Headquarters U.S. Air Force

Integrity - Service - Excellence

Fueling More Fight Through Innovative Energy Solutions

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What is Operational Energy?

- DOD Operational Energy
  - Energy required for training, moving, & sustaining military forces and weapons platforms for military operations
Office of Air Force Operational Energy

- Provides policy, guidance, and oversight on energy required to operate aviation assets and aerospace ground equipment

- **Mission:** Break barriers by connecting Airmen with technology, data, and innovative thinking to develop and champion energy-informed solutions for the Air Force

- **Vision:** Create an energy optimized Air Force that maximizes combat capability for the warfighter

*It's about more than saving fuel!*
Ultimate Objective

Maximize Mission Capability

Fuel MORE Fight
Air Force uses ~ 2B gallons annually on ~800K sorties

Air Force Budget
$129.17B, 95%

Energy,
$6.03B, 5%

Operational Energy,
$4.94B, 82%

Facilities Energy,
$0.98B, 16%

Vehicles Energy,
$0.11B, 2%
Defense Strategy, Air Force Priorities, and OE Goals

2018 National Defense Strategy
Rebuild Military Readiness--Strengthen Alliances--
Reform Business Practices
“Deliver Performance at the Speed of Relevance”

2018 USAF Priorities
Restore Readiness--Cost Effectively Modernize--Drive Innovation--
Develop Exceptional Leaders--Strengthen Alliances

Air Force Operational Energy Goals
1. Identify & deliver optimal operations planning & execution solutions for existing gaps
2. Provide innovative energy solutions for new and legacy aircraft and systems
3. Furnish energy-efficient weapons systems sustainment analysis
4. Support the production of energy-informed war plans
5. Educate the Force and build the culture for operational energy
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Deliver Optimal Operations Planning & Execution Solutions
Operations Planning & Execution Solutions

- Leading AF-wide effort to execute fuel data collection strategy
- Teaming with combatant & major commands to optimize flying operations through 21st century technology
- Analyzing mission operations and recommending optimized processes and policies
- Developing strategies to incentivize efficient mission execution

Data is critical to optimizing planning & execution

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Fuel Load Landing Weight Frequency

- Minimum Landing Fuel
- Minimum Fuel at IAP
- Actual Landing Weights

Target Range

Landing Weight (1000 lbs)

Frequency
Power of Data

Fuel Load Landing Weight Frequency

- Minimum Landing Fuel
- Minimum Fuel at IAP
- Ideal Distribution
- Actual Landing Weights

- Target Range

I n t e g r i t y - S e r v i c e - E x c e l l e n c e
Addressing inefficient operations =
Increased combat capability & enhanced readiness
Fusing Operational and Maintenance Data

Extra Landing Weight vs Landing Gear Maintenance

Avg 350 extra maintenance hours/aircraft per year
41 days a year non-mission capable across the fleet
Impact of ‘cost to carry’ excess fuel (based on one aircraft type)

- 350+ extra maintenance hours per aircraft annually
- 41 days per year non-mission capable across the fleet

Most heavy aircraft carry more fuel than required which negatively impacts efficiency, maintenance, and readiness
"JIGSAW" -- Replacing pencil power
Tanker Planning

Optimized operations planning

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Innovative Energy Solutions for New and Legacy Aircraft
Enabling Technologies for Next-Gen Mobility & Tankers

- Advanced Air-Vehicle Concepts
  - Efficient span-loading designs / lifting wing bodies
  - Advanced materials & manufacturing
  - Noise shielding
Enabling Technologies for Next-Gen Mobility & Tankers

- Airframe-Integrated Propulsion
  - Over-wing / over-body nacelles
  - Ultra-high bypass ratio turbofans
  - Boundary-layer ingestion

Credits: NASA/The Boeing Company
Credits: NASA/DZYNE Technologies/Brendan Kennelly
Legacy Aircraft Modernization

Lightweight Tie-downs

Active Winglets
Legacy Aircraft Drag Reduction

- Computational Fluid Dynamics Analysis
- Aft Body Drag Reduction Devices Program

C-17 fleet installation = ~5M gallons per yr avail for other missions
Aircraft Power & Thermal Optimization

- AETP, ADAPT, MegaWatt Aircraft
- Advanced APUs
  - Small Turbines
  - Fuel Cells
  - Turboelectric generators
- Airframe-Integrated Solar

Credits: Jet Central/ChiefAircraft.com

SOFC
Credits: Parker/FuelCellsWorks.com

Airframe-Integrated Solar
Credits: Bye Aerospace & SolAero

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Energy-Efficient Weapons Systems Sustainment Analysis
Turbine Engine Efficiency, Reliability, & Maintainability

IR Scanning Compressor Blade
Turbine Engine Efficiency, Reliability, & Maintainability

Coated vs. Uncoated Compressor Blade

With coating

Without coating
Support Production of Energy
Informed War Plans
Operational Energy & the Tyranny of Distance

Permissive vs Non-Permissive Bulk POL Supply Routes

- Alaska to Japan: 11 days vs 12 days
- W. Coast to Japan: 11 days vs 12 days
- Gulf Coast to HI: 16 vs 30 days
- Middle East to S. China Sea: 16 vs 30 days
- S. Africa to N. Australia: 22 days vs 36 days
Defining OE supply network back to refinery production and not just fuel storage at a given base.
Educate the Force and Build the Culture for OE
Educate the Force and Build the Culture for OE

MORE THAN JUST FUEL SAVINGS...
[ENERGY EFFICIENCY + INNOVATION = MORE FLIGHT HOURS]

OPERATIONAL ENERGY INNOVATION

FLY FAST, SAVE GAS?

Two F-22 CORONET demonstrations showed flying at a faster airspeed, including during air refueling, not only reduces transit time, but also saves fuel.

In January 2018, Maj. Sterling Boyer and Maj. Dan Shees, working with TAC and the AOS, developed the concept of flying and air refueling F-22 CORONETS near the F-22 maximum endurance airspeed of 885 KIAS instead of the standard 810 KIAS. The test demonstration flew 12 F-22s with KC-10 and KC-135 tanker support from Langley to Hickam, then on to Kadena, measuring a range of factors including fuel use, flight hours, and aircraft stability. Results indicated significant savings in not only flight time, but also fuel, which could have a large impact if the methods is implemented across the fleet.

“I think that’s awesome on many counts... Saves gas, saves time, empowers innovation.”
- Gen Mike Holmes, ACC Commander

FAST FACTS

1. Overall 10% decrease in flight time, 8% decrease in fuel used
2. F-22: Greater AR stability

INNOVATIVE RESOURCE SOLUTIONS

The max landing weight for the KC-135 is now 235,000 pounds because of the initiative displayed by one Airman in the CAOC. Concerned by the high incidences of fuel dumping, he was determined to reduce fuel dump frequency and avoid wasting an increasingly valuable resource. He came up with an innovative solution to change the 1955 policy 200,000 pound landing weight restriction, thereby reducing AOR dump frequency by 80% and volume dumped by 90%.

In his research, he found the 200k restriction was driven by A-Model engine-out climb performance. The JSF engines have long since been replaced by the B-model (CFM-56) engines, which produce about twice the thrust and completely change the engine-out go-around climb profile. With the increased performance, the KC-135 can safely land and execute an engine-out go around at 235k, eliminating most fuel dumping events.

He worked with maintenance, sustainment professionals, and operators to ensure there were no hidden costs or safety issues associated with the proposed increase. When none were identified, he successfully worked to change AFR-11-24KC-135V8 to reflect the new max landing weight.

This success story is just one example of how the current generation of aviators and maintenance professionals are embracing the smart use of operational energy resources. One of your roles is to support and apply this mindset throughout the Air Force, thus changing the culture and creating an operationally efficient force. Your leadership and endorsement of smart operational energy use creates an atmosphere where people are internally motivated to critically analyze and solve OE challenges.

“We must unleash the military from the tether of fuel” – James Mattis, Secretary of Defense

Office of the Secretary of the Air Force for Operational Energy

INTEGRITY - SERVICE - EXCELLENCE
Educate the Force and Build the Culture for OE

Promoting smart energy practices and policies

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- USAF will continue to be DoD’s largest fuel consumer

- Developing and championing innovative energy solutions is critical to improving combat capability and increasing readiness

LEARN MORE:

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QUESTIONS