

## ***Cryocooler Exported Vibration Reduction System (CEVRS)***

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High power 4 K cryocoolers are required for several proposed NASA space missions, including the Lynx X-ray telescope and the Origins Space Telescope (OST). High power linear cryocoolers, such as the Lockheed Martin 4-stage pulse tube cryocooler, are contemplated for these missions. Exported vibration from these large cryocoolers poses a jitter concern for these optically-sensitive deep space astronomy missions. West Coast Solutions is developing a standalone active vibration reduction system, called Cryocooler Exported Vibration Reduction System (CEVRS), that will reduce the vibrations exported from the cryocooler subsystem at the source. Recent progress and future plans for two approaches are described. The first, dubbed Electromechanical Vibration Cancellation (EVC), creates forces and moments that are equal and opposed to the forces and moments generated by the cryocooler mechanisms such that from the view of the attached structure, little or no net force exists. The second approach is Piezoelectric Vibration Decoupling (PVD), wherein the strategy is to dynamically decouple the cryocooler from the attached structure, allowing the cryocooler to move under its own generated vibration forces and moments without transmitting those forces and moments to the larger system.