BRIEFING CHART

NASA SBIR/STTR Technologies
Lightweight Magnetic Cooler with a Reversible Circulator
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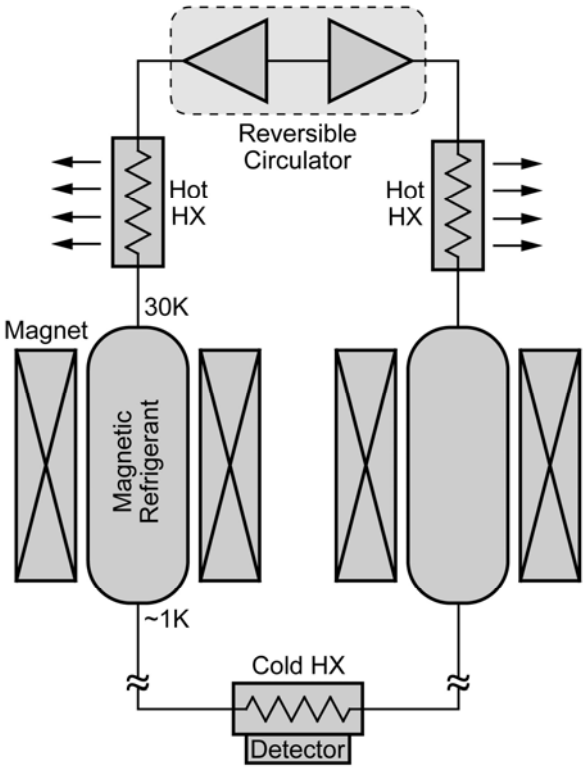
Identification and Significance of Innovation

- A lightweight, reliable, efficient Active Magnetic Regenerative Refrigerator (AMRR) for space applications
  - Cooling temperatures in the range of 1 K
  - Heat sink temperatures higher than 30 K
  - Much simpler and lighter than a multistage ADR
  - Much higher cooling capacity than a multistage ADR
- An innovative long-life, vibration-free circulator enable the operation of the AMRR
  - Enable the active regeneration process to increase the temperature span
  - Enable effective heat transfer for magnetic refrigerants to reduce cycle period and thus increase the cooling capacity
  - Eliminate the need for heat switches and therefore reduce mass
  - Enable remote/distributed cooling and thus reduce the magnet shielding requirement
- The circulator design will be based on Creare's space-proven micro-turbomachinery technology



System Schematic of an AMRR with a Reversible Circulator. The circulator switches the flow direction that cycles in concert with the magnetic fields.

Technical Objectives

- Prove the mass and performance benefits of the AMRR
- Demonstrate the feasibility of a long-life, vibration-free reversible circulator to enable the proposed AMRR

Work Plan

- Phase I
  - Detailed magnetic cooler system design
  - Detailed circulator aerodynamic and mechanical design
- Phase II
  - Build and demonstrate a prototype reversible circulator

NASA Applications

- Cooling systems for large format detector arrays (bolometers and microcalorimeters) for sensing X-ray, infrared and sub-millimeter radiation
- James Webb Space Telescope (JWST), the Terrestrial Planet Finder (TPF), the Constellation-X (Con-X) and the Single Aperture Far-Infrared Observatory (SAFIR)

Non-NASA Applications

- Cooling systems for:
  - Material microanalysis
  - Cryogenic particle detectors
  - Biomolecule mass spectrometry
- Coolers for hydrogen liquefaction