CASIS Fact Sheet: Hardware and Facilities

Biological Research:

Remove ABRS from the list of available hardware.

Add in the following:

Advanced Plant Habitat (APH): The Advanced Plant Habitat (APH) hardware is a large growth volume plant habitat, capable of hosting multi-generational studies, in which environmental variables (e.g., temperature, relative humidity, carbon dioxide level, light intensity and spectral quality) can be tracked and controlled in support of whole plant physiological testing and Bio-regenerative Life Support System investigations.

Biological Research in Canisters (BRIC) Series:

BRIC-60: The BRIC-60 mm Petri dish unit has both an upper and lower chamber and can fly as a half canister or full canister. The BRIC-60 maintains a light-tight environment inside the canister chamber. The BRIC-60 can hold a maximum of twelve 60-mm petri dishes per half canister or thirteen Teflon tubes per half canister. No power is required.

BRIC-100: BRIC-100 canisters have threaded lids on each end that allow for a breathable configuration. This configuration allows passive gas exchange of oxygen and carbon dioxide through a semi-permeable membrane. The vented BRIC-100 configuration is not a light-tight container; however, if gas exchange is not required the breathable lid (containing the semi-permeable membrane) can be replaced with a solid lid providing a sealed, closed experimental environment. The bottom and top lids of each breathable canister have twenty-five 1.0 cm holes and a Teflon membrane. Two septa located in the lid allow for gas sampling.

BRIC-100VC: BRIC-100VC is a completely sealed, anodized-aluminum cylinder providing containment and structural support of the experimental specimens. The top and bottom lids of the canister include rapid disconnect valves for purging the canister with selected gases of a defined composition. These specialized valves allow for specific atmospheric containment within the canister, providing a gaseous environment defined by the investigator. The lower portion of the canister has been equipped with sufficient storage space for autonomous temperature and relative humidity data loggers. The BRIC-100VC canister has been optimized to accommodate standard 100 mm laboratory Petri dishes or 50 mL conical tubes.

BRIC-Petri Dish Fixation Unit (PDFU): The BRIC-PDFU is designed to chemically fix (or stabilize) organisms on orbit using a minimal amount of astronaut crew time, the returned for post-flight processing. Biological specimens are placed into 60 mm Petri dishes containing agar-solidified media, although alternative approaches can be considered. Each Petri dish is then placed inside its own individually sealed PDFU that remains contained within the BRIC canisters during all phases of flight operations. The PDFUs are prepared with either one or two fluids, such as a nutrient solution and/or a chemical fixative. Crew-members perform up to two in-flight operations per PDFU to expose the biology to liquid treatments and/or chemical fixatives (e.g., glutaraldehyde, RNAlater, formaldehyde) on-orbit prior to return.

BRIC-LED (currently under development): The BRIC-LED is a biological research system that is being designed to complement the capabilities of the existing BRIC-PDFU. What differentiates this hardware from the BRIC-PDFU series is the inclusion of customizable, discrete illumination of the individual 60 mm Petri dishes. Four different wavelengths of LEDs are available for each Petri dish (default: blue, red, far-red and white). Light intensity and on/off cycling are configured as specified by the investigator. The hardware design is flexible enough to substitute LED packages that include non-default wavelengths. (Scheduled to launch to the ISS on Space-X12).

MSFI (currently under development): The multispectral fluorescence imager (MSFI) will have the capability to capture high-resolution multispectral images in a single field of view with dissection scope level

magnification. It will accommodate Petri plates, various sized multi-well culture plates, and other custom culture containers. Features will include programmable temperature and light cycles, ethylene scrubbing, CO_2 control and sufficient airflow to prevent condensation that would interfere with imaging. Specialized features include; (1) imaging the most common GFP-derived variants as well as additional fluorescent biomarkers, (2) rapid ability to switch between excitation and emission wavelengths, (3) dark-cycle IR imaging illumination, chlorophyll fluorescence, and (4) the ability to collect multispectral emission information for many spectral bands, and (5) perform full-multispectral analysis. (Scheduled to launch to the ISS on Space-X15).

KFT: Experiments performed on the International Space Station (ISS) frequently require the experimental organisms to be preserved until they can be returned to earth for analysis in the appropriate laboratory facility. The Kennedy Fixation Tube (KFT) was developed to allow astronauts to apply fixatives to biological samples without the use of a glovebox while maintaining three levels of containment. The KFT has been demonstrated to maintain its containment at ambient temperatures, 4ºC refrigeration and -100ºC freezing conditions. KFTs have been used over 200 times on-orbit with no leaks of chemical fixative.

Veggie: The Vegetable Production System (Veggie) was developed by Orbital Technologies Corp. to be a simple, easily stowed, and high growth volume yet low resource facility capable of producing fresh vegetables on the International Space Station (ISS). In addition to growing vegetables in space, Veggie can support a variety of experiments ranging from the current pillow configuration to Petri plate based experiments, designed to determine how plants respond to microgravity, provide real-time psychological benefits for the crew, and conduct outreach activities. Currently, Veggie provides the largest volume available for plant growth on the ISS.

Vencore

LIFE SCIENCES TECHNOLOGY DEVELOPMENT

Vencore is a proven information solutions, engineering, and analytics company that helps our customers solve their most complex challenges. For more than 40 years, we have designed, developed and delivered mission-critical solutions as our customers' trusted partner. The Engineering Services Contract, or ESC, provides engineering and design services to the NASA organizations engaged in development of new technologies at the Kennedy Space Center. Vencore is the ESC prime contractor, with teammates that include Stinger Ghaffarian Technologies, Sierra Lobo, Nelson Engineering, EASi, and Craig Technologies. The Vencore team designs and develops systems and equipment to be used for the processing of space launch vehicles, spacecraft, and payloads. We perform flight systems engineering for spaceflight hardware and software; develop technologies that serve NASA's mission requirements and operations needs for the future.

Our Flight Payload Support (FPS) team at Kennedy Space Center (KSC) provides engineering, development, and certification services as well as payload integration and management services to NASA and commercial customers. Our main objective is to assist principal investigators (PIs) integrate their science experiments into payload hardware for research aboard the International Space Station (ISS), commercial spacecraft, suborbital vehicles, parabolic flight aircrafts, and ground-based studies. Vencore's FPS team is AS9100 certified and a recognized implementation partner for the Center for Advancement of Science in Space (CASIS). In this work, we perform the following functions:

PRODUCT LIFECYCLE DEVELOPMENT:

- Payload hardware development from concept to fabrication and certification
- Payload software development for internal payload operations and remote monitoring and commanding capabilities
- Interface and safety requirements definition
- Certification testing to meet interface and safety requirements at KSC that include vibration, acoustic, pressure, thermal and electromagneticcompatibility testing
- AS9100 Certified

PAYLOAD MISSION SUPPORT:

- Mission operations planning
- Hardware integration with PI specimens
- Safety analyses
- Certification of Flight Readiness (CoFR) services
- Development of on-orbit procedures and astronaut training
- In-flight mission operations support to the ISS program, Mission Control Center – Houston (MCC-H @ JSC), and the Payload Operations
- Integration Center (POIC @ MSFC)
- Pre-flight scientific consultation and assistance for PIs.
- Post-flight de-integration and processing of payloads

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LIFE SCIENCES TECHNOLOGY DEVELOPMENT

OPERATIONS:

- Operate payloads and assist during on-orbit operation in the Experiments Monitoring Area (EMA) at KSC
- Conduct integrated tests and ground reference controls for flight experiments in a controlled environment simulator
- Provide secure bonded storage of flight hardware
- Use of on-site facilities for flight certification testing (such as vibration, acoustic, pressure, thermal, and electromagnetic-compatibility testing)
- Access to hardware development and integration laboratories equipped with laminar flow benches, fume hoods, and other support equipment
- NASA GeneLab data entry assistance and expertise for post-flight "-omic" data

RESEARCH AND SCIENCE SUPPORT LABS:

- Bio-molecular
- Microbiology
- Analytical Chemistry
- Organic/Inorganic Chemistry
- Biochemistry
- Air Analysis
- Advanced Bioimaging
- Microgravity Simulation Instrumentation
- Controlled Environment Chambers

ADDITIONAL SUPPORT FACILITIES:

- CNC Fabrication, Machining, 3D Printing

ISS CERTIFIED HARDWARE

- APH (Orbitec)
- BRIC-60
- BRIC-100
- BRIC-100VC
- BRIC-Petri Dish Fixation Unit (PDFU)
- Biotube-Magnetic Induced Curvature in Roots (MICRO)
- BRIC-OPTI
- Kennedy Space Center Fixation Tube (KFT)
- Veggie Unit (Orbitec)

HARDWARE IN DEVELOPMENT:

- BRIC-Light Emitting Diode (LED)
- BRIC-LED Canister
- Multi-Spectral Fluorescence Imager (MSFI)

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