

The background of the slide is a photograph of a Mars rover on a desert landscape. The rover is positioned in the lower right quadrant, facing left. The terrain is a vast, flat, orange-brown desert with subtle ripples in the sand. In the top left corner, there is a small, circular inset image of a planet, likely Mars, showing its characteristic reddish-orange color and some surface features. The overall color palette is warm and monochromatic, dominated by shades of orange and brown.

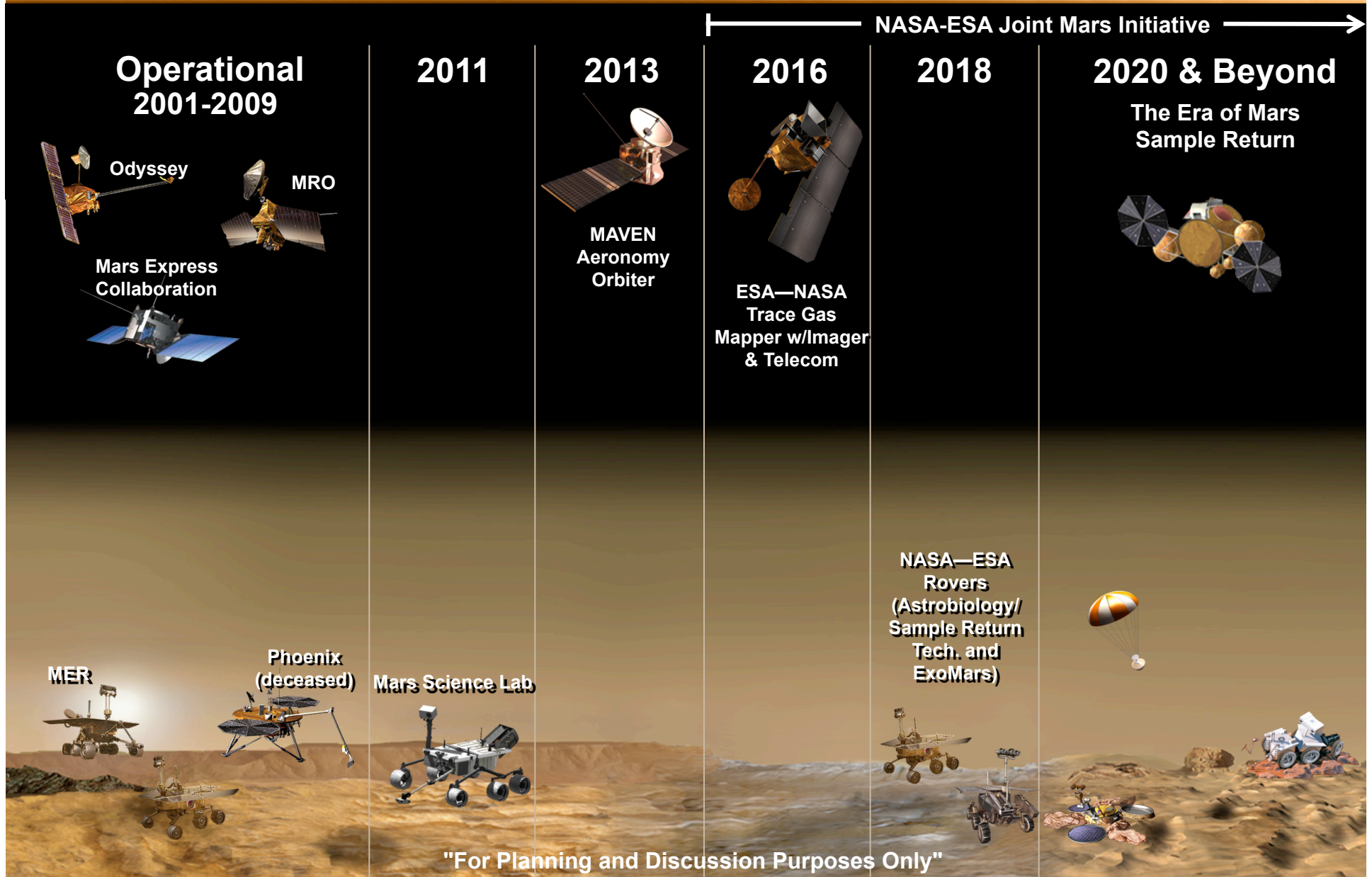
Discovery Potential Bidder's Conference

NASA's Mars Exploration Program

Doug McCuistion

11 January, 2010

Tentative Joint NASA-ESA Mars Initiative Portfolio Overview

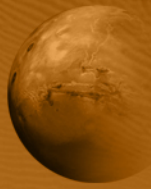




Mars Mission Communication Requirements

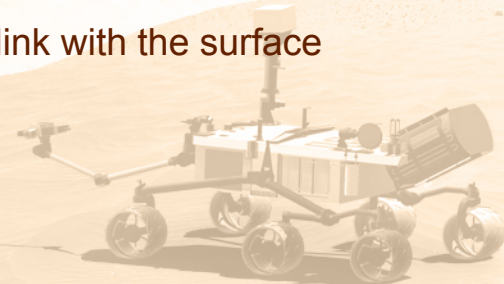
- For Mars Landers
 - Electra-lite: designed/built for Mars Science Laboratory (MSL)
 - Standardized software-programmable radio that ensures compatibility with mars communications infrastructure
 - Tailored to the mass, volume, and power constraints of Mars landers
 - Any proposed Mars lander is *strongly encouraged* to make use of Electra or Electra-lite ← This is a change from the Draft
 - If Electra/Electra-lite is not used, it is incumbent upon the proposed mission to be compatible with the current Mars orbiters for telecommunications (comply with the CCSDS Proximity-1 protocol).
- For Mars Orbiters
 - A single Electra is required to be carried
 - NASA/MEP will provide the Electra GFE, but proposer must account for:
 - Added mass/power/thermal/software requirements
 - Related accommodation and operations costs
- See the Program Library for more detailed information: “*Electra Mars Proximity-Link Communications and Navigation Payload Description*”, and “*Mars Relay Description for Discovery Proposals*”

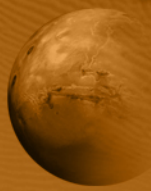




Orbital Asset Availability 2015-2017: Current Missions

- As many as 5 telecommunications support assets may be available during the timeframe of a proposed Discovery mission to the surface of Mars
- **Odyssey**
 - In orbit since 2001
 - Sufficient fuel to last beyond 2017, but final MSL arrival communications coverage could risk this date
 - No Electra but is the workhorse for UHF proximity communications
 - Proven performance with Spirit/Opportunity and Phoenix
- **Mars Reconnaissance Orbiter (MRO)**
 - In orbit since 2006
 - Sufficient fuel to last well beyond 2017, but final MSL arrival communications coverage could also risk this date
 - Last year's safe mode events create technical uncertainty for longevity
 - However MRO has been operating well since mid-December
 - Carries Electra communication package as main proximity link with the surface
 - Proven performance with Spirit/Opportunity and Phoenix
- **Mars Express**
 - ESA-owned asset, in orbit since 2003
 - Use of MEx can be negotiated, but proximity communications capability is limited





Orbital Asset Availability 2015-2017: Future Missions

- 2013 MArS Atmosphere and Volatile Evolution (MAVEN)
 - 2013 launch
 - Orbit insertion September 2014
 - Prime Science Phase ends September 2015
 - Goddard Space Flight Center is the Project Lead
 - Lockheed-Martin/Denver is the prime contractor
 - Orbit: 75° inclination, 4.5 hour-period, 150-km-periapsis-altitude science orbit
 - Electra will be carried for UHF proximity communication
 - Program intent is to minimize/avoid comm. load during prime science phase, unless it can be done on a non-interference basis
- 2016 Joint NASA-ESA trace gas orbiter
 - 2016 launch
 - Orbit insertion in 2016 via aerobraking (delays start of operations)
 - ESA is mission lead, with NASA leading orbital science and communications operations
 - Orbit: 74° inclination, 1.9 hour-period, 400km circular
 - Currently no relay requirements levied until arrival of 2018 mission in late 2018/early 2019.
 - Electra will be carried

