PCOS Technology Needs Inputs and Prioritization Process

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X-ray SAG

Prioritizing PCOS Technology Needs

- A PCOS program technology needs prioritization process has been put in place that will
  - Inform the call for SAT proposals
  - Inform technology developers of the program needs
  - Guide the selection of technology awards to be aligned with program goals
- The technology needs priorities and investment recommendation are published each year in the Program Annual Technology Report (PATR) – 2011 was first publishing year, 2012 PATR development is in progress
- This process
  - improves the transparency and relevance of technology investments
  - provides the community a voice in the process
  - ensures open competition for funding
  - leverages the technology investments of external organizations by defining a need and a customer

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The Process

- A Program Technology Management Board (TMB) is established to review/vet community input, define needs and priorities, and recommend investment consideration
  - TMB membership includes senior members of the program at NASA HQ and in the Program Office, and when needed, technical expert(s) from the community.
- The community identifies technology needs each summer by working with the PAG or through direct individual submission to the Program Office's web site.
- The Program TMB prioritizes these needs based on a published set of criteria that includes assessments of scientific priorities (Decadal Survey), benefits and impacts, timeliness, and effectiveness.
- These priorities are published each year in the PATR, along with the development status of technologies that were funded the previous year.
- Comment from the community is invited at every stage, and specific technology needs input is requested at the start of the summer (end of June) to begin the prioritization cycle again.

Needs Submission

- A technology need can be derived by anyone and provided to the Program for prioritization in two ways:
  1. Include it on the needs list consolidated by the PAG/SAG as requested by the Program Office each June. Thank you!
  2. Retrieve, fill out and submit the "Program Technology Needs Input" form located at http://pcos.gsfc.nasa.gov/technology/

- A technology need input should include as much of the information requested as possible and most importantly the goals and objectives of the technology should be clear and quantified. For example,
  – NO – "we need a better cryocooler"
  – YES – "we need a more efficient cryocooler with x power consumption, weighs less than y that can fit within z volume and can operate to xx temperature range"
- Clear description of potential relevant missions or applications is also very helpful

Excerpts of Technology Needs Table From TechSAG and Program Input Form

PCOS

Physics of the Cosmos Program

NASA

Cosmic Origins Program

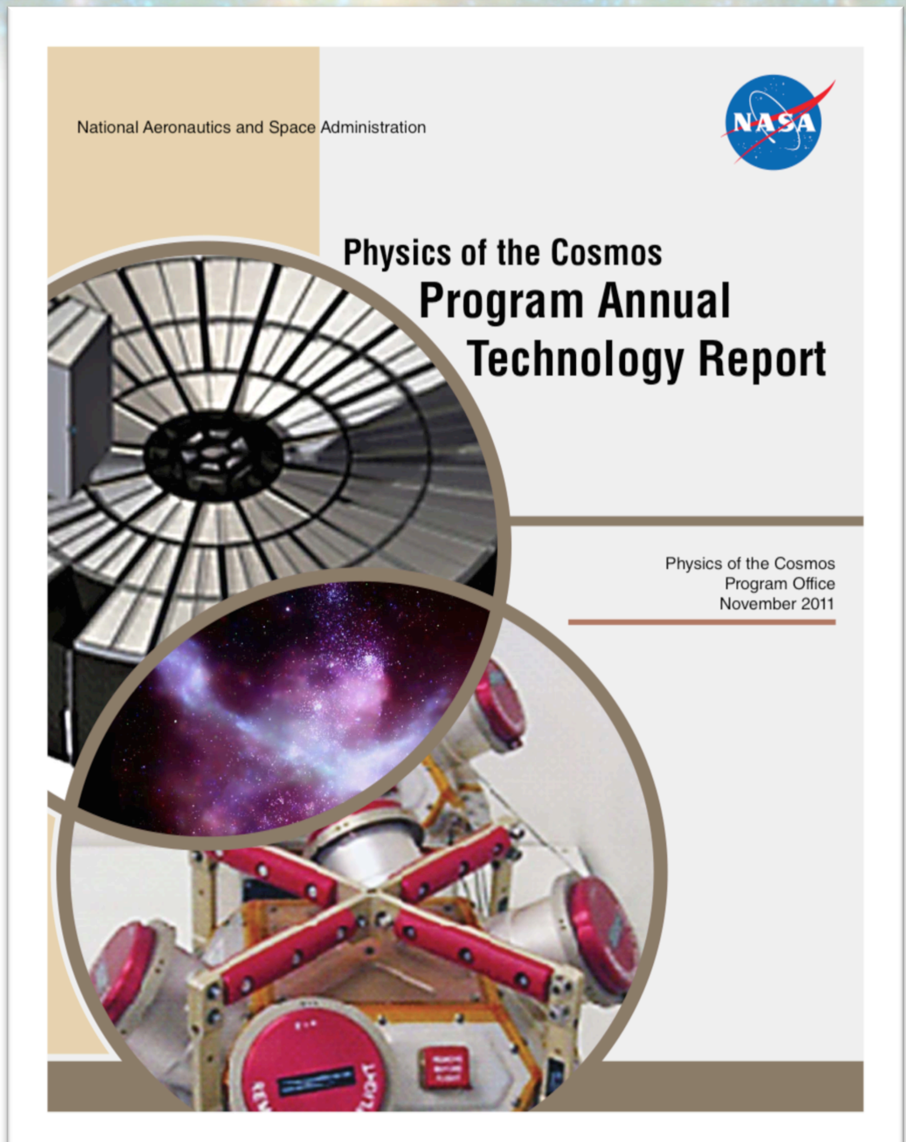
Table 2: IXO-Like

Name of Technology (256 char)	Thermal formed (slumped) glass mirror segments	Large-scale alignment and mounting of thin glass mirror segments	G
Brief description of the technology (1024)	Thermally form, to precision mandrels, thin glass sheets into Wolter I mirror segments. Includes cutting mirrors to appropriate size, and coating with x-ray reflective material.	Thousands of mirror segments need to be aligned to one another, made confocal, and mounted in a flight housing. Mounting must not distort the mirror figure.	H cr di
Goals and Objectives (1024)	Requirement for perfectly aligned primary-secondary mirror pair are 3.3-6.6 arc-sec HPD for 5-10 arc-sec HPD mission, respectively. Manufactureability requirements drive fabrication yield and fabrication time/mirror segment. Need TRL 6 by 2014 for future mission development.	Alignement requirement for multiple segments and multiple shells is ~ 1.5 to 3 arc sec HPD. Figure distortion due to mounting and alignment must be less than 1.2 to 2.5 arc sec HPD. System must survive launch seismic and acoustic loads. TRL 6 by 2016 for future mission development.	D la 1. of or
TRL	Estimate current TRL at 4 - 5. Have achieved ~ 8.5 arc-sec HPD, but have not yet demonstrated manufacturing times required for large area telescopes.	Estimate current TRL at 3. Mirror segment pairs have been aligned and mounted to < 1.5 arc sec HPD. Figure distortion due to mounting exceeds requirements. Have not yet demonstrated alignment and mounting of mirror segments from multiple shells.	Es gr de Li m
Tipping Point (100 words or less)	Better than 6.6 arc sec HPD will demonstrate performance for 10 arc sec mission positively rated by ASTRO2010. Process needs to be industrialized to make large scale production credible.	Moderate - alignment requirements met but mounting deformation ~ 5 times too high. Significant development still required.	M m
NASA capabilities (100 words)	NASA GSFC leads in development of thermal forming and is fully equipped to continue experimentation.	NASA GSFC and SAO have developed alignment mounting techniques. Alternatives or similar approaches could be developed in optics industry.	N ca St
Benefit	Thin mirror segments enable collecting area to exceed 1 sq m with existing launch vehicles. > 10x area of Chandra and better resolution than XMM. This enables study of early Universe, BH dynamics and GR, and WHIM.	Thin mirror segments enable collecting area to exceed 1 sq m with existing launch vehicles. > 10x area of Chandra and better resolution than XMM. This enables study of early Universe, BH dynamics and GR, and WHIM.	G ov
NASA needs	Required for moderate to large collecting area x-ray telescopes.	Required for moderate to large collecting area x-ray telescopes.	G (re er W gr
Non-NASA but aerospace needs	NONE	NONE	N
Non aerospace needs			
Technical Risk	Low - current performance within ~ 30 per cent of requirements	Moderate - alignment requirements met but mounting deformation ~ 5 times too high. Major development still required.	M pr
Sequencing/Timing	As early as possible - "heart" of a telescope	As early as possible - "heart" of a telescope	E sp
Time and Effort to achieve goal	3 year collaboration between NASA and industry	5 year collaboration between NASA and industry	3 in

PCOS Program Technology Needs Input

Technology Need Name:		Date:	
Your Name:	Organization:		
Telephone:	Email Address:		
PATR Prioritization Information			
Brief Description of Technology Need:			
Goals and Objectives:			
Current State of the Art:		Current TRL:	
Tipping Point:			
Scientific, Engineering and/or Programmatic Benefits:			
NASA Needs:			
Non-NASA Aerospace Applications:			
Non-Aerospace Applications:			
Technical Risks:			
Sequencing / Timing:			
Time and Effort:			
Technology is (check only one): ☐ Enabling ☐ Enhancing			
Potential Relevant Missions/Applications:			
Potential Providers, Capability, and Known Funding:			

The Inaugural PCOS PATRs



The PCOS PATR can be viewed and downloaded from the Program Office website: http://pcos.gsfc.nasa.gov

The Program Annual Technology Report (PATR)

- The PATR is an annual report that describes the state of the Program's technology development activities.
- Summarizes the Program's technology development status for the prior year
- Assesses the Program's technology needs with respect to scientific priorities, benefits and impacts, timeliness, and effectiveness of investment.
- Provides a prioritized list of technology needs to inform technology development call for the coming year
- Is updated annually and timed to support annual planning processes

Each Technology Need Is Evaluated Using a Rigorous Set of Prioritization Criteria

PCOS Physics of the Cosmos Program

COR Cosmic Origins Program

NASA

Technology Needs Prioritization Criteria (7/19/12)

#	Criterion	Weight	Score (0-4)	Weighted Score	General Description/Question	Score Meaning: 4	3	2	1	0
1	Scientific Ranking of Applicable Mission Concept	4	4	16	Scientific priority as determined by the Decadal Review, other community-based review, other peer review, or programmatic assessment. Captures the importance of the mission concept which will benefit from the technology.	Highest ranking	Medium rank	Low rank	Not ranked by the Decadal	No clear applicable mission concept
2	Overall Relevance to Applicable Mission Concept	4	4	16	Impact of the technology on the applicable mission concept. Captures the overall importance of the technology to the mission concept.	Critical key enabling technology - required to meet mission concept goals	Highly desirable technology - reduces need for critical resources and/or required to meet secondary mission concept goals	Desirable - offers significant benefits but not required for mission success	Minor implementation improvements	No implementation improvement
3	Scope of Applicability	3	4	12	How many mission concepts could benefit from this technology? The larger the number, the greater the reward from a successful development.	The technology applies to multiple mission concepts across multiple NASA programs **and** other agencies	The technology applies to multiple mission concepts across multiple NASA programs **or** other agencies	The technology applies to multiple mission concepts within a single NASA program	The technology applies to a single mission concept	No known applicable mission concept
4	Time To Anticipated Need	3	4	12	When does the					anticipated need
5	Scientific Impact to Applicable Mission Concept	2	4	8	Impact of the t applicable miss affect the scier					scientific improvements
6	Implementation Impact to Applicable Mission Concept	2	4	8	Impact of the t applicable miss simplify the im resources?					implementation provements
7	Schedule Impact to Applicable Mission Concept	2	4	8	Impact of the t mission concep implementatio					chnology will not be a factor the schedule of the plicable mission concept
8	Risk Reduction to Applicable Mission Concept	2	4	8	Ability of the technology to reduce risks by providing an alternate path for a high risk technology that is part of the applicable misssion concept.	Technology is a direct alternative to a key technology envisioned for the applicable mission concept. No other known alternate technologies	Technology is a direct alternative to a key technology envisioned for the applicable mission concept. At least one other known alternate technology	Technology is a direct alternative to a secondary technology envisioned. No other known alternate technologies	Technology is a direct alternative to a secondary technology envisioned. At least one other known alternate technology	No risk benefits or technology is already part of the applicable mission concept
9	Definition of Required Technology	1	4	4	How well defined is the required technology? Is there a clear description of what is sought?	Exquisitely defined	Well defined, but some vagueness	Well defined, but some conflicting goals not clarified	Not well defined, lacking in clarity	Poorly defined, not clear at all what is being described
10	Other Sources of Funding	1	4	4	Are there other sources of funding to mature this technology? If funding is expected to be available from other sources, this will lower the prioritization.	No, the Program is the only viable source of funding.	Interest from other sources can be developed during the development time of the technology	Interest from other sources is likely during the development time of the technology	Moderate investments (relative to the potential level for a NASA investment) in the technology are already being made by other programs, agencies, or countries.	Major investments (relative to the potential level for a NASA investment) in the technology are already being made by other programs, agencies, or countries.
11	Availability of Providers	1	4	4	Are there credible providers/developers of this technology? Where providers are scarce, there may be a compelling need to maintain continuity for the technology in the event there are no replacement technologies.	Potential providers/developers have insufficient capabilities to meet applicable mission concept needs	Potential providers/developers have uncertain capability relative to applicable mission concept needs	Single competent and credible provider/developer known	Two competent and credible providers/developers known	Multiple competent and credible providers/developers known

Technology prioritization metric contains 11 criteria and addresses science/mission priorities, benefits and impacts, timeliness and effectiveness of investment

PCOS Technology Needs Priority From 2011 PATR (top 3 of 5 priorities)

Priority	Technology	Science
1	X-ray calorimeter: central array (~1,000 pixels): 2.5 eV FWHM at 6 keV; extended array: 10 eV FWHM at 6 keV.	X-ray
	Telescope: Classical optical design. Surface roughness <lambda/30, backscatter/straylight. Athermal design with temp gradient dimensional stability: pm/sqrt(Hz) and μm lifetime, angular stability <8nrad	Gravitational Wave
	Laser: 10 yr life, 2W, low noise, fast frequency and power actuators	Gravitational Wave
	lightweight, replicated x-ray optics. Lightweight precision structure	X-ray
2	High resolution gratings (transmission or reflection)	X-ray
	High-throughput, light, low-cost, cold, mm-wave telescope operating at low backgrounds	Inflation
	Large format (1,000-10,000 pixels) arrays of CMB polarimeters with noise below the CMB photon noise and excellent control of systematics	Inflation
	Phasemeter: Quadrant photodetector: low noise. ADC: 10 yr life, low noise (amplitude and timing). Alignment sensing, optical truss interferometer, refocus mechanism	Gravitational Wave
	μN thrusters: 10 yr. life, low contam, low thrust noise. Not formation flying.	Gravitational Wave
3	Cryocoolers for detectors and other instrument HW	X-ray
	Low CTE materials	Gravitational Wave
	Passive Spitzer design plus cooling to 100 mK	Inflation
	Anti-reflection coatings	Inflation

2011 PATR Prioritizations

- **Priority 1:** Contains technologies determined to be of the highest interest and the most compelling to the PCOS Program. These are key enabling technologies for the near-term missions, and they have the strongest technology pull.
- **Priority 2:** Contains technologies of high interest to the Program. These technologies enable near-term missions and have a strong technology pull.
- **Priority 3**: Contains enhancing and general-use technologies that could benefit many missions across the Program.
- **Priority 4**: Contains technologies that enable or enhance a broad range of science themes with various time horizons.
- **Priority 5:** Contains technologies deemed to be supportive of PCOS objectives and mission concepts that are planned for the more distant future.

Conclusion

- Program Office seeks input on technology needs each June from the PhysPAG and the general science and research community
- Technology needs prioritization is determined by the Program TMB, using a stringent set of prioritization criteria that includes the Decadal Survey priority
- Program technology needs priorities are published each October in the PATR. This information:
  - Informs the call for SAT proposals
  - Informs technology developers of the Program needs
  - Guides the selection of technology awards
- Comment from the community is invited at every stage, and specific technology needs input is requested at the start of the summer to begin the prioritization cycle again.
- Will take opportunity to further refine and improve the prioritization process after the 2012 PATR is released this October – looking forward to inputs/ discussion with the SAGs. Planning to present changes to the process at the Long Beach meeting in Jan 2013
- For more information about the technology needs prioritization process or the Program Office, please visit us at http://pcos.gsfc.nasa.gov