

## NASA Cryocooler Development Program Overview

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Mechanical cryocoolers, building on a history of successful development over the years, represent a significant enabling technology for NASA's future observatory missions. Since 1991, long-life cryocoolers have been reliably providing a wide variety of multi-year infrared and gamma-ray space missions with continuous cooling in the 55-80 K range. Two more NASA cryocooler missions are scheduled to launch in 2004. The largest technology push within NASA right now is in the temperature range of 4 to 10 K. Missions such as the James Web Space Telescope (JWST) and Terrestrial Planet Finder (TPF) have baselined infrared detectors operating between 6-8 K, typically arsenic-doped silicon arrays, with IR telescopes from 3 to 6 meters in diameter. Similarly, bolometer-based missions such as Planck, and X-ray microcalorimeter missions such as Constellation-X, require 4-6 K cooling to precool the refrigerators required to achieve their sub-Kelvin detector temperatures. Future missions such as SAFIR plan to cool even the telescope itself to on the order of 4 K. To address cryocooler development for the next-generation missions, NASA is funding the Advanced Cryocooler Technology Development Program (ACTDP) as part of the TPF project. This paper summarizes NASA's cryocooler successes to date and presents an overview of the ACTDP program including programmatic objectives and timelines, and conceptual details of the cooler concepts under development.