EXPLORATION INTEGRATION AND SCIENCE DIRECTORATE

Committee on the Review of NASA's Planetary Science Division's Restructured Research and Analysis Programs

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NASA Strategic Objectives important to JSC Planetary Science

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- Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere *[FY2014 NASA Strategic Plan Objective 1.5]*
- Expand human presence into the solar system and to the surface of Mars to advance exploration, science, innovation, benefits to humanity, and international collaboration *[FY2014 NASA Strategic Plan Objective 1.1]*

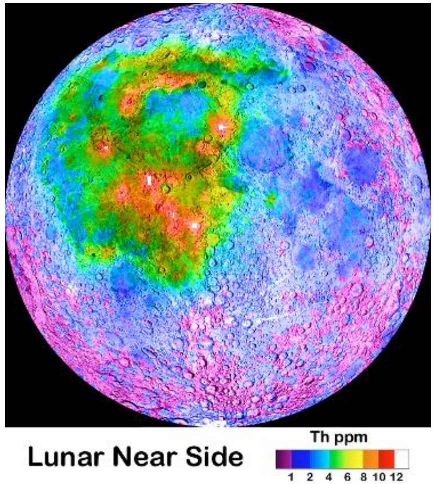
Decadal Priority Themes important to JSC Planetary Science

- Building New Worlds
  - What were the initial stages, conditions and processes of solar system formation and the nature of the interstellar matter that was incorporated?
  - What governed the accretion, supply of water, chemistry, and internal differentiation of the inner planets and the evolution of their atmospheres, and what roles did bombardment by large projectiles play?
- Planetary Habitats
  - What were the primordial sources of organic matter, and where does organic synthesis continue today?
  - Did Mars or Venus host ancient aqueous environments conducive to early life, and is there evidence that life emerged?
- Workings of Solar Systems
  - How have the myriad chemical and physical processes that shaped the solar system operated, interacted, and evolved over time?
  - What solar system bodies endanger Earth's biosphere, and what mechanisms shield it?

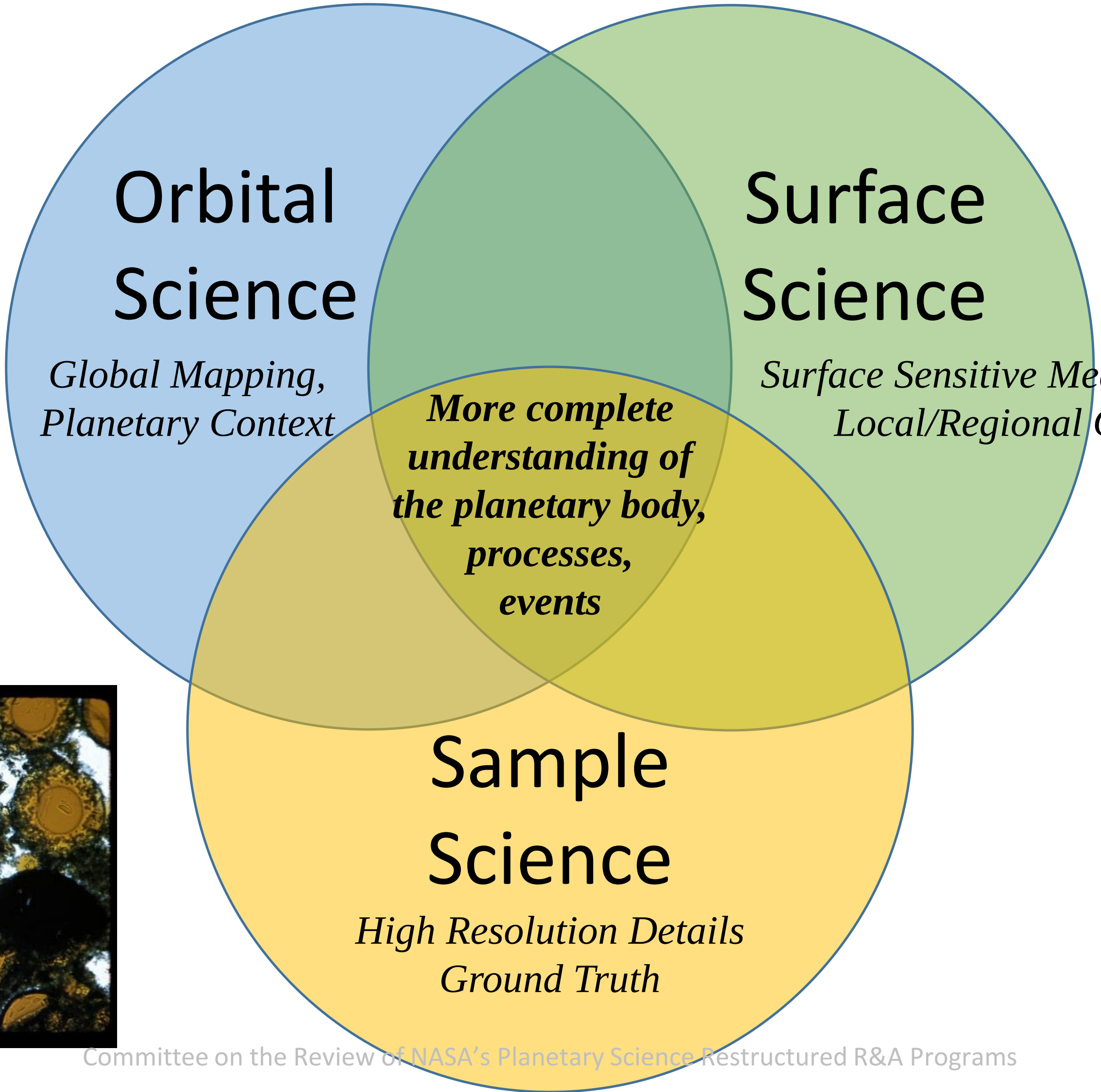
[Vision and Voyages for Planetary Science in the Decade 2013-2022]

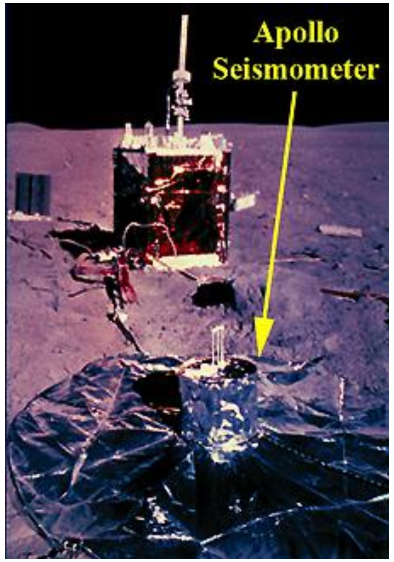
Planetary Science Activities at JSC

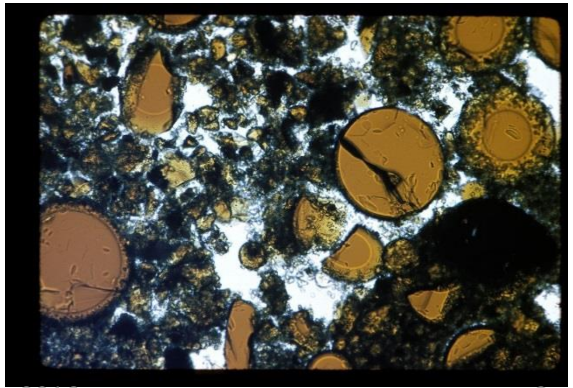
- Responsible for the curation of all NASA extraterrestrial samples
  - Associated research expertise is important to maintaining world-class standing
- Support to operational planetary missions (surface rovers, sample return, orbital spectroscopy)
  - Mars: Mars Phoenix, MER, MSL, Mars2020
  - Moon: LRO
  - Discovery/New Frontiers: Stardust, Genesis, OSIRIS-REx
- Independently Competitive peer-reviewed query-based research
  - Fundamental research is the foundation for interpreting mission measurements and providing insight/advice on new mission types and opportunities (particularly sample return)
- Exploration Science (particularly Lunar, Mars, Asteroid soils/surface)
  - SSERVI
  - HEOMD mission concept advice and support



Lunar Near Side







Planetary Science at JSC: Maximizing Science Return

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- Astromaterial Sample Analysis
- Planetary Process Simulation
- Robotic Mission Science Support

Capabilities of the JSC Planetary Sample Analysis and Mission Science Laboratory

E-beam	SEM, TEM, EPMA, FIB (+ field-emission)	EIL	Experimental Impact Laboratory
NanoSIMS	Nano-scale secondary ion mass spectrom.	EXPET	High-P,T petrological experimentation
Isotopes	TIMS, GC + Quadrupole mass spectrom.	Soil chem	Soil formation & modification analyses
Organics	Soluble organics, L^2MS, Raman	Analog & Mission inst.	Flight-like EGA, ChemCam, ChemMin, VNIR, Mössbauer for MER, Phoenix, MRO, MSL
ICPMS	Inductively-coupled plasma mass spectrom.	Sample Library	Samples for ground truth on remote sensing
Spectroscopy	XRD, FTIR, Mössbauer		

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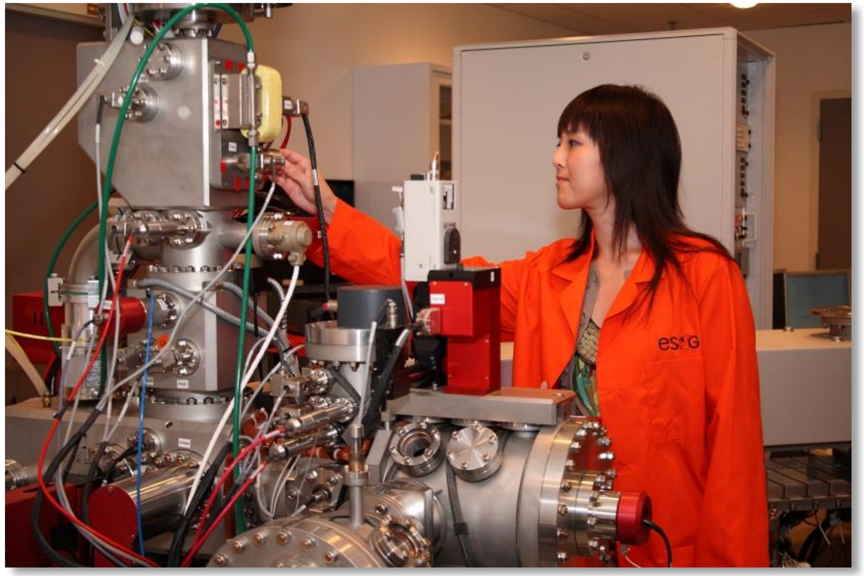
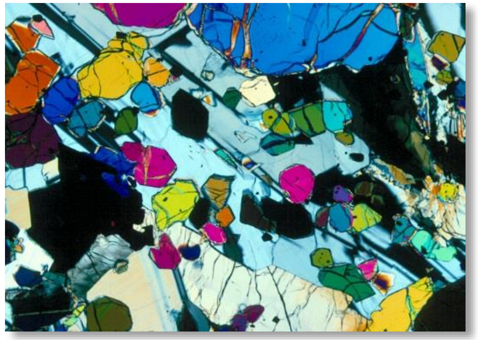
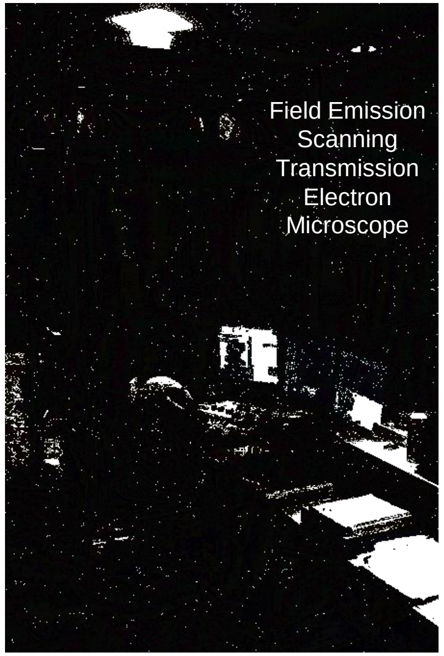
Astromaterial Sample Analysis

- Bulk, macro, micro, and nano-analysis
  - Mineralogical and crystallographic characterization
  - Elemental & Isotopic analysis composition/mapping
  - Geochronology
  - Organic compound analysis

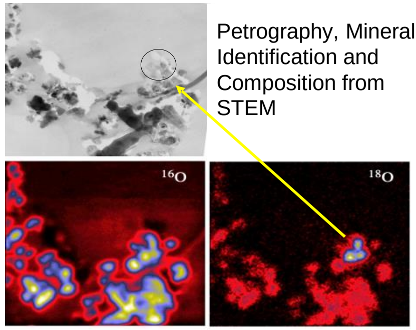




Coordinated Analysis

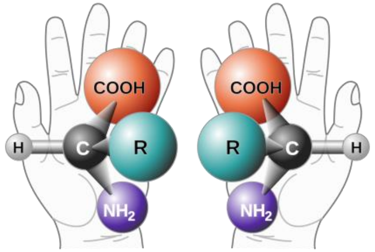


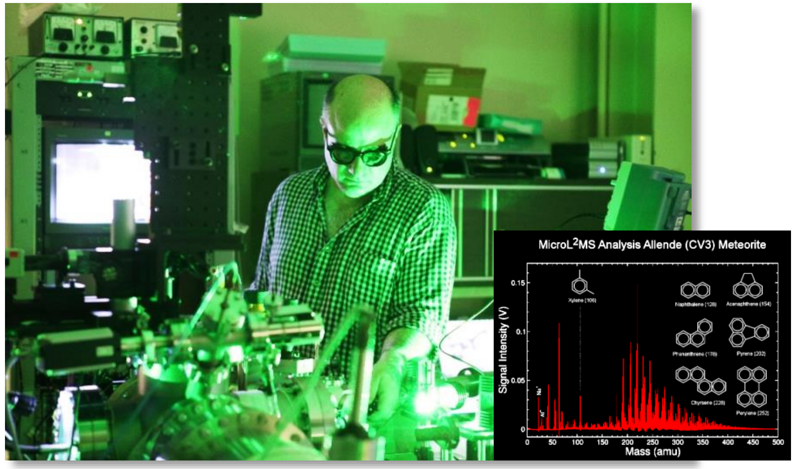
Presolar Olivine Grain
Formed In Supernova

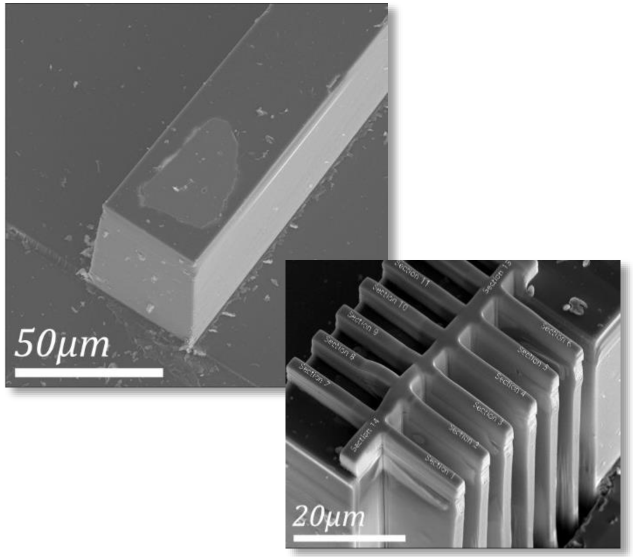


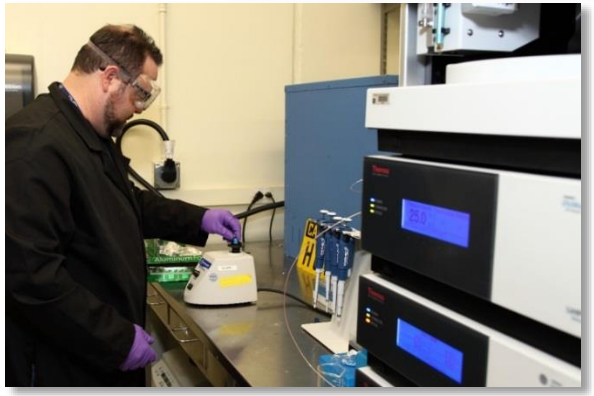
Petrography, Mineral Identification and Composition from STEM

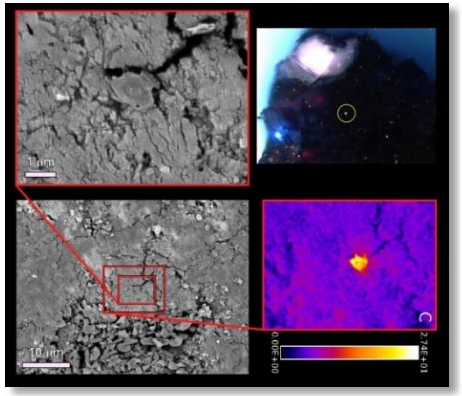
Oxygen Isotope Maps from NanoSIMS

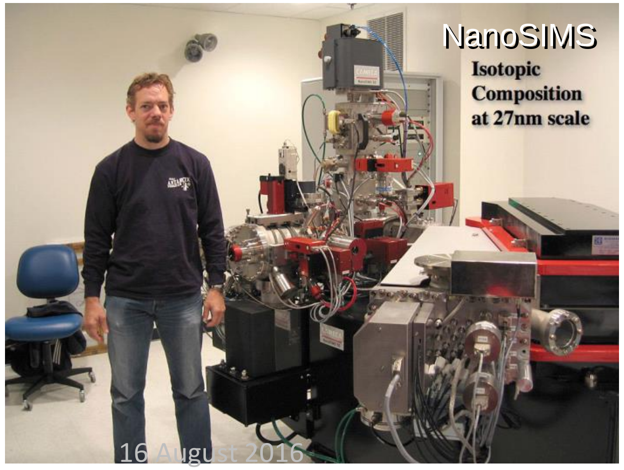












- Pioneering advanced analysis and sample handling techniques
- Smaller in scale = further back in time

Planetary Process Simulation

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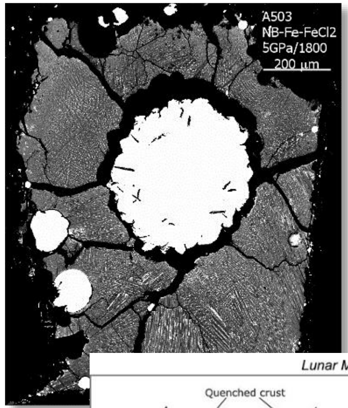
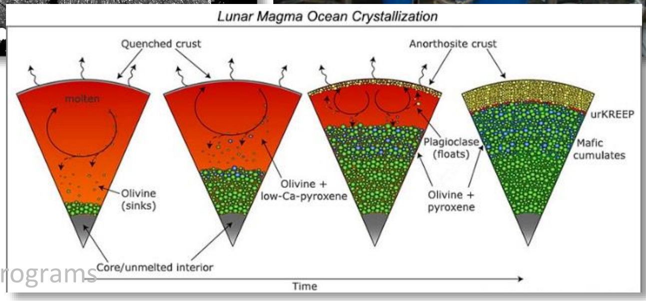
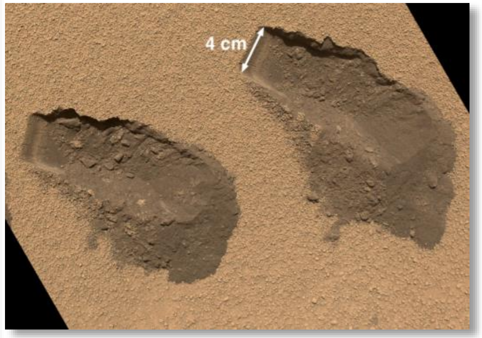
- Cratering Physics
  - shaping rocky and icy surfaces
- Planetary interiors
  - phase relations, magma oceans, partitioning
  - T, P, fO2 conditions up to Earth transition zone; Mars CMB; entire lunar & mercurian interiors
- Planetary soils
  - validating & interpreting MER, Phoenix, MSL data







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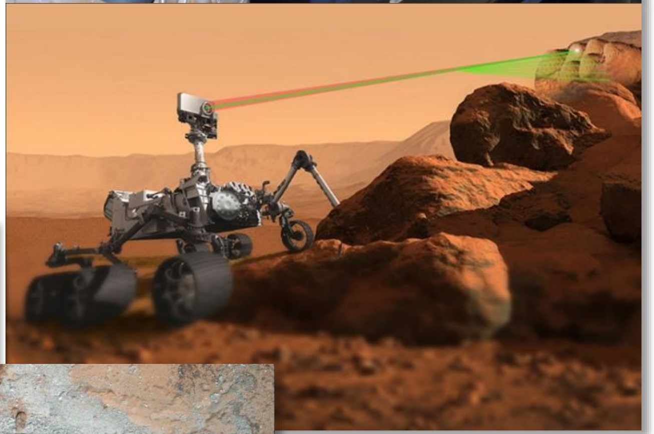
Robotic Mission Support

- Flight-like equipment for development, calibration, and qualification of planetary flight instruments
  - Laser-induced breakdown spectroscopy
  - Mössbauer spectroscopy
  - Fourier transform infrared spectroscopy
- Analog sample library (>10,000 samples)
  - Extensively characterized, fully documented
  - Ground truth for interpreting planetary mission data
  - Sample subsets cross-correlated across missions
- Science Operations Support
  - Traverse planning / objective prioritization
  - Uplink / downlink leadership



Net Impact of PSD R&A Reorganization

a. Can you identify specific sub-disciplines that have been impacted negatively or positively through this reorganization?
  - Positive—search for life and habitability
  - Negative—sample science

b. Are such impacts perceived as long-term?
  - Yes—these represent changes in priorities of PSD

c. If the impact is negative, is there a perception that a change in focus or presentation may remedy the issue?
  - PSD R&A Reorganization is specifically designed to map to priorities
  - SSW currently seems too large of a catchall
    - Challenge to assemble properly qualified panels for proposal review

Impact on Morale

3. Your sense of any impacts, positive or negative, on the morale of scientists within your programs

- Morale has been negatively affected.
  - Priority change to diminish sample studies—perception that contributions not valued
- Fewer programs—fewer opportunities to propose ∴ timing more critical, greater likelihood for gap year
- Lower selection rate—philosophy change from ~1/3 selection to ~1/5?

Refocus of Priorities

4. Your perspective on how well this reorganization results in a refocusing of NASA resources on priorities for the agency
   - Reorganized R&A programs map well to stated science goals (designed that way deliberately) and resources are allocated accordingly
5. Your thoughts on ways that the implementation of the reorganization may be improved going forward
   - Reevaluate scope of SSW (currently seems too large of a catchall)
     - Challenge to assemble properly qualified panels for proposal review
   - Remain mindful of foundational research areas—inclusive and diverse priorities
   - Provide additional access to specialized laboratories through the National Lab solicitation.

Implementation

6. Your thoughts on the transparency of the reorganization;
   - The reorganization was not adequately socialized prior to roll-out, it took the vast majority of affected scientists by surprise
   - Better communication of what is expected to be funded—shift from evolutionary understanding
7. Any thoughts you might have related to the task of the committee and future directions for NASA research
   - priorities
8. Do you see any aspects of the current Planetary Sciences Division R&A funding organization that has a negative effect on interdisciplinary research conducted either within the planetary sciences (to include astrobiology research) or among the planetary sciences and other disciplines, such as astrophysics or life sciences research? Similarly, do you see any positive effects?
   - Current programs structure should adequately promote any interdisciplinary research
     - Challenge with perception that proposals should be small and narrow focused to fit in relevance and to be possibly considered for funding