The Cost of Energy

Energy is a significant portion of the budget

AF FY14 Total Budget $108.7B

Energy 8%

Aviation Fuel 86%

Facilities 11%

Vehicles 3%

Energy is a significant portion of the budget
Air Force 30-Year Strategy lays out four Emerging Global Threats. Each one shapes how we think about energy at the Air Force.

- Rapidly emerging technological breakthroughs
- Geopolitical Instability
- Wide range of operating environments
- Increasing importance and vulnerability of global commons
What does the Air Force of the Future look like?

**STRATEGIC AGILITY**

- Resiliency
- Adaptability
- Flexibility
- Partnerships
- Inclusiveness

Mission Assurance through Energy Assurance
How we operate will change...

<table>
<thead>
<tr>
<th>Fuel Demand Comparison</th>
<th>Legacy</th>
<th>Future</th>
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<tbody>
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1 for 1 Fighter Replacement
We Don’t Fight Separately

M2A2 Bradley Fighting Vehicle

Army Ground Combat Vehicle

Operational considerations can be driven by other services force structure and procurements

Integrity - Service - Excellence
Why, What, and How

Geopolitical Cost
Mission Cost
Financial Cost
Environmental Cost
Fuel Efficiency Initiatives

- MAJCOM Policy: AFI’s, Ground Power Unit usage, Alternate destination fuel requirements...
- Operations: Air refueling optimization, Optimized diplomatic cleared routings …
- Training: More requirements and currencies completed in sims…
- Aircraft: Weight reduction, aircrew electronic publications…
- Wargames: Unified Engagement, Futures…
- Investments: Integrated air refueling simulator, KC-135 Propulsion Upgrade Program, …
- NextGen: Airspace access and efficient flight operations

Initiatives realize absolute savings & cost avoidance
# MAF Policy/Low-Cost Initiatives

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Start date</th>
<th>FY 15 Savings (Gal/$)</th>
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</thead>
<tbody>
<tr>
<td>Optimized Diplomatic Clearance Routes</td>
<td>Oct 07</td>
<td>0.06M</td>
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<tr>
<td>Aircraft Weight Reductions</td>
<td>Feb 09</td>
<td>0.43M</td>
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<tr>
<td>Reduce KC-135 Zero Fuel Weight</td>
<td>Jan 10</td>
<td>1.70M</td>
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<tr>
<td>Reduced APU Use</td>
<td>Aug 10</td>
<td>0.22M</td>
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<tr>
<td>Contingency Fuel Reduction (15 Min)</td>
<td>Sep 10</td>
<td>0.71M</td>
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<tr>
<td>Overfuel Elimination/Precise Fuel Loading</td>
<td>Sep 10</td>
<td>0.16M</td>
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<tr>
<td>Mission Indexed Flying / ACFP Overlay</td>
<td>Oct 10</td>
<td>2.76M</td>
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<td>Alternate Fuel Requirements Change</td>
<td>Jun 11</td>
<td>0.25M</td>
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<tr>
<td>Category I Fuel Elimination</td>
<td>Oct 11</td>
<td>0.64M</td>
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<tr>
<td>MAF Cost Avoidance Tankering</td>
<td>Jul 12</td>
<td>n/a</td>
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<tr>
<td>Surfing Aircraft Vortices for Energy ($AVE)</td>
<td>Sep 12</td>
<td>&gt;FY15</td>
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<tr>
<td>KC-135 Landing Weight Reductions</td>
<td>Aug 13</td>
<td>0.33M</td>
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</table>

**FY15 Projected Savings/Cost Avoid ~ 7.3M Gal/$40.9M**
Significant experience with using different fuels – it’s an operational necessity
Approach to Technology

- Three priority categories:
  - Technology Leader
  - Fast Follower
  - Technology Watcher

- Current technology initiatives include:
  - Aircraft and engine design
  - Renewable energy
  - Microgrids
  - Best practices in planning & operations

Air Force focuses on core capabilities in innovation
Utilizing Technology

Time to Develop and Fully Implement

Near-Term (0-5 years)
Mid-Term (5-10 years)
Long-Term (10+ years)

Policy and Behavioral Changes
Component Upgrades
RDT&E Efforts
Legacy Fleet Re-engine

Cost
Fuel Assessment and Evaluation

Motivation

- Conversion to commercial Jet A completed (2014)
- Challenges of jet fuel changes
  - Linking changes in fuel composition to performance
  - Updating consensus-based specifications
  - Complex logistics infrastructure
  - Specialty fuels for hypersonics, missiles

Key Events and Demonstrations

- FY14: JP-8 spec change to reduce allowable FSII but maintain icing inhibition and reduce maintenance
- FY14: 3rd alternative fuel approved for Jet A based on AFRL data (previous in 2009, 2011)
- FY14: Next Gen JP-7 for hypersonics ops & testing
- FY15: SAE E31 draft ARP for particulates (soot) released for ballot
- FY15: Complete sustainment program for JPTS thermal stability instrumentation (for U-2)
- FY16: Fuel Microbial Sensor
Revolutionary Configurations for Energy Efficiency

**Phase I:** Develop 90% Fuel Savings Fleet & Rank Highest Pay-Off Fuel Saving Technologies

**Best Performing Configuration**
- Conventional
- Box Wing
- Hybrid Airship
- Strut-Braced
- Flying Wing
- HWB

**Highest Payoff Technologies**
- Efficient Integration of Advanced Engines
- Laminar Flow
- Formation Flight
- Advanced Configs
- Next Gen Advanced Materials
- Wing Loads Alleviation
- Reduced Empennage Area

**Phase II:** Mature Technologies & Configurations

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
When do we address energy?

Once an asset is deployed, opportunities for energy efficiencies are limited.

*Integrity - Service - Excellence*
Conclusion

We must have millions of gallons of gasoline a day to do our job!

- Gen Hap Arnold