The focus of this subtopic is on technologies and techniques which may advance the state of the art of spacecraft systems by utilizing the International Space Station as a technology test bed.

Successful proposals will address using the long duration environment of the ISS to demonstrate component or system characteristics that extend beyond the current state of the art by:

- Increasing capability/operating time including overall operational availability.
- Reducing logistics and maintenance efforts.
- Reducing operational efforts, minimizing crew interaction with both systems and the ground.
- Reducing known spacecraft/spaceflight technical risks and needs.
- Providing information on the long term space environment needed in the development of future spacecraft technologies through model development, simulations or ground testing verified by on orbit operational data.

These demonstrations should focus on increasing the TRL in the following fields:

- Power generation and energy storage (e.g., regenerative fuel cells and battery).
- Robotics Tele-robotics and Autonomous (RTA) Systems.
- Communication and Navigation (e.g., autonomous rendezvous and docking advancements).
- Human health, Life Support and Habitation Systems (e.g. closed loop aspects of environmental control and life support systems).
• Science Instruments, Observatories and Sensor Systems.

• Nanotechnology.

• Materials, Structures, Mechanical Systems and Manufacturing.

• Thermal Management Systems (e.g., cryogenic propellant storage and transfer).

• Environmental control systems, including improved carbon dioxide removal.

• On-orbit trash processing/recycling.

• Radiation.

• Providing Engineering Motion Imagery "smart" imaging systems that reduce bandwidth but maintain high quality imaging in areas of interest; maintenance of window clarity on optical systems without creating a debris source; data storage and retrieval for instances when bandwidth is constrained or the rocket or spacecraft will not be retrieved; compression and/or modulation techniques to maximize efficiency of constrained telemetry downlinks; and imaging system components that are radiation and electromagnetic interference tolerant.

For the above technology subject areas, research should be conducted to demonstrate technical feasibility during Phase I and show a path toward hardware and/or material development as appropriate which occurs during Phase II and culminates in a proof-of-concept system.

**Phase I Deliverables** - Phase I Deliverables: Research to identify and evaluate candidate technologies applications to demonstrate the technical feasibility and show a path towards a hardware/software demonstration. Bench or lab-level demonstrations are desirable. The technology concept at the end of Phase I should be at a TRL of 3-6.

**Phase II Deliverables** - Phase II Deliverables: Emphasis should be placed on developing and demonstrating the technology under simulated flight conditions. The proposal shall outline a path showing how the technology could be developed into space-worthy systems. The contract should deliver a demonstration unit for functional and environmental testing at the completion of the Phase II contract. The technology at the end of Phase II should be at a TRL of 6-7.