NAC HEO Committee Members

- Ms. Bartell, Shannon
- Mr. Bejmuk, Bohdan, Co-Chair
- Mr. Bowersox, Ken, Chair
- Ms. Budden, Nancy Ann
- Dr. Chiao, Leroy
- Dr. Condon, Stephen "Pat"
- Mr. Cuzzupoli, Joseph W.
- Mr. Holloway, Tommy – did not attend.
- Mr. Kohrs, Richard
- Dr. Longenecker, David E.
- Mr. Lopez-Alegria, Michael (New Member)
- Mr. Malow, Richard N.
- Mr. Odom, Jim (James) – did not attend
- Mr. Sieck, Robert
- Mr. Voss, James (New Member)
NAC HEO Agenda – Monday, Dec. 9, 2013

NAC HEO Committee Meeting

Monday, December 9, 2013

Opening Remarks
Mr. Ken Bowersox, NAC HEO Chair & Dr. Bette Siegel, Chair & Executive Secretary NAC HEO Committee

Status of Human Exploration and Operations
Mr. William Gerstenmaier
Associate Administrator
HEOMD, NASA HQ

Status of Commercial Spaceflight
Mr. Phil McAlister
Director, Commercial Spaceflight Development Division, HEOMD
NASA HQ

Status of Exploration Systems Development
Mr. Daniel Dumbacher
Deputy Associate Administrator for Exploration Systems & Development, HEOMD, NASA HQ

ADJOURN
NAC HEO Committee Meeting

December 10, 2013

Opening Remarks
Mr. Ken Bowersox, NAC HEO Chair & Dr. Bette Siegel, Chair & Executive Secretary NAC HEO Committee

Update on the Capability Driven Framework & Status of Advanced Exploration Systems
Mr. Jason Crusan
Director, Advanced Exploration Systems Division, HEOMD, NASA HQ

Status of International Space Station
Mr. Sam Scimemi
Director, International Space Station, HEOMD, NASA HQ

Public comments and input

Committee Discussion and Deliberation

ADJOURN
Areas of Discussion

• Ways to develop understanding, support, and excitement for NASA’s human exploration mission
• Integration of HEO programs – across directorates, missions, vehicles and systems
• Management of programs with constantly uncertain funding
• Importance of setting an official target date for ending NASA’s support of ISS, and planning for what comes after.
• Topics for future discussion and recommendations for the council.
Chart from Advanced Exploration Systems
Presented by Jason Crusan
December 10, 2013
Capability Driven Framework

Incremental steps to steadily build, test, refine, and qualify capabilities that lead to affordable flight elements and a deep space capability.
Alignment Strategy for a Mission

**Asteroid Identify Segment**
- 2013: SST
- 2014: NEO WISE
- 2015: Enhanced assets & Initial candidates for further development
- 2016: Potential GEO-hosted payload detection
- 2017: Final target selection

**Asteroid Redirect Robotic Mission**

**Asteroid Redirect Crewed Mission**
- 2013: First flight of Orion
- 2016: EM-1: Un-crewed Orion test beyond the Moon
- 2018: Mission launch & SEP demo
- 2019: Asteroid rendezvous & capture
- 2020: Asteroid maneuver to lunar vicinity
- 2021: EM-2: Crew on Orion beyond the Moon (to asteroid depending upon timeline of asteroid redirect)
- 2022: Enhanced assets & Initial candidates for further development
- 2023: Final target selection
Chart from Exploration Systems Division
Presented by Dan Dumbacher
December 9, 2013
# ESD Summary Schedule

## Element

<table>
<thead>
<tr>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
<th>FY18</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HEO / ESD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-SRR ▼</td>
<td>C-SRR APMC ▼</td>
<td>EFT-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCR 12/5</td>
<td>SRR/SDR</td>
<td>PDR</td>
<td>CDR</td>
<td>CDR</td>
<td>DCR</td>
<td>EM-1 H/W</td>
<td></td>
</tr>
<tr>
<td><strong>SLS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASM 3/11</td>
<td>SRR/SDR</td>
<td>PDR</td>
<td>CDR</td>
<td>QM-1</td>
<td>QM-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/19</td>
<td>3/30</td>
<td>5/17</td>
<td></td>
<td></td>
<td></td>
<td>EM-1 H/W</td>
<td></td>
</tr>
<tr>
<td><strong>Booster</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9/14</td>
<td>BRR</td>
<td>PDR</td>
<td>CDR</td>
<td>QM-1</td>
<td>QM-2</td>
<td>DCR</td>
<td>EM-1 H/W</td>
</tr>
<tr>
<td>10/17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Production</td>
<td></td>
</tr>
<tr>
<td><strong>Core Stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade Studies Start</td>
<td>Issue JFOC @ Prime</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Production</td>
<td></td>
</tr>
<tr>
<td><strong>ICPS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTR 2</td>
<td>PTR 3</td>
<td>MPCV Synch</td>
<td>KDP-B APMC 1/30</td>
<td>DAC-1 K/O ERB</td>
<td>Delta PDR (UR)</td>
<td>CDR (UR)</td>
<td>SAR (UR)</td>
</tr>
<tr>
<td>6/18</td>
<td>11/17</td>
<td></td>
<td>1/25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Orion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTR 2</td>
<td>PTR 3</td>
<td>MPCV Synch</td>
<td>KDP-B APMC 1/30</td>
<td>DAC-1 K/O ERB</td>
<td>Delta PDR (UR)</td>
<td>CDR (UR)</td>
<td>SAR (UR)</td>
</tr>
<tr>
<td>6/18</td>
<td>11/17</td>
<td></td>
<td>1/25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flight Article</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTR 2</td>
<td>PTR 3</td>
<td>MPCV Synch</td>
<td>KDP-B APMC 1/30</td>
<td>DAC-1 K/O ERB</td>
<td>Delta PDR (UR)</td>
<td>CDR (UR)</td>
<td>SAR (UR)</td>
</tr>
<tr>
<td>6/18</td>
<td>11/17</td>
<td></td>
<td>1/25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GSDO</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCR 11/30</td>
<td>SRR/SDR</td>
<td>PDR</td>
<td>CDR</td>
<td>OPI W/C3R ORD</td>
<td>ML-VAB ORD</td>
<td>ML-PAD w/C3R ORD</td>
<td></td>
</tr>
<tr>
<td>11/30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Progress to date
- Milestones are "complete" unless noted
- EFT-1 flt h/w
- EM-1 flt h/w

For comments contact david.l.webster@nasa.gov
Charts from Advanced Exploration Systems
Presented by Jason Crusan
December 10, 2013
Six key strategic principles to provide a sustainable program:

1. Executable with current *budget with modest increases*

2. Application of *high Technology Readiness Level* (TRL) technologies for near term, while focusing research on technologies to address challenges of future missions

3. *Near-term mission* opportunities with a defined cadence of compelling missions providing for an incremental buildup of capabilities for more complex missions over time

4. Opportunities for *US commercial business* to further enhance the experience and business base learned from the ISS logistics and crew market

5. *Multi-use* space infrastructure

6. Significant *international and commercial participation*, leveraging current International Space Station partnerships and commercial companies
HEO Time Phased Capability Prioritization

Mission Classes and Design Reference Missions

Near Term Strategy

HEO MD Objectives and Strategic Knowledge Gaps

Capabilities

Information Captured for Sensitivity Analysis

Investment Priorities to HEOMD Divisions and Programs

Allows:
- Sensitivity analysis on objective satisfaction (asteroid mission, ISS testing, etc.)
- Make / buy / partner options
- Strategic considerations
- Portfolio recommendation
- Data required PPBE for programmatic decision / implementation processes

Partnerships (Commercial, International via GER)
Charts from International Space Station
Presented by Sam Scimemi
December 10, 2013
International Space Station is essential to meeting the Nation’s goals in space

- Returning benefits to humanity through research
- Enabling a self-sustaining commercial LEO market
- Laying the foundation for long-duration spaceflight beyond LEO
- Leading the world in an exploration partnership
Station is on the critical path to getting humans to Mars

In-space segment
- Life support
- Spacecraft reliability, supportability and maintainability
- Human performance for long durations in deep space
- Transportation system performance

Access to the surface: landing on, operating on, and then ascending from Mars
**Recommendation:** NAC endorses immediate action to officially extend NASA ISS support beyond 2020.

**MAJOR REASONS FOR PROPOSING THE RECOMMENDATION:**

We recommend an extension of NASA support for the ISS past 2020. Current analysis shows that ISS operations and utilization beyond 2020 is feasible.

- Returning benefits to humanity through research:
  - medical technologies and medicine, earth and space sciences, physical and biomedical research, National Laboratory/CASIS;
- Facilitating National Security:
  - Remote sensing, orbital intelligence and situational awareness;
- Enabling a self-sustaining commercial market in LEO:
  - pharmaceutical, materials, crew and cargo transportation industries
- Laying the foundation for long-duration spaceflight beyond LEO:
  - human health and performance, spacecraft technologies and systems, life support, operations;
  - Leading the world in an international exploration partnership and cooperation:
    - national security, foreign policy instrument, national leadership objectives.

**CONSEQUENCES OF NO ACTION ON THE PROPOSED RECOMMENDATION:** Permanent loss of U.S. leadership position in spaceflight, medical and pharmaceutical research, cost effective research and technology development in basic research and earth and space science; inability to expand long duration human spaceflight beyond LEO and onto Mars; crippling the development of commercial LEO market.