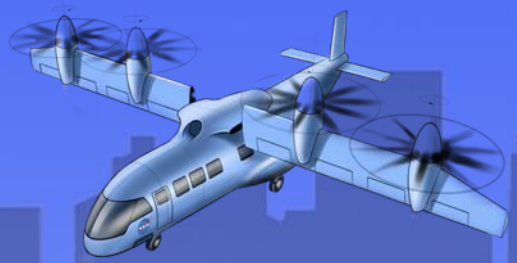
Electric Motor Noise Testing



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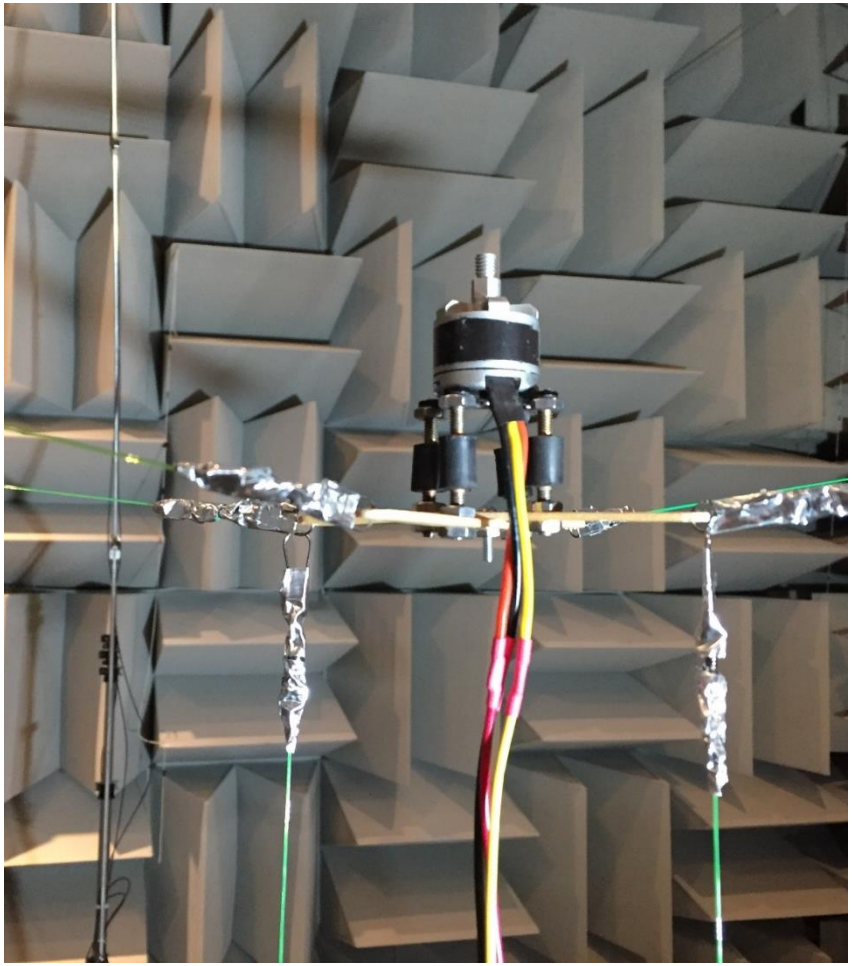
Project Objectives

- This work supports RVLT.2.3.2.1 Source Noise Modeling; Milestone RVLT.23.21.L490 Initial acoustic model for kW class electric motors
- Characterize the impact of different motor loads on the sound generation
  - Quiet loading device has been built and will be used soon
- Study the sound of larger motors
  - Preliminary results of the Scorpion SII-4020
- Compile this knowledge into an ANOPP module

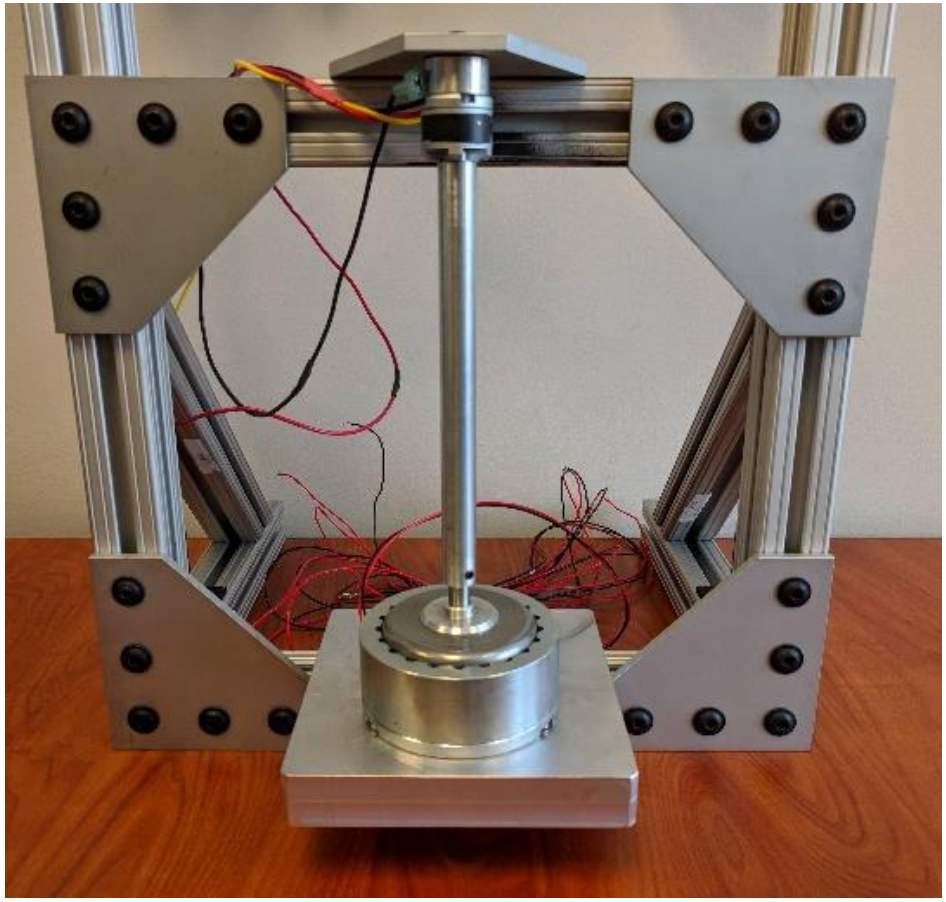
Previous Work

- Previous measurements concentrated on the acoustics of small 300 watt motors used in hobby quad-copters
- Motor generates tones that are acoustically relevant even in the presence of a prop
- The strength of these tones is RPM and load dependent



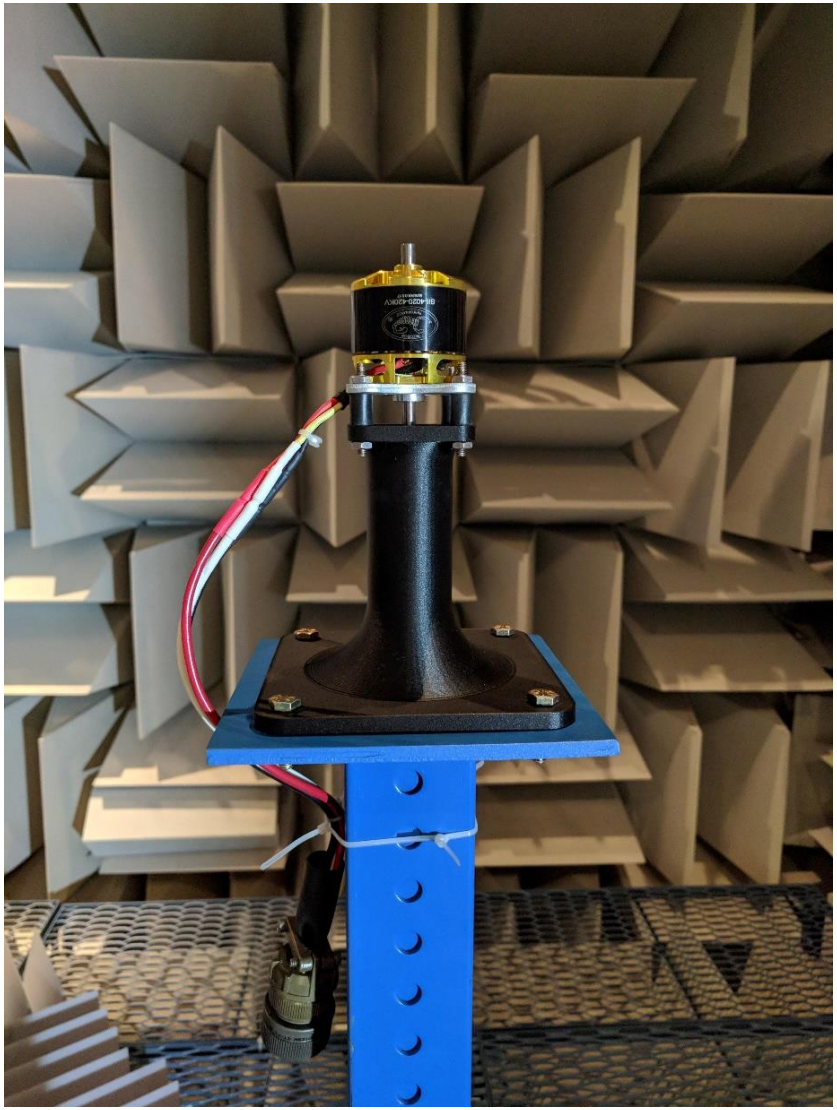
Quiet Motor Loading

- Apply variable load to small quadcopter motor
- Load is provided by an Eddy current variable brake
- System went through alignment and balancing
- Measurements will be performed using the phased array due to the structures near the motor



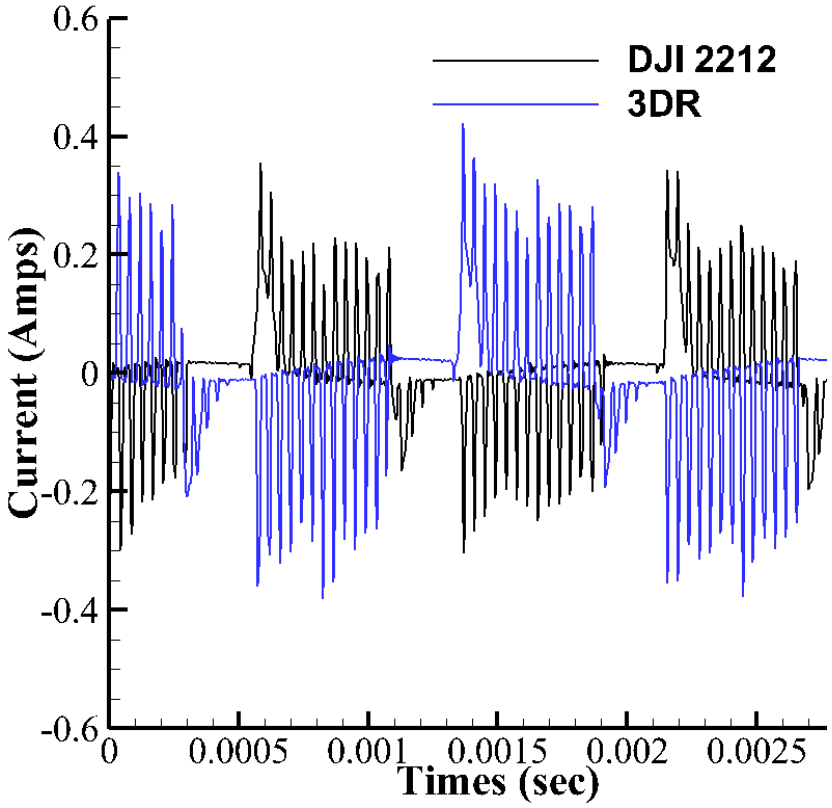
Scorpion SII-4020 Installation

- Motor used on the GL-10 Greased Lightning drone developed at NASA Langley
- Scorpion is a 1.9 kW peak motor
- New Motor Mount in the ATL

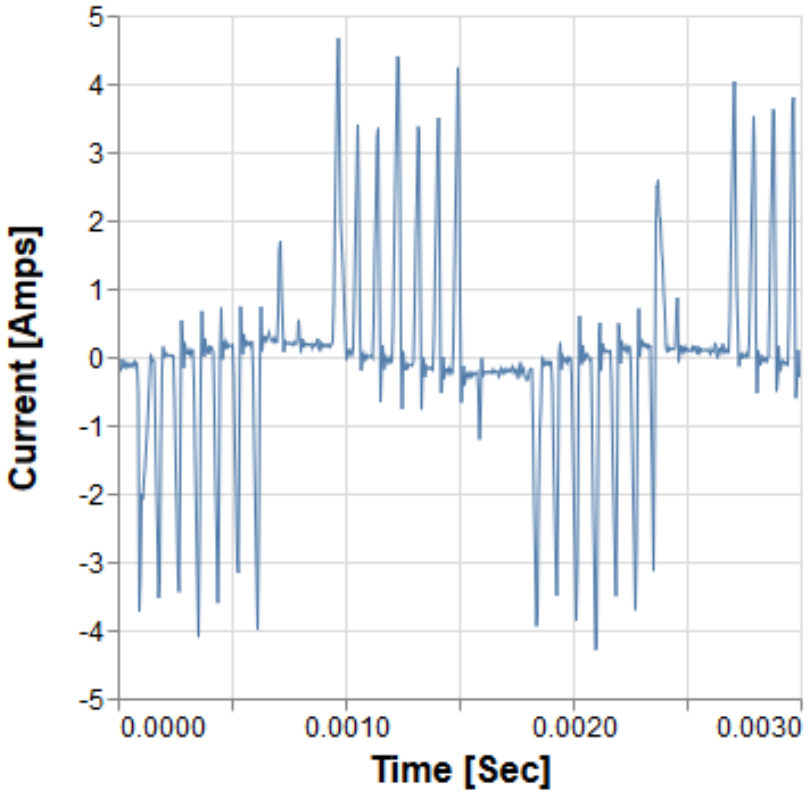


DJI 2212 vs Scorpion SII-4020 Current

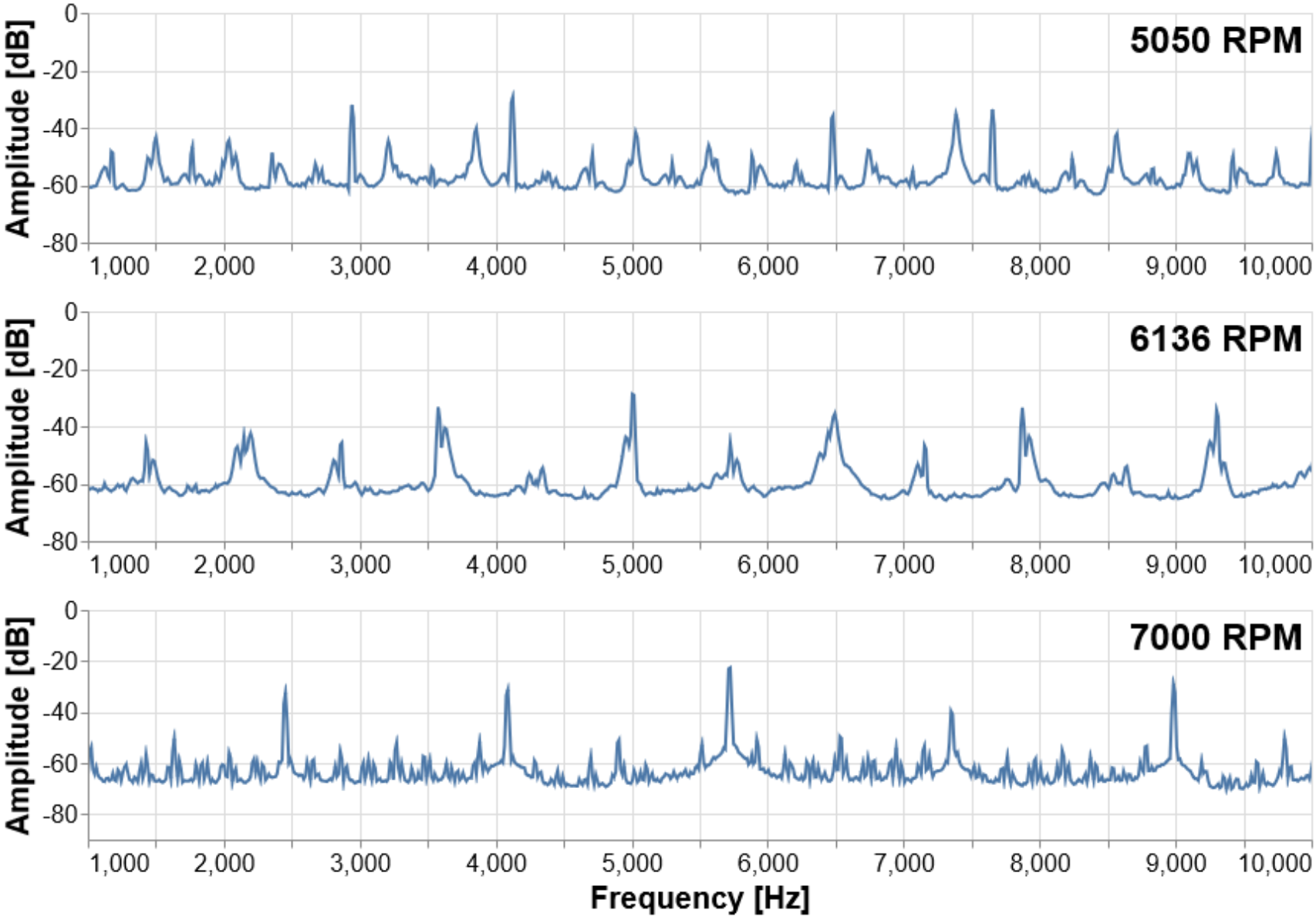
Small Quadcopter



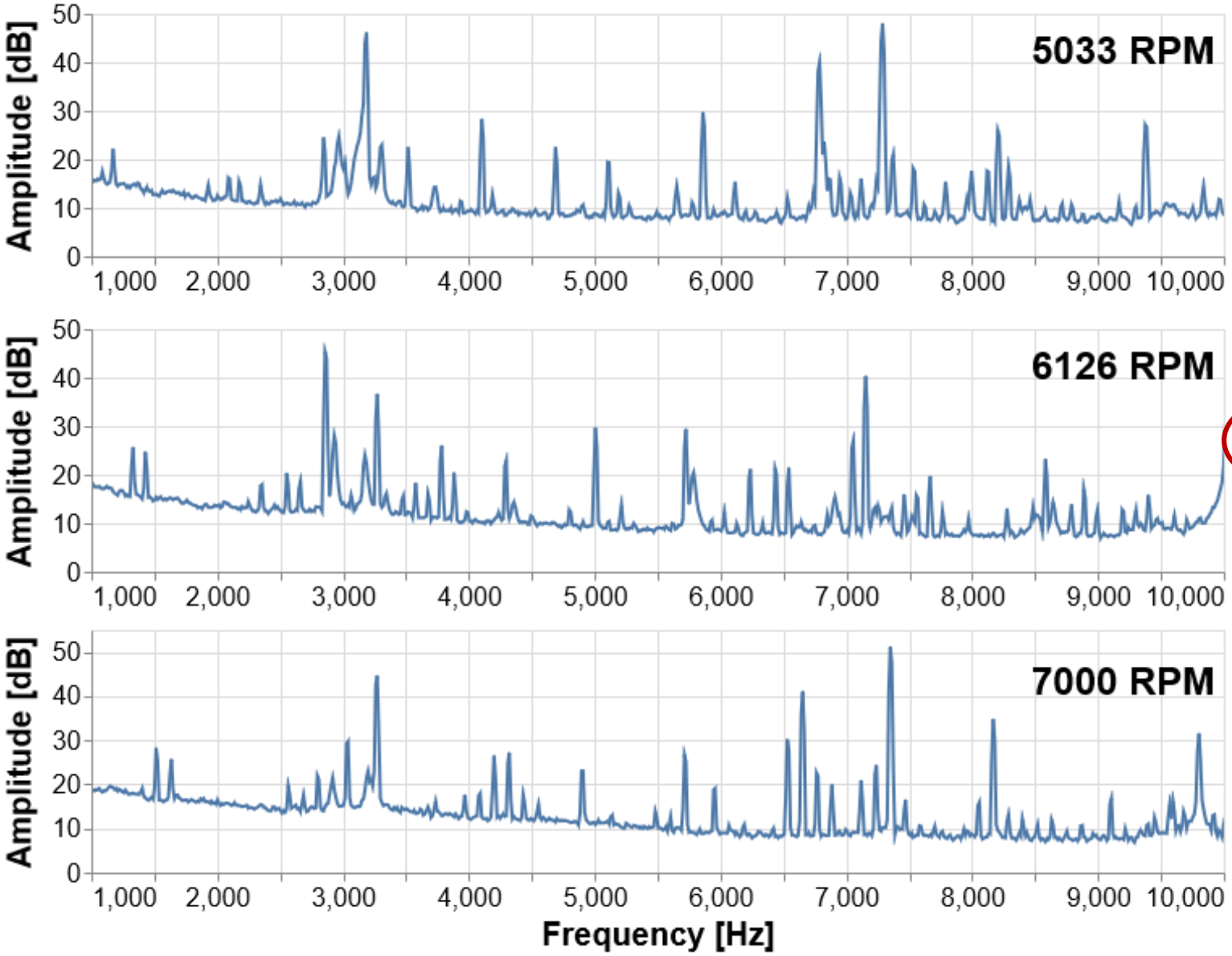
Scorpion SII-4020

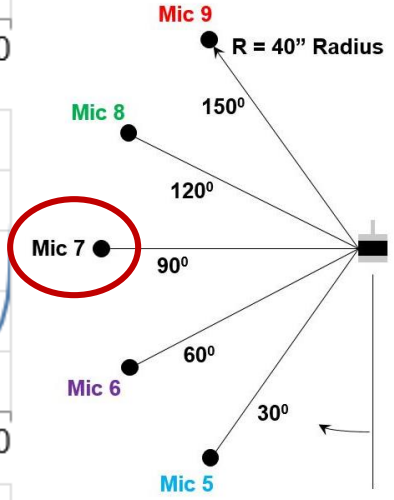


Scorpion Current Spectra - Unloaded

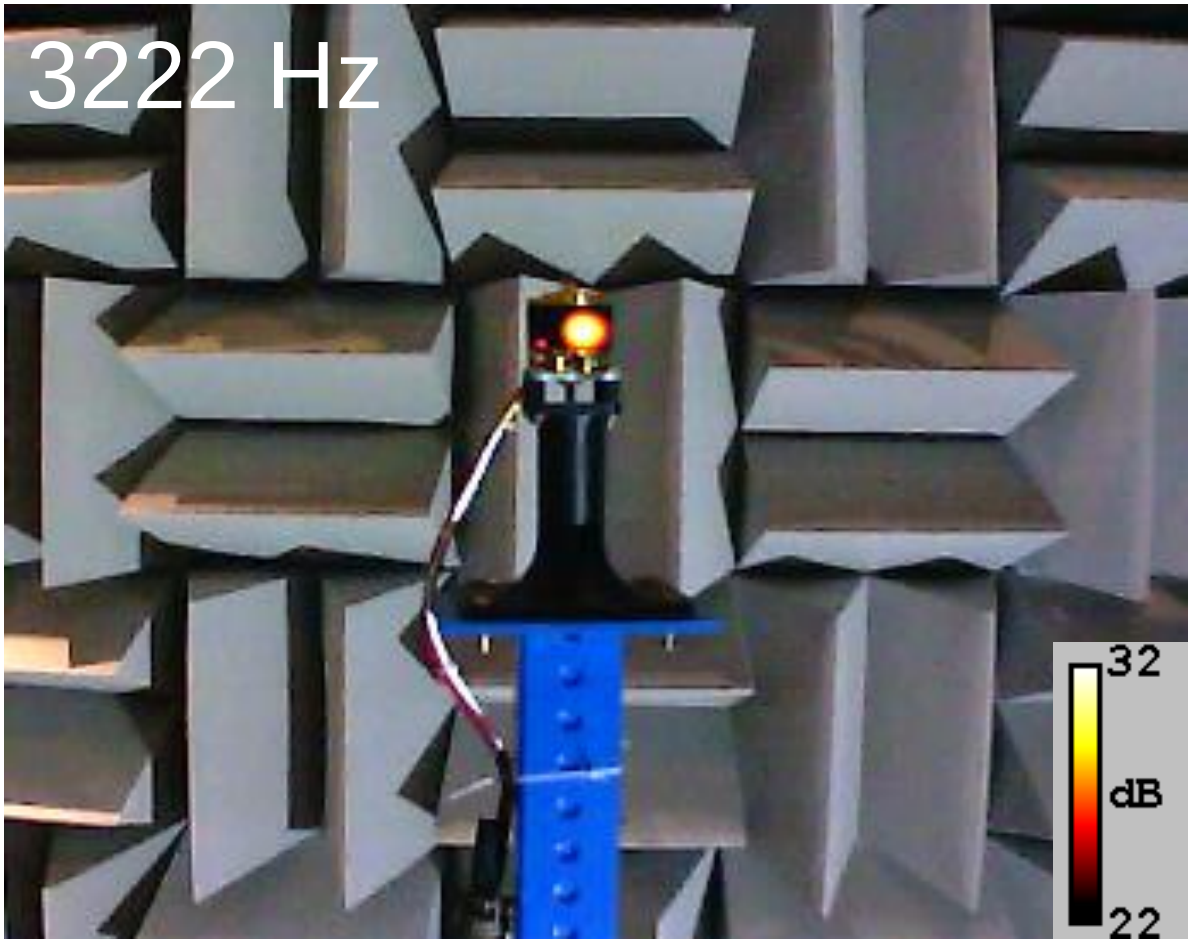


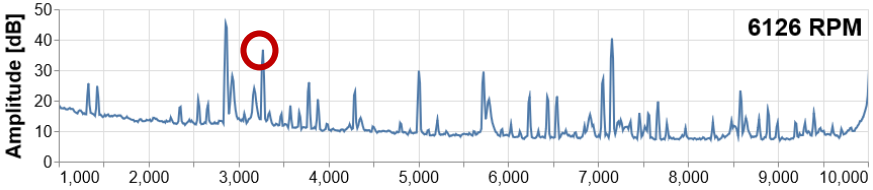
Scorpion Acoustic Spectra - Unloaded





Scorpion Beamforming – 6420 RPM





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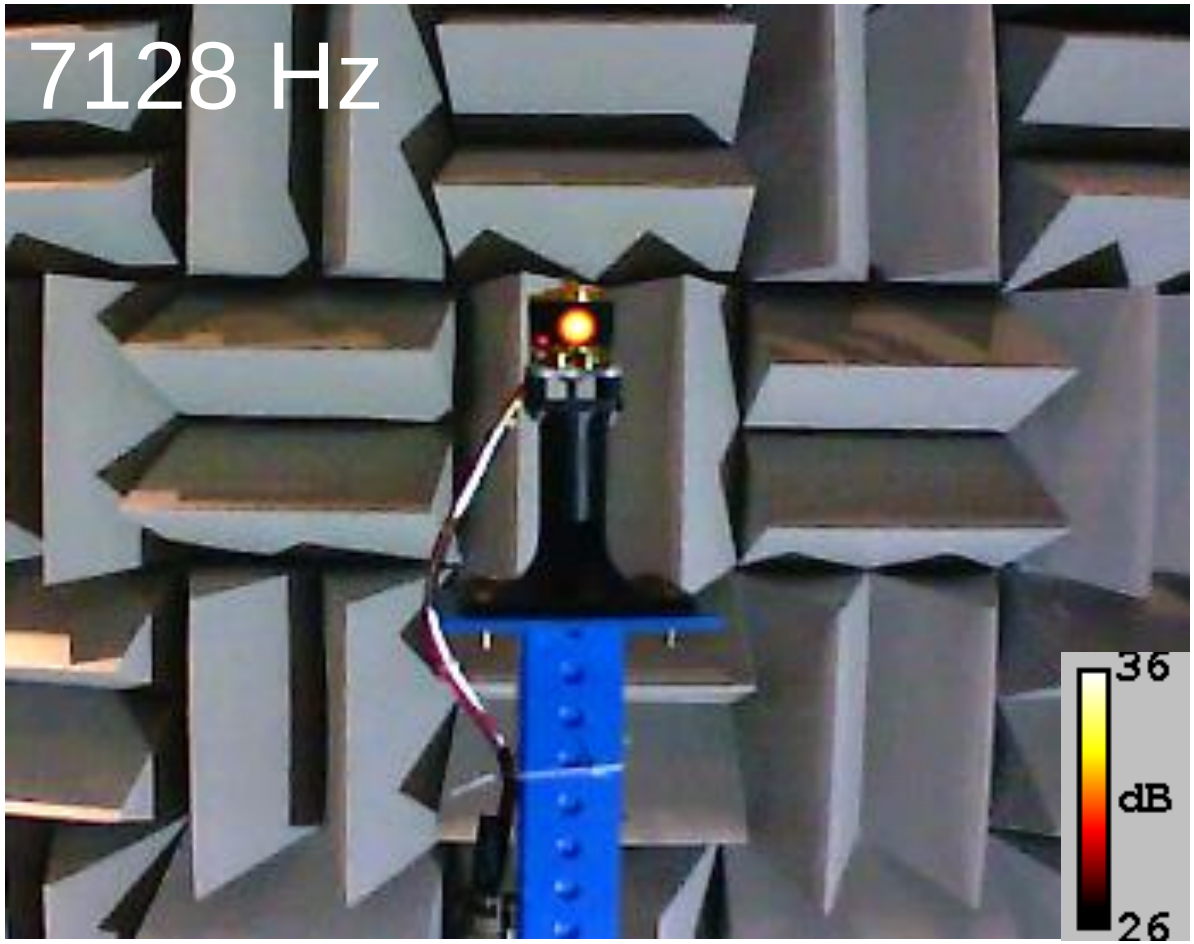

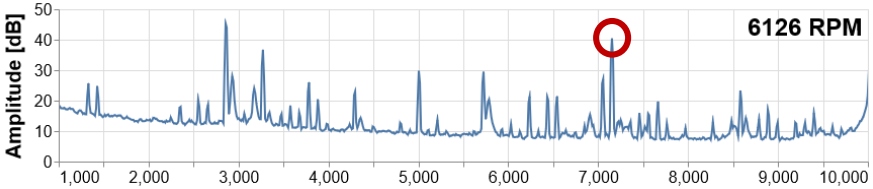

Conclusions

- A quiet loading device has been developed and will be used soon
- The Scorpion mount is performing well
- The current signal of the Scorpion SII-4020 is very similar to that of the small quadcopter motors
- The acoustic signal is similar as well with significant tones and a resonance that occurs around 6,000 RPM
- Beamforming locates these strong tones on the motor shell as expected
- Upcoming Work
    - More detailed measurements of the acoustics and vibrations of the Scorpion SII-4020
    - Acoustic measurements of the small motor with variable loading