Data Review

• Reviewed available data on recent/near-term missions
  – Focused on missions going to high profile destinations, coming in contact with body surfaces and/or returning samples

• Of the missions of interest, able to identify costs specified as for planetary protection for 6 missions
  – Primarily bookkept as part of Mission Systems Engineering
  – Likely not the extent of the total cost as there are likely additional costs at lower hardware/engineering levels

<table>
<thead>
<tr>
<th>Mission</th>
<th>Categorization*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europa Clipper</td>
<td>III (TBD)</td>
</tr>
<tr>
<td>InSight</td>
<td>IVa</td>
</tr>
<tr>
<td>Mars 2020</td>
<td>V (restricted)</td>
</tr>
<tr>
<td>Mars Exploration Rovers</td>
<td>IVa</td>
</tr>
<tr>
<td>Mars Science Laboratory</td>
<td>IVa</td>
</tr>
<tr>
<td>Phoenix</td>
<td>IVc</td>
</tr>
</tbody>
</table>

• Additional research and discussion with subject matter experts provided data for comparison

*https://planetaryprotection.nasa.gov/missions; as of June 26, 2017
Cost for Planetary Protection

*Planetary Protection: All of the Planets, All of the Time; February 9, 2004
** June 2016 NASA Advisory Council Planetary Subcommittee (June 1-2, 2016), Meeting Minutes, pg. 10
General Observations

• Mission impact is highly dependent on the planetary protection category
  – Category 1 and 2 requirements have minimal impact on program or hardware design
  – Category 3 and 4 level programs will affect the choice of landing site, materials selection used for hardware, interface control, cleaning methods, handling/access restrictions and facilities
  – Additionally, for sample return missions (Category 5), a method that isolates the sample to prevent biological contamination of Earth is required

• Planetary protection work needs to be planned as part of every step of the design, integration and test just like any other part of the hardware design and construction
  – Need to get early advice from the PPO and then engineer the system with Planetary Protection in mind
  – Well thought out Planetary Protection program that is deeply integrated with the systems and I&T tasks, dealing with ICDs, testing, bagging (bio-barriers), separate bakes, etc are manageable and do not need to spiral out of control