National Aeronautics and Space Administration

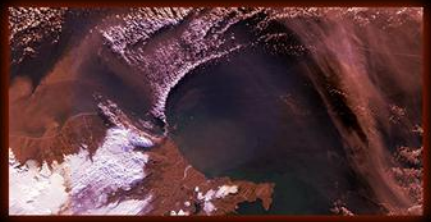
NASA Science

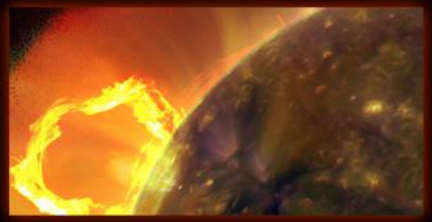
International Collaboration Opportunities

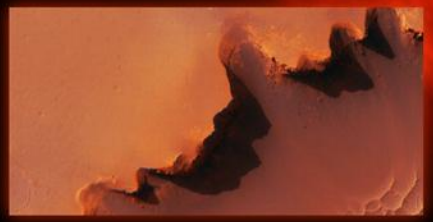
International Conference on Radiation Belts and Space Weather
30 May 2012

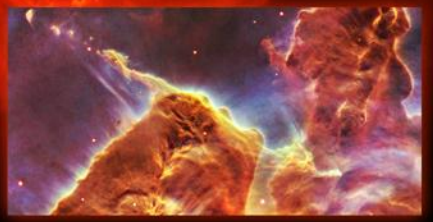
John Lee

Program Executive for Solar Probe Plus, Science Mission Directorate (Heliophysics Division)









US National Space Policy (2010) - Goals

2 of 6 goals touch on international cooperation/partnership

- Expand international cooperation on mutually beneficial space activities to: broaden and extend the benefits of space; further the peaceful use of space; and enhance collection and partnership in sharing of space-derived information.

- Pursue human and robotic initiatives to develop innovative technologies, foster new industries, strengthen international partnerships, inspire our Nation and the world, increase humanity's understanding of the Earth, enhance scientific discovery, and explore our solar system and the universe beyond.

Cited from http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf

Essential Principles for Cooperation

NASA policy foundations are unchanged after 50 years

- **“**Designation by each participating government of a central agency for the negotiation and supervision of joint efforts
- Agreement upon specific projects rather than generalized programs
- Acceptance of financial responsibility by each participating country for its own contributions to joint projects *[no exchange of funds]*
- Projects of mutual scientific interest
- General publication of scientific results**”**

Cited from *International Programs*, NASA Office of International Programs, 1962
In-place by September 1959 per Homer Newell’s book, *Beyond the Atmosphere* (p. 306)

Science Mission Directorate General Principles

Investment choices are made via **open competition** and based on **scientific merit** determined by **peer review**

Active participation by the research community beyond NASA is critical to success

Effective international and interagency partnerships to leverage NASA resources and extend the reach of our science results

A **balanced** portfolio of space missions and mission-enabling programs to sustain progress toward NASA's science goals

Progress toward science goals of NRC decadal surveys in all four science areas is the measure of success

Broad public communication of programs and results

Space mission scientific data to be shared as promptly and widely as possible

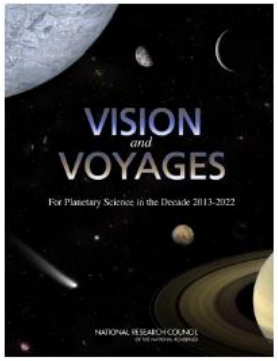
Setting Science Priorities

Congress and the White House expect that NASA Science Priorities will be shaped by recommendations from the U.S. scientific community through NRC Decadal Surveys

Heliophysics (2003; revision due in early 2012)

Earth Science (2007)

Astrophysics (2010)



Planetary Science (2011)

Two Types of NASA Missions

Strategic missions are the backbone of the science roadmaps in each area and are usually large and multi-purpose; generally assigned to a NASA Center for implementation, with science instruments and platform components selected in open competitions (AOs and RFPs).

PI-led missions are employed to meet focused science objectives via innovative missions with low technology risk; solicited as complete investigations via open AOs by a team led by a Principal Investigator (PI); responsibility for success vested in PI.

	Small*	***Medium****	***Large****	***Flagship***
Strategic	ES Systematic Lunar Quest	ES Systematic Mars Exploration Solar Terrestrial Probes Living With a Star Exoplanet Exploration	ES Systematic Mars Exploration Living With a Star Cosmic Origins Physics of the Cosmos	Outer Planets Flagship, Mars Science Laboratory, JWST
PI-led	ESSP Explorers, Venture class missions	Discovery	New Frontiers	

** Entries under Small, Medium, and Large are Mission Lines from 2010 Science Plan Appendix 2*

Strategic Missions

- **Missions prioritized by NRC decadal surveys; often multi-decade projects**
- **Lead Center assigned to manage each project**
- **Foreign contributions negotiated by NASA Headquarters**
- **Science requirements set by community-based Science Definition Team**
- **Instrument investigations selected through AO**
- **Often have competitive opportunities for broadened community participation**
  - Science teams
  - Participating scientists
  - Interdisciplinary scientists
  - Data analysis funding

SMD Small, PI-led Mission Flight Programs

SMD currently operates 3 small, PI-led mission programs

Explorer, recently divided into 2 separate budget lines

- Astrophysics
- Heliophysics

Discovery, now limited to our own Solar System

- No longer open to exoplanet missions like Kepler

Earth Venture

- EV-I: instruments only
- EV-1: suborbital (aircraft, sounding rockets, balloons)
- EV-2: small missions (e.g., hosted payloads, very small launchers)

Also: Missions of Opportunity, solicited in various ways

[New Frontiers is PI-led, but not "small" (> $1 billion each)]

Announcements of Opportunity (AOs)

NASA PI-led missions are solicited by AOs as "investigations"

- Proposals must be for a COMPLETE investigation: science definition, instruments, spacecraft, launcher, mission operations, and data analysis
- Often a two-step selection process: study phase then competed downselect
- AOs are also used for Missions of Opportunity (MOs; see next chart)

SMD AOs for PI-led flight programs are highly standardized

- All classes of PI-led missions, plus the MOs, use a standard format solicitation; all ask for the same information
- Typically 90 days are allowed for proposal submission after release
- Makes it much faster to prepare and issue AOs, easier for proposers

NASA desire is to release AOs in each program on a regular basis

- NRC recommends frequency
- General goal is every two years for Discovery and Explorer; Earth Venture cadence is more complicated
- Reality is that release frequency is lower, depends on budgets

Missions of Opportunity (MOs)

AOs for full missions may also invite proposals for Missions of Opportunity

- Individual MO awards are generally in the $10-50M range
- A typical MO is an instrument to fly on a foreign spacecraft (SXS on Astro-H)
- One or more MO awards may be made from each solicitation, depending on costs and available budget
- Science and technical evaluation process is the same as for full missions (e.g., Explorer or Discovery; see below)
- Often solicited in a single step (directly for implementation); some in two steps (a funded study phase followed by a competitive downselect)
- Subject to the same implementation management processes as full missions

Stand-Alone Mission of Opportunity Notice (SALMON)

Developed to separate solicitation of MOs and other smaller opportunities from the major mission AOs to enable:

- Faster response to science and budget opportunities
- Add flexibility to the types of investigations that can be competed
- Better align with partnership opportunities (see FMO on next chart)

Overarching SALMON AO in force for 5 years; specific opportunities can be solicited under it at any time

- A new Program Element Amendment (PEA) for a new opportunity can be issued at any time
- The PEA is a short statement that focuses on objectives, cost ceiling, and any unique constraints; all the rules are in the parent SALMON AO

Frequency of SALMON PEAs is set by available budgets

SALMON Opportunity Categories

Under upcoming new SALMON, 4 categories of opportunities will be supported:

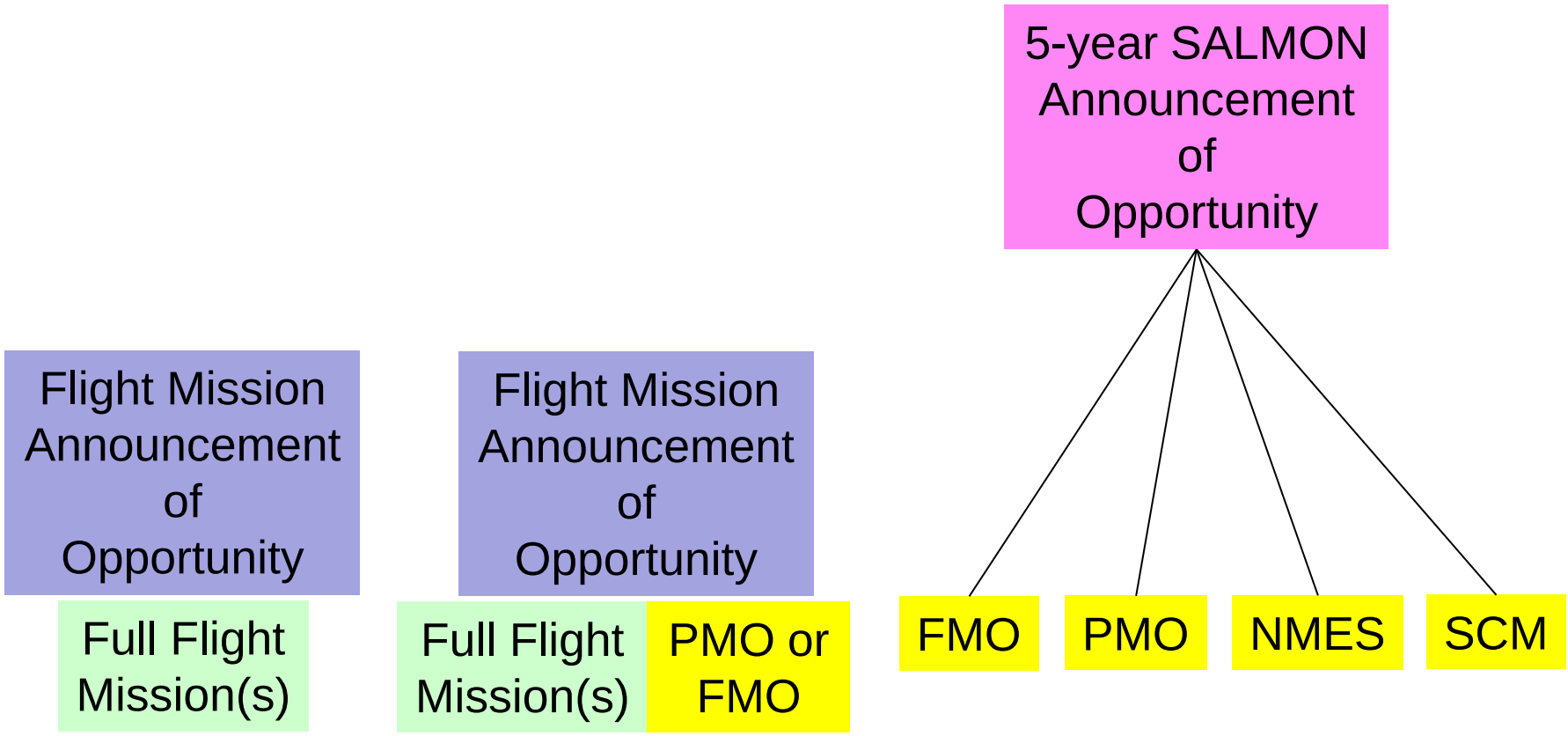
Partner Mission of Opportunity (PMO): investigation based on providing a critical component to a non-NASA or non-U.S. mission, e.g., a complete instrument or hardware or software components; open to any scientific objectives within PEA guidelines

Focused Mission of Opportunity (FMO): Similar to PMO, but limited to a specific, NASA-identified flight opportunity

New Mission using Existing Spacecraft (NMES): investigation that applies an existing spacecraft to a new scientific objective in an extended mission

Small Complete Mission (SCM): valuable but inexpensive complete mission investigation realizable under limited cost, using NASA-provided access to space (as described in the PEA), or without it

Summary of AO Types



Early Preparation

NASA: often releases a draft AO to the community of prospective proposers

- Release is typically 6 months before release of the final AO
- Goal is to alert prospective proposers to specific scope and guidelines, as well as any changes to standard principles; supports team formation
- Comments received from reviewers are considered and may result in changes to the final AO

Proposers: early team formation is critical to success

- Aspiring PI usually leads team formation process; sometimes industry
- The 90-day proposal response period is not enough to identify optimum partners, analyze and allocate responsibilities, and begin conceptual mission design and development planning
  - Science goals are generally known in advance (from SMD Science Plan and NRC Surveys
  - Previous AOs for the program can be used for very early planning
  - Evolving planning can be sharpened using a draft AO
- Critical team members can include: the PI, science team members, industrial partner(s), a NASA center, and foreign participants

Potential Challenges to Collaboration

Management Complexity

- Decision-making
  - Complexity grows with number of partners
  - Timing of decisions
  - Who is in charge?
- Communications difficulties
- Differing specifications, standards and assumptions
- Export control regulations/laws

Technical and Programmatic Risk

- The “critical path” – open for discussion
- Interfaces difficult to manage at a distance
- Difficult to monitor progress and get early warning of problems

Political Risk

- Budgetary and bureaucratic uncertainties
- Potential linkage to activities unrelated to the cooperation

Opportunities for New Partners

Numerous possibilities exist for developing new partnerships

1. Scientist-to-Scientist Collaboration (Visiting scientist at GSFC & at various U.S. universities)
2. Data Sharing for Research (RBSP & SDO)
3. Multilateral Forums and Science-based Organizations (American Geophysical Union (AGU), Committee on Space Research (COSPAR), International Living with a Star (ILWS),Committee on Earth Observing Satellites (CEOS), World Climate Research Program (WCPR), etc.)
4. Earth Applications
5. Ground-based Measurements in Earth Science
6. Suborbital Investigations
7. GLOBE Education Program

NASA – MEST/KARI/KASI Collaboration

October 2008 – NASA-MEST Joint Statement of Intent signed at MEST
April 2009 – NASA-MEST Bilateral Working Group hosted by KARI
September 2009 – UN BSS & IHY Workshop in Daejeon – Heliophysics/KASI
October 2009 – Joint NASA – Korea technical groups established in Daejeon
February 2010 – KASI visit to NASA Headquarters Heliophysics Division
July 2010 – Agreement signed by NASA and KASI on RBSP and SDO

- RBSP dish antenna in Korea to receive broadcast data
- SDO Data Center in Korea to receive data

November 2010 – Agreement signed by NASA and KASI on space geodesy
December 2010 – 1st Bilateral between NASA –MEST/KARI/KASI at NASA
November 2011 – MEST/KARI delegation to NASA HQs
December 2011 – Associate Administrator visit to MEST/KARI/KASI & KMA
May 2012 – Antenna dedication & International Conference on Radiation Belt and Space Weather hosted by KASI

August 2012 – RBSP scheduled to Launch