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# Reducing Aircraft Downtime for Airborne Instrumentation

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# Purpose



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- Utilize processes and technology to significantly reduce dedicated time required to install airborne instrumentation.
- The specific use case addressed is the F-16 fighter jet.
  - Developmental Test (DT) aircraft from 5 - 7 months to ~1.5 months (Core instrumentation + all add-ons)

Note: Tech/Processes are not new to industry. Due to gov't specific challenges (cyber, a/w, etc) the DoD has been slow to incorporate these into practice.



# Defining the Scope



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Core Capabilities
Video/Audio
MIL-STD-1553 Bus Data
TM/GPS/Beacon
Weapons Bus Data

Optional Capabilities
Weapons Discretes
HSDN Ethernet
Separations Sensors
Separations Cameras



# Technology Innovations



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- Battery
- Wifi
- Next generation airborne instru recorders

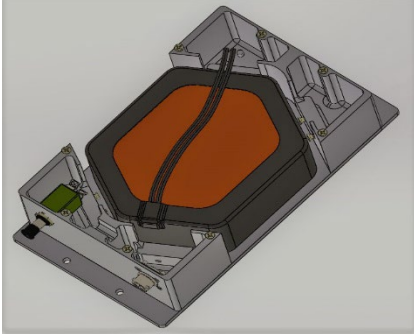


# Battery



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## F-15E Battery for Separation Sensors



Currently use NiMH batteries

Primarily due to airworthiness concerns

Note: Li Ion batteries had limitations on how many cells we could use in series due to thermal runaway issues

### Current Use Cases:

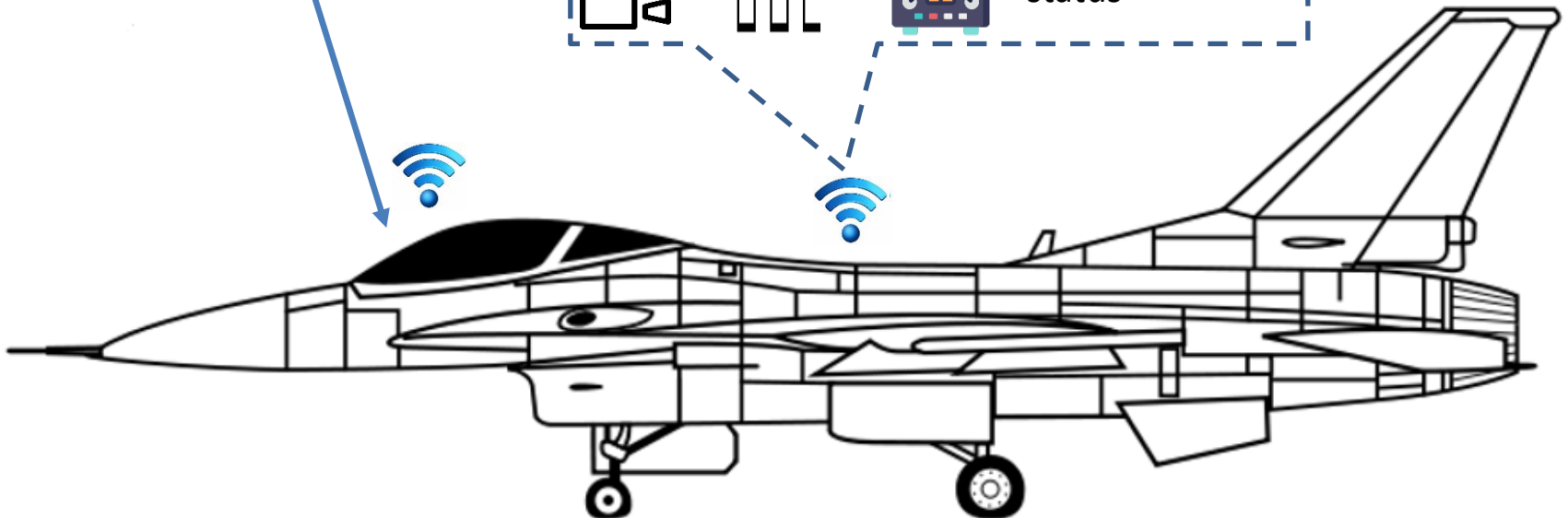
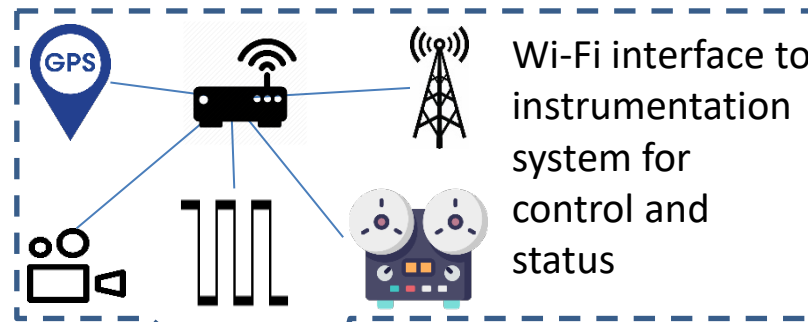
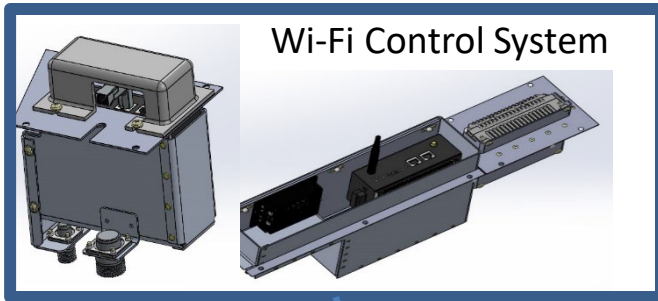
- BRU-47 Weapons Separation Analog Sensor Data Acquisition
- Wireless Camera System



# Wifi Control System



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# Recorders - Why Upgrade?



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...to a recorder like the Calculex 1401/5? Why not just use the same old Calculex 2300's?

- Solves obsolescence
- More capabilities (legacy requirement + new capabilities)
  - Move towards Chapter 7 telemetry
- Smaller size
  - More options for installation locations
- More throughput



# Calculex 1401



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- 8 Channels of MIL-STD-1553
- 8 Channels of video w/ audio
- 2 Channels of GigE Ethernet
- 5 Channels of PCM @ 20Mbps
- Chapter 7 output (4 selectable videos, data PCM, audio channel)

**TBD: 1 Channel of 16PP194 input yet to be verified**





# Process Innovations



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- Pre termination of cabling
- Equipment location standardization



# Partial Cable Pre-Termination



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Terminate cable harnesses on AB side and run to other areas.

- a) Pre-fab harnesses (unterminated at target ends but terminated at AB/source end)
- b) Use gun tube area for wire run area (AB to AEB) to save time
- c) Reduces choke points - personnel man hours at AB location
- d) Reduces overall aircraft downtime

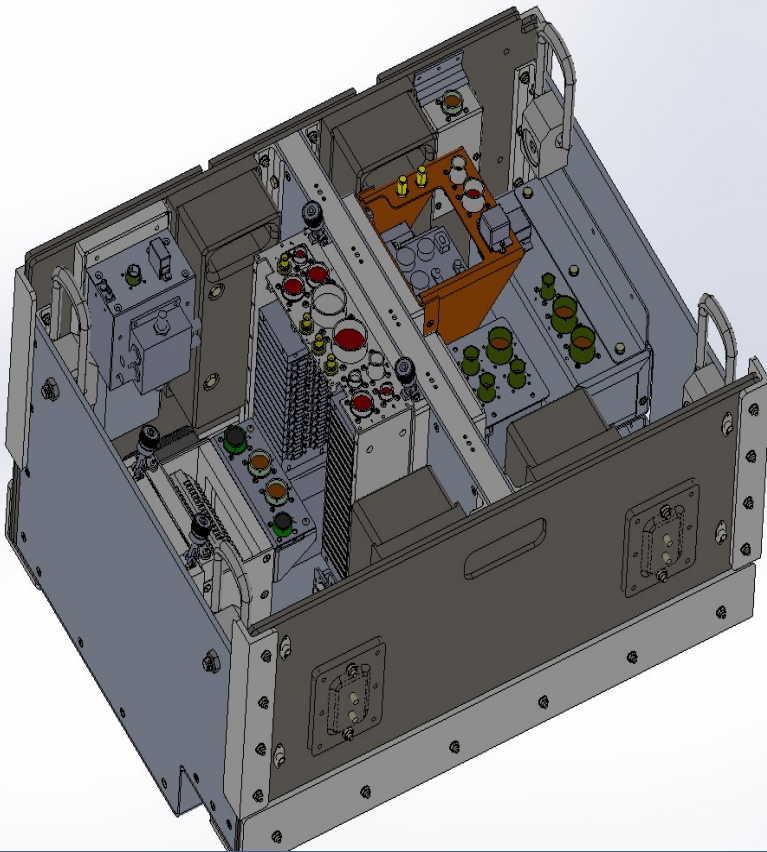


# Equipment Standardization



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## F-16C Centralized Design



## F-16 Standardized Ammo Bay Pallet Equipment Includes:

- CB Box
- Recorder
- TM System
- Beacon
- Ethernet Switch
- ESIR (Interface Remote for Control System)
- Wi-Fi Adapter



# Centralized Instrumentation



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## Advantages to Centralized instro in Ammo Bay (AB)

- a) Entire system can be bench tested before installation.
- b) Reduces a/c downtime due to reduced install effort
  - i. Greatly reduced mechanical effort on aircraft.
- c) Reduces a/c downtime due to reduced checkout time.
- d) “Future-proof” design reduces re-work to deconflict with aircraft standard additions/changes.
- e) Standard design reduces complexity of msn support



# Successes



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- Progress towards centralized designs on F-16C
- Battery-powered standalone BRU-47 system installed on 1<sup>st</sup> F-15E
- Accomplished design and installation of wireless control system on F-15E to demonstrate future feasibility during flight testing
- Next gen (1400s, 5500s) recorders flying on F-15EX



# Challenges



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- High work load
- Limited resources dedicated to work load and daily operations
- Limited aircraft availability due to small, dynamic test fleet
- Historically standardization of test fleet instrumentation has been a challenge
- 1400/5500 series recorder acquisition / maturity

Challenges driving innovations to lowest priority