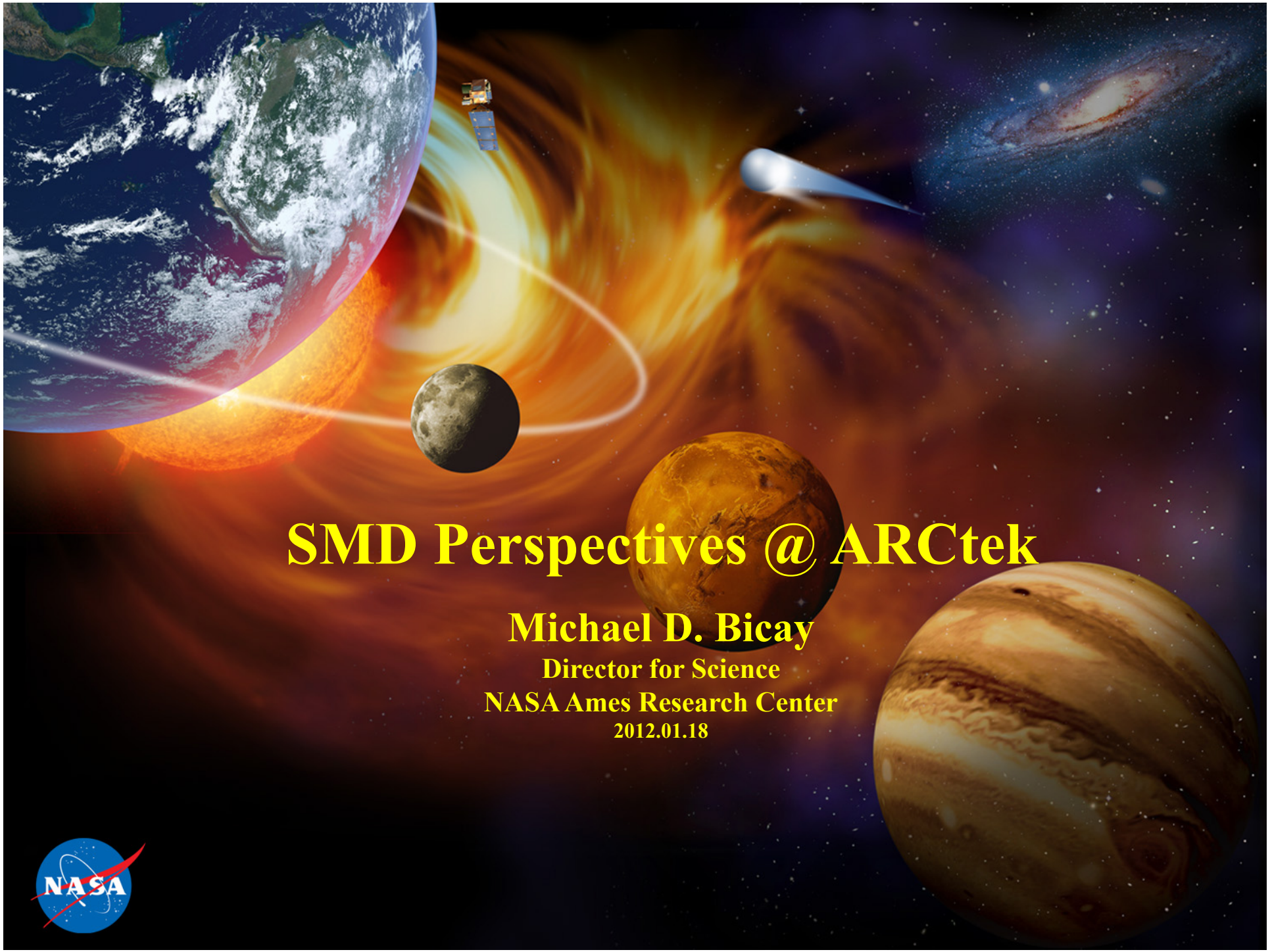


SMD Perspectives @ ARCtek

Michael D. Bicay

Director for Science

NASA Ames Research Center

2012.01.18

NRC Decade Survey (2010): Astronomy & Astrophysics

- **Large Space-Based Programs (priority order)**
  1. WFIRST: Wide-Field Infrared Survey Telescope
  2. (Astrophysics) Augmentation to Explorer Program
  3. LISA: Laser Interferometer Space Antenna
  4. ISO: International X-Ray Observatory

  [Note: #3 and #4 have been cancelled; funding for #1 has not been identified.]

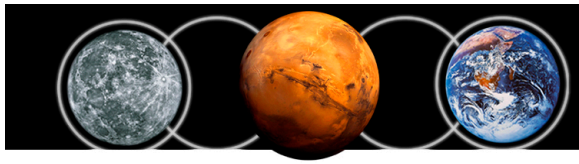
- **Medium Space-Based Programs (priority order)**
  1. New Worlds Technology Development
  2. Inflation Probe Technology Development

NRC Decade Survey (2011): Planetary Sciences

Flagship Missions

Recommended	"Cost Constrained"	"Less Favorable"
• Descoped Mars Astrobiology Explorer Cacher (MAX-C) • Descoped Jupiter Europa Orbiter (JEO) • Uranus Orbiter/Probe (UOP) • Enceladus Orbiter • Venus Climate Mission	• Descoped MAX-C • UOP	• Descope/Delay Flagships We are here!

- **Discovery-Class Mission every 24 months (<$500M, excl. LV)**
- **New Frontiers-Class Mission, two total in 2013-2022 (<$1B, excl. LV)**
- **Augmentation to R&A Program (+5% in FY12, +1.5% subsequently)**
- **Technology Development (~7% of total Planetary budget)**



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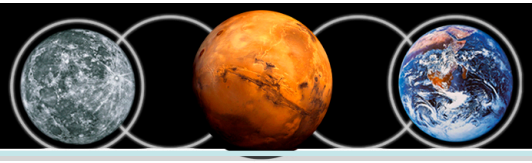
Fully Competitive SMD Flight Missions

	New Frontiers	Discovery	Explorer	Earth Venture	SALMON: MoO
Science Theme	Planetary	Planetary	Astro & Helio	EarthSci	All
Cost Cap ($M)	~1000	~500	250 (MIDEX) 125 (SMEX)	150 (orb) 90 (instr) 30 (sub)	60
Next AO	2015 August	2013 November	2014 Nov (MIDEX) 2012 Nov (SMEX)	2011 Jun (orb) 2011 Dec (inst) 2013 Jul (sub)	TBD
Selections	mid-CY16	early CY15	2013 Sep (SMEX)	mid-CY12	TBD
Approved Missions	New Horizons	**Lunar Prospector**	WISE	**ATTREX (sub)**	STROFIO
	Juno	Deep Impact	Swift	HS3 (sub)	LaRa
	OSIRIS-Rex	Stardust	WMAP	AMOSS (sub)	
		Dawn	FUSE	CARVE (sub)	
		Kepler	IMAGE	AirQual (sub)	
		NEAR	THEMIS		
		Mars Pathfinder	FAST		
		GENESIS	SAMPEX		
		CONTOUR	SWAS		
		MESSENGER	TRACE		
		GRAIL	HESSI		
			GALEX		
			AIM		
			IBEX		
			IRIS		
			GEMS		

Schedule of SMD Flight Solicitations

Targeted by ARC	CY2011												CY2012												CY2013												CY2014												CY2015											
NEW OPPORTUNITIES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Explorer + SALMON MoO									ϕA																ϕB																																	
EV - 2 (satellite)			d			AO			29													ϕA																																			
SOFIA 2nd Generation Instruments							AO			7			ϕA																																													
HOPE - 3 (training)										AO		16				ϕB																																									
EV - Instrument 1									29				AO										ϕA																																			
2012 SALMON															d			AO																																							
2013 SMEX + MoO																	d			AO															ϕA																						
Mars 2018 Instruments																			d						AO																																
HOPE - 4 (training)																									AO								ϕB																						
EV - 3 (airborne)																												d			AO																							
EV - Instrument 2																												d			AO				ϕA																			
2013 SALMON																															d			AO																			
Discovery - 13																																	d		AO																		
HOPE - 5 (training)																																					AO				ϕB												
2014 SALMON (next-gen instr)																																								d			AO				ϕA						
2015 MIDEX + MoO																																									d			AO				ϕA					
EV - Instrument 3																																										d			AO				ϕA				
EV - 4 (orbital)																																											d			AO							
New Frontiers - 4																																												d			AO						
Discovery-14																																													d			AO					
	CY2011												CY2012												CY2013												CY2014												CY2015											
APPROVED STUDIES	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
EXCEDE (Explorer)																									ϕB																																	
TESS (Explorer)																									ϕB																																	
	CY2011												CY2012												CY2013												CY2014												CY2015											
APPROVED MISSIONS	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
ATTREX (EV-1)																																																							
HSSS (EV-1)																																																						
COAST (HOPE-2)																																																						



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SMD Opportunities

- **Roles in Strategic Missions**
  - Mars Sample Return (early 2020s)
    - Cache Box, Drilling
  - Exoplanet Imaging (late 2020s)
    - Imaging (Internal) Coronagraph
- **Fully Competed Missions**
  - Earth Venture Missions
    - Airborne, Instruments, Orbital
  - Comet Coma Sample Return (New Frontiers)
  - Mars IceBreaker (Discovery)
  - DARE (Explorer)

ARC Capabilities

- Drilling Technologies, Sample Handling Tech.
- XRD/XRF analysis
- Exobiology / Planetary Protection
- EDL/TPS
- PIAA Technology Testbed
- Kepler Science Operations Management
- In Situ & Remote Sensing Instruments
- ESPO Project Management (airborne)
- SmallSat Management
- Small Bodies Science (comets, NEOs)
- Sample Return Science

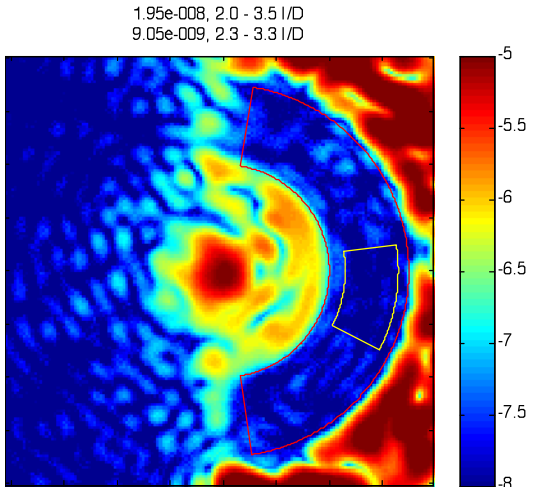
Technologies Needed

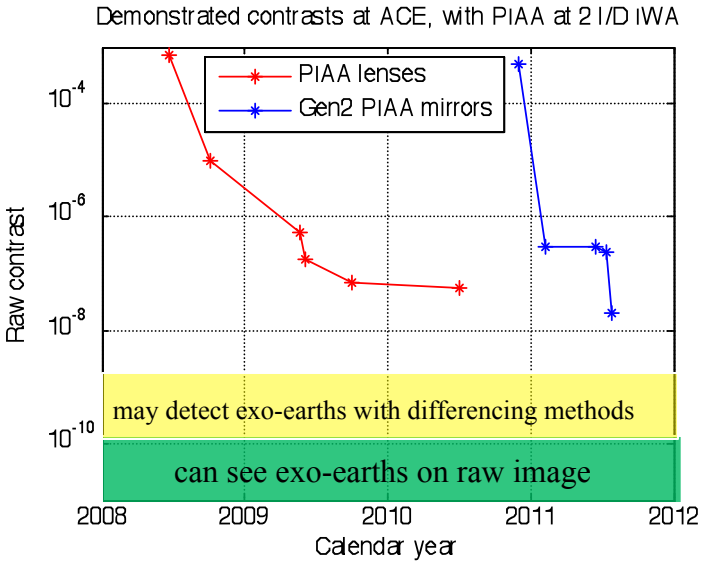
- Drilling Technologies to 2+m depth
- Robust sample handling/archiving
- Second-generation CheMin instrument
- Robust EDL/TPS Program (w/ LaRC)
- Demonstrated PIAA Coronagraph
  - High contrast, Small IWA
  - Compact architecture
- Compact EarthSci Instruments
- Comet coma probe & sample acquisition system
- Low-cost launch to cislunar space

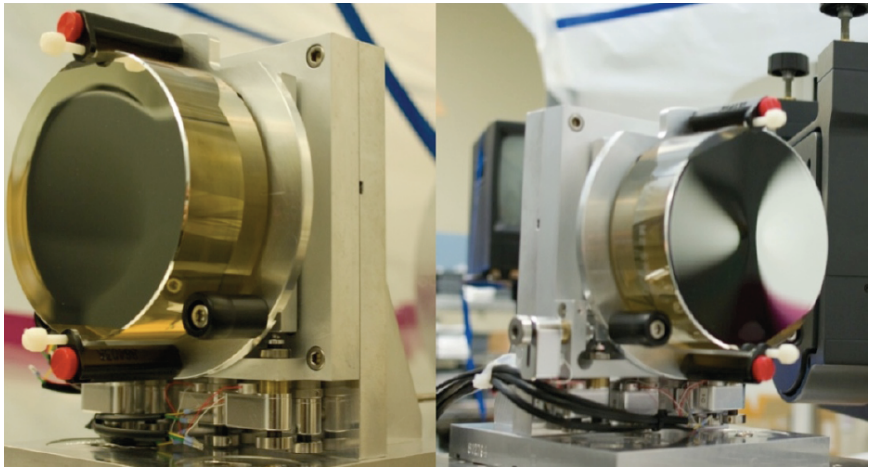
Other Needs to Succeed

- Stable funding for space/Earth sciences
- Robust Core Competencies
- Re-invigoration of drilling/analog work
- Continued PIAA Coronagraph development
- New EarthSci hires (in process)
- Development of strategic partnership w/ APL
- Fair TMCO assessment of competed proposals

ACE: Ames Coronagraph Experiment







"2nd-generation" PIAA mirrors

- Setting new contrast benchmarks
  - 1.9e-8 from 2.0 to 3.4 λ/D
  - 1.4e-6 from 1.2 to 2.0 λ/D
- Active thermal control system achieved 0.4mK stability rms over ~1 hour.