Mid-InfraRed Optimized Resolution Spacecraft (M IRORS)

Lawrence A. Wade, Hiroshi Kadogawa, Gerald W. Lilienthal, and Susan Terebey

Jet Propulsion Laboratory, California Institute of "J'ethnology, Pasadena, CA 91109

A concept study was performed to d evelop a mission design which achieves the highest possible spatial resolution in the 10-30 micron range within a $100 million mission cost cap. The approach selected for the resulting Mid-InfraRed Optimized Resolution Spacecraft (MIRORS) design utilizes a five meter partially filled aperture. The telescope has been optimized to operate in the n]i(i-infrared, where large format, high quality detector arrays are available. 1 liRes techniques developed for IRAS will be used to reconstruct an image from several observations taken at different position angles about the line-on-sight, resulting in nearly diffraction-limited performance at 10 microns (0.5 arcsec resolution), Image stabilization and fine pointing is achieved through use of a novel actuated Offner relay. A simple deployment scheme permits this spacecraft to be fit within the volume envelope and mass capabilities of a Med-lite spacecraft.

A Lissajous orbit about the L_2 sun-earth libration point (sun-earth-L_2 on a straight line) is adopted because of its extremely stable environment. The resulting thermal stability leads to a very high mechanical stability and hence to a highly stable optical performance. The selection of this 1 .issajous 1,2 orbit also enables the optics to be passively cooled to 30 K through radiation An inflatable sunshield and four' stage radiative shield will be employed, saving mass and eliminating the telescope tube structure. The heat dissipated by the infrared detectors will be removed by a vibration-free, long-life sorption refrigerator. Using an active cooler instead of a cryostat significantly simplifies the instrument design, decreases the spacecraft mass, and extends the mission lifetime. The performance offered by Ml RORS would result in breakthrough observations. It is clear that MIRORS has the potential to enable large aperture astrophysics observations within a small to moderate mission cost constraint.