**Motivation**
- Adapt and Evaluate Advanced Sensing and Computing Technologies for Autonomous Sensor Processing in SmallSat Form-Factor

**Hybrid Space Computing**
- Multifaceted Hybrid Space Computing
  - Hybrid SoC: CPU + FPGA
  - Hybrid Architecture: COTS + Rad-hard
  - Robust Design: Worst mix of COTS, rad-hard, and fault-tolerant computing

**Featured Computing Technologies**
- CHREC Space Processor (CSP)
  - Features Zynq-7020 SoC
  - Operational on STP-H5-CSP (Mar’17) and STP-H6-SSIVP (May’19) on-board ISS
- SHREC Space Processor (SSP)
  - Features Zynq-7045 SoC, MGTs, and FPGA-dedicated DDR memory
  - μCSP Smart Module
  - Small form-factor Smart Module for thermal management and gimbal control
  - Intel’s Optane Phase-Change Memory (PCM)
  - Internally rad-tolerant non-volatile memory for large data storage
- AMD G-Series GX-216HC
  - Commercially purchased GPU for ML/CV app acceleration

**Mechanical & Power**
- Single-DoF system allows for 15° rotation towards starboard
- Stepper motor with 30:1 gear reduction ratio provides 1/10 FoV pointing accuracy
- Hinge joint contributes to thermal isolation of optical assembly

**Active Thermal Management of Optics**
- Six heaters and thermocouples manage temperature of optics
- System cold biased for all beta angles
- 15-layer multi-layer insulation ensures stability as orbital conditions vary

**Radiation-Hardened Power Components**
- CASPR uses VPT power converters
- SSP uses Texas Instruments power devices
- Enables reliable power to system as a whole

**Features**
- Satellite ISIM-90
  - Ultra-low ground resolved distance (GRD) at ISS altitude: 3.7 m (1.7 m with super-resolution)
  - Small form-factor for SmallSat earth observation
  - 12-megapixel (3072x4096) Senstech imager
  - Multispectral (NIR, red, green, blue)

- Syssley Neuromorphic Sensor
  - Event-driven high frame-rate capture with low data rate for object tracking
  - Static background ignored by sensor
  - QVGA resolution (364x240)
  - 50 kfps @ 1000 Lx

**Success Criteria**
- Accelerate computing with MGT communications
- Perform low-GSD experiments autonomously
- Neuromorphic Sensor
- Tracking space objects for space situational awareness
- GPU
  - Accelerate Machine Learning and Computer Vision apps
- PCM
  - Long-term storage of data collected from sensors