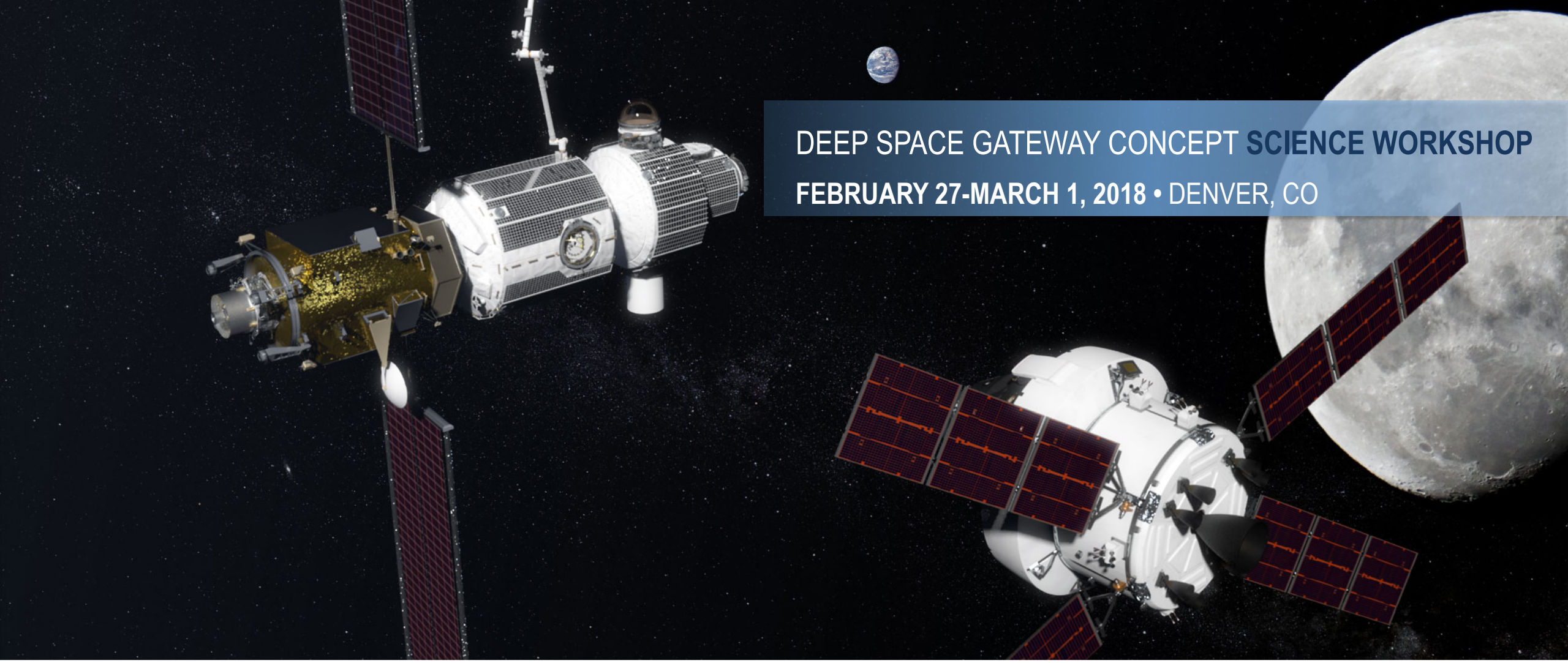

DEEP SPACE GATEWAY CONCEPT **SCIENCE WORKSHOP**

FEBRUARY 27-MARCH 1, 2018 • DENVER, CO

CISLUNAR INTERCHANGEABLE OBSERVATORY FOR HELIOPHYSICS (CLIOH): A Deep space Gateway Solar Viewing Platform for Technology Development and Research Payloads

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Instrument Function Statement and Gateway Usage

STATEMENT	INSTRUMENT/CONCEPT DETAILS
The DSG offers an incredible opportunity to test and utilize a rotating suite of Heliophysics payloads through the capability of a multi-use platform in an environment not available in low earth orbit. The facility's unique capabilities fill a cost/space-access gap in solar instrumentation use and development.	The concept centers around a **azimuthal solar-viewing pointing platform with four slots** available for interchangeable instrumentation with naturally short turn-over rates. Ideal for: • instruments providing real-time solar monitoring conditions to astronauts • experimental instrumentation being considered for free-flyer satellites • instruments requiring consumables that would otherwise be ineligible for free-flyer missions.
Unlike free-flyer satellites, the DSG is an accessible facility with the added benefit of high telemetry rates and power supply, as on the ISS. Compared to the ISS, though, the DSG has reduced contamination and vibration and provides a testable radiation environment with ample solar viewing.	Any instrument that would fit within a 10" or 18" sounding rocket skin (standard experimental design constraints) is a viable option for this configuration (e.g., coronagraphs, magnetographs, spectropolarimeters, dosimeters, etc.). Along with functioning as a solar observatory, this DSG platform would be an ideal environment for testing the radiation tolerance of instrument components.

Function

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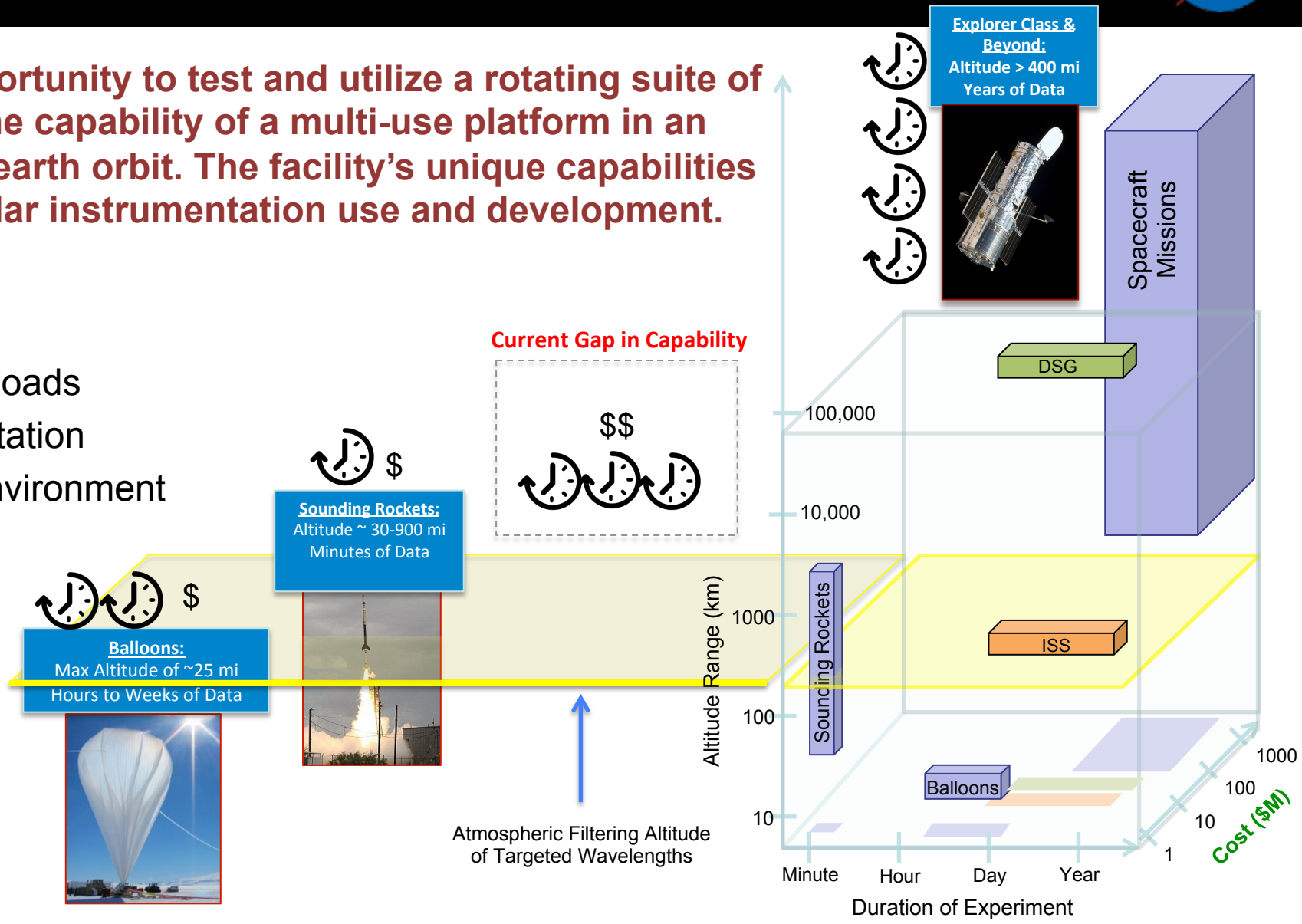
The DSG offers an incredible opportunity to test and utilize a rotating suite of Heliophysics payloads through the capability of a multi-use platform in an environment not available in low earth orbit. The facility's unique capabilities fill a cost/space-access gap in solar instrumentation use and development.

Multi-use platform

- 4 plug and play instrument slots
- Rotating suite of Heliophysics payloads
- Operations, Research, Experimentation
- TRL qualifications in a radiation environment
- Fills a gap between low cost access to space and spacecraft missions at reduced risk
- Creates a new platform for developing technology and evaluating innovative research
- Strong space weather research and operations capability



Why the DSG

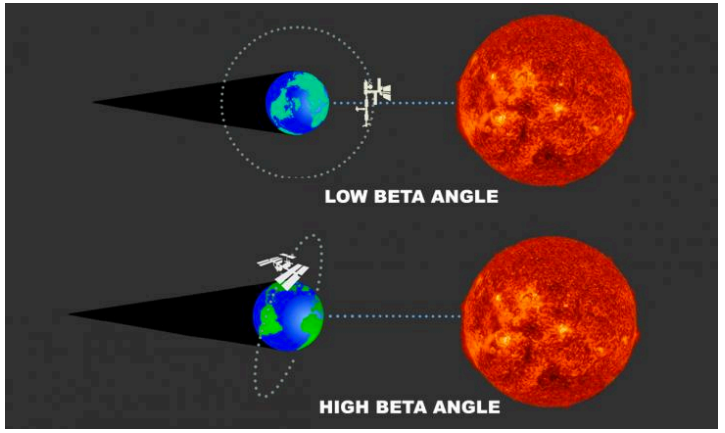
Unlike free-flyer satellites, the DSG is an accessible facility with the added benefit of high telemetry rates and power supply, as on the ISS. Compared to the ISS, though, the DSG has reduced contamination and vibration and provides a testable radiation environment with ample solar viewing.

Comparable to ISS:

- Accessibility
- High telemetry rates
- Ample power

Advantages over ISS:

- Lower contamination
- Reduced vibration
- Improved solar viewing
- Testable radiation environment



Earth obscuration
Structural obscuration

JITTER

Contamination from passing vehicles

Facility/Observatory Concept

The concept centers around an azimuthal solar-viewing pointing platform with four slots available for interchangeable instrumentation with naturally short turn-over rates. Ideal for:

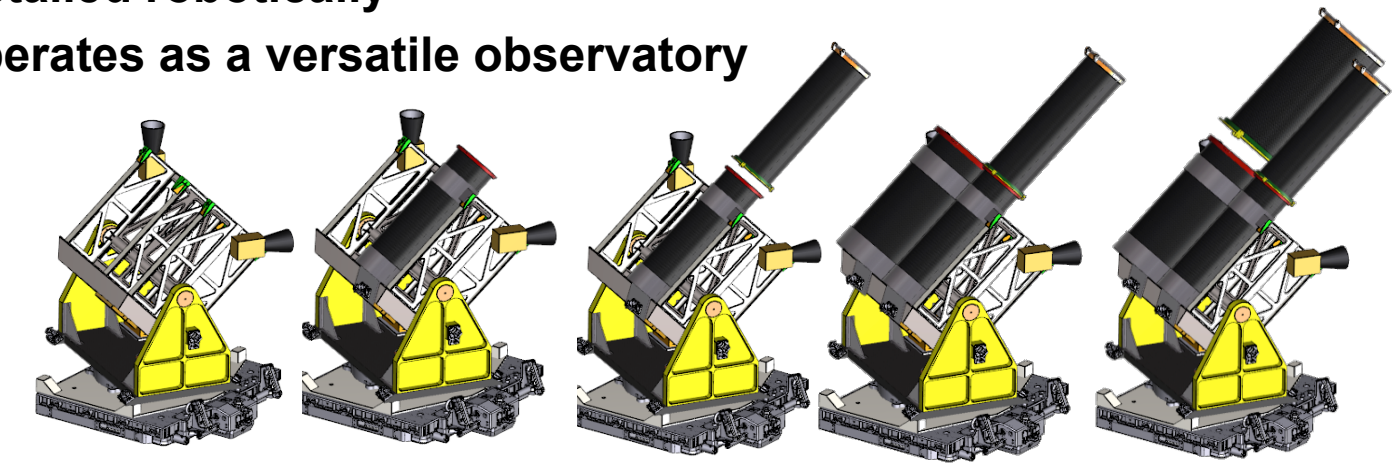
- instruments providing real-time solar monitoring conditions to astronauts
- experimental instrumentation being considered for free-flyer satellites
- instruments requiring consumables that would otherwise be ineligible for free-flyer missions.

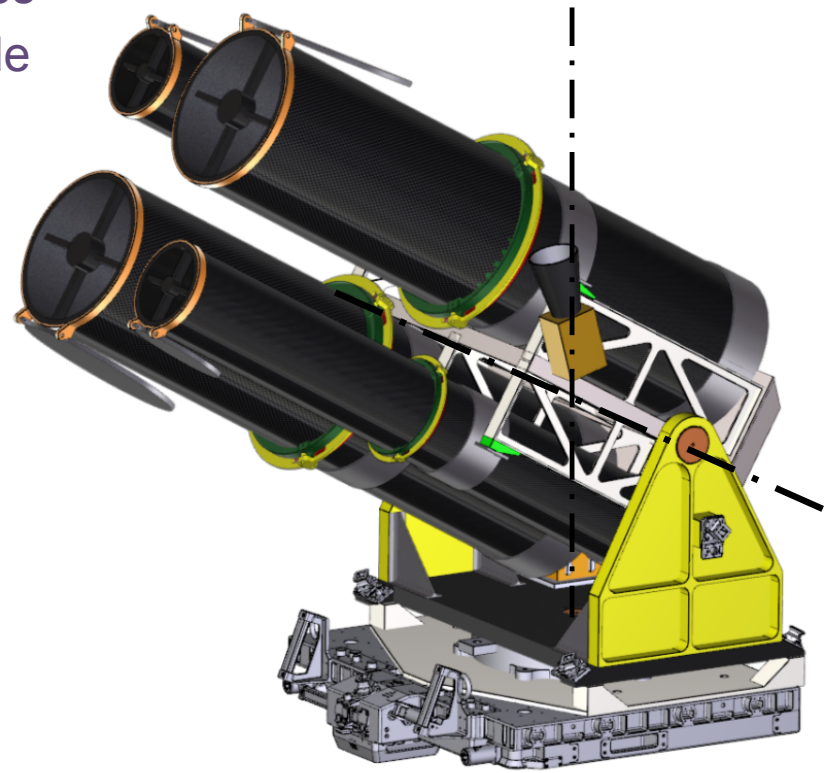
Shared resources

Primary and Secondary Payloads

Installed robotically

Operates as a versatile observatory





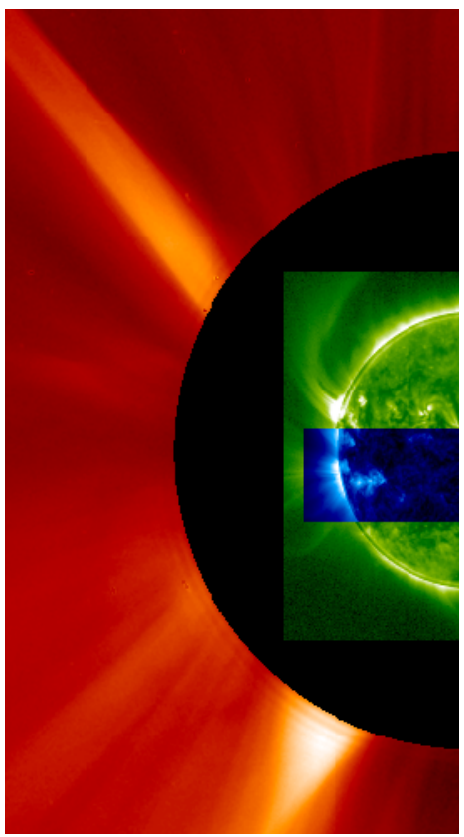
Instrument Concepts

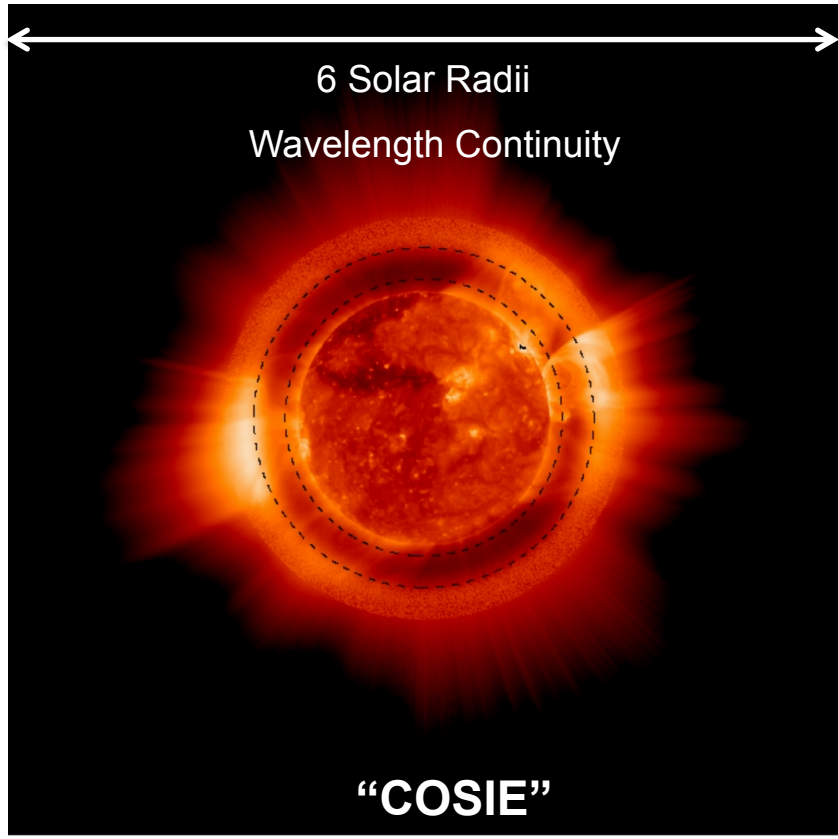
Any instrument that would fit within a 10” or 18” sounding rocket skin (standard experimental design constraints) is a viable option for this configuration. Along with functioning as a solar observatory, this DSG platform would be an ideal environment for testing the radiation tolerance of instrument components.

Suitable for remote sensing & *in situ* experiments

- Complementary Coronal Mass Ejection (CME) tracking coronagraphs (ideal)
- High resolution imagers (low jitter!)
- X-ray and Gamma-ray instruments (high duty cycle for catching flares!)
- Solar wind abundance sensors
- Magnetographs, spectropolarimeters, dosimeters…
- Low noise radiation tolerant cameras / detectors…

Domestic, international, government, private partnership opportunities





Basic Instrument Parameters

PARAMETER	INSTRUMENT ESTIMATE & ANY COMMENTS
MASS (KG)	~200 kg for the platform; ~50-100 kg per instrument (4 instruments)
VOLUME (M)	~47”x41”x78” [based on ISS Flight Releasable Attachment Mechanism footprint]
POWER (W)	120 Vdc & 28 Vdc for the platform; 224 W @ 28 Vdc for the primary instruments; 112 W @ 28 Vdc for the secondary instruments
THERMAL REQUIREMENTS	Instrument dependent; Heaters likely need to be considered for this environment (power draw); Consumables may be needed to cool some instruments
DAILY DATA VOLUME	~ 15 Mbits/second, continuous (adjustable, depends on established Concept of Operations plan)
CURRENT TRL	Variable; Primary purpose to increase TRL of experimental payloads
WAG COST & BASIS	Platform ~~$30M; Instruments highly variable: ~~$20-50M [Based on ISS design, considering rad-hardening of some components]
DURATION OF EXPERIMENT	Nominal 1-2 year cycle
OTHER PARAMETERS	External installation via robotic arm; Module ephemeris information needed to maintain pointing stability

Instrument Gateway Usage

USAGE	INSTRUMENT REQUIREMENTS & COMMENTS
ORBIT CONSIDERATIONS	Desired orbits for solar viewing: NHRO, EMDRO, or EML2 (LLO not suitable; ELO moderately suitable)
FIELD OF VIEW REQUIREMENTS	Solar pointing; Instruments may require FOVs on order of degrees
REQUIRES USE OF AIRLOCK	TBD
CREW INTERACTION REQUIRED?	Only to install with robotic arm
WILL ASTRONAUT PRESENCE BE DISRUPTIVE?	Could increase jitter and add contamination environment during docking.
DOES THE INSTRUMENT PRESENT A RISK TO THE CREW	No
OTHER CONSUMABLES REQUIRED	TBD, Instrument dependent
SPECIAL SAMPLE HANDLING REQUIREMENTS	No
NEED FOR TELEROBOTICS?	Yes (for installation)
OTHER REQUIREMNTS OF THE GATEWAY?	Possibly requires a static holding platform for transfer during installation; TBD

References and Status of Work in this Field

- **The multi-use platform was designed by NASA/MSFC based on the International Space Station configuration.**
- **A single-use version of the platform design and COSIE coronagraph are undergoing TRL development by NASA/MSFC in close partnership with the Smithsonian Astrophysical Observatory.**

Backup/Additional Information