



NASA Office of Planetary Protection Space Science Week 2023 Updates

The National Academies of Sciences, Engineering and Medicine Committee on Planetary Protection

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N. Benardini¹, E. Seasley¹, A. Spry² and A. Baker²

¹NASA Headquarters, Washington D.C.; ²SETI, Mountain View, CA

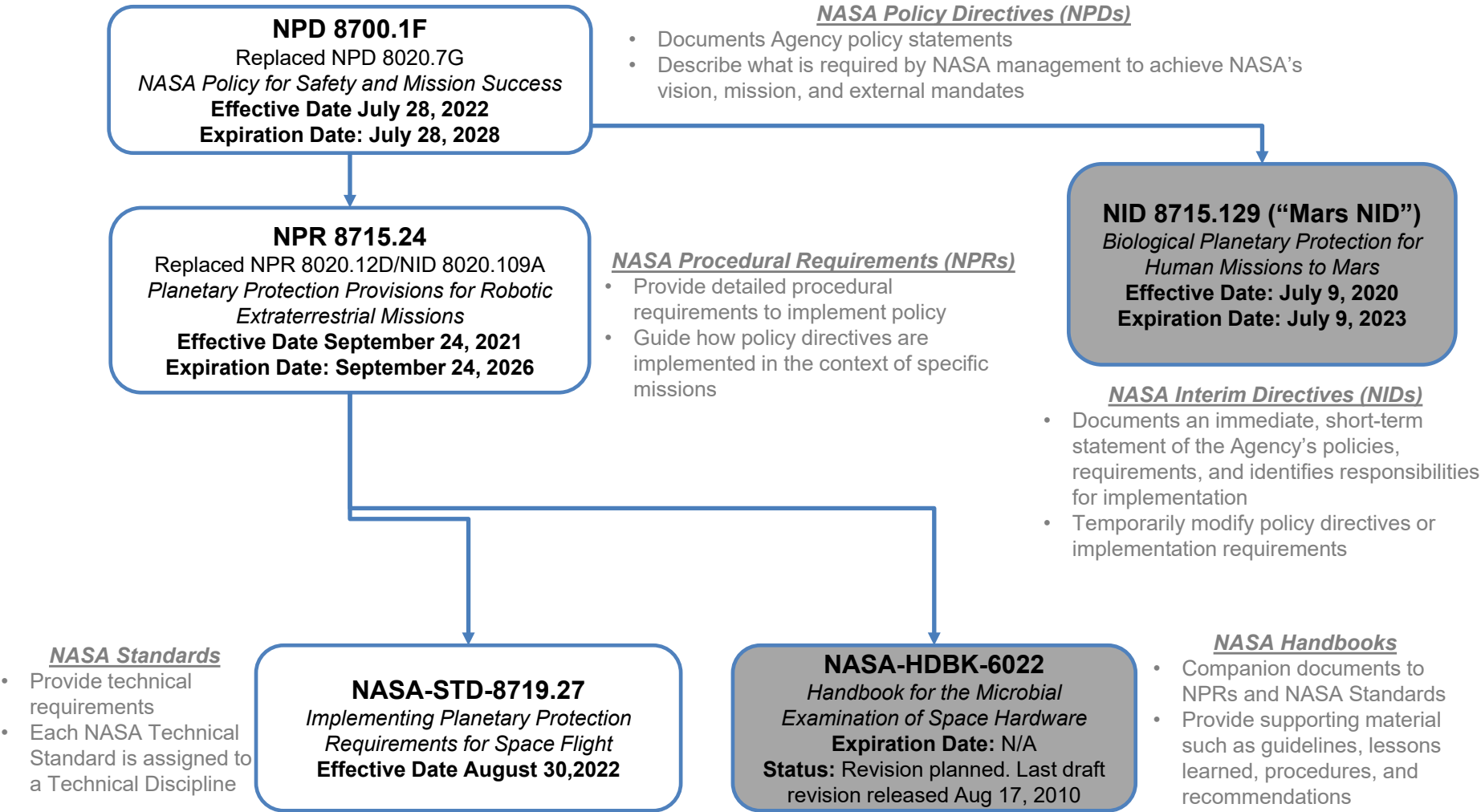
Overview of Updates

- NASA Policies, Standard, and Handbook
 - Handbook and Implementation Tool Updates
 - Crewed Knowledge Gap Workshop Path Forward
 - Opportunities Identified to Review and Consider Policy Updates
- Scientific Consensus
- Research Opportunities
 - SBIR, EPSCoR

Updates to NASA's Planetary Protection Policy Documents



Link to NASA Planetary Protection policy and guidance documents at www.sma.nasa.gov



All published documents found in NODIS: <https://nodis3.gsfc.nasa.gov/> or the OPP website: <https://sma.nasa.gov/sma-disciplines/planetary-protection#PolicyGuidance>

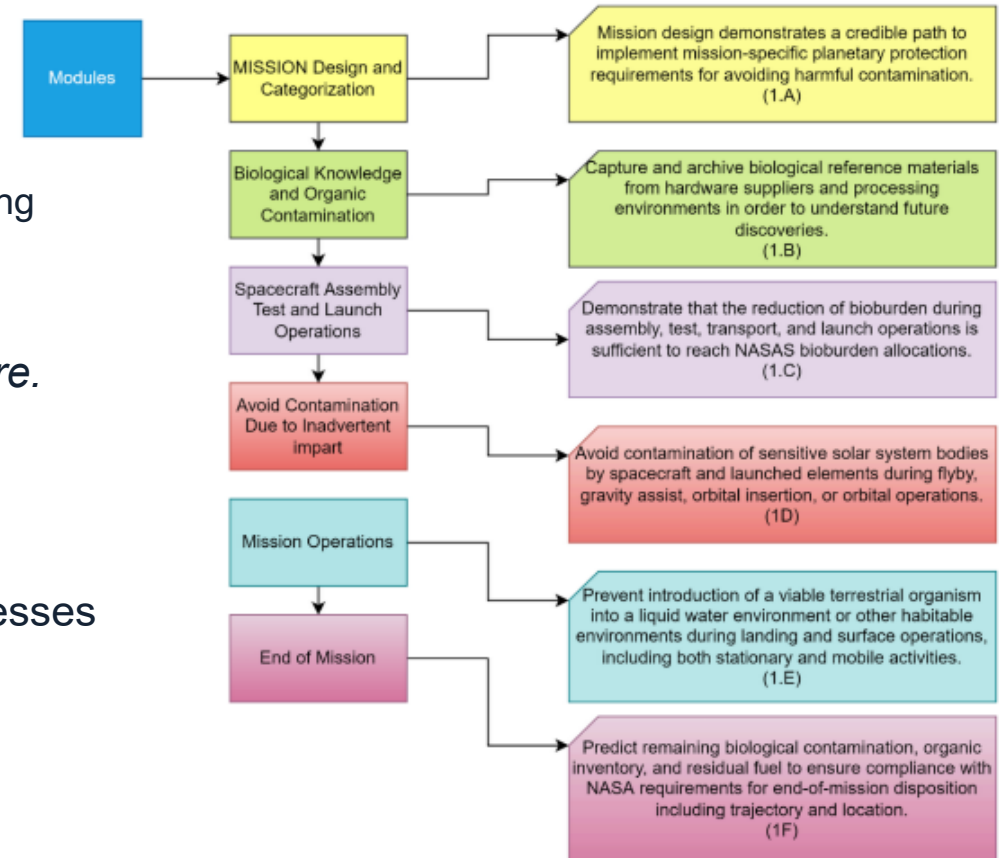
 = Documents to be updated

PP Handbook and Implementation Tools Update

- Will document additional background, guidelines, lessons learned and the “how to” processes to support mission developers
- Delivery format - online wiki format (internal) and PDF version (external)
 - Engages SMEs across the agency
 - Allows for new techniques to be leveraged at a faster cadence while maintaining appropriate review and configuration management prior to release.
- Technical updates to include:

NOTE: all technical updates in draft will leverage peer-reviewed literature.

 - Membrane filtration for bioburden assays
 - Genomic based approaches
 - Impact Avoidance
- Increased focus of Quality Assurance and Quality Control (QA/QC) processes
- In parallel, we are pushing to release PP development code to NASA’s Software Catalog:
 - FY23 – Bioburden Accounting Tool
 - FY24 – Bioburden Analysis Framework



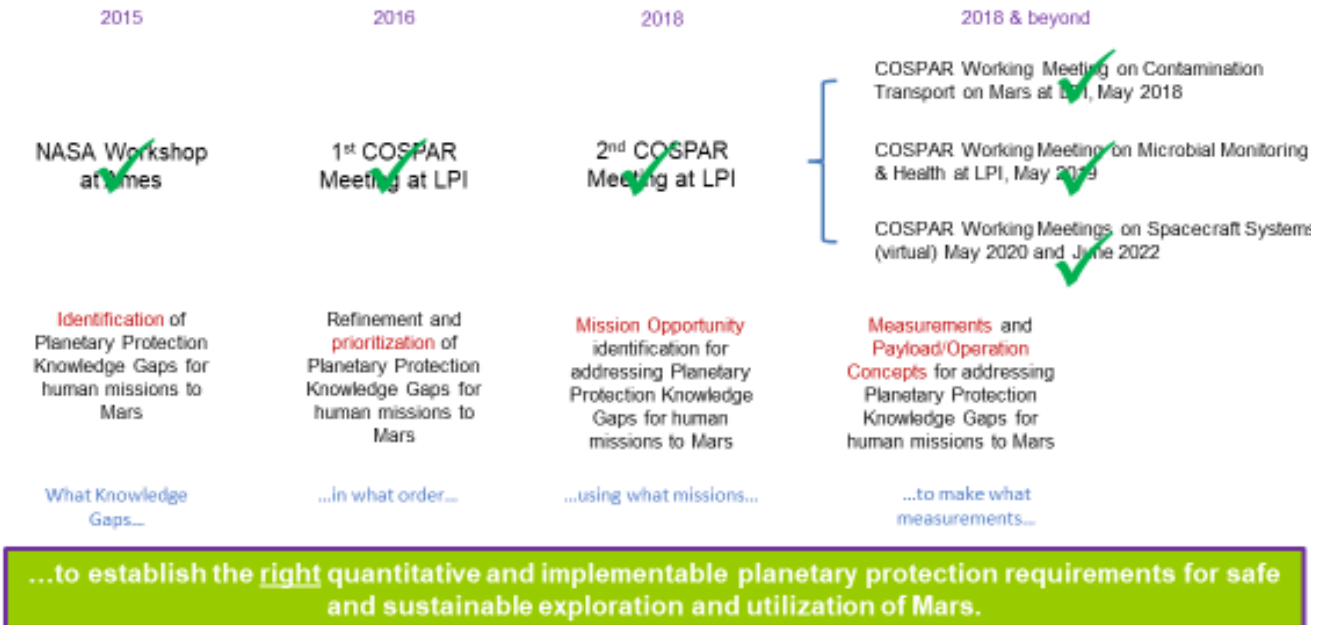
Modular strategy ensures alignment to PP Technical Standard and enables future training development

Crewed Knowledge Gap Path Forward to Updating Policy

- Knowledge Gap Workshops (2015-2022) were NASA and NASA/COSPAR sponsored defined and focused on three topic areas:
 - natural transport of contamination on Mars;
 - microbial and human health monitoring, and;
 - technology and operations for contamination control.
- Manuscript in progress entitled, “Planetary Protection Knowledge Gap Closure Enabling Crewed Missions to Mars”
 - Objective – To summarize the current state of the art of the PP knowledge gap areas leveraging the workshop reports and updated science inputs.
- Draft path forward to be discussed at upcoming COSPAR PPP meeting in April to further coordinate activities, facilitate discussions for follow-on workshops/symposia, and international guideline updates.

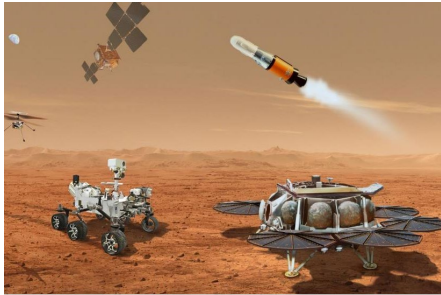


Key knowledge gaps: microbial and human health monitoring, spacecraft technology and operations, and natural transport of contamination at Mars



Opportunities Identified to Review and Consider Updates to Policy

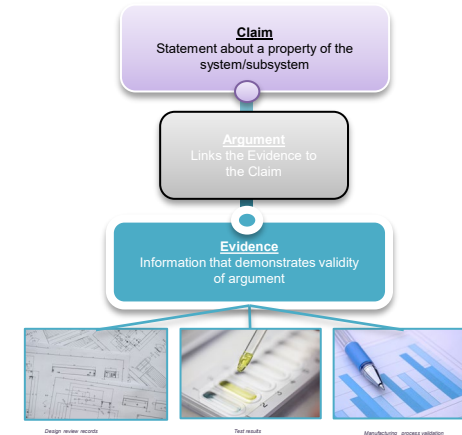
- Planetary Protection policy should leverage the latest scientific consensus to build a sound technical science and engineering rational for each requirements.
- Requirements should be periodically reviewed.
- Areas identified for future work:



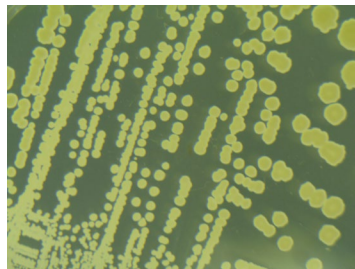
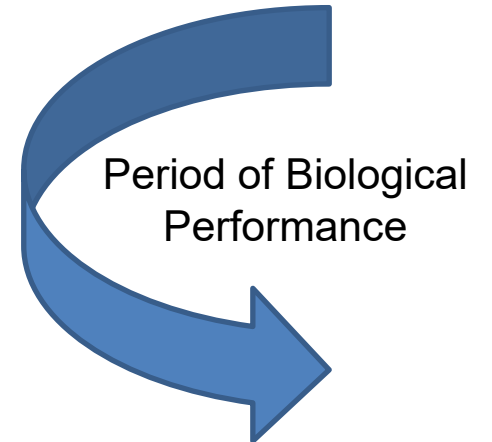
Back PP Documentation



Crewed NPR, STD



Assurance Case Guidance



NASA Standard Assay → Industrial Standard



Receiving Facility



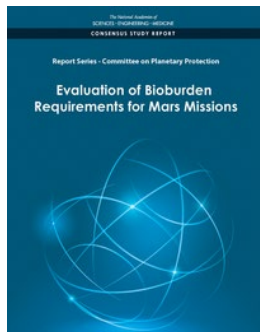
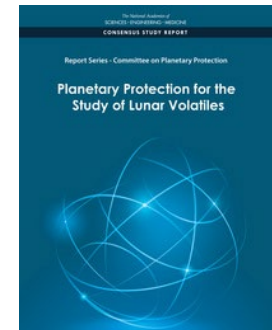
Organic Inventory/ Archiving

Scientific Consensus in Practice

- Scientific consensus mentioned throughout NPR 8715.24 and NASA-STD 8719.27, but what does this mean in practice?
- Need to establish a process in which missions can leverage scientific consensus throughout the project life cycle and/or the discipline can update policy and broad scale approaches.

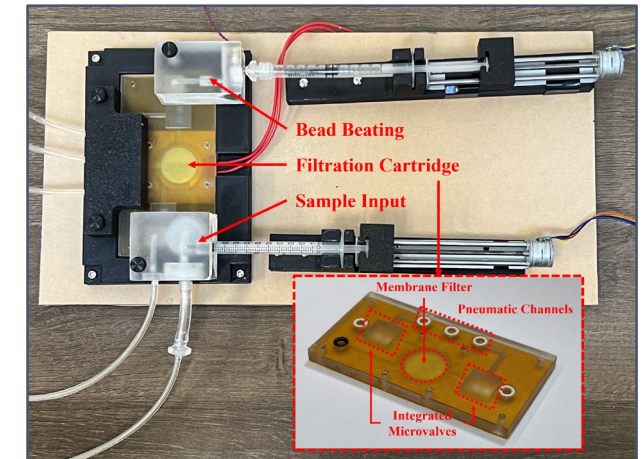
	Small	Medium	Large
Engineering	Table top review	Tiger Team	Standing Review Board
OSMA / OPP	Subject Matter Experts	Non-advocate review board	CoPP

- Subject Matter Expert
 - Peer-reviewed manuscript – adoption of membrane filtration to assess bioburden on spacecraft surfaces
- Non-Advocate Review Board (ad hoc)
 - NASA Office of Chief Scientist independent review – Ganymede Utilization for End of Mission Disposal (2021), Updated Review of Titan Science (2022) and Feasibility of leveraging ultraviolet radiation as an alternative approach to bioburden control and management for PP sensitive missions (Present topic)
- CoPP – Study of Lunar Volatiles, Evaluation of Biobu



PP Research Opportunities

- PP Research and Technology Development Steering Group makes investment recommendations and set priorities for PP R&TD.
- Coordination of activities include:
 - SMD's **Research Opportunities in Space and Earth Science Planetary Protection Research (ROSES-PPR)** program (Becky McCauley Rench, ROSES-PPR Manager)
 - STMD's **Small Business Innovative Research (SBIR)** program Sub-topic 13.04 Contamination Control and Planetary Protection (JPL/GSFC sub-topic technical managers)
 - FF21 Phase 2 – 1 award
 - FY22 Phase 2 – 1 award
 - FY22 Phase 1 – >10 proposals, 2 awards
 - FY23 Phase 2 – multiple proposals under current review and recommendation
 - FY23 Phase 1 – review and recommendation kickoff has begun with another strong year of proposals
 - STEM Engagement's **Established Program to Stimulate Competitive Research (EPSCoR) program** (OSMA/PPO technical manager)
 - FY22 3 awards funded (LSU, UI, Nevada)
 - FY23 proposal review and recommendation underway



SBIR – Integrated Microbial Detection Instrument to concentrate large volume samples, purify nucleic acids and perform qPCR detection. Credit: HJ Science & Technology, Inc.



EVA swab hardware being readied for flight. Credit – NASA.

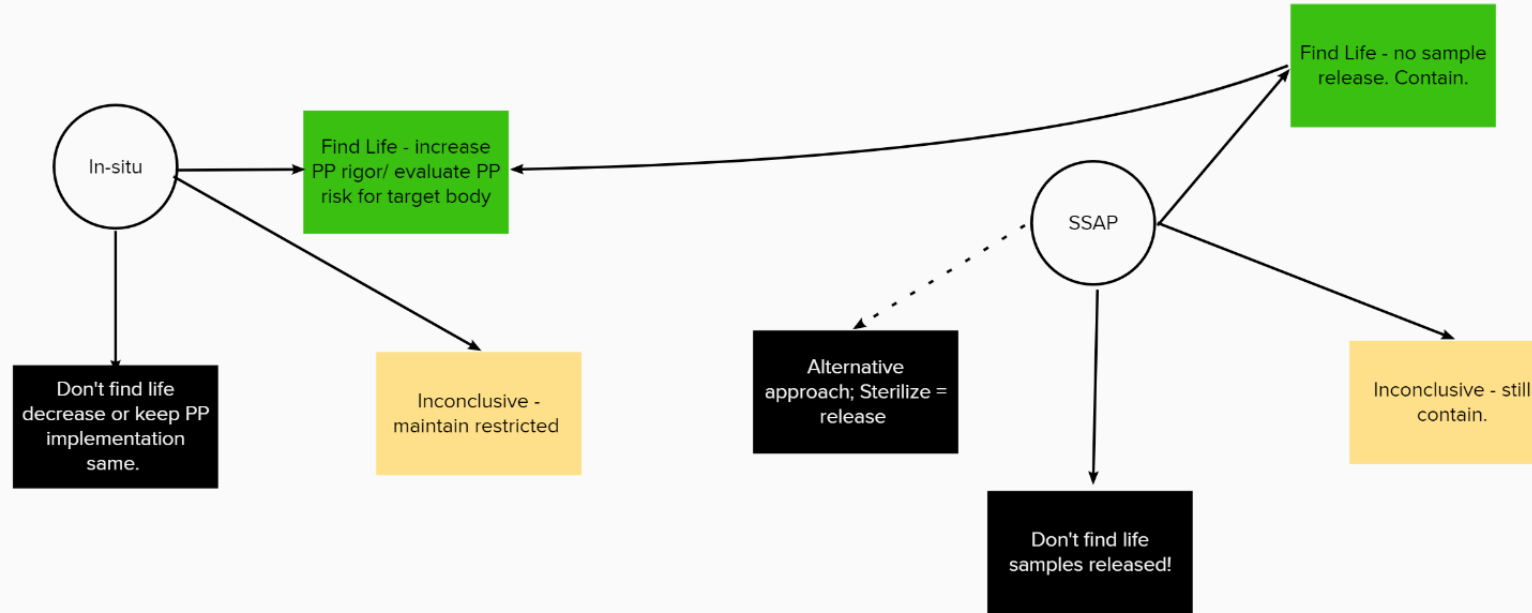
BACKUP

- Agency Policy Management
 - “Requirements” language follows system engineering language: “shall” is the requirement whereas “NOTES” provide additional context for consideration for the missions.
 - NASA Online Directives Information System (NODIS) process followed for release
 - Comprehensive 1 year review across NASA, reviewer participation process is extensive (MDs, centers) and a well established process (ultimate peer-review) within programmatic, technical, legal domains.
 - NPR 8715.24 and NASA STD 8719.27 had a widespread and balanced participation with 180 and 775 comments, respectively. Notably, 8020.12C/D underwent the same process but they had a much more limited interest and participation.
- PP Discipline Management
 - Old NPR 8020.12 (superseded) was parsed into two documents by deliberately separating programmatic from technical requirements to align with NASA process.
 - New NPR and STD documents are complementary in the PP process – not stand alone documents. Heavy reliance on other vehicles for communicating PP such as the handbook, training materials, communication forums, collaboration with OPP, etc.
 - NASA PP policy is informed by COSPAR policy and guidelines, advice from NASEM, and other expert advice.
 - Roles and responsibilities culture shift - where missions identify the relevant requirements, develop responsive implementation, and responsible for the execution and reporting to NASA.
 - NASA Standard Addresses both robotic and crewed missions
 - The NASA standard is one accepted standard and others may be chosen as appropriate (ISO, ECSS, etc.)

Life Detection and Planetary Protection – A Notional Construct

PP is a **stakeholder** in the outcome of scientific consensus of results, but **should NOT define “how-to” or prescriptive parameters.**

Life Detection Roadmap



Resources Available Through The OPP Website



Articles



[What Are Spores?](#)



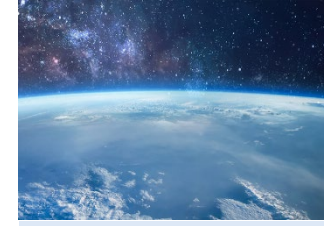
[How to Build a Clean
Spacecraft](#)



[Cleanroom Gowning
or How to Dress in
the Cleanroom](#)

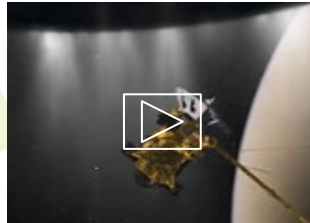


[Ground Support
Equipment](#)

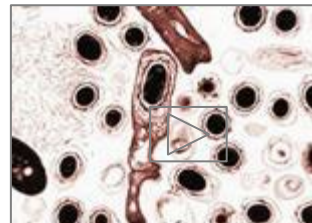


[Protecting the Planet:
Planetary Protection vs.
Planetary Defense](#)

Videos



[Planetary Protection:
An Introduction](#)



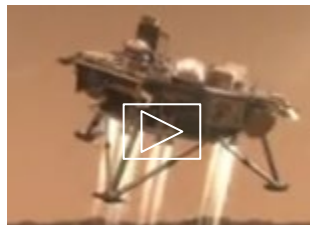
[Just How Small is a
Spore?](#)



[Forward and Backward
PP Overview](#)



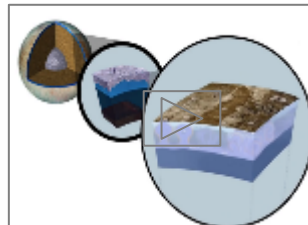
[Behind the Spacecraft
Perseverance](#)



[Mission Design and PP
Categorization](#)



[Probability of Impact](#)



[Ocean Worlds](#)



[End of Mission
Disposition](#)



<https://sma.nasa.gov/sma-disciplines/planetary-protection/explore>