Wireless Hub Architecture

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Current situation

- Extensive wiring needed for aircraft instrumentation
  - Adds weight, complexity for integration
  - Long integration time for each sensors
- Sensors on same aircraft may not share common protocols
  - Requires separate modules to control, receive data
- Additional installation cost for each additional sensor
  - Requires aircraft wiring modification for each sensor
- Multiple types of wireless sensors are proposed by industry
  - Each sensor requires a dedicated receiver
  - Presently, no existing centralize hub for receiving and interpreting aircraft sensor

Goals and Objectives

- Faster flight test integration during sensor installation
- Interchangeable flight test sensors without extensive wiring modification
- Free up airframe for more flight test time, less time spent on integration
- Transmitting and receiving data using different protocols utilized by different sensors
- Capture data from multiple sensors using a single software defined radio and computer
- Able to capture data from multiple types of sensors

Concept

- Wireless hub patent from Matthew Waldersen (NASA)
  - Described in DRC-TOPS-42
- A wireless “gateway” for sensor communication
- Integration relies on software interpretation of sensor
- Use SDR (software defined radio) as frequency converter
  - Centralize sensor information collection
  - Control and interpret via software module
  - Change communication protocol in software without hardware changes
  - Able to receive and transmit multiple protocols and frequencies
- Hub is sensor agnostic
- Less data acquisition hardware weight

Proof of concept

- Verifying concept operation using low risk sensors and flights
- Working with Boundary Layer Data System (BLDS)
  - Flight proven sensor with added radio transceiver
  - Sensor and transceiver provided by Cal Poly SLO
- Using previously flight approved hardware and open source modules
- Fly on King Air B200
  - Low risk, low environmental constraints for flight
  - Provide ability to fly non experienced flight crew

- Environment suitable for maturing wireless hub
  - Understand integration process for wireless work
  - Understand frequency/spectrum regulations of wireless work
  - Defining challenges of wireless communication via SDR on flight

Summer 2023 Flight Test Campaign

- Fly proof of concept
- Test data collection & protocol
- Test aircraft integration and concept of operations
- Low risk and high chance of success
- Evaluate any potential technical issues or risk to aircraft
- Create a path for airworthiness approval
- Procedures keyed to BLDS, but can be changed on software and hardware side

Goals Expected to be Achieved

- Flight test to develop claims of the patent
- Develop path to fly other hardware and sensors
- Understand range restrictions of SDR/wireless equipment
- Open channels for collaborations with sensor developers
- Lower risks for technology transfer

Future Plans

- Integration of different sensors and protocols in flight test
  - Optical sensors (FOSS)
  - MIMO (multi-input multi-output)
  - Multiple SDRs
  - Mesh network
  - LiFi communication
- Explore other platforms
  - Commercial aircraft flight test
  - Military flight research
  - Spacecraft
- Open to other developers
  - Non-NASA, commercial, military
- License technology for industry

Questions?

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