Challenger 850 Modifications

UPDATE AND DISCUSSION

Conveners: Beat Schmid, Fan Mei, Darielle Dexheimer

2:00 - 4:00 pm EST (11:00-13:00 PST), June 24, 2020

Aircraft Modification Status

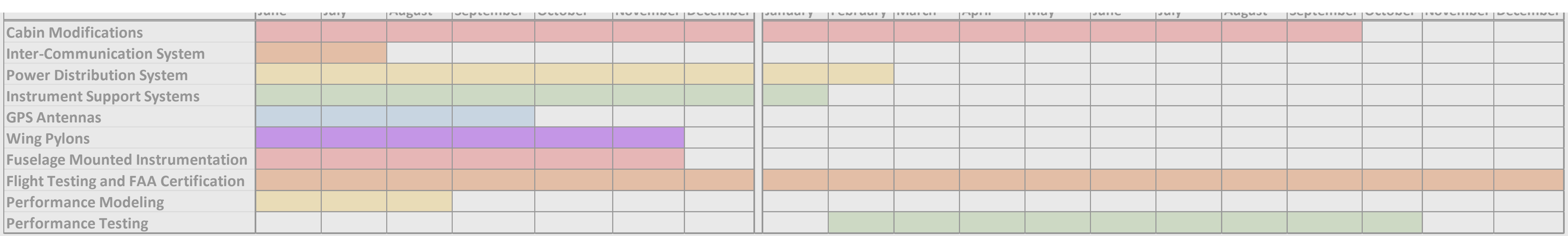
- Contract Signed on June 07, 2020
  - FMS Aerospace is the prime
- Aircraft arrived at Voyageur Aviation on June 22, 2020

	2020							2021											
	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
Cabin Modifications	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Inter-Communication System	■	■																	
Power Distribution System	■	■	■	■	■	■	■	■	■										
Instrument Support Systems	■	■	■	■	■	■	■	■											
GPS Antennas	■	■	■	■															
Wing Pylons	■	■	■	■	■	■													
Fuselage Mounted Instrumentation	■	■	■	■	■	■													
Flight Testing and FAA Certification	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Performance Modeling	■	■	■																
Performance Testing									■	■	■	■	■	■	■	■	■		

Aircraft Modification Status

- Contract Signed on June 07, 2020

Everything Presented is Notional and Subject to Change

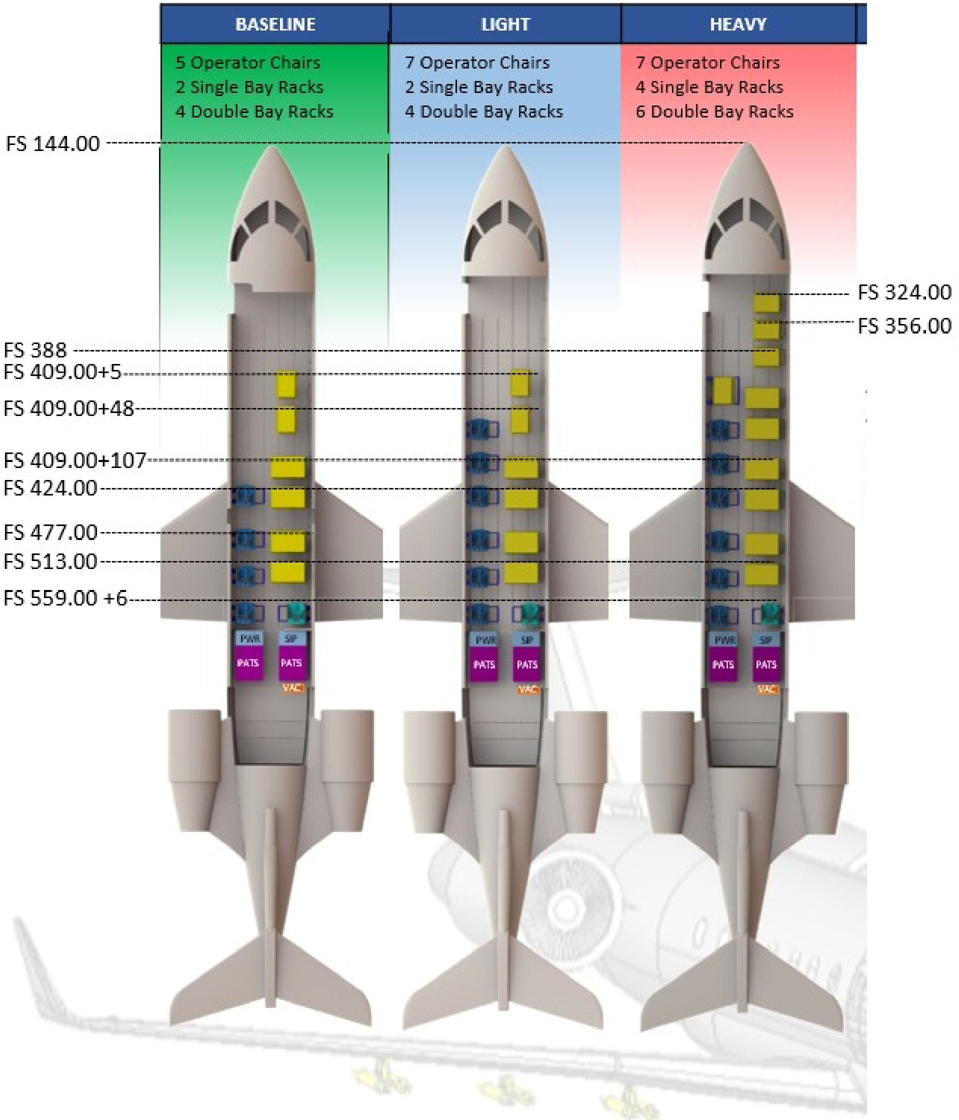


Cabin Modifications

- **Ease of access**
  - Remove existing galley and storage
- **Durable**
  - Replace original floor and interior covering
- **Safety**
  - LED Lighting
  - ICS for Communication between the flight deck and the flight crew in the cabin

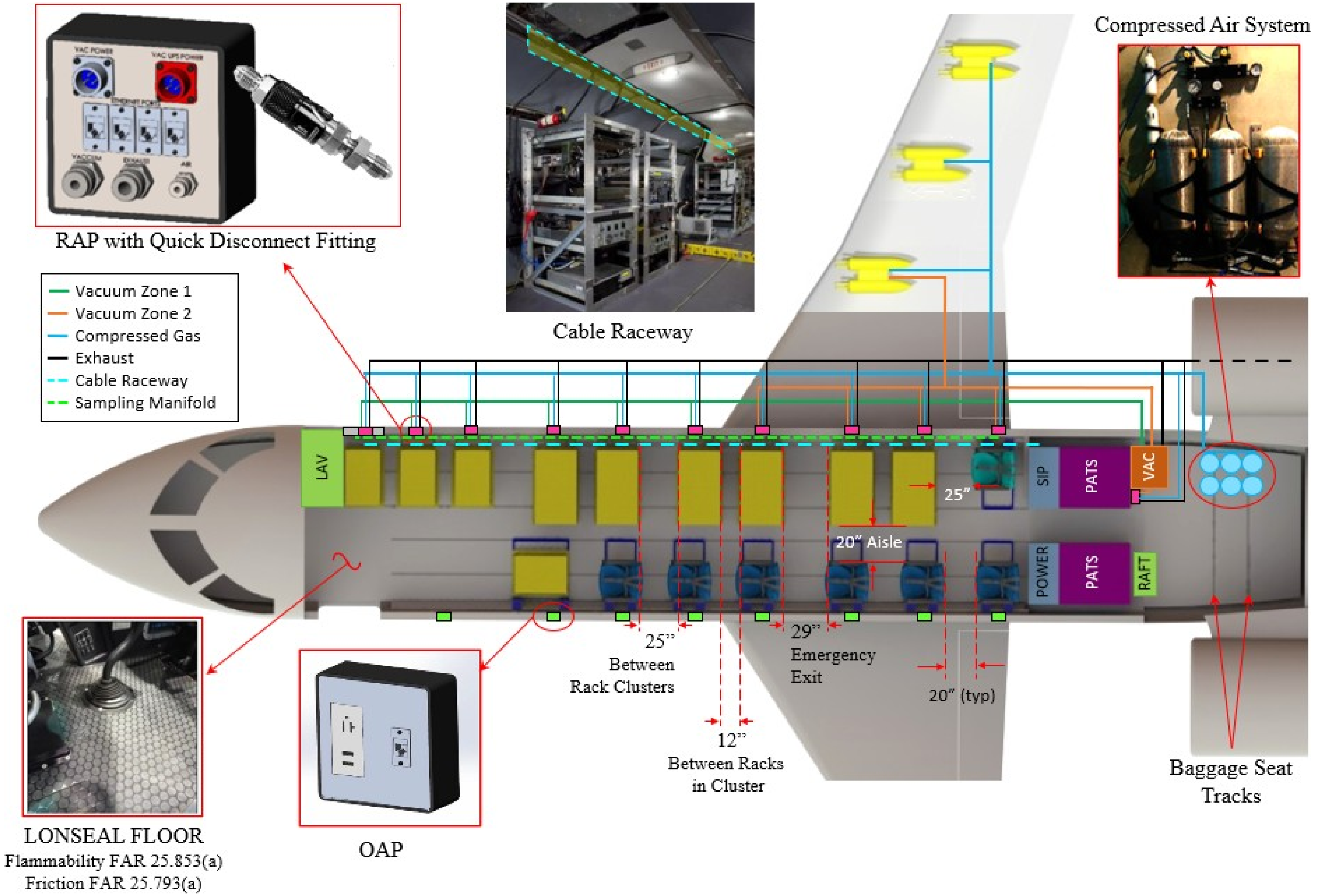
Cabin Proposed Layout

- **Rapid integration and modularity**
  - Fixed installation locations
  - Fixed seating positions
  - Clean Cabin



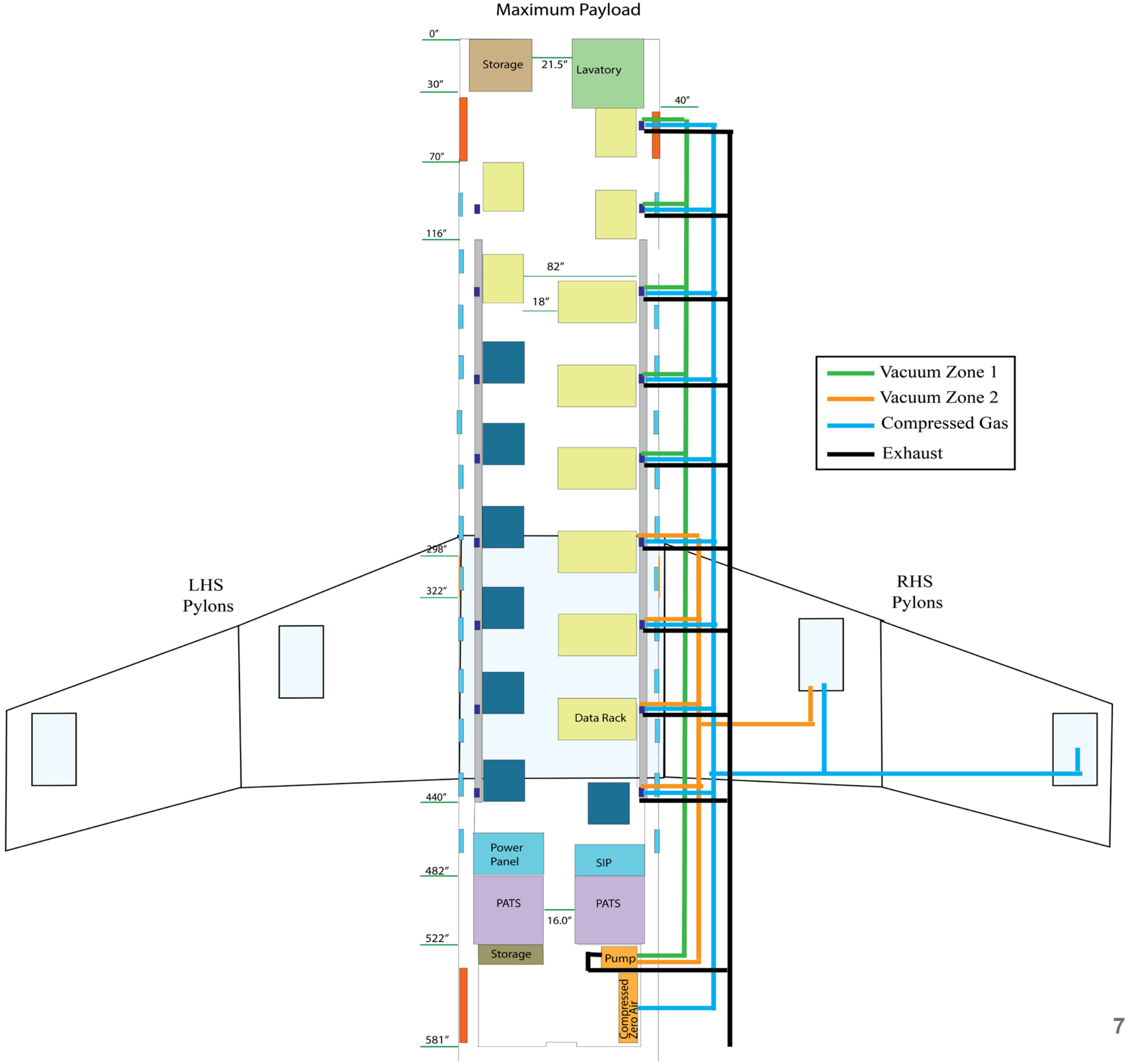
Cabin Proposed Infrastructure Layout

- Rack Access Panel
  - 115 VAC 60 Hz UPS @ 20 A
  - 115 VAC 60 Hz Non-UPS power @ 20 A
  - Ethernet - 4 ports
  - Vacuum, exhaust, and compressed air
- Operator Access Panel (OAP)
  - 115 VAC 60 Hz Non-UPS power @ 20 A
  - USB power ports (5 V)
  - Ethernet
- System Interface Panel (SIP)
  - Patch Panel



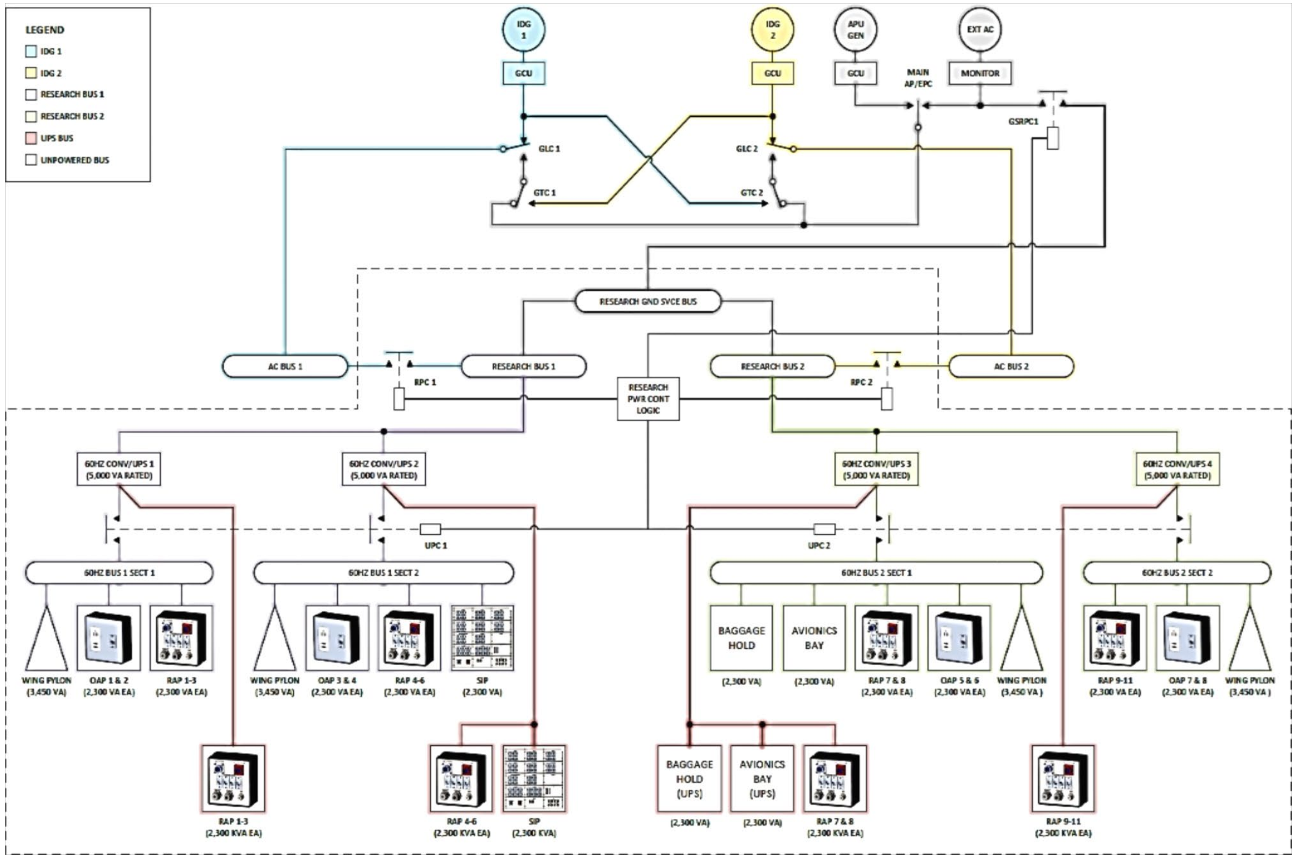
Cabin Modifications

- **Vacuum Source**
  - Pump ideally located in the baggage hold
  - Two zones
  - RHS innermost pylon
- **Exhaust**
  - Tied to a common overboard dump
- **Compressed Air**
  - OFOI - 6 Self-Contained Breathing Apparatus (SCBA) compressed air bottles
  - Max pressure @ 100 PSI
  - Both pylon locations on RHS



Research Power and Distribution

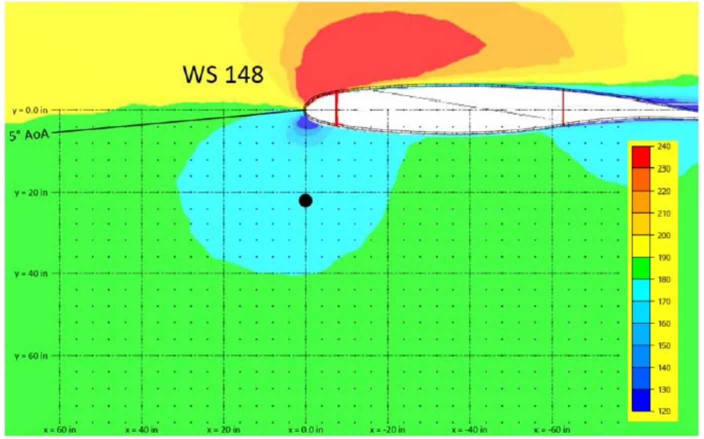
- A primary power distribution panel shall distribute the aircraft generated research power to the fuselage and wing receptacles
  - 20 kVA at 115VAC 400 Hz dedicated solely to research
  - Nova Electric combined Frequency Converter and UPS. Uninterrupted power for up to 4 minutes.
  - Eaton model PXM2250 Compact Power Quality Meter – Monitor via LAN
  - Load shedding
- Avionics will not power up while on ground power
- 10 kVA APU power option while on the ground



Wing Pylons

Wing Pylons

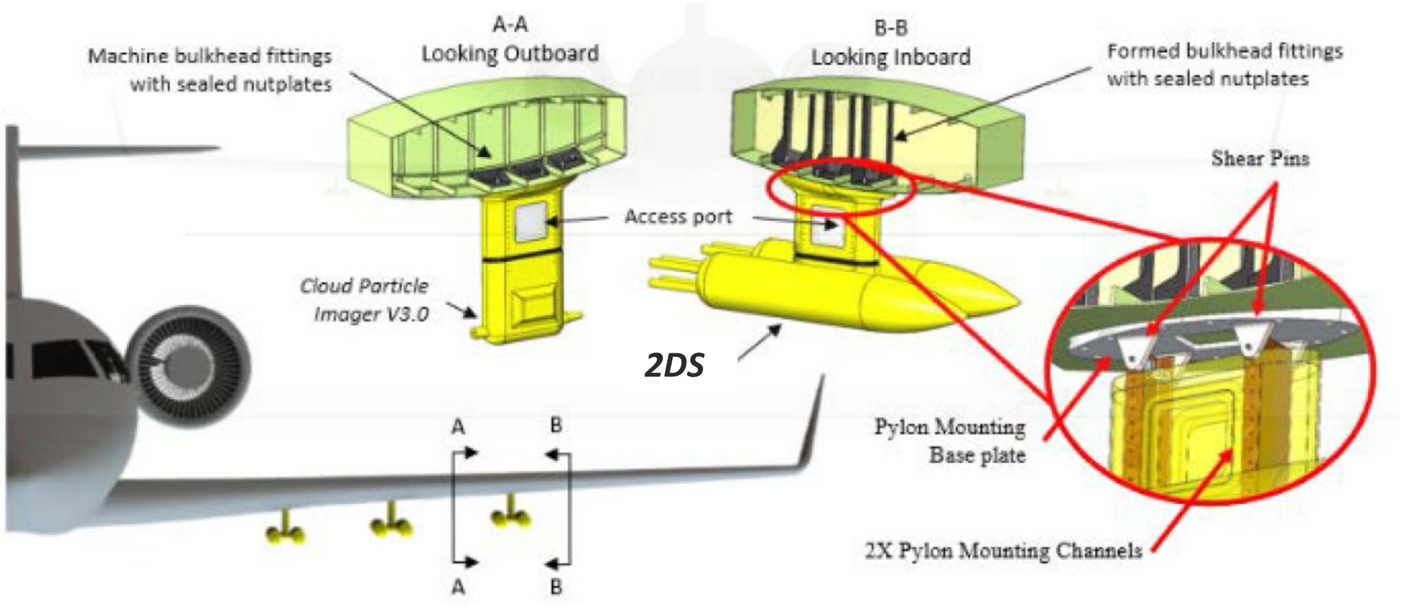
- Design Requirements
  - Optimize the strength-to-weight ratio for the pylons
  - Minimize drag coefficient
  - Incorporate known modes of failure for the pylons or separation from the aircraft
  - Locate the face of the canister where air flow disturbances are minimal, stationary, and well characterized
    - Below leading edge of wing (~20”)
    - Toed-in at about 5 degrees
    - Pitched down 5 degrees
  - Installed pylons with instruments shall have FAA approval to fly in restricted airworthiness



TAS: 190 kts
Green: 180-190 kts
Blue: 170–180 kts

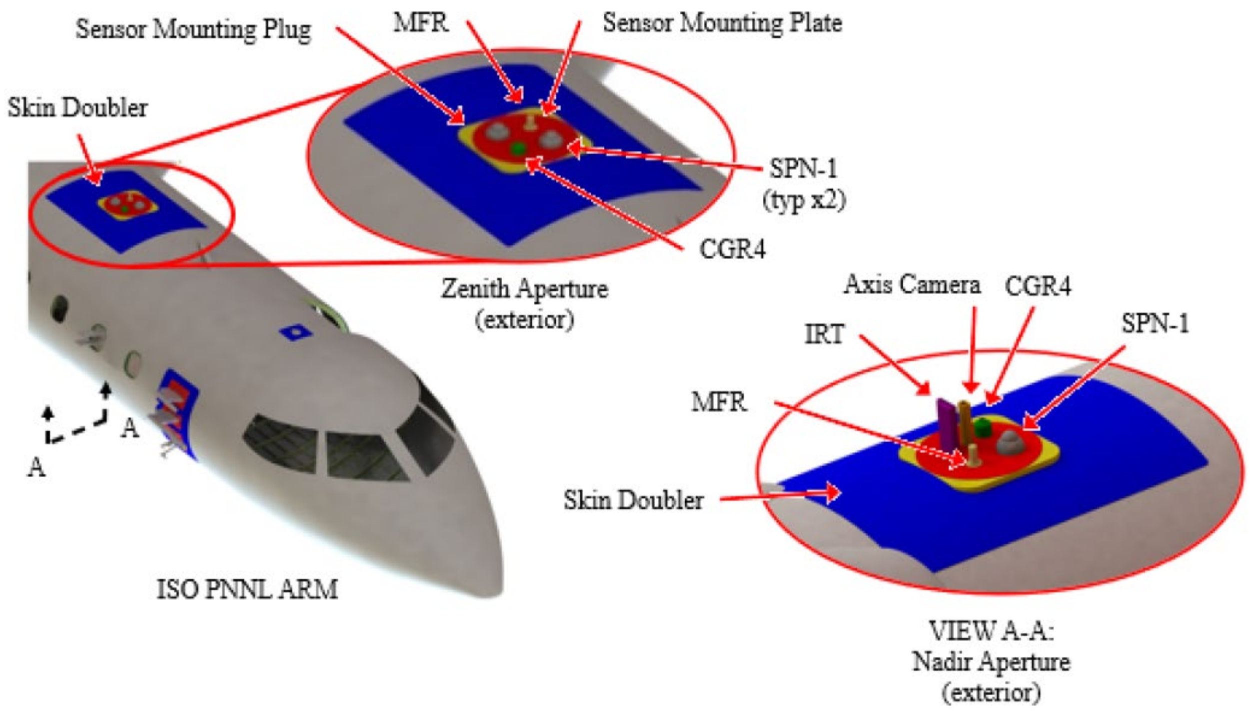
Wing Pylons

- At Each Pylon Location:
  - Power
    - 20 A of 115 VAC 60 Hz single phase power available
    - 20 A of 28 VDC
    - Switch control VAC and VDC
  - 4 Ethernet ports
- RHS pylon locations
  - Both have compressed air
  - Outer pylon has a connection GPS antennas
- Innermost RHS pylon has a vacuum connection



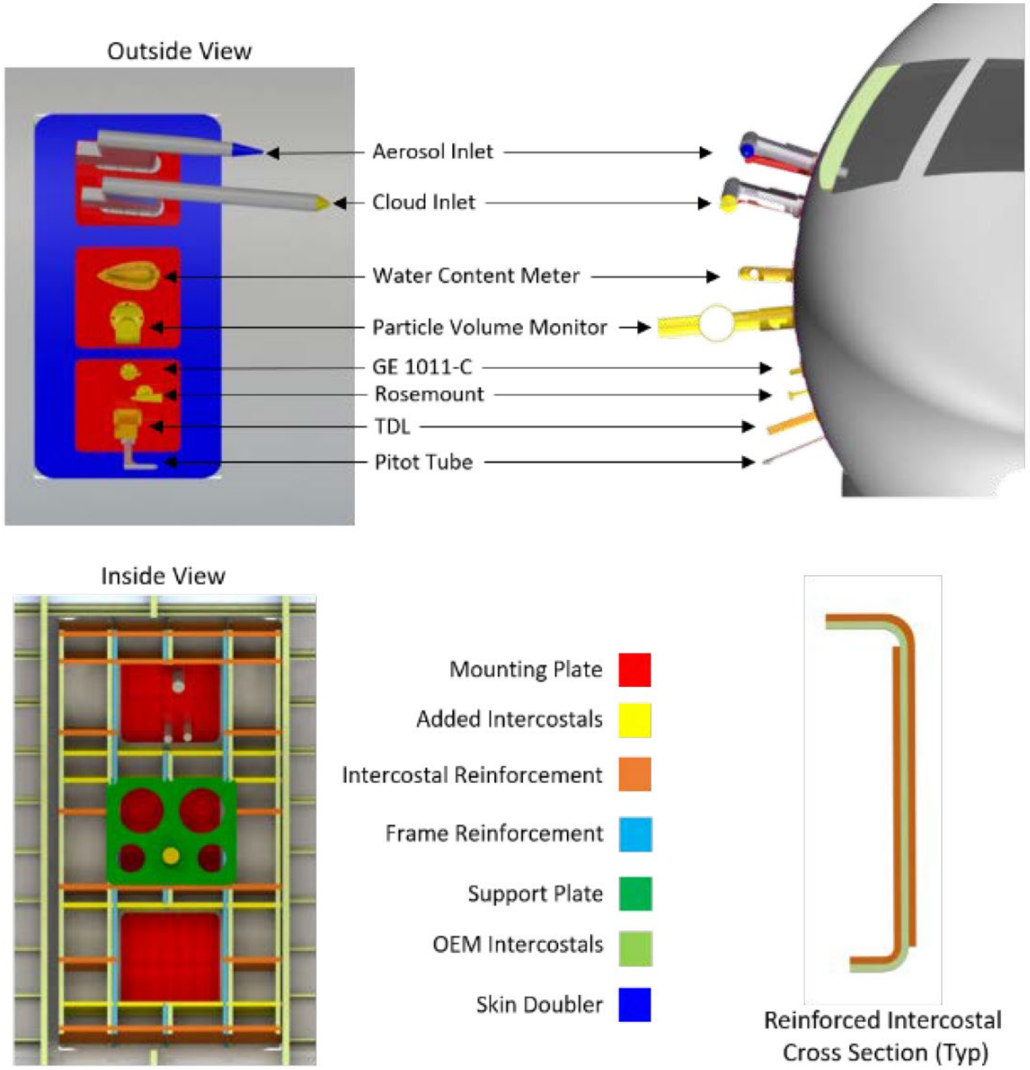
Fuselage Mounted instrumentation

- Zenith and Nadir Aperture
  - 20.5” circular aperture
    - Static load of 50 lb with a maximum lateral offset of 10 inches
    - 20 lb load with a maximum lateral offset of 20 inches



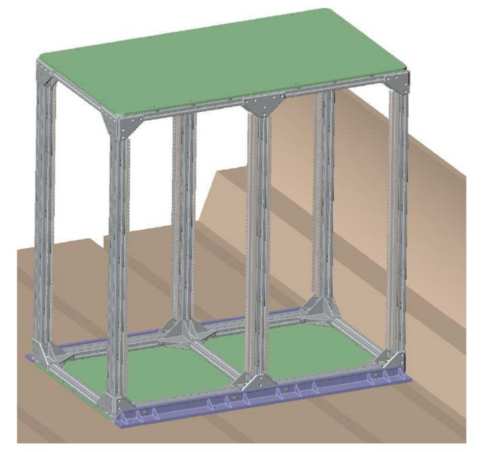
Fuselage Mounted instrumentation

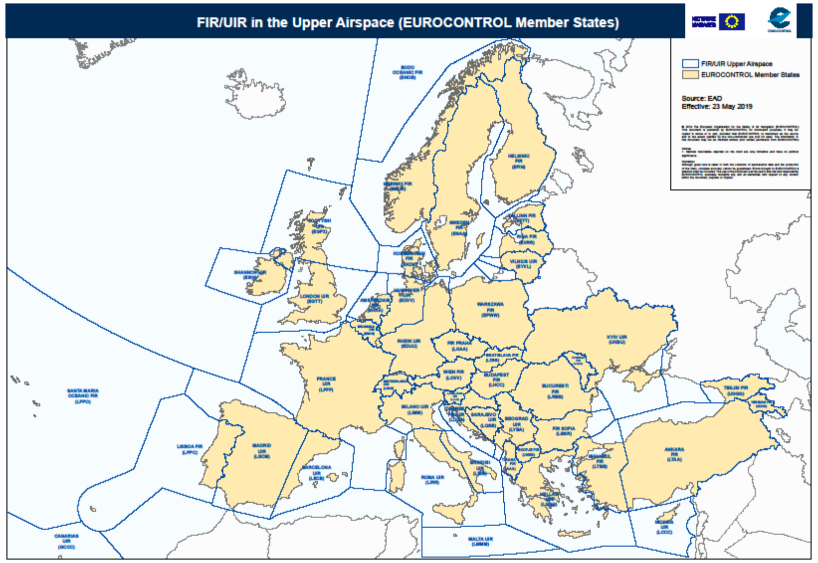
- RHS Galley Service Door
  - All equipment anti-iced (>1.5”)
  - Two 9”x12” apertures
    - Cloud droplet and aerosol inlets
  - Two 12” x 12”
  - 25 lb load with a maximum lateral offset of 10 inches
  - 10 lb load with a maximum lateral offset of 20 inches from the plate.
- Two window plates that can be installed into windows 1 and 2
  - 10 lb with a maximum lateral offset of 20 inches from the plate.



Pathway to Global Operations

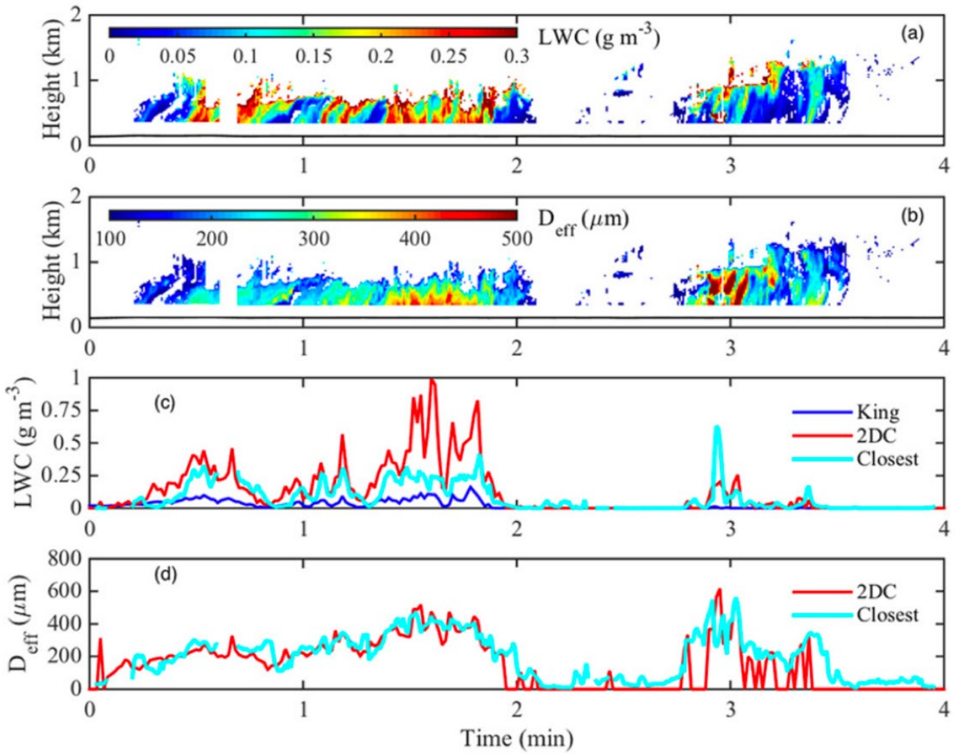
- Deferred Scope
  - Before the first test flight
    - Double and single bay racks
  - Before the first low altitude test flights
    - ADS-B IN
    - Pulselight
  - Before Global Operations
    - Second WAAS-Capable GPS
    - Future Air Navigation (FANS) 1/A, Controller–Pilot Data Link Communications (CPDLC), and Link 2000+
    - Global SATCOM
  - When needed
    - Lightning Detector





Workshop

- Significant Additional Engineering/Modifications:
  - LiDAR
    - Provide information on aerosol layers and their distribution
  - Radar
    - Put aerosol information into context with clouds



An example from the CSET field campaign (Schwartz et al. 2019) showing how nadir cloud radar and lidar measurements can be combined with in situ data to (a-b) retrieve microphysical properties (LWC and effective diameter in this case) throughout the cloud and precipitation layer. (c-d) The retrieval (cyan) is compared with in situ bulk LWC from the King probe and 2DC probe estimated LWC and effective diameter, highlighting good agreement.

Polling Questions

- Direct the future engineering efforts
  - Please choose the first engineering effort you think that ARM should undertake for the Challenger 850
    - LiDAR
    - Radar beyond PMS canister based
    - Dropsonde unit and chute
    - Turbulence Radar for aircraft
  - Please choose the second engineering effort you think that ARM should undertake for the Challenger 850
  - Please choose the third engineering effort you think that ARM should undertake for the Challenger 850
  - Please choose the fourth engineering effort you think that ARM should undertake for the Challenger 850