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2021

Bento Box - Modular Stratospheric Balloon Payload to Enable Artificial Intelligence for Small Unit Maneuver

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Monterey, California: Naval Postgraduate School

http://hdl.handle.net/10945/69782

The Bento Box: A Modular Bus for Stratospheric Applications

Naval Postgraduate School

The Structure

- Leverages existing CubeSat, a small satellite form factor, specifications

- Adaptive plates to integrate various payloads

- Command & Data Handling component utilizes UART, I2C, or USB to integrate payloads

- Bus capable of providing power to payloads at 3.3V, 5V, and 12V

- Multiple Configurations: stand-alone on high-altitude balloon (HAB), modular component of marsupial UAV, or CubeSat
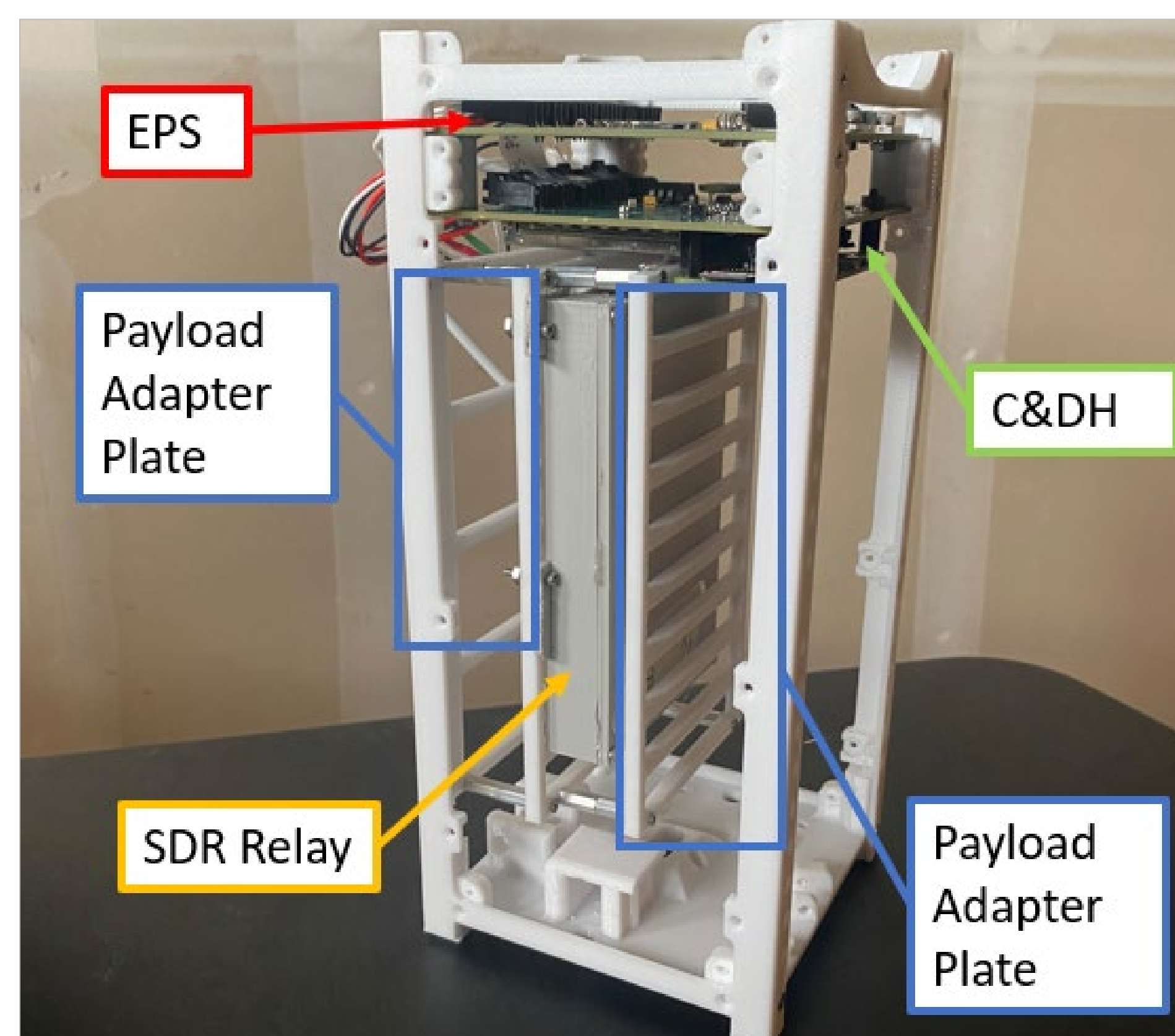
Bento Box without covers showing adaptive plates for payload boards

Drone Relay Case Study

- Relays video feed beyond line-of-sight (BLOS) via tethered high-altitude balloon

- Utilizes Adalm Pluto Software Defined Radio (SDR) capable of switching frequencies remotely

- Developed by Naval Postgraduate School students in the Space Systems Payload Design course

  - Students from Space Systems Engineering (591), Space Systems Operations (366), and Applied Design for Innovation (697) curricula

Hexacopter drone represents A.I. drone sending video feed to end user via SDR relay on HAB

CONOP Demonstration

- Scenario: relay of drone and SOF operator body-camera video feeds, video coverage of operational area from HAB, and validation of precision timing for advanced payloads

- Payloads: Drone Relay SDR, Electro-Optical Sensor, Chip-Scale Atomic Clock, and LED Payload

Future Work

- Utilize precision timing capability for advanced payloads

- Gimbaled antennas for increased range

- Integration into marsupial recovery system

- HAB flights at increased altitude
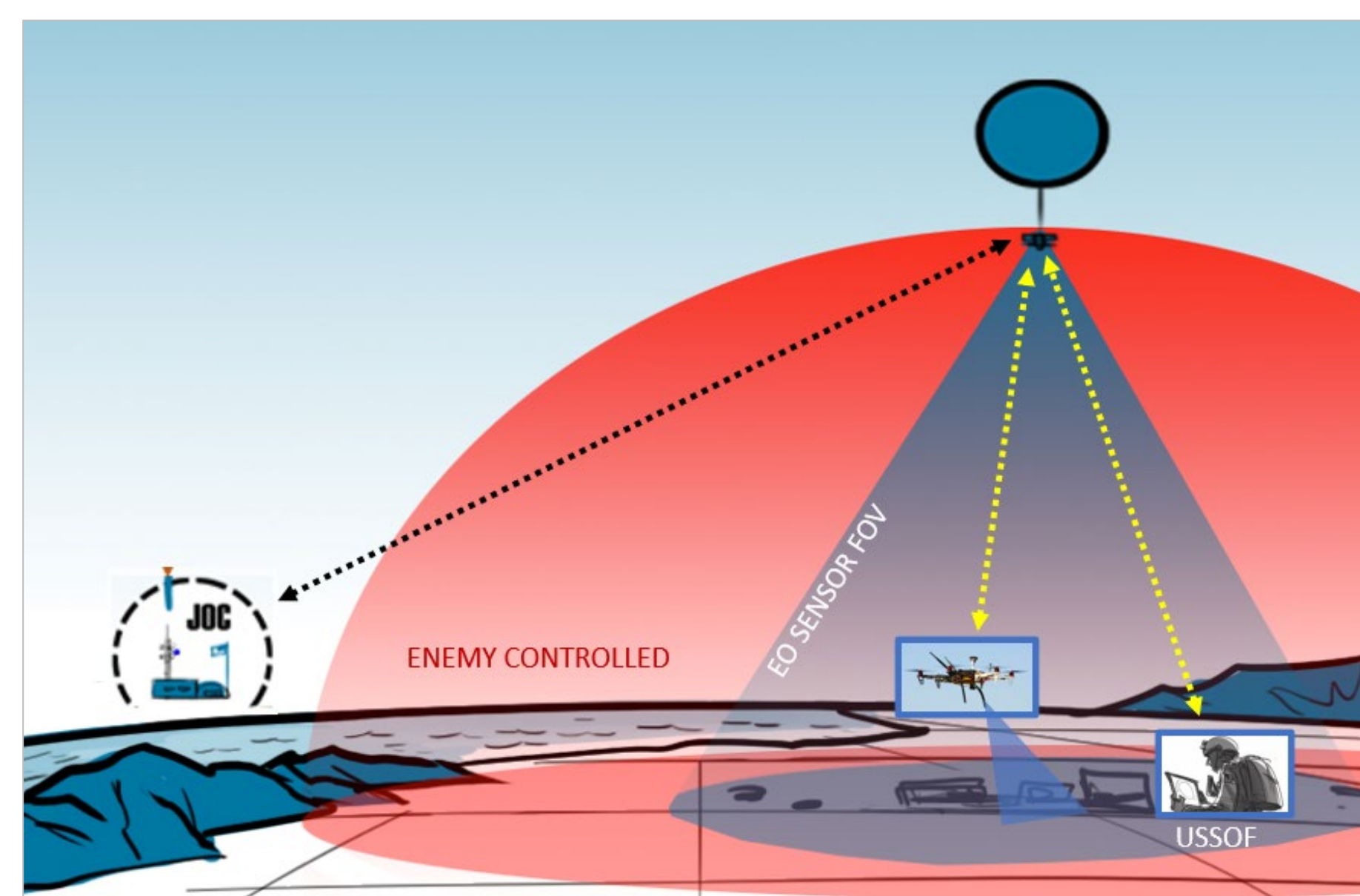
Bento Box providing overwatch and relaying video feeds from drone and SOF element back to JOC