BEAM Me Up, Scotty! Mitigating the Decibel Levels on the BEAM Space Module Using a 1:10 Scale Model with Acoustic Engineering Techniques for Long Term Space Missions

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Background: The BEAM module is being tested on ISS for several environmental aspects like radiation, space debris etc. but one area of concern for astronaut's health is the acoustic levels, which is >75 db. As NASA plans for bigger expandable modules for Mars mission, hearing is important for situational awareness and mission success. Methods and Procedures: 1. Researched NASA's TransHab and Bigelow Aerospace's BEAM module and identified their construction features. 2. Designed and built a 1:10 scale model of the BEAM module using data from NASA, using similar materials (Kevlar, polyurethane foam, thermal insulation) – a 3 layer outer shell with canvas cloth, foam and backing, and sewed it together with a semi-rigid collapsible metallic frame. 3. Researched and obtained the background noise audio on the ISS, and used that for testing the acoustics inside the scale model 4. Researched various audio analysis software - Audacity, Raven, Matlab & WavePad, learning to use them for audio analysis 5. Played ISS sound file within the scale model, and recorded the audio using Labview myDAQ hardware and a GRAS microphone inside the BEAM model, treating this as the control 6. Obtained several commercial acoustics noise reduction materials, and tested them inside the model, playing the ISS audio and recording it. 7. Analyzed and compared the signals with Matlab, looking at frequency responses in the Octave bands for the various materials 8. Researched various acoustic modeling software, such as i-Simpa and EASE, and learning to use them for the BEAM scale model. Conclusion: By incorporating the right material (Absorptive/Noise Barrier Quilted Curtain) into the BEAM module, we can reduce the decibel levels, making it a better habitat for prolonged space missions.