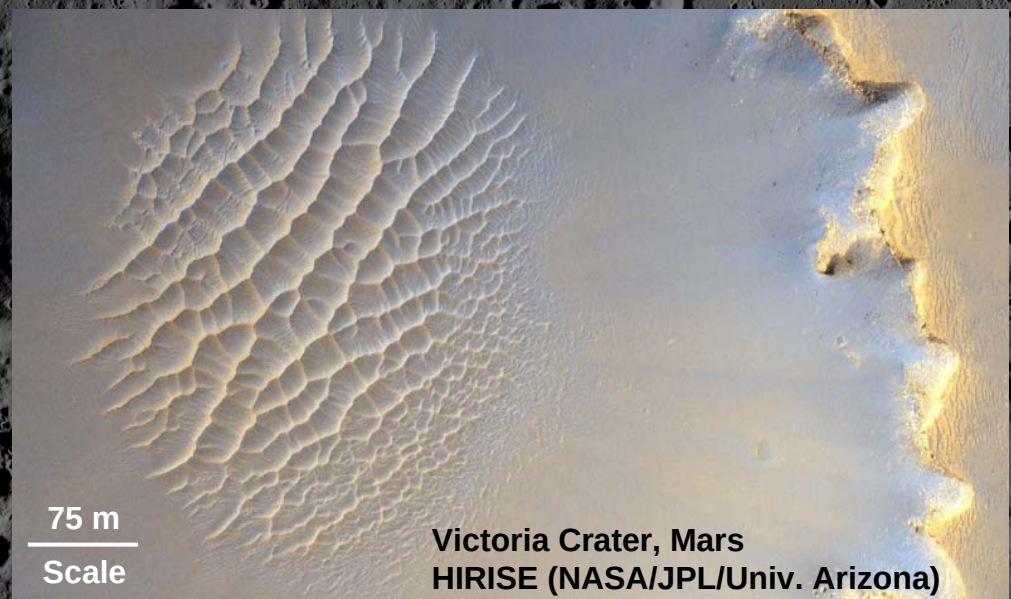
"Home Plate" Panorama, Spirit Rover, Gusev Crater

NASA/JPL/Cornell

Science Committee report to the NASA Advisory Council April 17, 2008

AS15-M-2087 (Moon)

Mars HST



75 m Scale

Victoria Crater, Mars
HIRISE (NASA/JPL/Univ. Arizona)

Highlights in SMD

- Increases in 2008 and 2009 for R&A programs in Astrobiology and in Lunar Science, and strong program of R&A across the board (Astrophysics, Heliophysics, Planetary Science).
- Stand-Alone Mission of Opportunity Notification (SALMON), with a first release in May 2008 and annual releases thereafter.
- JWST passed Preliminary Design Review (PDR) with no major issues identified; Non-Advocate Review (NAR) this week
- Mars Phoenix Scout mission en route to Mars with landing May 25
- MESSENGER on the way to a second encounter with Mercury on Oct 6

FY09 Program Changes

- Earth Science:
  - $600M over 5 years for new Decadal missions
  - Soil Moisture Active/Passive (SMAP) and IceSat II (2012, 2015 launches)
- Astrophysics: Joint Dark Energy Mission (JDEM) (launch in 2014)
- Heliophysics: Solar Probe Plus (launch in 2015)
- Planetary:
  - Outer Planets Flagship (launch in 2016/2017)
  - Lunar science orbiter, LADEE (launch in 2010/2011)
  - International Lunar Network (planning for FY12-FY14)

Changes represent good use of efficiencies, out-year mission Ops Savings, and re-phasings for several missions.

Meeting Focus

- The SC's focus in this meeting was on NASA's Planetary Science portfolio:
  - FY09 President's Budget discussion
  - Status of Outer Planets Flagship mission concept studies
  - Plans for next New Frontiers and Discovery opportunities
  - Mars Science Laboratory Status
  - Mars Sample Return planning
- Briefings by:
  - James Green, Director Planetary Science Division
  - Doug McCuistion, Director Mars Exploration Program
  - In attendance: Chuck Gay / SMD's new Deputy AA
- Other Briefings:
  - Strategic Review of Expendable Launch Vehicle Options (with Space Ops); presentation by Bill Wroebel
  - Lunar Rover Trades and Status (with Exploration & Space Ops) – M. Gernhardt

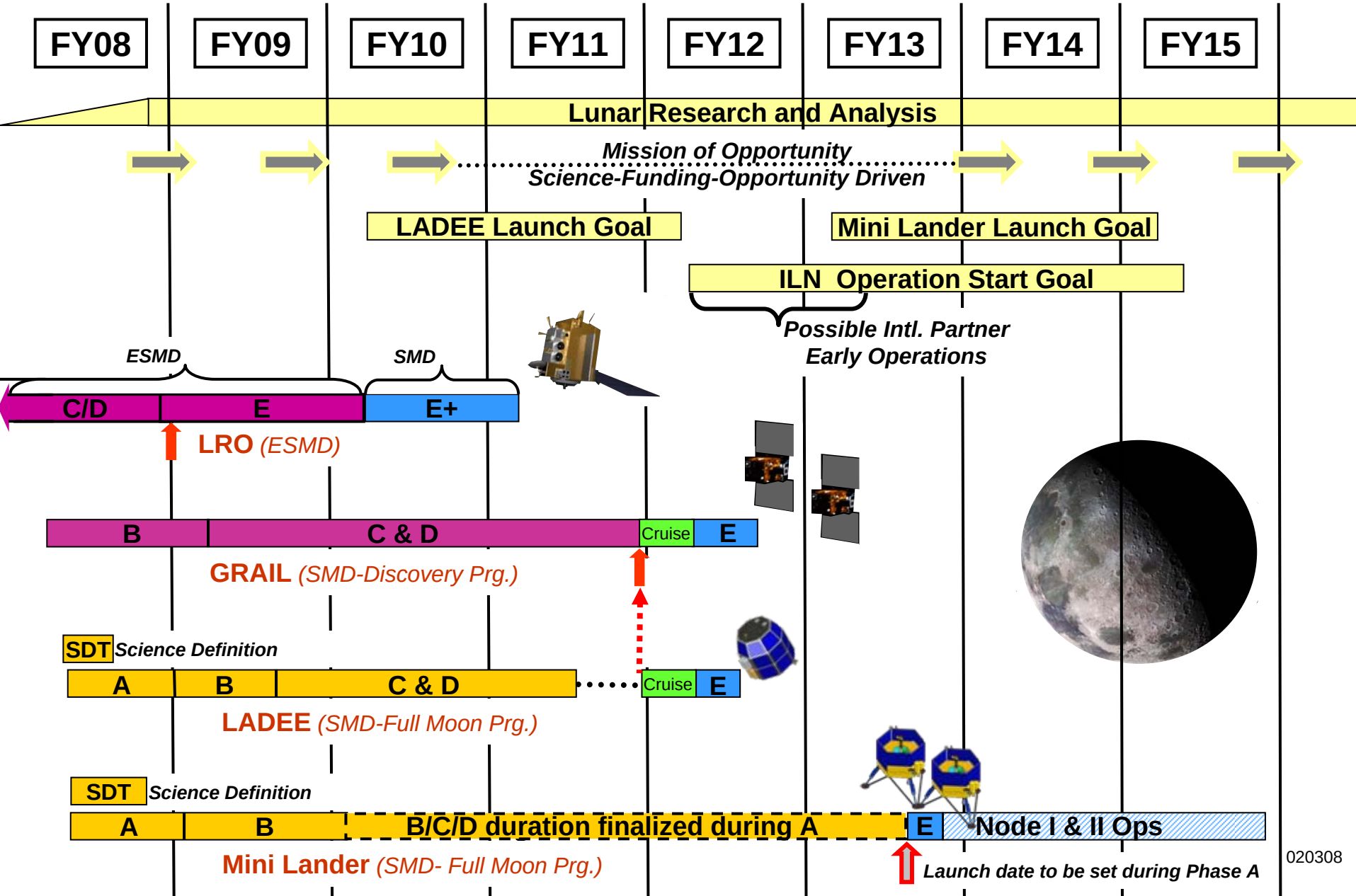
Planetary Science Portfolio

- The Planetary Science portfolio is well balanced along some key dimensions:
  - Good mix of small, medium and large missions
  - Good mix of strategic and competed, PI-led missions
  - Programs exist that provide opportunities extending to the full range of solar system targets (but not all at once!)
- Mars is the focus of a sustained campaign of scientific exploration
  - Continued need to integrate Mars intellectually with the rest of Planetary Science; next NRC decadal survey (to start up in 2009) will help
  - Mars Sample Return remains the goal; promises largest leap in understanding after MSL
  - Mars budget took a significant reduction in the FY09 request vis-à-vis the FY08 request

Lunar Science Program to Complement US Space Exploration Policy

- The Lunar Science “Full Moon” Program complements the Lunar Exploration Architecture.
  - Provides robotic science precursor missions.
  - Supports training of next generation of scientists for lunar program.
- SMD has initiated plans to implement a NASA Lunar Science Institute (administered through Ames), with distributed nodes to be established through a competitive proposal process.
  - Themes include exploration as well as science.
  - ESMD support of one or two nodes would be appropriate.
- OSEWG (NASA) and LEAG (NAC, stakeholder communities) working to develop science and exploration roadmap that is consistent and integrated with the exploration architecture.

Lunar Missions Schedule



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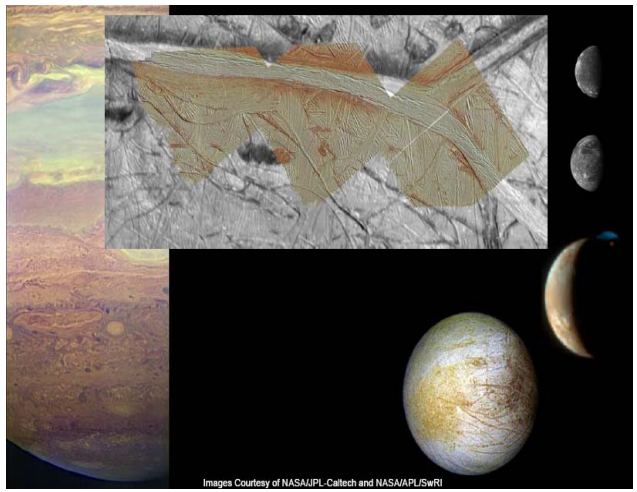
Planetary Science Portfolio Challenge

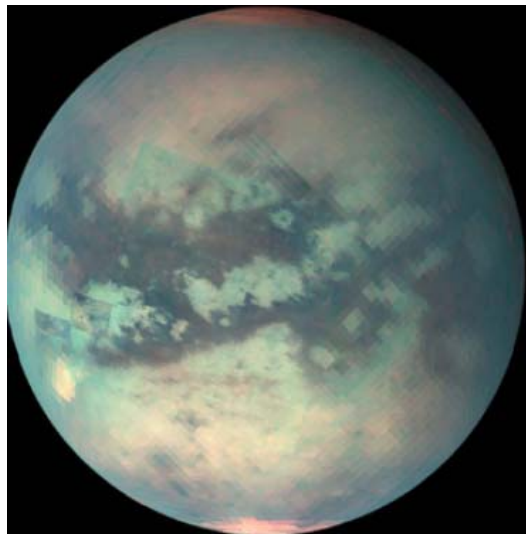
- FY09 includes both an Outer Planets Flagship (2017) and Mars Sample Return (2018/2020) as new programs
- However, out-year profile makes it highly unlikely both can be done at the same time -- NASA needs to work this over the next few budget cycles
- Both missions require - and will benefit greatly from - international collaboration

Outer Planets Flagship Mission Studies

Europa - NASA lead



Jupiter System - ESA lead



Titan - NASA lead

- Outer Planet Mission program characteristics:
  - Focused missions (not like Cassini, Galileo)
  - Europa Jupiter System Mission (EJSM) consisting of NASA Europa Orbiter, ESA Jupiter Planetary Orbiter, JAXA Magnetospheric Orbiter
  - Titan Saturn System Mission (TSSM) consisting of NASA Titan Orbiter, ESA *in situ* vehicles (lander & balloon)
  - NASA cost cap ($2.1B FY07), MMRTGs only, 34m DSN

Mars Exploration Program

- Work on the Mars exploration architecture is focused on optimizing the mix and timing of missions to meet the highest priorities of the scientific community.

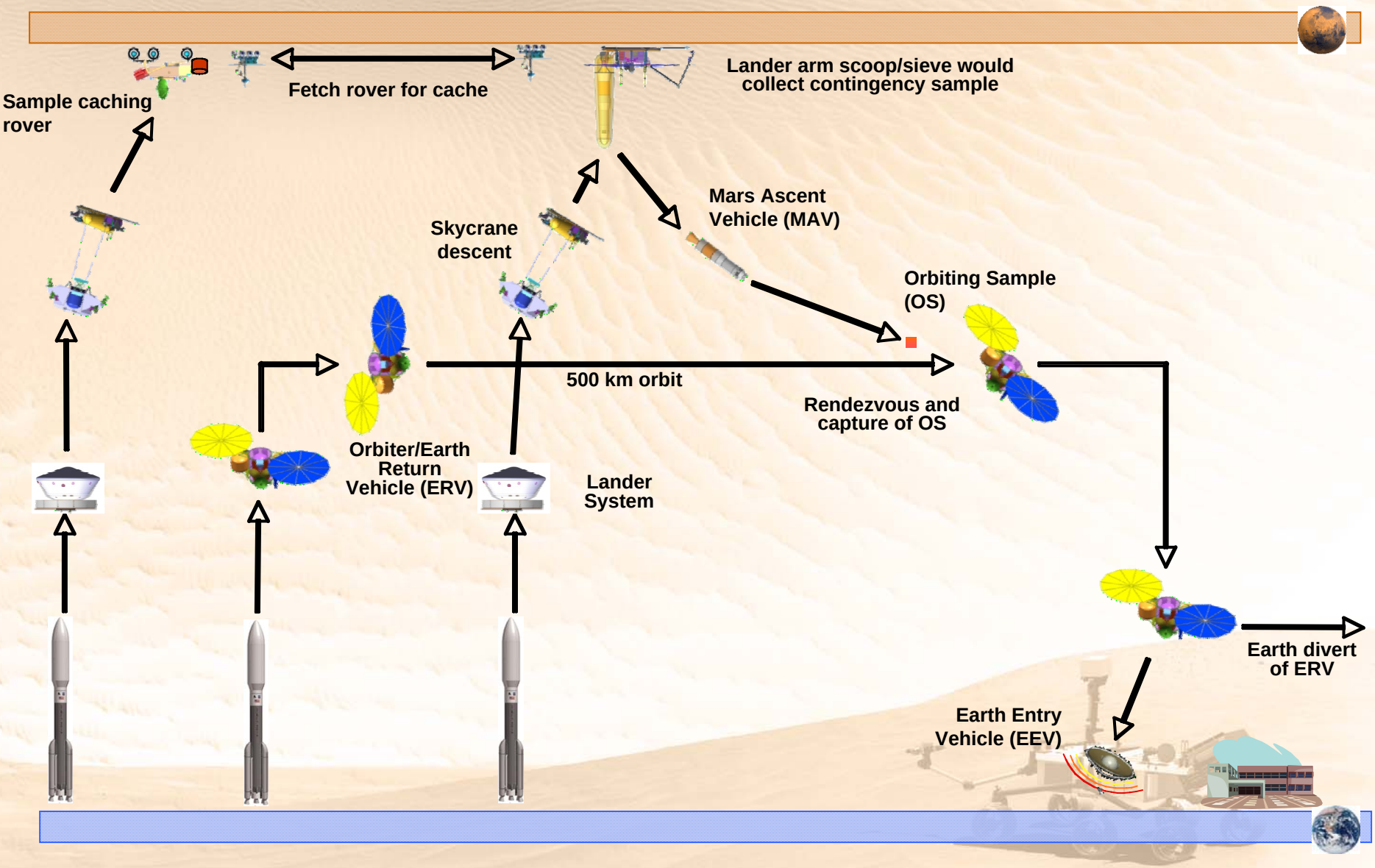
- The planetary science community, through NRC, MEPAG, and the NAC Planetary Science Subcommittee, supports Mars Sample Return (MSR) as a goal, and supports plans to enable the launch of an MSR mission or missions the 2018-2020 timeframe as long as it can be done capably and at cost that is not detrimental to the overall Mars Exploration and Planetary Science programs.

Mars Exploration Program

- Ongoing planning, including budgetary and cost considerations, of the Mars Exploration Architecture for Mars Sample Return is proceeding well.
  - MEPAG Feb. ’08; Mars Architecture Tiger Team (Feb and Apr ’08)
  - Includes focused efforts to make and incorporate realistic estimates of associated costs and risks into architecture planning.

- Because of cost and scope, international partnerships are necessary for MSR
  - NASA has begun efforts to coordinate such partnerships through the IMARS (International Mars Architecture for the Return of Samples).

Mars Sample Return (3-launch Scenario)



Mars Science Laboratory (MSL)

- Cost growth in the MSL Project remains a concern within the Mars Exploration Program and the Planetary Science Division.
- The Mars program recently investigated the consequences of a launch slip from 2009 to 2011 if required by schedule pressures.
- The additional cost of slipping the launch, however, could be as high as $350M. Given the cost of a delayed launch, it will be more efficient to solve MSL's cost growth problems in 2008 and 2009 so that the mission can remain on schedule for a 2009 launch.
- MSL is not only a key mission for the Mars Program, but also has priority at the Agency level.

Mars Science Laboratory

Short Title of Recommendation

- Launch the Mars Science Laboratory in 2009

Brief Description of Recommendation:

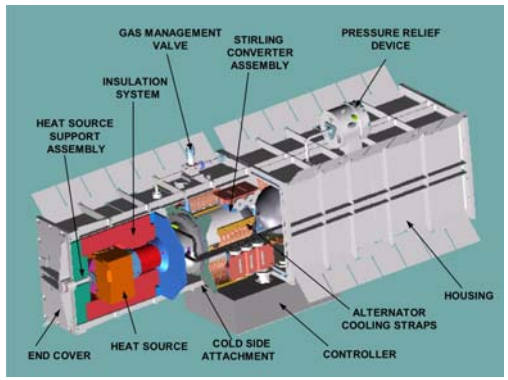
- NASA should continue to make every effort toward MSL mission success with a launch in 2009. NASA should continue to recognize MSL as an Agency-wide priority, and the Agency should assist the program in finding the resources necessary for mission success

Background - Long-lived Power Sources

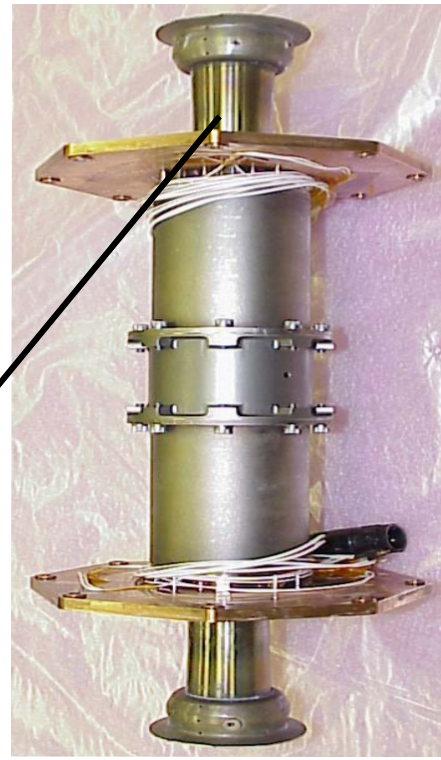
- For many planetary mission concepts, solar / battery power is insufficient for long-term power supply or sustainability through operation at extremely low temperatures.
- Development of the Advanced Stirling Radioisotope Generator increases greatly the efficiency of usage of radioisotope fuel and is a positive step, but an adequate supply of Pu(238) is also important.
- An immediate beneficiary of such development would be the International Lunar Network landers, but such power supplies would benefit other missions including a Mars surface network and missions to the outer planets.

Advanced Stirling Radioisotope Generator Engineering Unit

- Operation in space and on surface of atmosphere-bearing planets and moons
- Characteristics:
  - ≥14 year lifetime
  - Nominal power : 140 We
  - Mass ~ 20 kg
  - System efficiency: ~ 30 %
  - 2 GPHS ("Pu^{238} Bricks") modules
  - Uses 0.8 kg Pu^{238}
- Final wiring and connections for ASRG engineering unit underway
- Reliability to be demonstrated by the end of 2009



Lockheed Martin/Sunpower



Paired converters with interconnect sleeve assembly

Outboard Housing and Paired ASC-Es

Long-lived Power Supplies

Short title of recommendation

- Develop long-lived power supplies for planetary missions

Brief Description of Recommendation:

- Take steps to develop or ensure the availability of long-lived power supplies for landed networks and other planetary missions.

Future Work

- Review NASA responses to selected NAC recommendations arising from the Tempe Lunar Science Workshop in the July meeting

- E/PO will be on the SC agenda for July
  - Will invite Human Capital Committee participation