GPMS Foresight MX

Health and Usage Monitoring/ Fault Monitoring Systems

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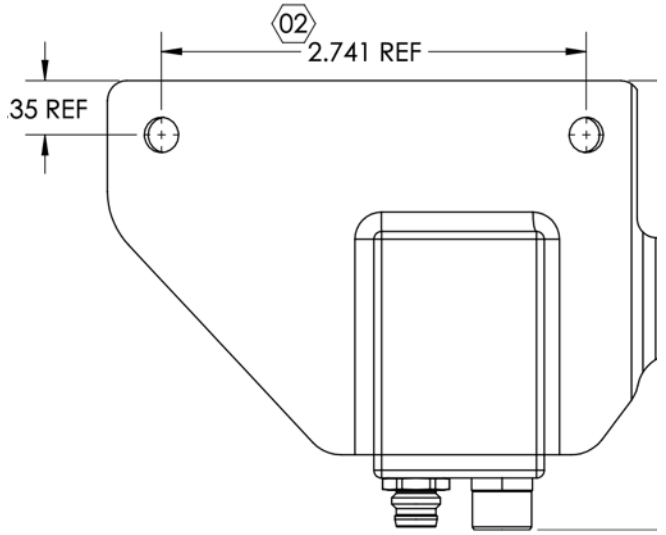
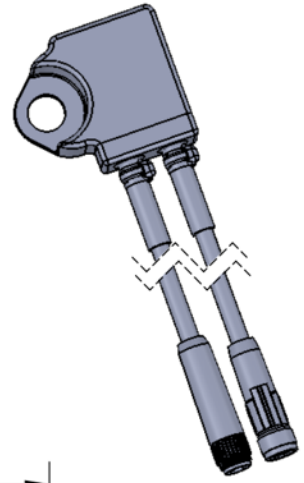
What Should Fault Monitoring Systems Do?

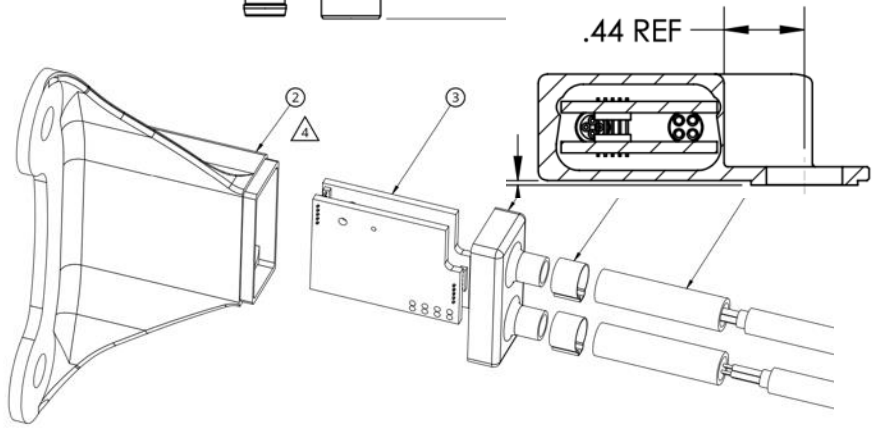
- Key Goal of Any System:
  - Improve Safety
  - Improve Readiness
  - Decrease Mx Time and Labor
  - Reduce Costs
- Improve on Legacy HUMS
  - Lightweight
  - Accurate
  - Predictive
  - Automated
  - User Friendly/Intuitive
  - Maturable

Key Architecture Innovation

- Bused Smart Accels
  - MEMS accelerometer processes data locally:
    - RS485 Transceiver
    - Microcontroller (DSP)
    - Signal conditioning
    - TfV (Tach from Vibe) can provide its Own Tach
    - Packaging is an important issue
  - Lower cost/lightweight/ease of installation
  - Designed for Aviation Installations
    - Environmental durability
    - Good transfer function: First Mode is 17kHz

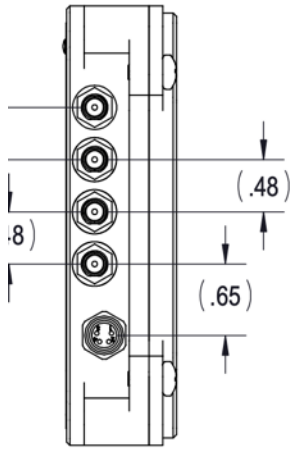


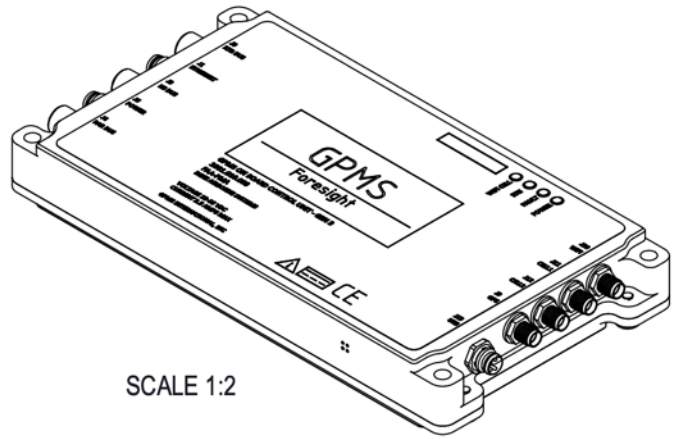


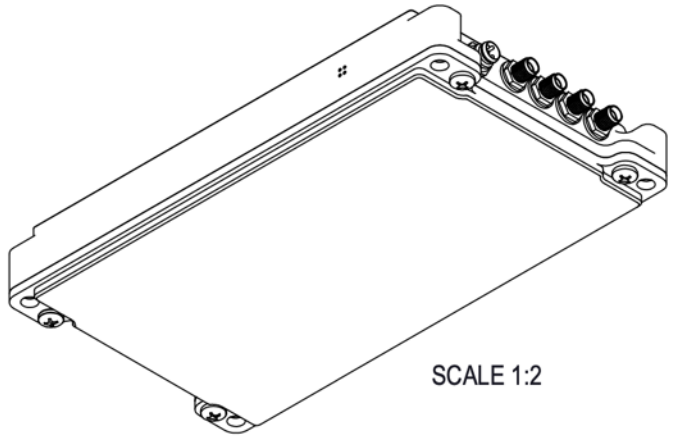


Onboard Control Unit (OBCU)

- Compact Design
  - 7x3.5x1 inch, 1 lbs
- Low Power Requirements
  - Typically, Less than 0.5 amps
  - Single Point for Power, Control of Sensor
- Tactical Grade IMU
- Wi-Fi, Bluetooth, Ethernet, LTE, USB download Options
- 20-Minute Holdup for Download Post Flight

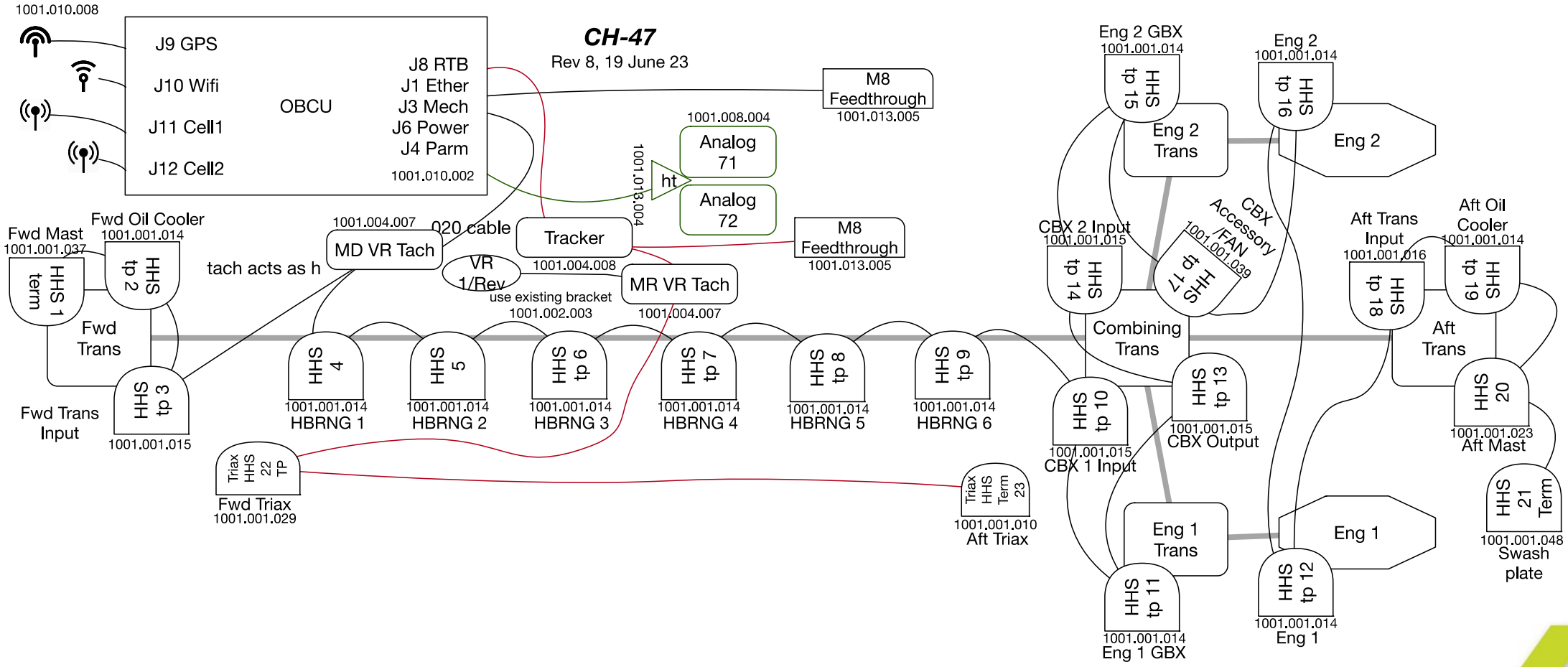




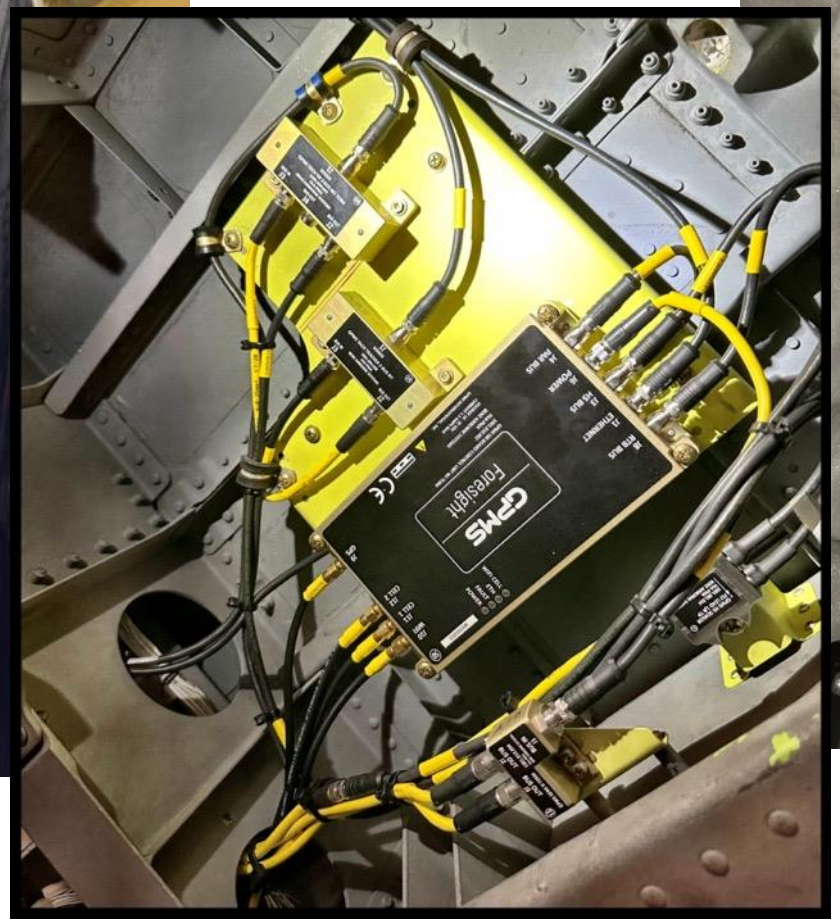


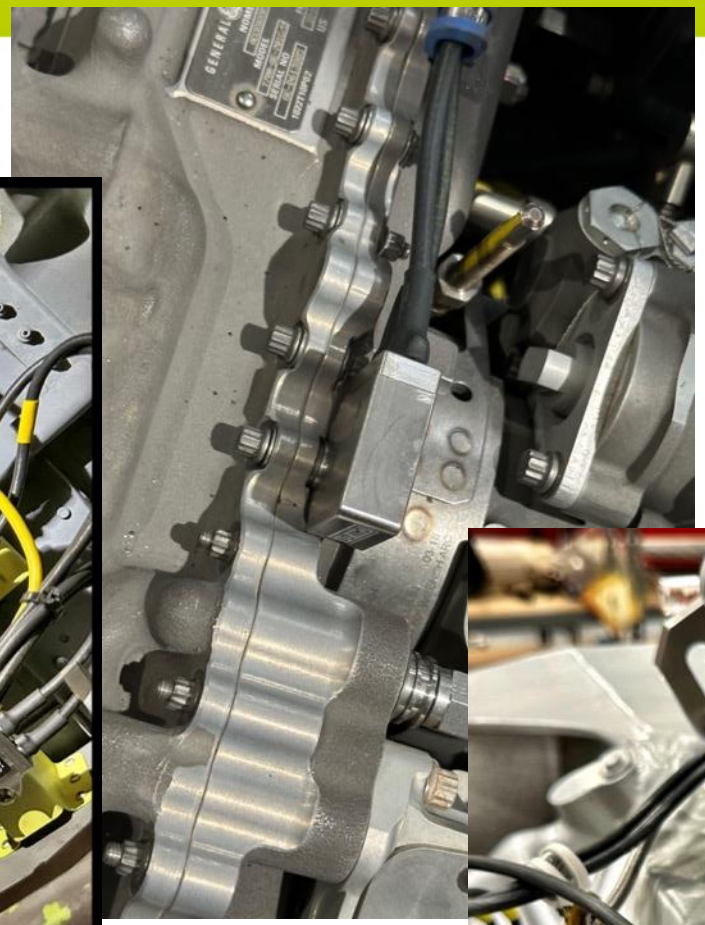
Bused Architecture

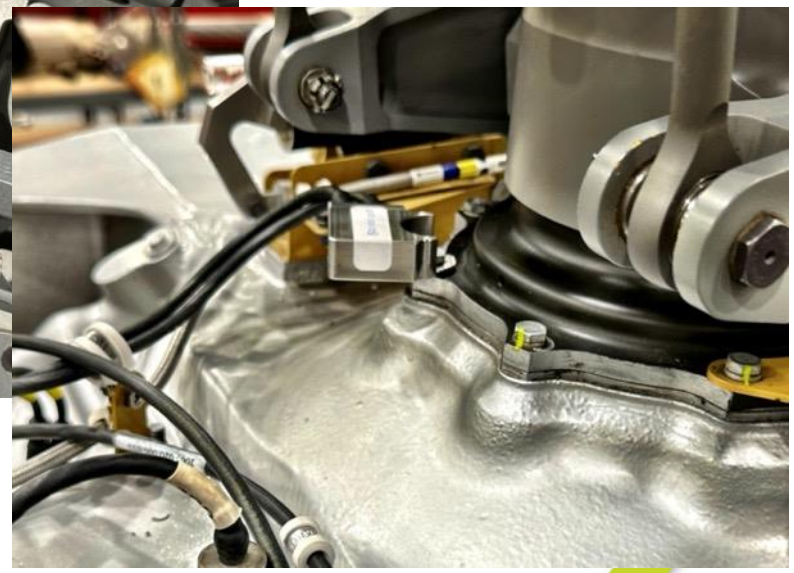
- Example: CH-47D



Installation



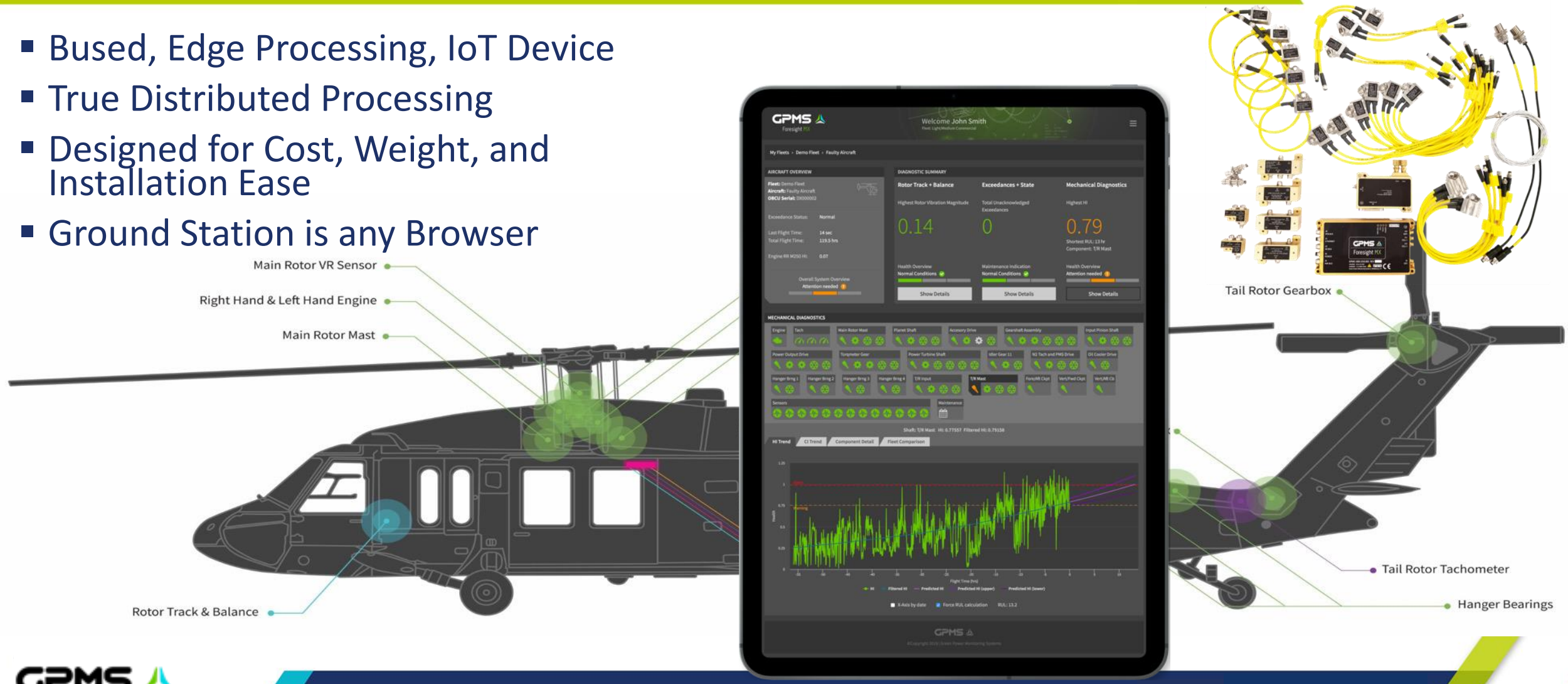




FIND THE FUTURE

Foresight MX: An Edge to Cloud Solution

- Bused, Edge Processing, IoT Device
- True Distributed Processing
- Designed for Cost, Weight, and Installation Ease
- Ground Station is any Browser

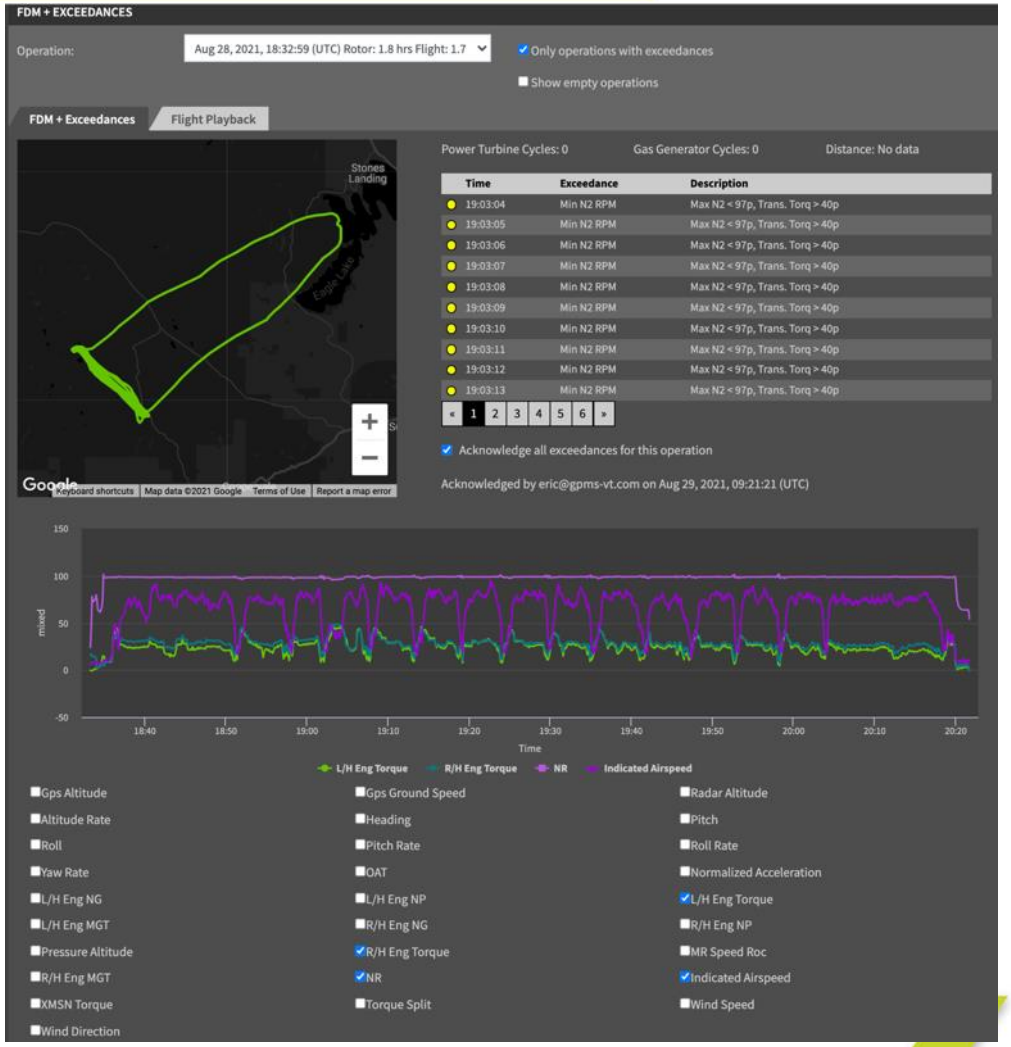


Some Examples of Capabilities/Analysis

- FDM / Exceedance Monitoring
- Regime - What am I doing and what should I be doing based on that
- Rotor Track & Balance
- Engine Performance
- Mechanical Diagnostics & Prognostics

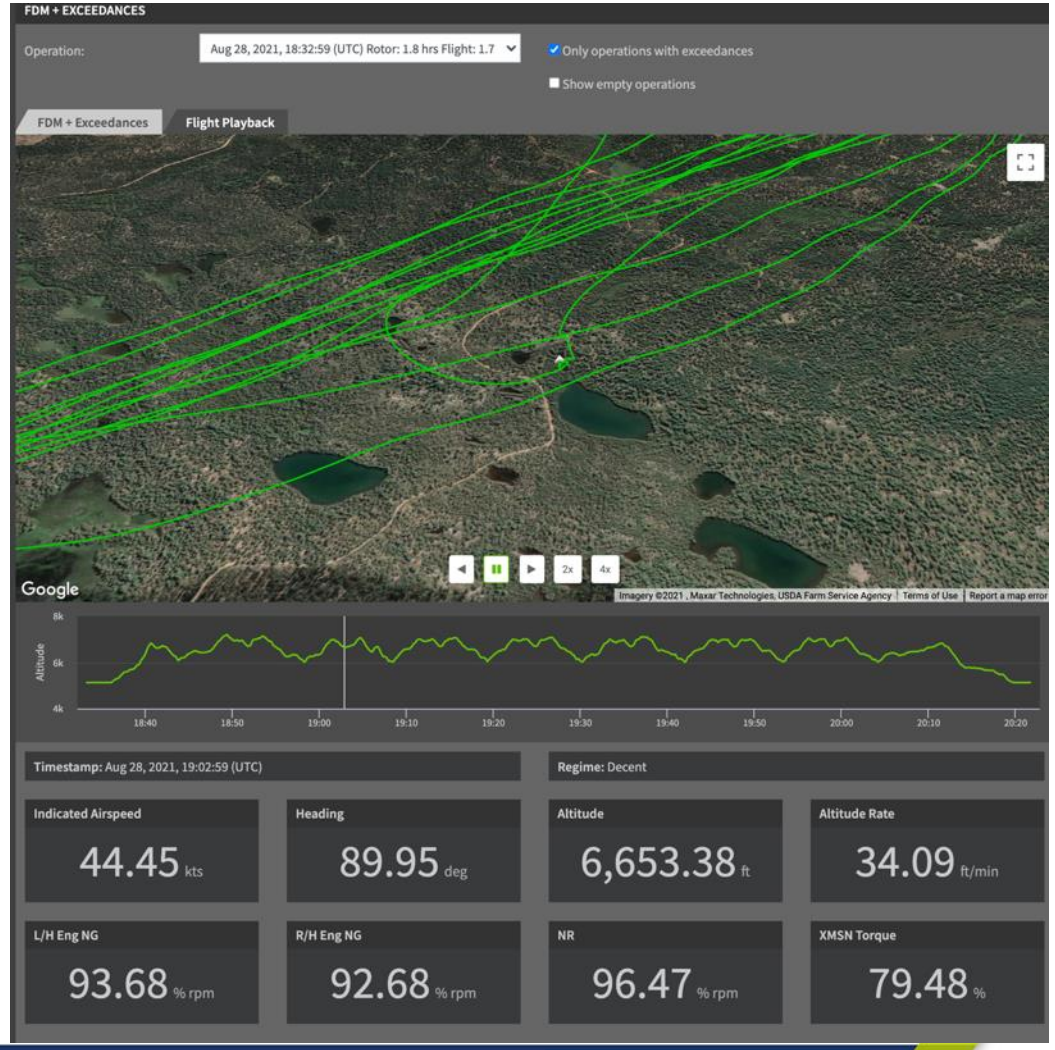
Data Monitoring & Exceedances

- Provides a Record of Vehicle State
- Automates User Manual Exceedances
- Allows for Post Analysis and Training
- Adds a layer of Asset Protection with a Record of How the Vehicle was used



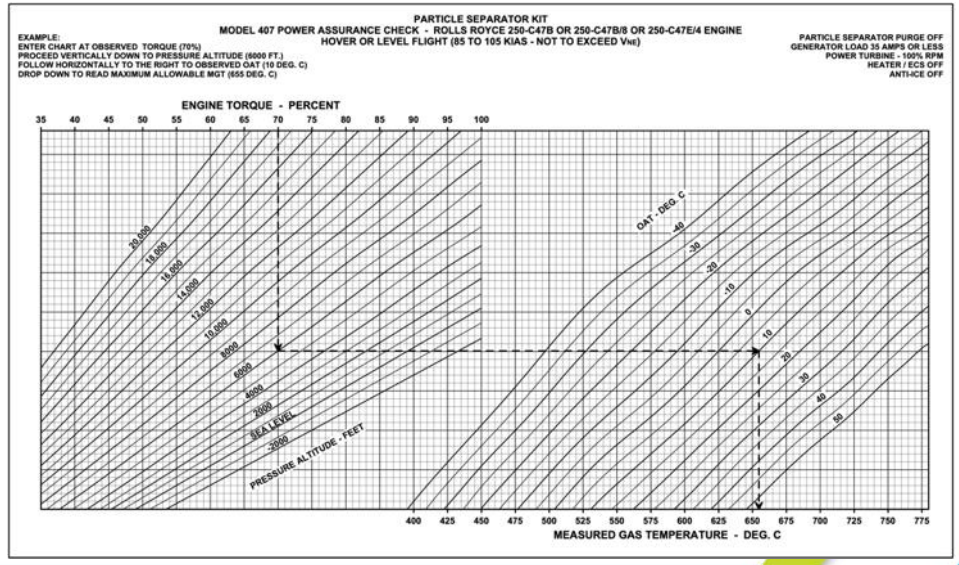
DM Playback/Training

- Data Helps Supports:
  - Maintenance Decisions, Aircrew Training
  - Safety Management System



Model Base Analysis: Engine Performance

- Automate Flight Manual Engine Performance Check
- Ensures Engines are Always w/in Margin
- Full Record of Temps, Pressures, RPMs
  - OEM Support Trouble Calls
- Helps Spot Issues, Faster



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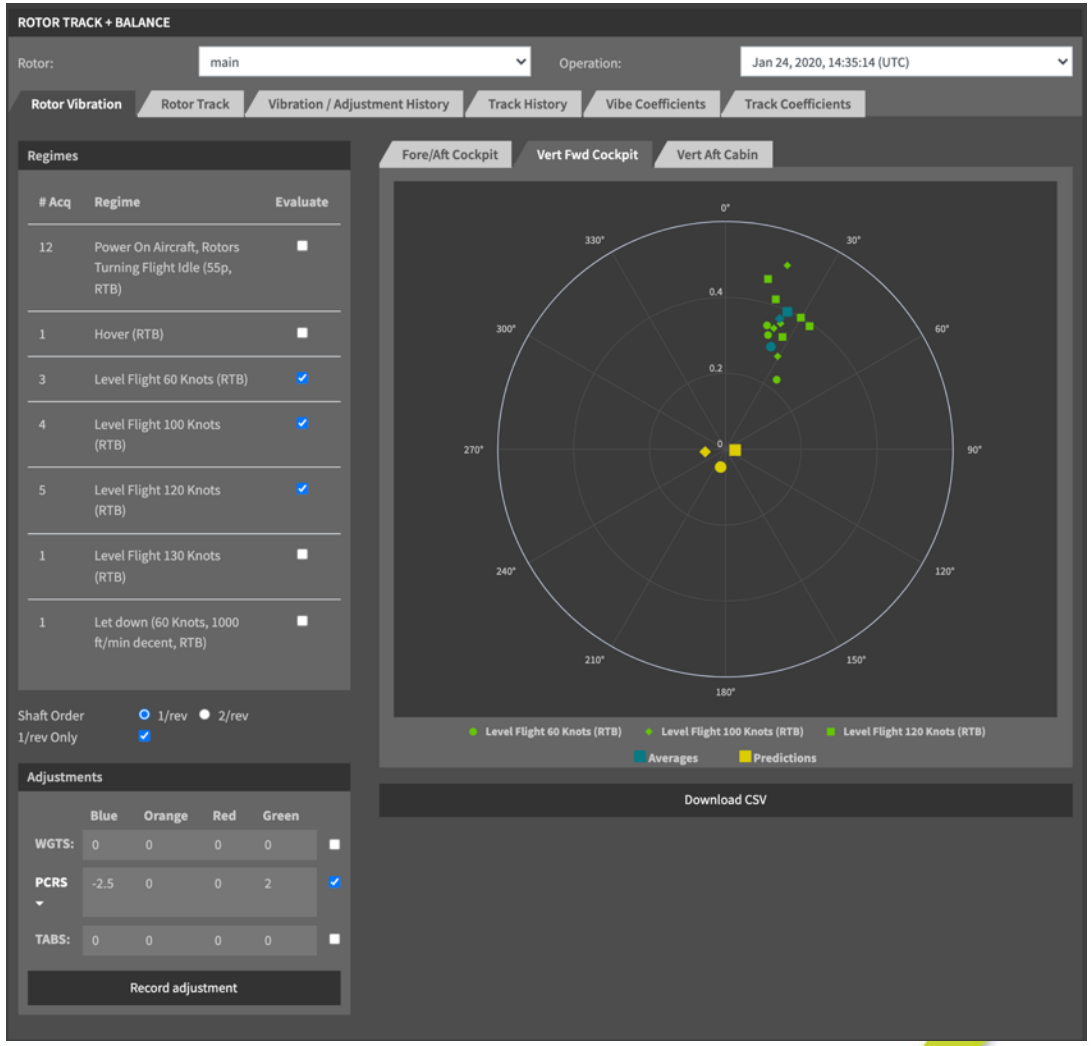
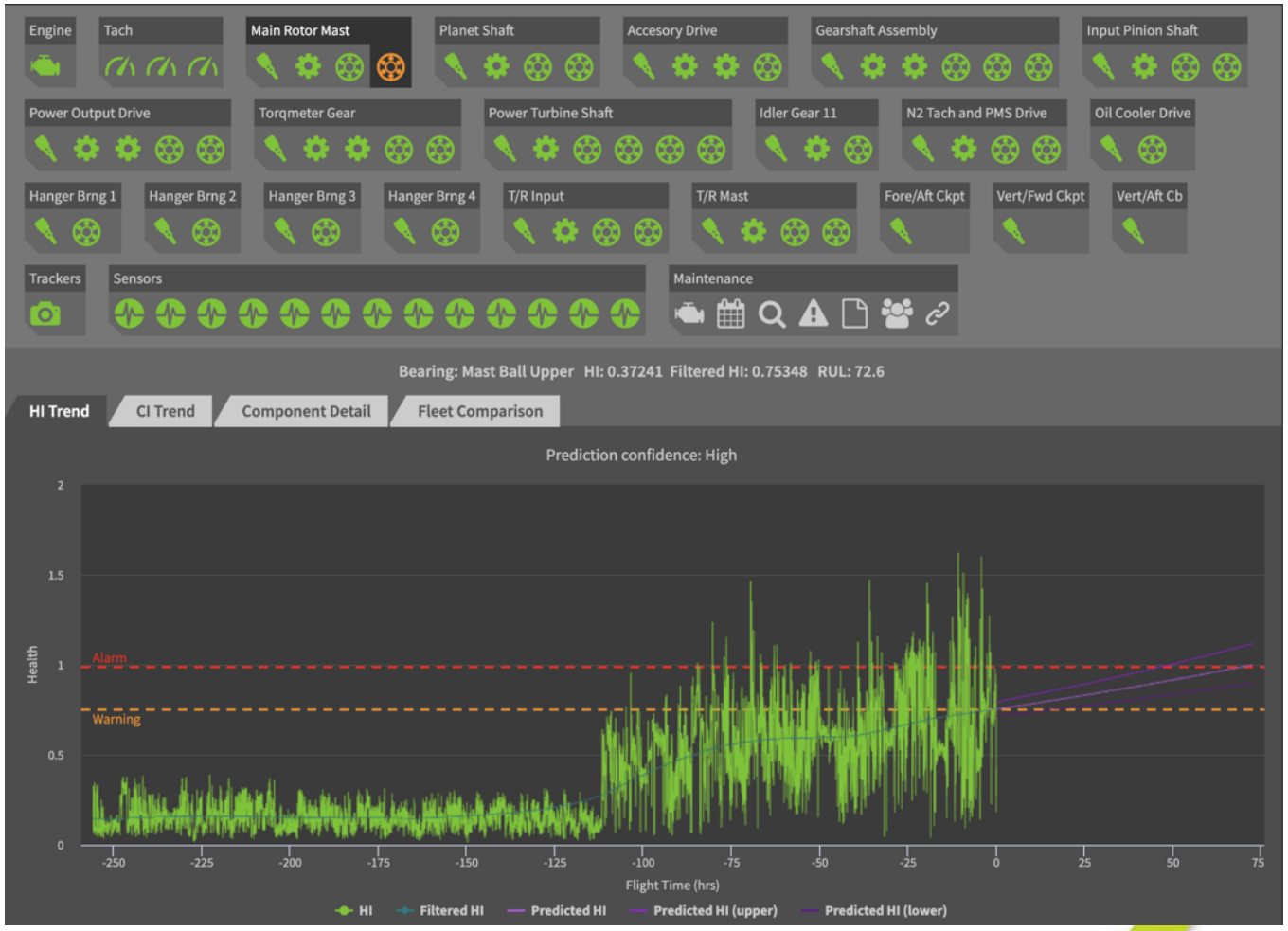
Rotor Track and Balance

- This is a HUGE Value of HUMS
  - No need for carryon equip. to acquire data
  - Adjustment always available
  - Rotor smoothing for comfort, less wear & tear
  - Alleviates the need for dedicated MX flights
  - Takes ~3 Hr exercise to 30 minutes



The Value of Diagnostics and Prognostics

- Protects Operator from Catastrophic Failures
- Prevent Chips Light
- Diagnostics Speeds Mx
- Prognostics/RUL for Mx Planning
- The Presentation will Focus on the Interpretation of data.
- For Prognostics, use Digital Twin



Step Change Detection

- Often, the damage is from high cycle fatigue or other relatively slow degradation processes.
- However, some events, such as maintenance, result in a step-change in the component's health.
- While high cycle fatigue degradation can be trended, a step-change in component health.