

Air Force Petroleum Office Quality & Technical Directorate (PTQ)

Air Force Advancements in Fuel Testing, Production, and Monitoring



U.S. AIR FORCE

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PURPOSE:

The PEAK is a mobile, field-deployable fuel laboratory designed for rapid, on-site quality analysis of aviation kerosene.

PRIMARY MISSION:

To provide the capability to test and certify fuel quality in expeditionary environments, ensuring that captured or locally sourced fuel is safe for use in military aircraft, vehicles, and equipment.

KEY CAPABILITIES:

The kit allows for comprehensive testing of critical fuel properties, including:

Automatic Particle Counter: Identifies and quantifies microscopic particulate contamination..

Digital Free Water Detector (Hydro-Light): Detects dissolved water in fuel down to the parts-per-million level.

Handheld Conductivity Meter: Verifies the correct concentration of Static Dissipater Additive (SDA).

Digital Density Meter: Measure fuel density, essential for accurate aircraft weight & balance calculations.

Digital Refractometer: Measures the precise concentration of Fuel System Icing Inhibitor (FSII).

Continuously Closed Cup Flashpoint Tester: Determines the exact temperature at which fuel vapors can ignite.



The PEAK kit contains a suite of ruggedized, portable testing equipment that meets ASTM standards for fuel analysis. All equipment is housed in hardened, waterproof cases for deployment in austere conditions.

- ASTM D7777 Digital Density Meter
- ASTM D7619 Automatic Particle Counter (APC)
- ASTM D3240 Undissolved Water Detector
- ASTM D5006 Digital Refractometer (FSII)
- ASTM D2624 Conductivity Meter
- ASTM D6450 Flash Point

The system will meet all base level (C++) test requirements IAW MIL-STD-3004-1, 00-80T-109, and 42B-1-1 in a portable hardened case capable of operating in extreme environmental conditions (-200 F to +1200F).



BATTLEFIELD FUEL PRODUCTION QUALITY ASSURANCE

- Contract awarded Jun 2025 to D2 Inc.
- Develop enhanced synthetic aviation turbine fuel/renewable diesel fuel specification testing capabilities based on the D2 Inc. Petroleum Expeditionary Analysis Kit (PEAK) to support battlefield fuel production. Referred to as EPEAK.
- Exploring supplemental analysis capabilities beyond current PEAK to include sulfur, thermal stability, distillation, H₂ content, hydrocarbon profiling, Cl/LI, water separation, and enhanced particle counter with capabilities for conductivity, H₂O, and density in a single unit.
- Targeted initial testing late CY2026.

SINGLE RUN THERMAL STABILITY BREAKPOINT

- Contract awarded Aug 2025 to Falex Corp.
- Develop a prototype thermal stability oxidation stability instrument and supporting test method to support single-run automated breakpoint detection.
- Draft test method and initial prototype configuration undergoing initial evaluation/validation.
- Formal prototype/test method testing late C2026.



Services coordinating with D-2 Inc. on development and acquisition of PEAK, Air Force, and Navy variants of the APC. Some DOW sites already have and are using APCs for sediment and free water assessments.

Ruggedized

- Environmental protection from dust and water ingress to IP67, MIL-STD-810 Method 512 Immersion Procedure 1
- Drop tested

Basic Features

- Service tailored user interface
- Output in terms of ISO 4406 and particle count
- Capable of closed loop and bottle testing
- Minimes 1620 connection fittings
- Portable: Weighs 11 lbs, padded carry case with shoulder strap and storage
- Two-button operation
- Test-flush cycles differ by Service variant (ex. 2.5 min test time for Navy version)
- Rechargeable Li-ion battery
- Internal pump control flow in and out of unit

Data Management

- Data management includes storage by location, date, and time
- 400 measurement memory

Operating Range

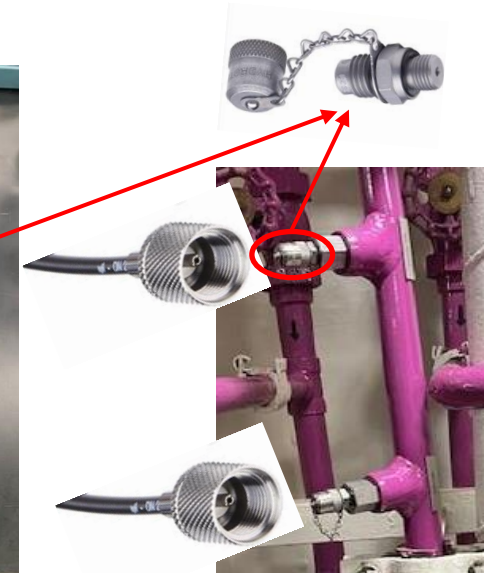
- Maximum operating pressure 500 psig
- Temperature operating range -30C to 50C

Calibration

- OEM (D-2 Inc) calibration every 3 (Navy) or 5 years with 6 (Navy) or 12 month verification
- If verification fails, send to D-2 for service
- No additional shipboard maintenance reqd.



Navy version of the APC with Minimes 1620 connection points highlighted



Minimes 1620 7/16"-20UNF
<https://www.hydratechnik.co.uk/minimes%20%AE-1620-test-point>



Passing Result



Failing Result

PURPOSE:

The Low-Pressure Cryogenic Analyzer and Sampler is a comprehensive system designed for the safe, rapid, and efficient testing and collection of Aviator Breathing Oxygen (ABO) samples.

PRIMARY MISSION:

To replace the high-pressure legacy ABO quality analysis process with a modern, field-deployable system that provides on-site, automated analysis and eliminates the safety risks and logistical burdens of high-pressure, hazardous samples.

KEY CAPABILITIES:

The system integrates advanced analysis with inherently safer sampling technology:

Centralized Laboratory Analysis: The analyzer is an analytical instrument used at designated AFPET and DLA labs to analyze cryogenic product (ABO) used throughout the Department of War (DoW).

Rapid, Non-Hazardous Shipping: Low-pressure sample cylinders are shipped as non-hazardous cargo (below 30 psi vs. the 1000 psi legacy system), allowing for faster shipment by air transport and eliminating high-pressure safety risks.

Significant Product Reduction: The process is highly efficient, requiring only 10 gallons of LOX per sample, a significant reduction from the 30 gallons consumed by the legacy system.



FIELD LEVEL MDA DETECTION INSTRUMENT

- ASTM D8545 test method updated for both laboratory and portable LC units.
- DLA Energy discussing/reviewing field trials for late CY 2026.
- Contract complete.



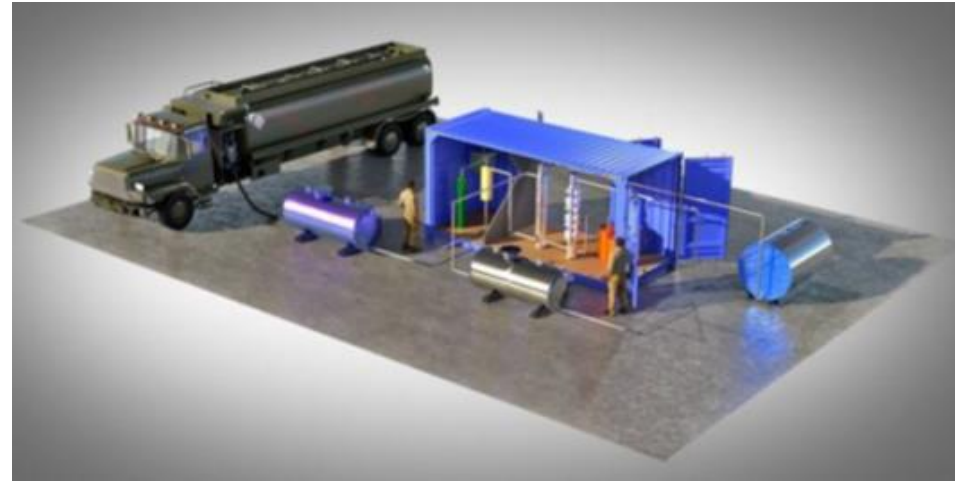
HAND-HELD HYDRAULIC FLUID/PAO COOLANT CONTAMINATION DETECTION IN JET FUEL INSTRUMENT

- Contracts awarded Mar 2024 to D2 Inc. and Forward Edge.
- D2 Inc./WaveGuide prototype evaluation completed Nov/Dec 2025. Instrument being upgraded based on field trials and user feedback. Follow on trials scheduled for May 2026.
- Forward Edge prototype evaluations targeted for Apr 2026.
- Targeted for use by flightline refueling operators and maintainers to support defuel operations/depot maintenance.
- Targeted detection level at $< 0.25\%$ contamination.



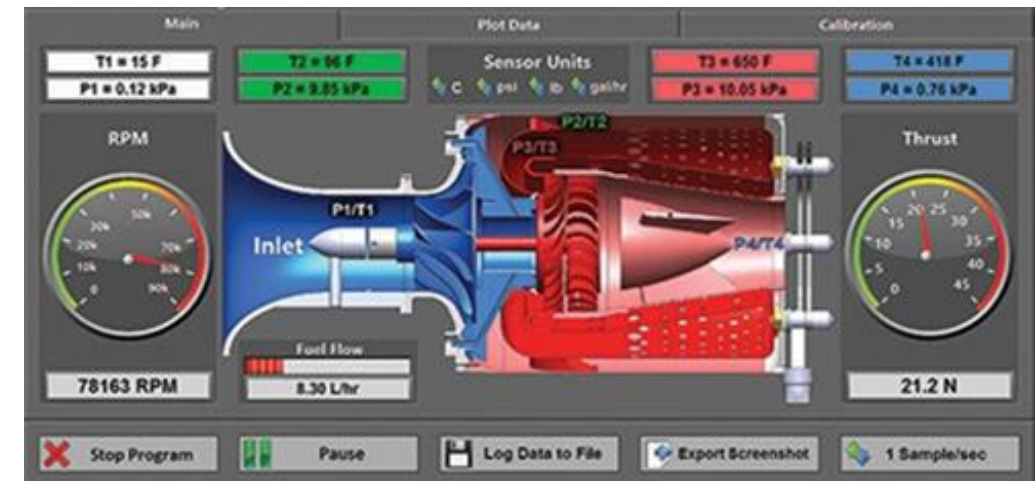
DEPLOYABLE POINT-OF-USE FUEL DESULFURIZATION CAPABILITY

- Contract to design/build 300 GPD proof of concept operational prototype and follow-on operational field evaluation awarded 2024 to University of Dayton Research Institute.
- Prototype critical design completed Dec 2024.
- Prototype full scale fabrication completion May 2026.
- Engineering/Scalability Technical Data Package Aug 2026.
- Prototype/Fuel Fit-For-Purpose Demo/Evaluation Oct 2026.



MIL-PRF-25017 CI/LI ENGINE WEAR TEST MODELING/SIMULATION

- Project being developed as potential alternative evaluation method to current 100-hour engine wear test required for qualification of new potential CI/LI candidate products.
- Looking to leverage engine modeling/simulation using small scale turbine engines to reflect modern engine configurations and potential synthetic formulations.



SYNTHETIC FUELS IN CONTESTED ENVIRONMENTS

- Contract awarded July 2025 to Air Company.
- Develop and demonstrate liquid fuel production system to support fixed on-site and forward mobile jet and renewable diesel fuel production.
- On-site synthetic fuel generation system that uses energy, CO₂, and H₂O to produce drop-in fuels at point of need.

Program objectives:

- Mobile, Adaptable, and Dynamic “MAD” Fuel System Development – Progress mobile. system TRL for successful transition
- Commercial System Scaling – bring AIRCO SPK to market.
- Fuel Formulation and Certification – Ensure that AIRCO SPK meets ASTM D7566 Annex A1 and enter the AIRCO SKA into certification processes (ASTM/DOW).



FLUID POWERED ADDITIVE INJECTOR (FPAIC)

HAMMONDS MODEL AC800-2L-1P7-1P7

Purpose & Mission

- The FPAIC is a mobile, non-electric cart designed to automatically inject the correct amounts of additives into fuel during Into-Plane servicing.
- Its primary mission is to upgrade commercial-grade fuel (Jet-A1) to military-specification fuel (JP-8) by accurately blending FSII, Corrosion Inhibitor, and Static Dissipater Additive. It contains a calibration cylinder to monitor injection rates in real time.

Main Components:

- **Fluid Motor:** The Hammonds Model 800 Driver serves as the core of the system, powered by the main fuel flow.
- **Additive Pumps:**
 - One (1) 2L pump for FSII.
 - Two (2) 1P7 pumps for Corrosion Inhibitor (CI) and Static Dissipater Additive (SDA).
- **Additive Storage:**
 - Two (2) 10-gallon tanks for CI and SDA.
 - A cradle for one (1) 55-gallon drum for FSII.



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- **Air Force is currently reviewing ASTM D8073 Water Separation Instrument**
 - **Goals:**
 - referee method for downstream testing of problematic surfactants in jet fuel
 - incorporation to specification– MIL-DTL-83133
 - **Current MSEP State– ASTM D3948 & ASTM D7224**
 - **Aligns with EI 1581 5th edition and higher filter media**
 - **Partnering with D2, Inc.**
 - **Partnering with Navy and Five Eyes Air Force Interoperability Council (AFIC) to evaluate instrument**

■ Field Level Quantification of CI/LI Additive

- NAVAIR developed and patented technology
- Turbidity-based method for quantification of CI/LI additive
- CY27 release

