Non-Radioisotope Power Systems for Sunless Solar System Exploration Missions

Pl: Michael Paul

The Applied Research Lab at Penn State
<table>
<thead>
<tr>
<th>Role</th>
<th>Members</th>
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<tbody>
<tr>
<td>Team Leader</td>
<td>Michael Paul, PSU</td>
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<tr>
<td>COMPASS Lab Leader</td>
<td>Steve Oleson, GRC</td>
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<tr>
<td>Science, PI</td>
<td>James Kasting (PSU), Geoff Landis, GRC</td>
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<tr>
<td>Robotic elements</td>
<td>Geoff Landis (GRC), Gary Hunter (GRC)</td>
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<tr>
<td>HERRO Venus Advisor/HERRO Venus PI</td>
<td>George Schmidt, GRC / Geoff Landis GRC</td>
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<tr>
<td>System integration / CONOPS/PEL</td>
<td>Carl Sandifer (GRC)</td>
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<td>Mission Trajectory Design</td>
<td>John Dankanich, Aerodank Inc.</td>
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<td>Guidance, navigation, and control</td>
<td>Michael Martini, QNA Corp.</td>
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<tr>
<td>Propulsion / Cryogenics</td>
<td>James Fittje, QNA Corp., David Chato, GRC</td>
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<tr>
<td>Mechanical systems</td>
<td>John Gyekenyesi, ASRC, David McCurdy, ASRC</td>
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<td>Thermal</td>
<td>Tony Colozza, QNA Corp.</td>
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<tr>
<td>Power</td>
<td>Paul Schmitz PCS, Timothy Miller (PSU)</td>
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<td>Configuration and data handling</td>
<td>Glenn Williams, GRC</td>
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<td>Communications</td>
<td>Chuck Sheehe, GRC</td>
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<td>Configuration</td>
<td>Tom Packard, QNA Corp.</td>
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<td>Cost</td>
<td>Jon Drexler</td>
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Non-Radioisotope Power Systems For Sunless Solar System Explorations on Missions

Can metal-combus/ on power systems enable mid-dura/ on explorations on missions to:

- The Aitken Basin?
- Venus?
- Titan?

A 2011 NASA Institute for Advanced Concepts Proposal
PI: Michael Paul (Penn State); with John Dankanich (Gray Research), James Kasing (Penn State), Geoffrey Landis (NASA GRC), Tim Miller (Penn State), and Steve Oleson (NASA GRC)
238Pu
Li + SF₆
Al + H₂O
Mg + CO₂
Li + CO$_2$
120
200 kg
850 kg
56 GPHS
ALIVE!
Advanced Long-life Lander
Investigating the Venus Environment
ALIVE Science Goals

• Atmospheric Structure Investigation (ASI) – Starting at 90 km altitude; ten 12-bit measurements every 10m for a total of 1.1 Mbits of data, compressed at 10:1
• Neutral Mass Spectrometer (NMS) – Starting at 30 km; 300 measurements for a total 1.8 Mbits of total data
• Tunable Laser Spectrometer (TLS) – Starting at 30 km altitude, 300 measurements. Expected data volume: 3.6 Mbits
• Descent Imager – Used during the last 10 km of descent; 20 images; 96 Mbits (LOCO compressed)
• Raman/Laser Induced Breakdown Spectroscopy (LIBS) – Steerable, targets chosen by science team after landing; 5.2 Mbits per sample; 12 samples; Expected data volume: 62.4 Mbits
• Context Imager – 12 images at 20 Mbits each for a total of 220 Mbits; taken of targets for Raman LIBS
• Panoramic Camera – Two eight-frame panoramas for a total of 308 Mbits
• Meteorology Data (ASI) – Pressure, temperature, wind speed, sound speed; Operating at 1 bps for the duration of the science periods (27.6 hrs) for a total of 100 kbits
Thank you!

Questions?