Air Force Achieves Fuel Efficiency through Industry Best Practices

The U.S. Air Force's Air Mobility Command (AMC) is changing the way it does business. It is saving energy and money through an aircraft fleet fuel-efficiency program inspired by private industry best practices and ideas resulting from the empowered fuel savings culture.

Although profits drive the need for industry fuel savings, AMC, the Air Force's largest user of aviation fuel, understood that creating a fuel-savings culture was key to attaining fuel savings objectives. Why? Simple. In 2011, the AMC Mobility Air Forces (MAF) consumed more than 63% of all Air Force fuel, further underscoring the importance of fuel efficiency throughout the command.

The MAF created the Aviation Fuel Efficiency Office (FEO) to develop tools, processes, metrics, and organizational interfaces to lead the implementation of aviation fuel conservation improvements. The FEO carries out the Air Force's vision for fleet fuel efficiency, which was derived from the 2010 Air Force Energy Plan. This plan is built upon three pillars: reduce demand, increase supply, and culture change. It also established the goal of reducing aviation fuel 10% by 2015 and introduced cultural parameters to help make energy a consideration in all it does.

Fuel Savings Culture

The fuel-savings culture began with the creation of a robust governance structure to gather fuel-efficiency ideas and implement initiatives with the highest potential to save aviation fuel. All MAF personnel are encouraged to propose fuel savings ideas. These ideas are then processed as initiatives, assigned a primary point of contact, and routed through an analysis process to prepare the initiative for presentation to the Air Force's corporate structure. The corporate structure then evaluates and determines the initiatives with the highest potential fuel savings.

Fuel-saving efforts focus on six major areas: policy, planning, execution, maintenance, science and technology, and fuel-efficient aircraft systems. The MAF also established a predetermined set of fuel-savings metrics and required reporting.

In fiscal year 2011, implemented fuel initiatives saved the MAF more than 42 million gallons of aviation fuel in both operations and training.

The Air Force Energy Plan is built upon three pillars: reduce demand, increase supply, and culture change. *Photo from U.S. Air Force*

Best Practices from Industry Fleets

AMC modeled its fleet fuel savings on private industry best practices. Fuel is a major cost factor for any fleet. AMC looked to the commercial airline industry for best practices for reducing fuel use and costs. These simple but effective best practices, which can be adopted by any type of fleet—whether aircraft or vehicle, include:

- Data capture and analysis: Data is the fundamental enabler for all fuel-efficiency efforts and highlights opportunities for fuel reduction, as well as measures the success of fuel-saving initiatives.
- Weight reduction: Removing excess equipment and supplies, such as galley equipment, redundant armor, and extra survival equipment, reduces the fuel consumed during flight.

An eco-engine wash to clean the inside of a engine is used as a fuel conservation measure. *Photo from U.S. Air Force*

- Fuel planning: For the same reason airlines are reducing unneeded equipment carried on their aircrafts, they are also planning fuel loads more precisely to reduce costs of carrying unnecessary fuel.
- Flight/trip planning: The commercial industry is continually investing in state-of-the-art flight planning systems that minimize fuel consumption. The industry also engages with air traffic service providers to minimize the fuel required to safely accomplish flights through more efficient routing.
- Cost analysis: Cost analysis, also known as cost indexing, allows airlines to reduce the total operating costs of its enterprise by balancing flight time costs, fuel costs, and maintenance costs.
- Engine wash: Commercial carriers routinely clean aircraft engines resulting in reduced fuel consumption and maintenance costs.

AMC incorporated each of these fuel-saving methods into its operations, as well as other initiatives, such as an online fuel data collection and reporting tool.

Because many of the fuel data collection methods available to the airlines are not commercially available, AMC created the Wing Dashboard, an online tool that contains a variety of metrics to report overall fleet fuel efficiency. Everyone within the MAF has access to this tool in an effort to foster the culture change that is critical to the long-term success.

171st Air Refueling Wing

Located in Pittsburgh, the Air Force's 171st Air Refueling Wing (171st ARW) is home to the Pennsylvania Air National Guard and is a part of the MAF. Its mission: provide resources for global engagement to meet national objectives and assist local and State of Pennsylvania authorities.

The 171st ARW Aviation Energy Efficiency Program's (AEEP) goal was to streamline efforts and achieve the Air Force's goal of reducing fuel consumption by 10% by 2015. The 171st ARW aided the AMC Aviation Fuel Efficiency Office with its expertise and established best practices for fuel savings. AMC modeled its first web-based fuel-tracker data-collection tool after the system used by the 171st

ARW. The 171st ARW also shared its best practices, data collection tools, and initiatives with other military organizations worldwide to help them increase fuel efficiency.

The 171st ARW pioneered its fuel savings by first looking internally and realizing there were some questions that needed to be answered to properly frame the problem and develop a solution. They included:

The 171st ARW aided the AMC with its expertise and provided their fuel tracking data-collection tool, which became the foundation for the Wing Dashboard.
Illustration from 171st ARW Pennsylvania Air National Guard

- What is our culture?
- How do we view fuel and energy?
- What are our current practices?
- How do we compare?
- Can we do better?
- Can we adopt any proven commercial practices locally?
- Can we develop metrics and goals?

By answering these questions, the 171st ARW identified a need for organizational structure, culture change, and fuel data to establish a baseline to achieve its goal.

Organizational Change

The 171st ARW reorganized their operational framework so every person involved in aviation operations would understand the fuel reduction goal and why it was important, as well as the processes to implement solutions. In 2007, the permanent-standing AEEP was established to explore, develop, and institute fuel-efficiency initiatives in the 171st ARW. The AEEP instituted a procedure that evaluated fuel-efficiency tactics, techniques, and procedures after every flight for each crewmember. The AEEP also maintains an informational bulletin board, which includes the current price of jet fuel and any other pertinent information concerning fuel conservation and efficiency.

Culture Change

The new AEEP also determined that culture change was a necessary tool for the implementation of fuel conservation at the 171st ARW. The 171st ARW had a core of pilots who worked in the airline industry. For these individuals, fuel conservation was a regular part of business and bottom line. This provided the 171st ARW with onsite expertise and a launching point for a culture change. Embarking on culture change in any organization can be challenging but even more so in the military. As a result, the working group created a "road map for culture change," which outlined elements critical for success. These elements noted that:

- The commander's support would be critical to the program's success.
- All agencies on base that affect the process must be involved, so everyone is a stakeholder in the outcome.
- The monitoring and evaluation of the process must include aircrews, planners, maintainers, and logisticians.
- A document must be developed to set the standard for planning and execution.

The 171st ARW then determined how to improve fuel conservation and how those improved results were going to be maintained once culture change was underway. Four seemingly simple concepts were used to guide and refine its day-to-day flying operations:

- Operations staff engaged in better flight planning to save fuel and maximize labor and equipment
- Aircrews flew jets more efficiently using concepts like flying aircraft within the best power range, specific fuel consumption parameters, and other performance principles to increase fuel efficiency
- Unnecessary nonfuel weight was removed from jets to increase fuel efficiency
- Flight planners also determined how to carry the right amount of fuel for each specific trip (a common practice by the airline industry).

By implementing these concepts, the 171st ARW was able to collect data, establish processes and goals, and ultimately form an aviation energy management system.

Fuel Savings through Data

The 171st ARW's aviation energy management system required no monetary investment, because it was created with "human capital" using a simple spreadsheet. The system, which is backed by 171st ARW staff, is used to collect and process flight data in an effort to identify areas for improvement. The system created a baseline that allows the 171st ARW to analyze fuel use and chart progress. The analysis revealed that planes were carrying too much fuel and were flying inefficiently.

The 171st ARW staff meticulously plans fuel-efficient flights by avoiding unnecessary weight, which also includes fuel weight. In fact, the 171st ARW reduced the carriage of unnecessary fuel by 35% since 2006, resulting in a cost avoidance of about $800,000. The 171st ARW has also reduced greenhouse gas emissions by 9.2% since 2006. In 2010, the 171st ARW achieved

its goal of reducing fuel consumption by 10% from its baseline. It should be noted that the 171st ARW can't limit its number of flights per year because its mission is to provide global support when called. Accordingly, in 2010, even through the 171st ARW executed 91% more flying hours than it did in 2005, it was able to achieve a 10% reduction in gallons per hour.

The 171st ARW now operates with a leaner flying hour program, which results in fuel and environmental savings. The 171st ARW continues to offer its industry-based fuel efficiency expertise through AMC and other military installations that desire an aviation energy-efficiency program.

The Air Force continues to innovate and look for ways to integrate best practices to save fuel, energy, and money. Adopting industry best practices has assisted the Air Force to achieve many of its energy reduction goals, and it continues to look for ways to improve its energy management practices agency-wide.

Fuel-saving efforts are focused on six major areas: policy, planning, execution, maintenance, science and technology, and fuel-efficient aircraft systems. *Illustration from Mark Diamond, AMC Public Affairs*

Two 1.5 MW net-metered wind turbines provide power for the clean-up project at MMR. *Photo from Air Force Center for Engineering and the Environment*

Wind Powers Groundwater Remediation Project

The Air Force doesn't stop with fuel savings. It is also reducing energy costs and environmental impacts by using wind power on an environmental cleanup project. The Air Force faced remediating one of the military's most visible environmental cleanup locations at the Massachusetts Military Reservation (MMR) on Cape Cod. The Air Force Center for Engineering and the Environment (AFCEE) completed environmental investigations at MMR and constructed nine groundwater treatment systems designed to clean more than 17 million gallons of contaminated water per day. The AFCEE led the effort to enhance the sustainability of the remediation program by saving energy, water, and the environment at the MMR.

The AFCEE team developed an innovative approach and is using 4.5 MW of net-metered wind energy to power the project. The project also reuses the treated water to supplement a portion of the base's landscape irrigation needs. The Air Force has incorporated a full-spectrum of energy-efficiency measures into the operation of the remediation project to reduce energy demand, such as the use of energy-efficient lighting with occupancy sensors, energy-efficient windows, and a no-idle policy for fleet vehicles. The result of this innovative approach will result in offsetting greenhouse gas emissions by more than 6,600 metric tons of CO_2 per year and will have a lifetime cost savings of more than $68 million. The project demonstrates the Air Force's dedication to changing the way it does business.

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