

PCOS Program Technology Capability Gap Input Form

<u>Technology Capability Gap Name:</u>	High-resolution, lightweight X-ray optics	<u>Date Submitted:</u>
<u>Your Name:</u>	Alexey Vikhlinin	<u>Organization:</u>
		X-ray Surveyor STDT
<u>Telephone:</u>	<u>Email Address:</u>	

PATR Prioritization Information (instructions on next page)

Brief Description of the Technology Capability Needed (100 – 150 words):

The science of X-ray Surveyor requires a large-throughput mirror assembly with sub-arcsec angular resolution. These future X-ray mirrors have a set of requirements which collectively represent very substantial advances over any currently in operation or planned for missions other than X-ray Surveyor. Of particular importance is achieving low mass per unit collecting area, while maintaining Chandra-like angular resolution.

Proposed technology improvement methods may include: piezo cells to adjust the figure, magnetic smart material (MSM) shaping with magnetic field; ion implantation, zero-stress Si, differential deposition, coating the substrate back with a localized and controlled “stressy” material. Development of X-ray reflecting coatings with low stress, or controlled stress, is an essential component of the high-resolution, lightweight optics work.

NOTE 1: THIS IS ENABLING TECHNOLOGY FOR X-RAY SURVEYOR. STDT BELIEVES THAT THE OPTICS DEVELOPMENT SHOULD BE THE PRIMARY FOCUS OF THE X-RAY SURVEYOR RELATED NASA TECHNOLOGY INVESTMENTS. WHILE GOOD PROGRESS IS REPORTED BY SEVERAL GROUPS, NONE IS YET EMERGING AS MEETING REQUIREMENTS. CONTINUED SUPPORT OF SEVERAL TECHNICAL APPROACHES IS VITAL AT THIS STAGE.

NOTE 2: THE STDT FEELS THAT ACHIEVING LOW COST PER UNIT MIRROR AREA (MENTIONED IN THE 2015 PATR) IS BEST DONE VIA COLLABORATION WITH THE INDUSTRY, AND SHOULD NOT BE BY ITSELF A GOAL FOR NASA TECHNOLOGY DEVELOPMENT PROGRAMS.

Assessment of the Current State-of-the-Art (SOTA) (100 – 150 words):

Chandra optics:

- Angular resolution $< \sim 0.5$ arcsec;
- Effective area 750 cm² at 1 keV; and
- Mirror mass 951 kg.

Current TRL of SOTA:

Current TRL of Full Solution:

TRL 2-3 for various technologies for high-resolution, light-weight mirrors mentioned above.

Target Goals and Objectives to Fill the Capability Gap:

- Mirror technologies must be scalable to a few square meter class assemblies.
- Angular resolution of order 0.5 arcsec

Scientific, Engineering, and/or Programmatic Benefits (100 – 150 words):

This type of X-ray optics will enable study of the early universe to complement JWST, maintain US leadership in lightweight X-ray optics for space, and facilitate future missions and minimize their schedule and costs.

Applications and Potential Relevant Missions for PCOS, COR, and ExEP:

Enabling technology for X-ray Surveyor. May be used in future explorer-class missions.

Time to Anticipated Need (time to anticipated or estimated launch date for enabled/enhanced missions):

Development needed for 2020 Decadal.

Internal Use

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