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ScanEagle Secondary Controller

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Monterey, California: Naval Postgraduate School

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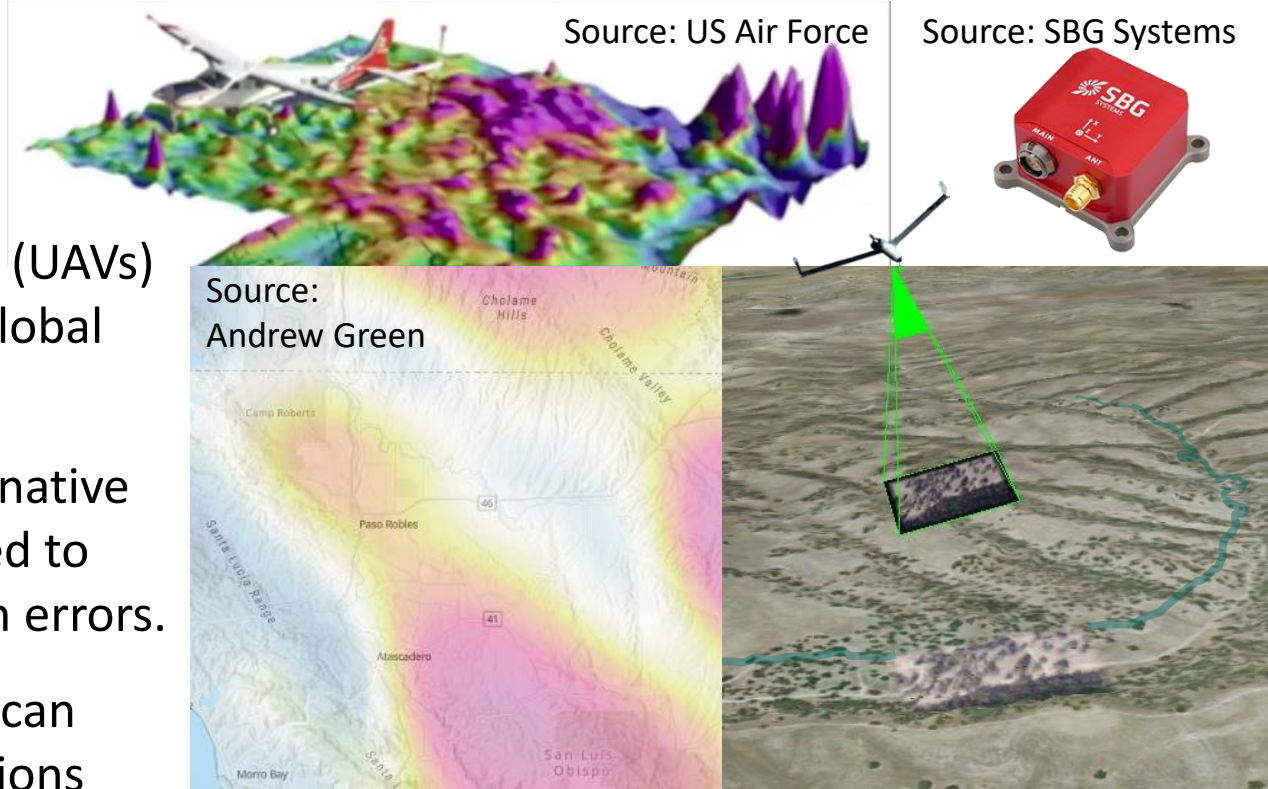
ScanEagle Secondary Controller JIFX 21-02

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4 March 2021

Background

- Unmanned aerial vehicles (UAVs) are overly reliant on the global positioning system (GPS).
- If GPS is unavailable, alternative navigation fixes are needed to reduce inertial localization errors.
- Feature-based navigation can enable continuous operations without GPS.
- Alternative navigation techniques combine visual, inertial, and other sensing modalities.



- Geomagnetic maps can be effective in areas without recognizable visual features.

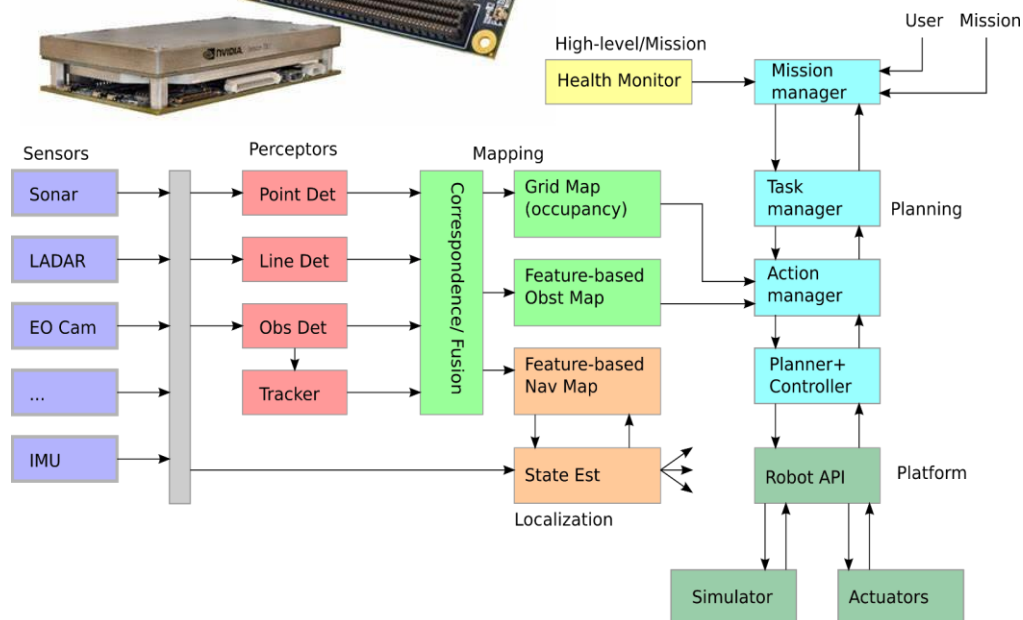
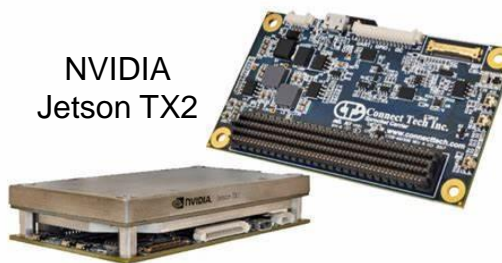
Secondary Controller Architecture

- NPS UxV systems are military vehicles with proprietary software
- “Backseat Driver” paradigm exploits autopilot communications interface
- NPS researchers use a common “Secondary Controller” framework
- COTS single-board computer (NVIDIA Jetson TX2, ODROID-XU4, etc.)
- Open architecture, platform agnostic
 - Ubuntu Linux
 - Robot Operating System (ROS)
 - CAVR software architecture for vehicle autonomy

ODROID-XU4



NVIDIA Jetson TX2



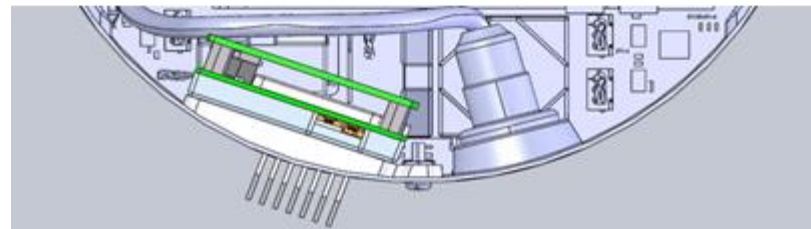
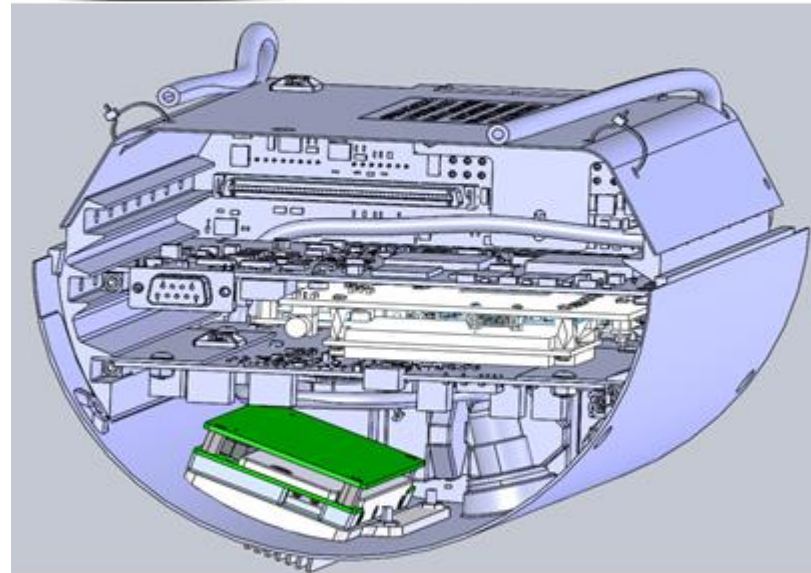
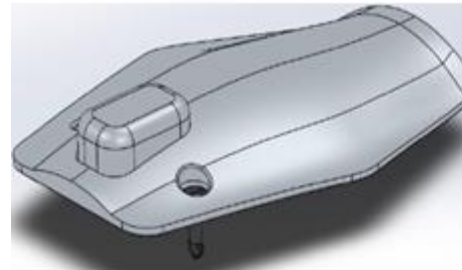
ScanEagle Integration

- New Secondary Controller payloads by NIWC Pacific
 - NVIDIA Jetson TX2
 - Custom PCB & heatsink
 - Mounts in avionics slice
 - New SBG IMU in dorsal hatch
- Microcontroller interface by NAWCWD China Lake
 - Enables communications with autopilot & camera turret
 - Validates “backseat driver” commands
- PCB powers TX2 and Wave Relay radio
 - Mobile ad-hoc network (MANET) node
 - C2 can power cycle the Secondary Controller

Naval Information Warfare Center



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JIFX 21-2 ScanEagle Test Plan

- **Synchronized telemetry and video collection**
 - Enable further research, development, and flight testing of visual navigation methods
 - Correlate visual odometry with aircraft GPS to measure accuracy
 - 10 flight tests
 - Varied time of day
 - Varied SPOI location
 - Varied EO/IR sensor orientation
- **Situational awareness (SA) from secondary controller using Cursor-on-Target (CoT)**
 - Provide visual cues at ground control station (GCS) using existing tools
 - Enhance operator's awareness without increasing cognitive burden
 - Demonstrate with arbitrary data

