Commercially-Enabled RapId Space Science (CERISS) & CLD

BPAC November 16, 2022

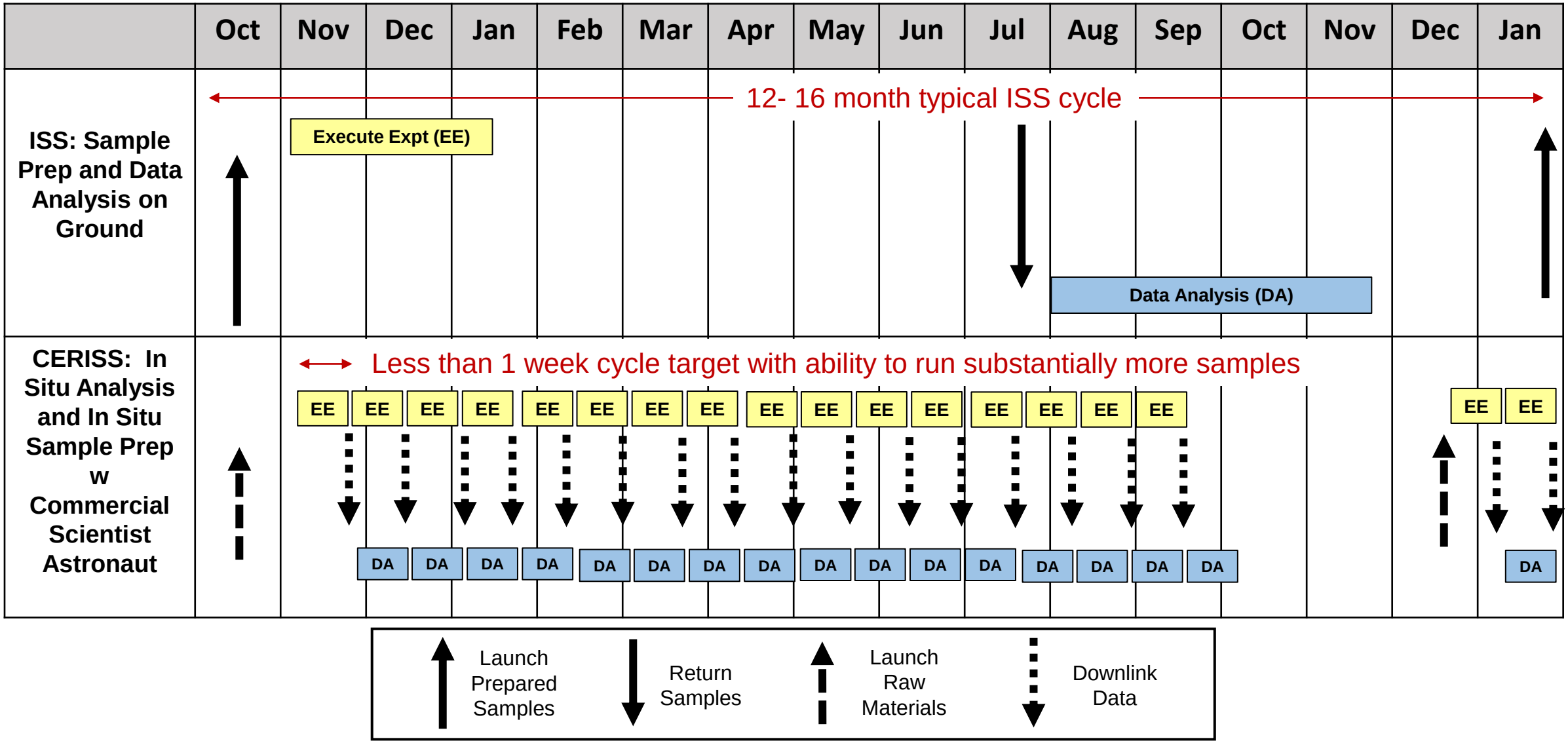
Lisa Carnell, PhD
Program Scientist for Translational Research
DeVon Griffin, PhD
Program Manager for Physical Sciences

Biological and Physical Sciences Division
NASA HQ

Commercially-Enabled RapId Space Science (CERISS) | Overview

- **Focus Area**
  - Develop transformative research capabilities with commercial space industry to dramatically increase pace of research
- **Long-Range Goals**
  - Conduct Scientist Astronaut Missions (SAMs) on the ISS and Commercial LEO Destinations
  - Develop automated hardware for experiments beyond low Earth orbit (e.g., lunar surface)
- **Motivation**
  - The pace of ISS research is too slow for OGAs and industry; it takes years to plan, develop, launch, operate, return samples and begin the cycle again.
- **Context**
  - New capabilities for platforms and payload are being developed now by commercial space in preparation for the transition from ISS in 2030
  - There are gaps in the development of capabilities for in situ analysis and in situ experiment preparation
  - Private Astronaut Missions provide a new mechanism for hyper-specialized researchers to conduct research in LEO
- **Benefits**
  - 10- to 100- fold faster pace of research for a wide range of research sponsored by BPS, NASA Human Research Program, OGAs, and industry
  - Increases demand for R&D in low Earth orbit, facilitating growth of commercial space industry

CERISS Dramatically Improves Pace of ISS Research



CERISS | Approach

- **Develop and deploy in situ analysis and in situ preparation capabilities in low Earth orbit for use by all astronaut types (NASA, PAM, SAM)**
  - Conduct gap analysis with Space Operations Mission Directorate and issue RFIs
    - RFI 1: Existing state-of-the-art capabilities, capabilities in development (open until March 2023)

      Focus: determine ***space community*** interest in developing and validating in-situ analysis capabilities, sample or experiment preparation techniques, and other research hardware for crew-tended microgravity investigations with the possibility of hardware testing occurring by crew in suborbital flights.

    - RFI 2: Scientist utilization and needs for in-situ analysis and sample preparation (opening November 2022)

      Focus: determine interest from the ***science community*** in utilization of in-situ analysis capabilities, sample or experiment preparation techniques, and other research hardware for crew-tended microgravity investigations, and interest in preliminary hardware testing occurring by crew in suborbital flights

- **Conduct TechWatch meetings**
  - Allow the space community the opportunity to meet with CERISS leadership to discuss hardware plans privately in one-on-one meetings
    - Website will open in December 2022
    - Provide a brief description of your technology, or capability, accompanied by a slide deck, manuscript, publications, or other ***non-confidential*** information of your choosing. Only NASA government officials are invited to join the TechWatch meetings and are bound by law to maintain the confidentiality of what is presented and discussed.
  - Benefits: Gain visibility for your solution, receive feedback from NASA, get insight on how your solution could fit within the CERISS initiative, better prepare you for a formal proposal submission

***Note: TechWatch submissions are not considered for potential funding**

CERISS | Approach

- **RFP: Compete contracts for the development of in situ analysis and in situ preparation capabilities based on gap analysis from RFIs**
- **ROSES:**
  - Compete research grants for using and refining capabilities
    - Ground-based
    - Commercial suborbital flight (crewed), as needed
  - Compete research grants to use capabilities in low Earth orbit operated by NASA and/or private astronauts
    - Initially on ISS, then on Commercial LEO Destinations

- **Develop plans for BPS missions building on in situ capabilities**
  - Scientist Astronaut Missions (SAM)
    - Use Private Astronaut Mission (PAM) capability to fly hyper-specialized scientist for up to 30 days to conduct fast-paced transformative research
    - Initially on ISS, then on Commercial LEO Destinations
  - Support development of automated experiments beyond low Earth orbit
    - Artemis Commercial Lunar Payload Services, Gateway, and Human Landing System
    - Deep Space Free-Flyers

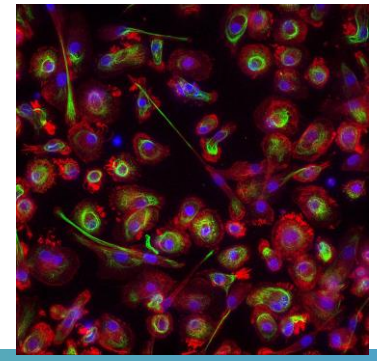
Examples:

- MicroPREP
  - Canadian lab-on-a-chip technology based on centrifugal microfluidics and uses smartphone-sized microfluidic chips.
  - From a sample of body fluids, MicroPREP technology can isolate multiple macro-molecules such as DNA, proteins or rare cells, making it possible to assess immune system state, inflammation, bone loss or radiation effects.

- MOCHII: Scanning Electron Microscope (SEM) with Energy Dispersive X-ray Spectroscopy (EDS)
  - Sent to ISS in August 2022
  - analytical tool for the morphological, textural and chemical characterization of extraterrestrial samples and impact craters produced by exposure to the space environment.

Astronaut Kayla Barron working with Mochii on the International Space Station.

- FLUMIAS: Flouroescent Microscope
  - Flown on ISS
  - Miniaturization of a fluorescence microscope capable of providing 3 dimensional imaging of biological samples



Utilization Customers

Exploration Space Development Mission Directorate (ESDMD)
- *Space Tech*

Space Operation Mission Directorate (SOMD)
- *Space Tech*

Space Technology Mission Directorate (STMD)
- *Space Tech*

Science Mission Directorate (SMD)
- *Biological & Physical Science (BPS)*
- *Earth Science Division (ESD)*
- *Heliophysics Division (HPD)*

National Laboratory (NL)

Human Health Utilization (HHU)

International Partners are also customers but not added to this presentation

BPS and CLD

- BPS participates in CLD Working Group to provide requirements/needs to conduct current and future science on CLDs
- Input for multi-user capabilities and unique facilities
- Discussions underway on how to leverage new capabilities developed by CERISS to be hosted on CLDs
- Discussions with NASA Commercial Crew Program Office on inclusion of language regarding PAM mission to conduct BPS science

Determining BPS Needs:

- **BPS is National Academy Committees (NAC) decadal-survey driven and expects significant post 2023 decadal growth over historical data**
  - LEO is critical for conducting transformational science and studies to define Artemis science