Current Status of Mars Scouts

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Outline

➢ Why Mars Scouts?
➢ What are Mars Scouts?
➢ When is a Scout likely to launch?
➢ Summary of Concepts to Date
➢ Concepts Currently Studied
➢ Mars Infrastructure and Scouts
➢ Scout Technologies
➢ Future Work
Why Mars Scouts?

Respond to discoveries at Mars.

Provide the flexibility to quickly accomplish the best science.

Optimize the use of limited resources otherwise covered in the baseline plan.

Achieve program science goals.
# Mars Mission Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2001</td>
<td>MGS Relay</td>
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<tr>
<td>2004</td>
<td>Odyssey Telecom Relay</td>
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<tr>
<td>2005</td>
<td>Mars Express Telecom Relay</td>
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<tr>
<td>2006</td>
<td>Navcam</td>
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<tr>
<td>2007</td>
<td>MER Communications Relay</td>
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<td>2008</td>
<td>MER Communications Relay</td>
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<tr>
<td>2009</td>
<td>Odyssey Orbit</td>
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<tr>
<td>2010</td>
<td>Odyssey Orbit</td>
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</tbody>
</table>

**Orbiters (on-orbit)**

**Landers (surface operations)**

- Beagle 2
- MFR Twins
- Netlanders
- MSL

**Competed Scout Mission**

**Smart Lander, MSR and Other Technologies**

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What are Mars Scouts?

PI-led missions:

Orbital

Aerial Platforms

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When is a Scout Going to Launch?

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<td>Draft AO released</td>
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<td>Step 1 proposals</td>
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<td>11/1</td>
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<tr>
<td>Phase A (Step 2)</td>
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<td>7/1</td>
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<td>Phase B</td>
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<td>7/1</td>
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<td>6/30</td>
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<td>Phase C/D (max)</td>
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<td>6/30</td>
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<td>Schedule reserve</td>
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<tr>
<td>Launch Period</td>
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<td>3rd</td>
<td>4th</td>
<td>1st</td>
<td>2nd</td>
<td>3rd</td>
</tr>
</tbody>
</table>

*Step 1 and 2 duration based on recent Discovery experience*
May '01 Scout Workshop

➢ Encourage Community Cross-Fertilization
➢ Select 6-10 Concepts for Further Study
➢ Selected Concepts Help Scope '02 AO
  ✔ Possible Science
  ✔ Needed Technology
  ✔ Cost/Schedule/Risk
➢ 43 Concepts Submitted, 10 Selected
➢ Selected Concepts DO NOT Prejudice AO
Summary of Submitted Concepts

- Science Instrument: 5%
- Maybe Use '01 lander: 9%
- Combo of Platforms?: 9%
- Subsurface access?: 4%
- Rover (mobility): 7%
- Sample Return: 5%
- Orbiter: 13%
- Lander: 24%
- Balloon: 11%
- Aircraft: 13%

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Concepts Currently Studied

- Maybe Use '01 lander: 13%
- Science Instrument: 0%
- Balloon: 0%
- Aircraft: 6%
- Lander: 32%
- Combo of Platforms?: 6%
- Subsurface access?: 6%
- Rover (mobility): 6%
- Sample Return: 6%
- Orbiter: 25%

Ten Concepts Selected for Study
(≈150K each)

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## Ten Selected Scout Studies

<table>
<thead>
<tr>
<th>Area</th>
<th>Study Title</th>
<th>PI (institution)</th>
<th>Short Description</th>
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</thead>
<tbody>
<tr>
<td>Landers/Rovers</td>
<td>The Urey Mission</td>
<td>Plescia (USGS)</td>
<td>Lander/Rover for age dating</td>
</tr>
<tr>
<td></td>
<td>The NALADES</td>
<td>Grimm (Blackhawk Geoservices)</td>
<td>Low frequency electromagnetic sounding for groundwater.</td>
</tr>
<tr>
<td></td>
<td>Artemis</td>
<td>Paige (UCLA)</td>
<td>Multiple polar small landers to the north and south poles.</td>
</tr>
<tr>
<td></td>
<td>Cryoscope</td>
<td>Carsey (JPL)</td>
<td>North Polar probe melts into ice.</td>
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<tr>
<td></td>
<td>PASCAL</td>
<td>Haberle (ARC)</td>
<td>Global meteorology network.</td>
</tr>
<tr>
<td>Orbiters</td>
<td>Mars SAR</td>
<td>Campbell (Smithsonian)</td>
<td>Global imaging radar from orbit.</td>
</tr>
<tr>
<td></td>
<td>Mars Atm Const Obs</td>
<td>Kursinski (UA)</td>
<td>Radio sounding of Mars atmosphere from multiple orbiters.</td>
</tr>
<tr>
<td></td>
<td>Mars Env Obs</td>
<td>Janssen (JPL)</td>
<td>Orbital observation of Mars atmosphere.</td>
</tr>
<tr>
<td>Aerial</td>
<td>KittyHawk</td>
<td>Calvin (UNR)</td>
<td>Multiple gliders observing Valles Marineris.</td>
</tr>
<tr>
<td>Sample Return</td>
<td>Sample Collection for Investigation of Mars</td>
<td>Leshin (ASU)</td>
<td>High altitude Martian dust collection and return to Earth via Mars atmospheric flyby.</td>
</tr>
</tbody>
</table>

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General Scout Technologies

- Lightweight Propulsion Components
  - Tanks
  - Filters, Regulators, Valves
  - Thrusters (Low Min Impulse Bit [mN])

- Lightweight telecomm components
  - Antennas
  - Transmitters
  - Receivers

- Minimum mass structures

- Low mass, low power, small volume instruments
Scout Orbiter Technologies

- Minimum mass Electra
- High capacity, low mass, on-board storage (mass memory)
- Low mass Mars-Earth antennas (deployable?)
- High power, low mass Mars-Earth transmitter
- Cross-link (receive only?) capability

Driver for orbiters is always data to Earth capability!
Scout Near-Surface / Surface Technologies

- Small, robust Entry/Descent systems (delivered surface payload varies from 5 - 150 kg)
- Precise control of entry corridor (similar to MSL)
- Entry/Descent Critical Event Comm
- Accurate delivery to atm interface (opnav, adv radio nav techniques)
- Autonomy --> ability to carry out mission with minimal ground interaction as time is short for small missions
Near-Surface (airplane, balloon) Technologies

- Guidance and Navigation (small, lightweight, sun sensors, horizon sensors, terrain recognition)
- Extremely lightweight telecomm (total payload may be only a few kg per probe, including instruments)
  - Antennas
  - Transmitters/Receivers
- High efficiency, light weight solar cells
- Adv structures (thin materials for balloon, light weight airfoil shapes, deployment mechanisms)
Surface Technologies

- Low temperature, long life, low mass (low power?) power sources (solar, battery, RHU, RPS)
- Precision landing, hazard tolerance (hazard avoidance?) similar to MSL, but for very much smaller probes (5 - 150 kg payload)
- Mobility (meters to kilometers)
- Deployment mechanisms (during various phases of EDL and on surface)
- Low mass (~0.1 kg?), long-life (years), low power (mW - W) power systems enabling for network mission

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Future Work

- Get AO out so schedule can proceed!!!
- Finish Analyzing Results of Studies
- Begin Preparation for Competed Scout Technologies for post-2007 Scouts
- Get 2007 Mission Selected for Flight

Mars Scouts are an Exciting Addition to the Mars Program!

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