National Aeronautics and Space Administration
Cosmic Origins Program Office

Program Office Technology Management Process

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COPAG Workshop
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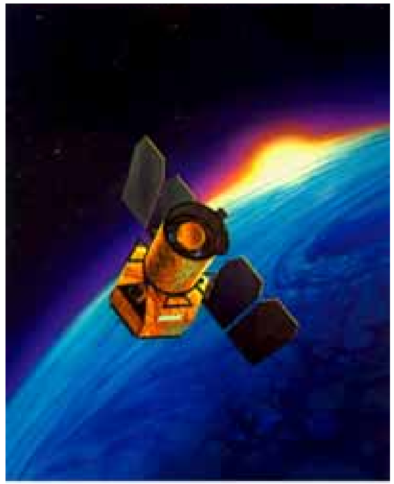
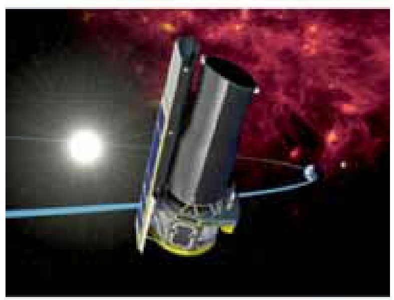
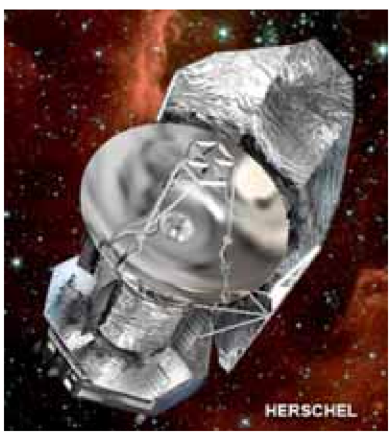
Why are we here?

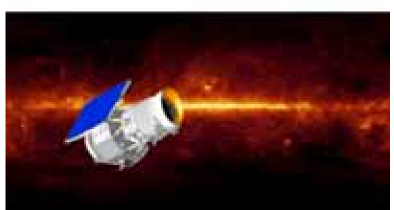
Science Portfolio

Already

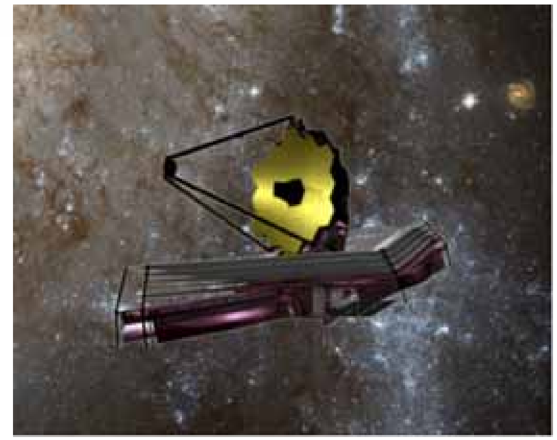








Upcoming



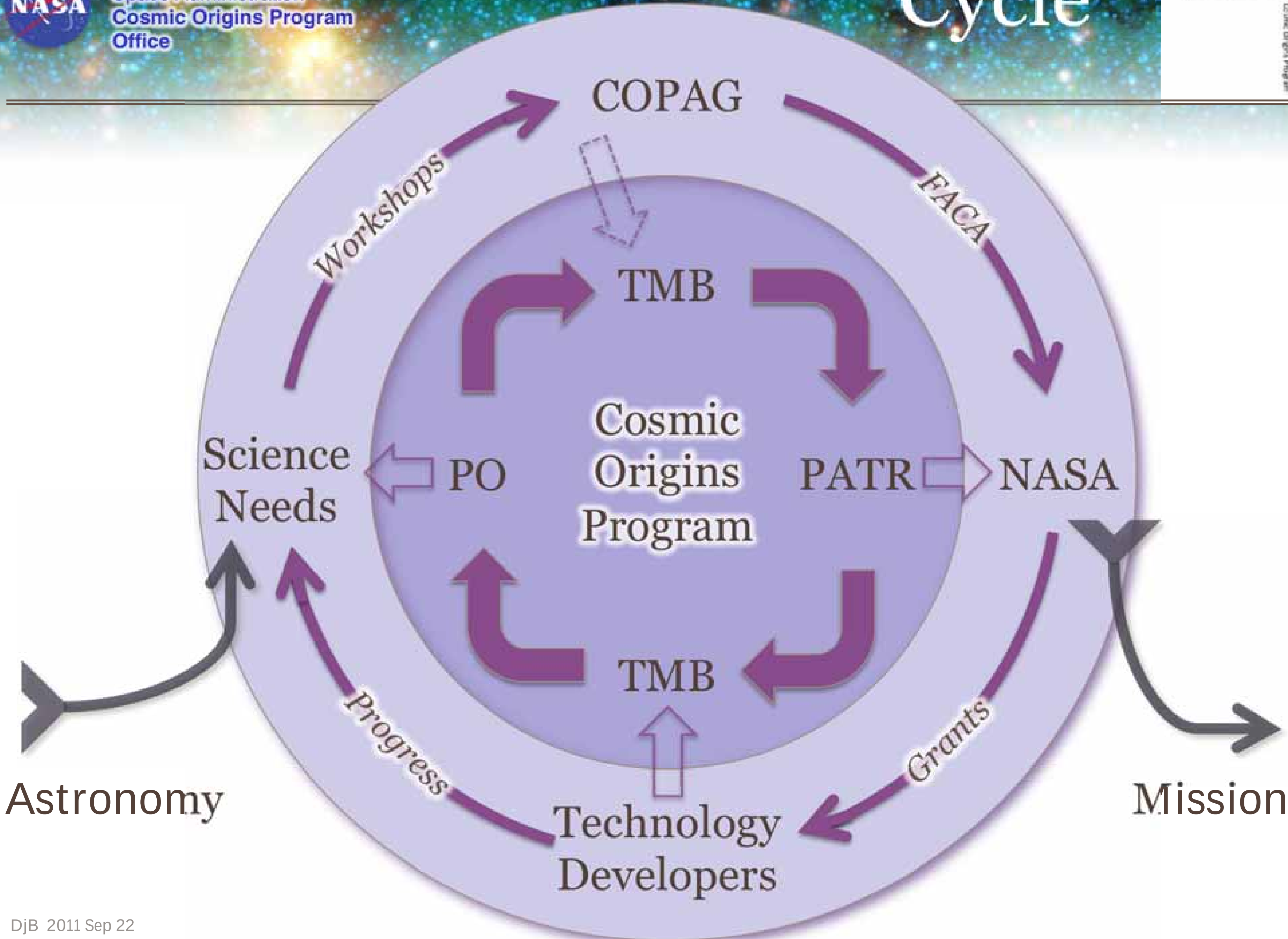
Possibles: Recommended by Decadal Survey

et alia...

Technology++

- Program Office implements technology maturation, inheriting needs from the broadest community
- Stakeholders identify science needs
- COPAG = formal introduction mechanism

Cycle


COPAG
FACA
NASA
Grants
Technology Developers
Progress
Science Needs
Workshops
TMB
PATR
TMB
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Cosmic Origins Program
Astronomy
Missions

What Next?

- Technology Management Board (TMB):
  - Reviews Program's technology needs and recommends priorities.
  - Provides input to Program technology development activities and planning.
  - Reviews proposed Technology Development Plans; approves milestones.

Mansoor Ahmed, Dominic Benford, Allan Cohen, Chris Davis, Richard Griffiths, Beth Keer, Mike Moore, Mario Perez, Thai Pham, Jackie Townsend

SAT/COR FY12

Proposal Title	PI	Institution	Area
Advanced UVOIR Mirror Technology Development for Very Large Space Telescopes	Phillip Stahl	Marshall Space Flight Center	*Advanced, Normal Incidence Optics*
High performance cross-strip micro-channel plate detector systems for spaceflight experiments	John Vallerga	UC Berkeley	*Detectors*
Enhanced MgF2 & LiF Overcoated Al Mirrors for FUV Space Astronomy	Manuel Quijada	Goddard Space Flight Center	*Ultraviolet Coatings*

Starting Point

High QE, low noise, large-format UV photon counting detectors	UV coatings	Large, low-cost, light-weight precision mirrors for Ultra-Stable Large Aperture UV/Optical Telescopes	Large format, low noise Far-IR direct detectors	Large, cryogenic far-IR telescopes	Sub-Kelvin Coolers
Future NASA UV missions, particularly those devoted to spectroscopy, require high quantum efficiency (>50%), low noise (<1e-7 ct/pixel/s), large-format (>2k x 2k) photon-counting detectors	High reflectivity, highly uniform UV coatings are required to support the next generation of UV missions, including explorers, medium missions, and a UV/optical large mission. High reflectivity coatings allow multiple reflections, extended bandpasses, and accommodate combined UV and high-contrast exoplanet imaging objectives.	Future UV/Optical telescopes will require increasingly large apertures to answer the questions raised by HST, JWST, Planck and Hershel, and to complement the ≥ 30-m ground-based telescopes that will be coming on line in the next decade. For diffraction limited performance, the pointing budget gets tighter as aperture grows and wavelengths shrink, requiring $\theta \sim 0.1\ \lambda/D$ pointing accuracy. Technologies are therefore required that provide a high degree of thermal and dynamic stability, and wave front sensing and control	Future NASA Far-IR missions require large format detectors optimized for the very low photon backgrounds present in space. Arrays containing up to tens of thousands of pixels are needed to take full advantage of the focal plane available on a large, cryogenic telescope. Detector sensitivity is required to achieve background-limited performance, using direct (incoherent) detectors to avoid quantum-limited sentivitiy.	Large telescopes provide both light gathering power, to see the faintest targets, and spatial resolution, to see the most detail and reduce source confusion. To achieve the ultimate sensitivity, their emission must be minimized, which requires that these telescopes be operated at temperatures that, depending on the application, have to be as low as 4K. Collecting areas on the order of 10m are needed.	Optics and detectors for far-IR and certain X-ray missions require very low temperatures of operation, typically well below 1K. Compact, low-power, lightweight coolers suitable for space flight are needed to provide this cooling..
The goal is to produce large-format, high QE, low-noise UV-sensitive detectors routinely that can be employed in a variety of explorer, medium, and strategic missions.	Development of UV coatings with high reflectivity (>90-95%), high uniformity (<1-0.1%), and wide bandpasses (~100 nm to 300-1000 nm). New coating technologies such as Atomic Layer Deposition are particularly promising. Some will be required for large optics (0.5-4m), many for smaller instrument optical elements.	Develop lightweight UV and optical mirrors with Areal density <20kg/m2, surface roughness 5 to 10 nm rms, cost <$2M/m2, for telescopes with > 50 m2 aperture,<1 mas pointing accuracy, and < 15 nm rms stability	Detector sensitivities with noise equivalent powers of 10^{-19} W/√Hz are needed for photometry, and ≈$3{\cdot}10^{-21}$ W/√Hz are needed for spectroscopy.	The goal is to develop a feasible and affordable approach to producing a 10m-class telescope with sufficiently high specific stiffness, strength, and low areal density to be launched, while maintaining compatibility with cryogenic cooling and far-IR surface quality/figure of ~1μm RMS.	A cryocooler operating from a base temperature of ~4K and cooling to <0.1K with a continuous heat lift of 10μW is required for several mission concepts. Features such as compactness, low power, low vibration, intermediate cooling and other impact-reducing design aspects are desired.

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Metrics

Physics of the Cosmos Program

Cosmic Origins Program

TMB Technology Investment Prioritization Evaluation Criteria (Draft 9/6/11)

#	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	Ranking not known	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	Unknown
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 agencies	The technology applies to multiple mission concepts across multiple NASA programs	The technology applies to multiple mission concepts within a single NASA program	The technology applies to a single mission concept	Unknown
4	Time To Anticipated Need	3	4	12	How much time is available before the technology is needed to be at TRL6?	3 years or less	> 3 to 5 years	> 5 to 7 years	> 7 to 9 years	> 9 years
5	Scientific Impact to Applicable Mission Concept	2	4	8	Impact of the technology on the scientific harvest of the applicable mission concept. How much does this technology affect the scientific harvest of the mission?	Needed for baseline	Major improvement (> ~2x) to primary scientific goals	Only enables secondary scientific goals	No scientific improvements	Unknown
6	Implementation Impact to Applicable Mission Concept	2	4	8	Impact of the technology on the implementation efficiency of the applicable mission concept. How much does this technology simplify the implementation or reduce the need for critical resources?	Needed for baseline	Enables major savings in critical resources (e.g., smaller launch vehicle, longer mission lifetime, smaller spacecraft bus, etc.) or reduces a major risk	Enables minor savings in critical resources or reduces a minor risk	No implementation improvements	Unknown
7	Schedule Impact to Applicable Mission Concept	2	4	8	Impact of the technology on the schedule of the applicable mission concept. How much does this technology simplify the implementation to bring in the schedule?	Technology drives the mission concept critical path	Technology drives the critical path for a key component	Technology drives the critical path for a minor component	Technology is not likely to be on critical path	Unknown
8	Risk Posture Impact to Applicable Mission Concept	2	4	8	Impact of the technology on the risk of the applicable mission concept. How much does this technology reduce the risk?	Major mission concept risks directly mitigated by this technology, workarounds not currently known	Major mission concept risks directly mitigated by this technology, workarounds currently known	Minor mission concept risks mitigated by this techology	No risk benefits	Unknown
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	Already being developed by other programs, agencies, or countries.	Unknown
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.	Single competent and credible provider/developer known	Two competent and credible providers/developers known	Multiple competent and credible providers/developers known	Providers/developers known but no assurance of competence or credibility	Unknown
	Total Score:			100						