

Status of Gateway Power and Propulsion Element (PPE)

National Aeronautics and
Space Administration



NASA ADVISORY COUNCIL

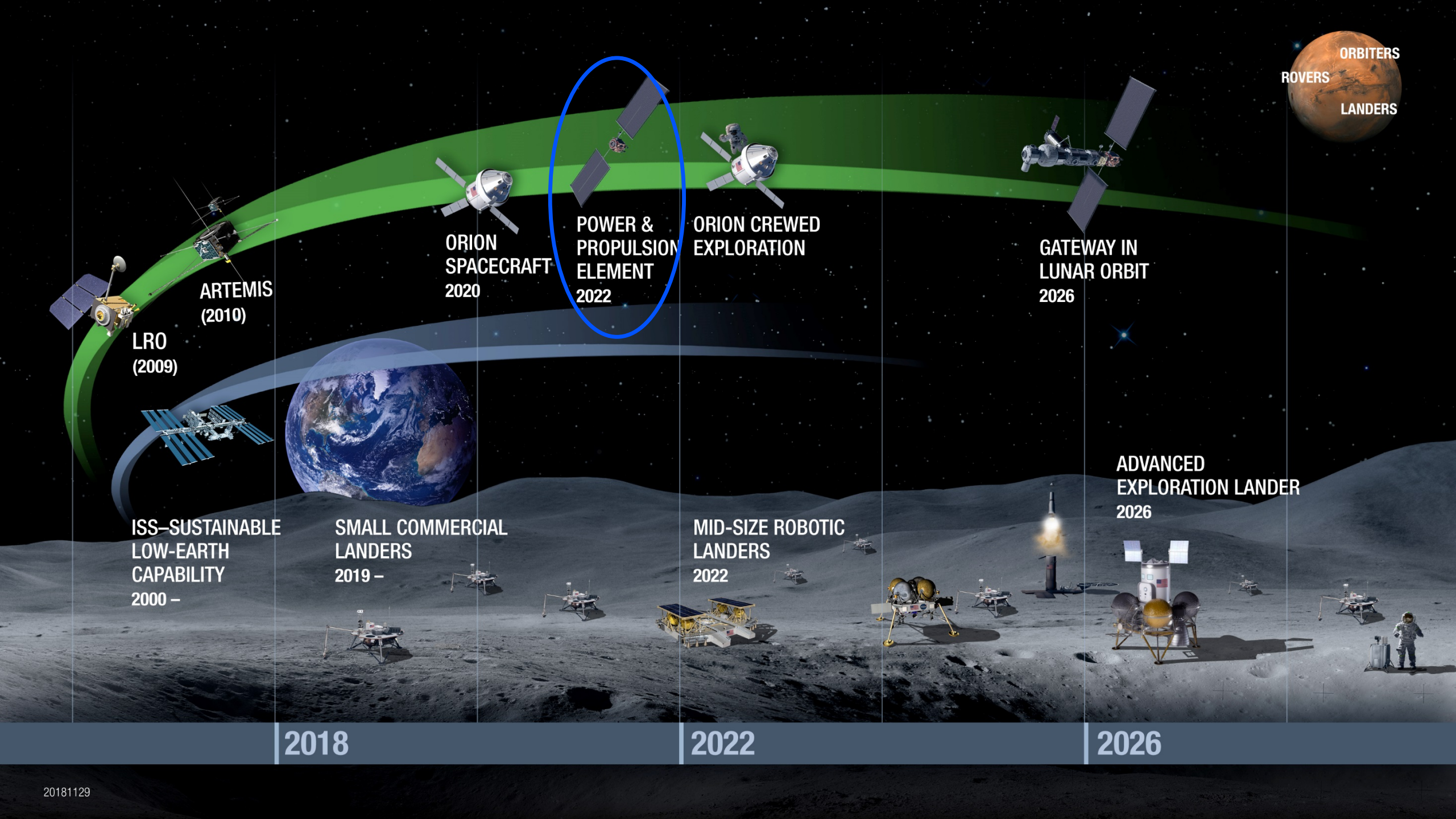
Human Exploration and Operations Committee

Michele Gates

Program Director, Power and Propulsion Element
NASA HQ

07 December 2018





LRO
(2009)

ARTEMIS
(2010)

ISS—SUSTAINABLE
LOW-EARTH
CAPABILITY
2000 –

SMALL COMMERCIAL
LANDERS
2019 –

ORION
SPACECRAFT
2020

POWER &
PROPULSION
ELEMENT
2022

ORION CREWED
EXPLORATION

MID-SIZE ROBOTIC
LANDERS
2022

GATEWAY IN
LUNAR ORBIT
2026

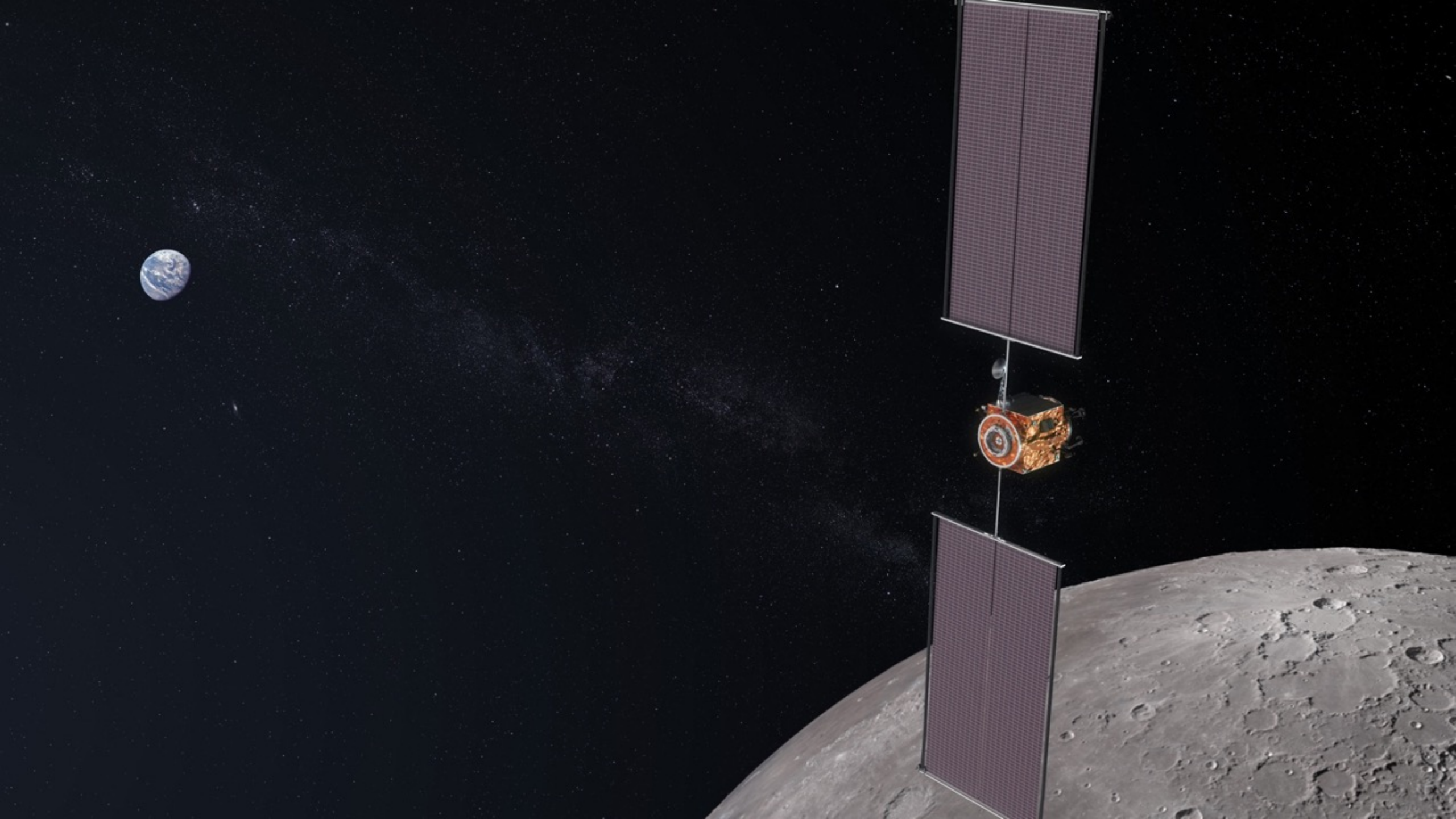
ADVANCED
EXPLORATION LANDER
2026

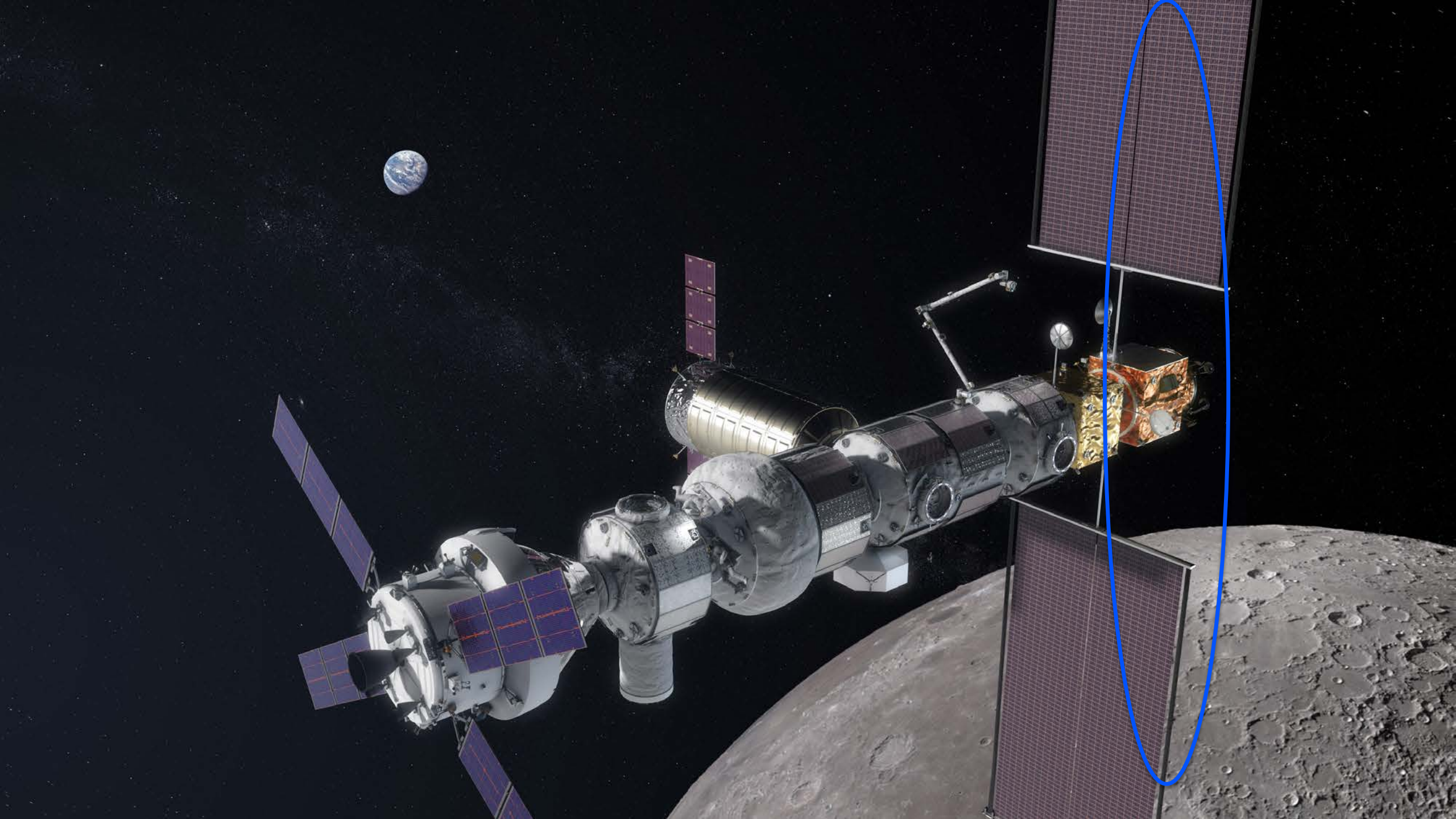
ORBITERS
ROVERS
LANDERS

2018

2022

2026

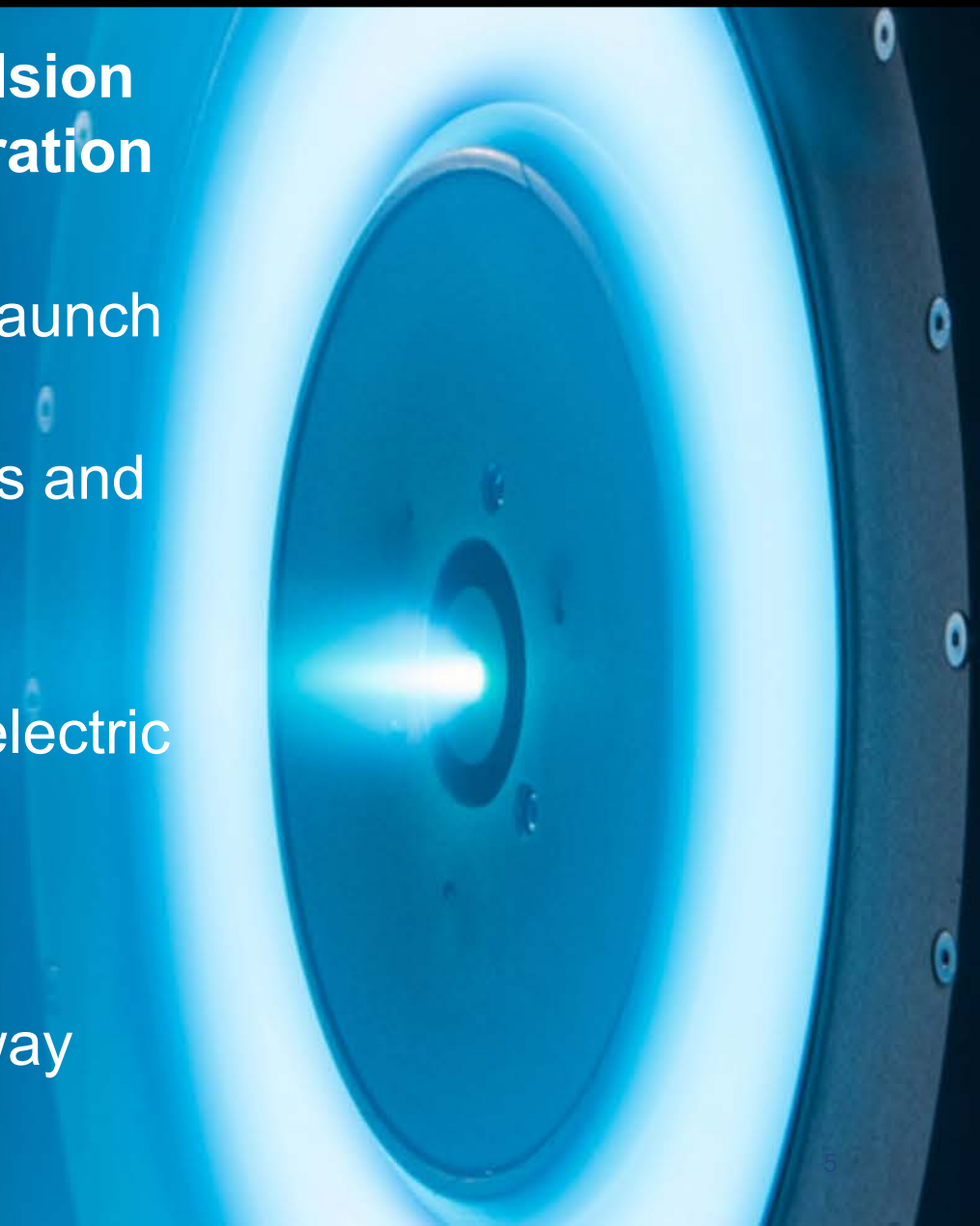






Approach to Power and Propulsion Element Development

- **PPE leverages advanced solar electric propulsion (SEP) technology development and demonstration formulation:**
 - First Gateway element capability targeted for launch readiness in 2022
 - Leverage with U.S. industry current capabilities and future plans for future use of SEP
 - Developed through public-private partnership
 - Spaceflight demonstration of advanced solar electric propulsion spacecraft for industry and NASA objectives
 - Also provides for communications, and transportation, controls, power to future Gateway elements





- **Broad Agency Announcement for PPE [released](#); proposals were due on November 15 (note, we are in blackout)**
- **Followed RFI, studies with 5 companies solicited through BAA, sources sought, draft solicitation release & industry comment. Worked very closely with industry throughout to address their written comments and questions.**
- **PPE development and demonstration through research and development partnership with industry**
- **Partner will own PPE through up to 1 year spaceflight demonstration**
- **Includes contract option to acquire residual asset (PPE) for NASA use, after demonstration completion**
- **More than one industry partner may be selected.**
- **NASA and its PPE partner(s) will begin upon contract award, which is targeted for March 2019 (TBD).**
- **Launch date September 2022, followed by demonstration up to one year**
- **Partnership concludes 24 months after successful spaceflight demonstration if all options are executed.**

PPE NASA-Unique Spaceflight Demonstration Objectives



- **Demonstrate high-power, 50kW-class solar array and electric propulsion technology in relevant space environments**
- **Demonstrate continuous long-term electric propulsion operation sufficient to predict the xenon throughput capability and lifetime of high power systems**
- **Demonstrate the deployment and successful long-term, deep-space operation of high power solar array systems with applicability to future higher power missions**
- **Characterize in space operation of a next generation electric propulsion string**
- **Demonstrate integrated SEP end-to-end system performance in relevant space environments**
- **Observe and characterize performance of integral high-power SEP system including thrusters, arrays, bus, and payloads as they operate as an integrated system and as they respond to the natural and induced in-space environments**
- **Demonstrate extended autonomous high-power SEP operations in deep space**
- **Demonstrate a high data throughput uplink and downlink communication system**
- **Demonstrate PPE insertion into a crew-accessible Near Rectilinear Halo Orbit (NRHO)**
- **Obtain design, development, and flight demonstration data to determine acceptability of the PPE for the Gateway**





Gateway Milestones: PPE Highlights

- ✓ September 6: PPE Final Solicitation Released
- ✓ September 9: Schedule Technical Interchange Meeting (TIM) with International Partners
- ✓ September 10-14: Formulation Sync Review (FSR) Kickoff
- ✓ October 2 – 5: International Habitat Technical Interchange Meeting (TIM) @ ESTEC
- ✓ October 4: FSR Requests for Action due
- ✓ October: European Space Agency/European System Providing Refueling Infrastructure and Telecommunications (ESPRIT) Virtual TIM
- ✓ October 23: Logistics Services Sources Sought Notice Issued
- ✓ December 17: Habitation Element and Logistics Element Procurement Strategy Meetings

Looking Ahead

- Gateway program transition from formulation to center program management
- PPE Selection(s) – March 2019
- Science/Utilization Workshop – Spring 2019
- Gateway U.S. Logistics and U.S. Habitation solicitations – Spring/Summer 2019

Recent examples of PPE efforts supporting Gateway



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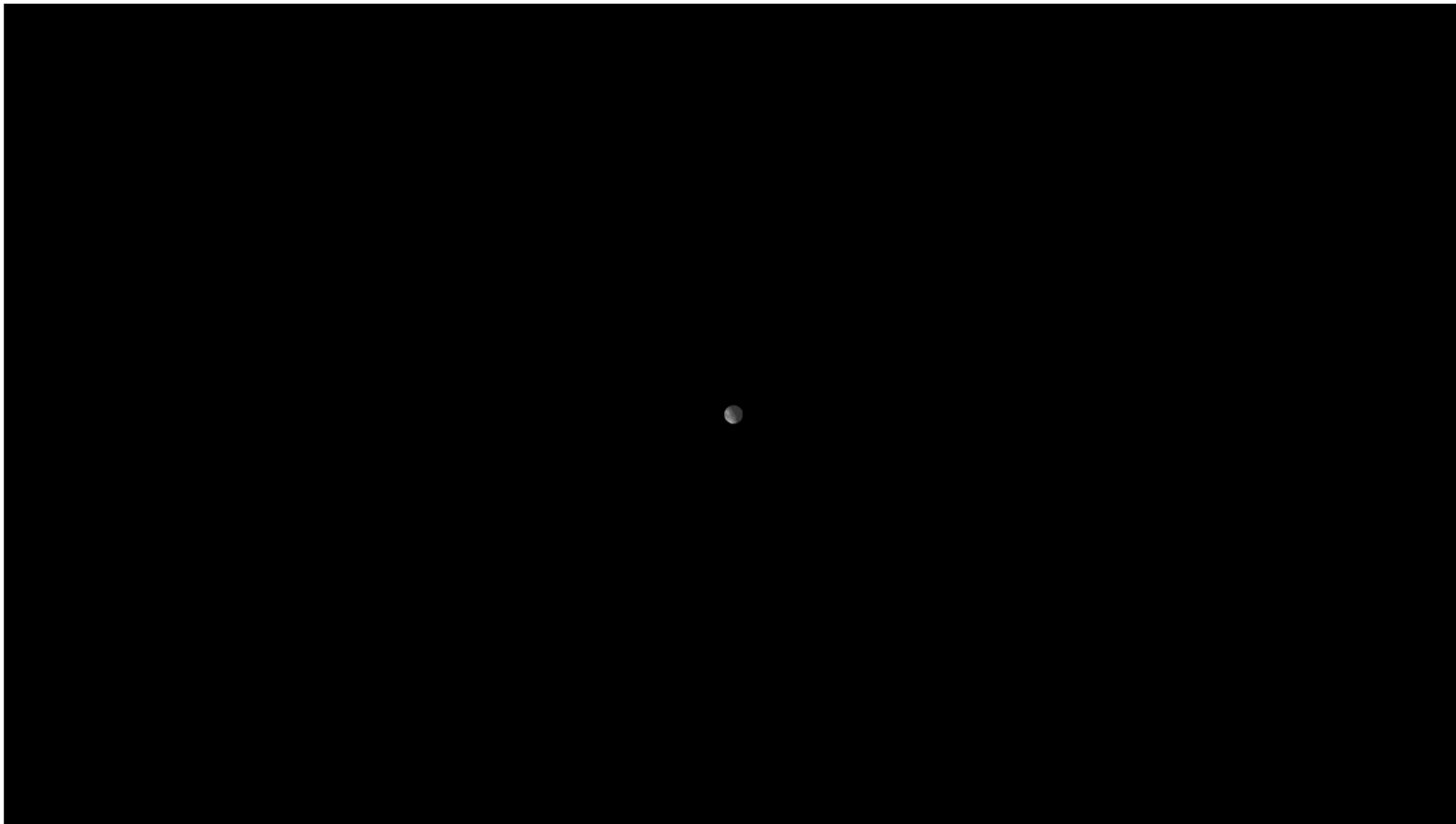
EXAMPLES:

- PPE presented initial refueling concept of operations analysis results at the TIM with Gateway and European Space Agency/European System Providing Refueling Infrastructure and Telecommunications (ESPRIT)
- PPE is supporting Gateway FSR activities and closure plans
- PPE supported NASA Docking System (NDS) Block 2 System Requirements Review (SRR)

Gateway in the Near Rectilinear Halo Orbit (NRHO)



NRHO/EML2 Halo Transfer



PPE Milestones & Events the Past Quarter



- ✓ Final BAA released for Spaceflight Demonstration of a PPE Sept 6, 2018
- ✓ PPE participation in ISS/Gateway schedule Technical Interchange Meeting (TIM) with international partners Sept 9, 2018
- ✓ Gateway Formulation Sync Review (FSR) Kickoff Sept 10-14, 2018
- ✓ AIAA Space Forum panel participation* Sept 18, 2018
- ✓ International Astronautical Congress 2018 PPE status presentation* Oct 1, 2018
- ✓ PPE participation in Gateway/ESPRIT/PPE Virtual TIM with international partners Oct 16, 2018
- ✓ PPE Leadership Retreat, Plum Brook Station Oct 24-25, 2018
- ✓ Proposals to Final PPE Solicitation due Nov 15, 2018
- ✓ NASA Day on the Hill* December 4, 2018
- PPE partnership contract selection(s) March 2019 (TBD)
- IEEE Aerospace Conference PPE studies presentation* March 2-9, 2019

**External events*

