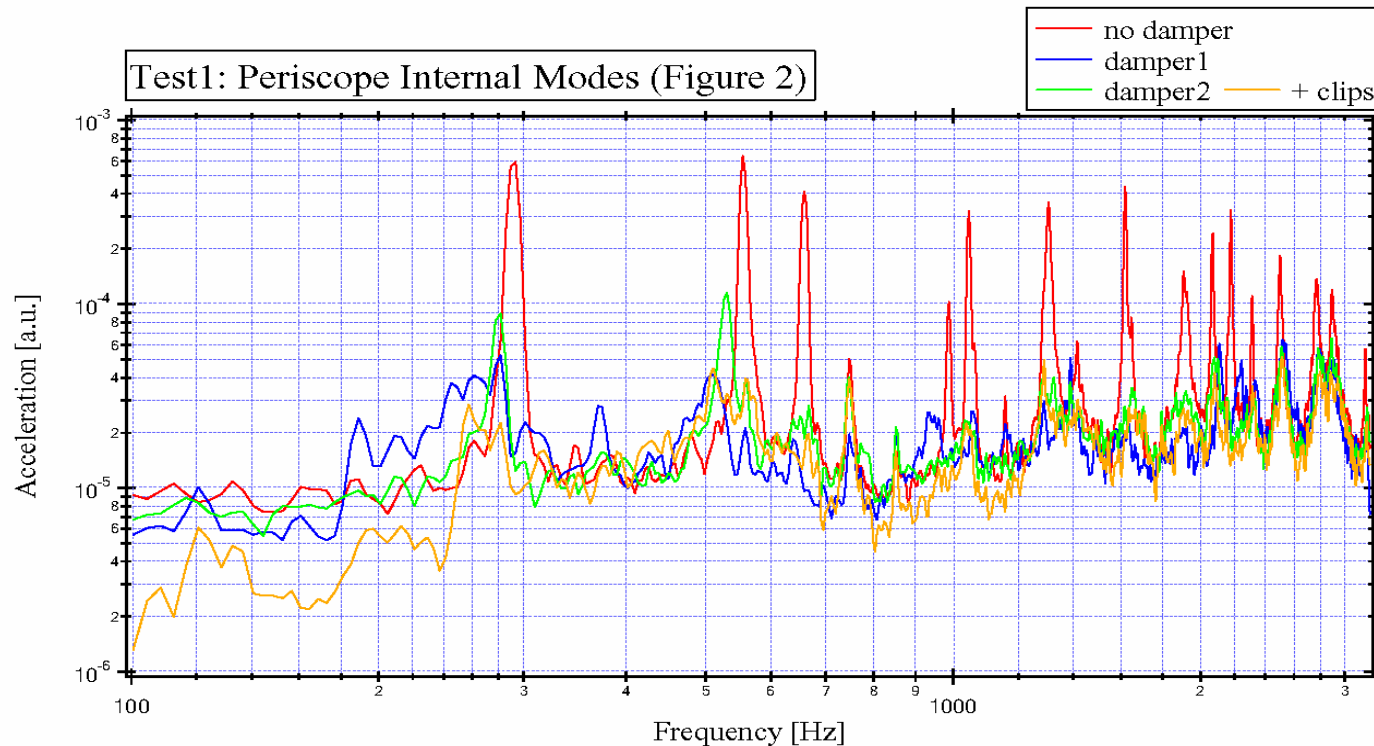


Acoustic Foam on Older Style Periscope



Acoustic Foam on Older Style Periscope

- No Damper
- Damper 1: 5mm steel plate / ½” foam
- Damper 2: 1mm steel plate / ¼” foam with additional clips



Acoustic Foam on Older Style Periscope

