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**

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Everything Presented is Notional and Subject to Change

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

Installed on the SPEC Learjet
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
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**
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.
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
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.
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