NASA SBIR/STTR Technologies

S3.02-7676 - Ultraflat Tip-Tilt-Piston MEMS Deformable Mirror

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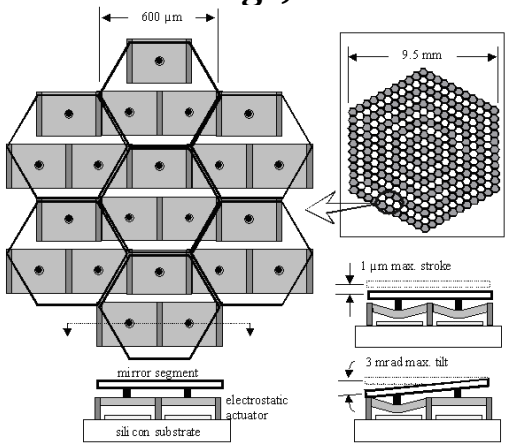
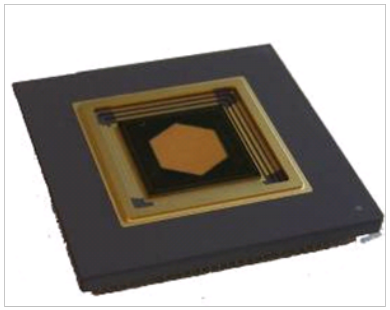
Identification and Significance of Innovation

A MEMS micromirror array consisting of closely-packed ultra-flat hexagonal mirror elements, each capable of 3mrad of tip and tilt, and 1µm of piston motion with sub-nanometer precision of the local wavefront phase as required for a space-based hyper-contrast coronagraph imaging telescope. A 331 element device has been fabricated using a scalable architecture and fabrication processes that may be used for devices up to 1027 elements as required for NASA's planned visible nulling coronograph instruments.

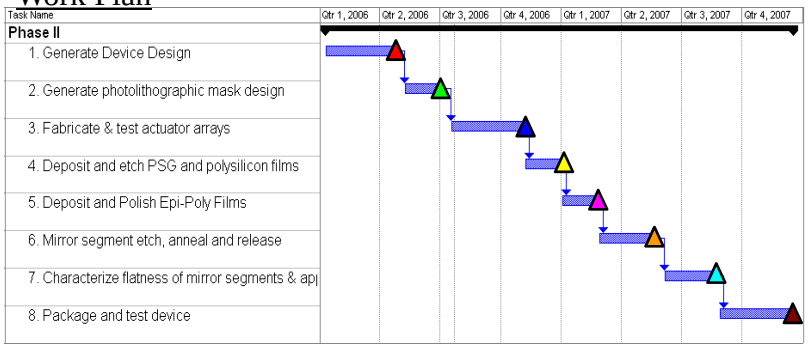




Technical Objectives

1. Generate Device Design for flexure-based electrostatic actuators to support the ultra-flat mirror and that allow tilt motion while minimizing the bending moments in the mirror segments.
2. Integrate EPI Poly/Polysilicon mirror segment fabrication process with baseline DM fabrication process
3. Coat, package, and evaluate device performance

Work Plan



NASA and Non-NASA Applications

The processing technology developed in this program will allow the future development of deformable mirrors for non-NASA applications as well. Ultra-flat highly reflective mirror surfaces are required for a number of commercial applications. Examples of these applications include high power lasers and optical lithography, and photometry. Leaders in both of these markets are currently exploring the use of adaptive optics to enhance performance of their optical systems. There is currently no commercially available deformable mirror capable of producing the high quality wavefront that could be achieved using the proposed mirror technology.

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