PYTHAGORAS
The Next Stage of Tanker Planning Optimization

AIR FORCE OPERATIONAL ENERGY

Streamlined Planning Enables New Efficiencies

In June 2017, a tanker scheduling software, Jigsaw, replaced the manpower-intensive process used to produce daily tanker plans at the 609th Combined Air Operations Center (CAOC). Developed by Defense Innovation Unit (DIU), Jigsaw digitized the outdated whiteboard planning process, which reduced the number of required personnel and decreased the planning time from 8-12 hours to approximately 4 hours. Initial analysis of operational data indicates that Jigsaw improves tanker asset utilization by **3.6%.**

To support continued efficiency improvements, SAF/IEN funded the development of an auto-planning feature, known as Pythagoras. The added capability aims to further increase scheduling efficiency through optimization algorithms implemented by Kessel Run, the development organization responsible for the AOC weapon system.
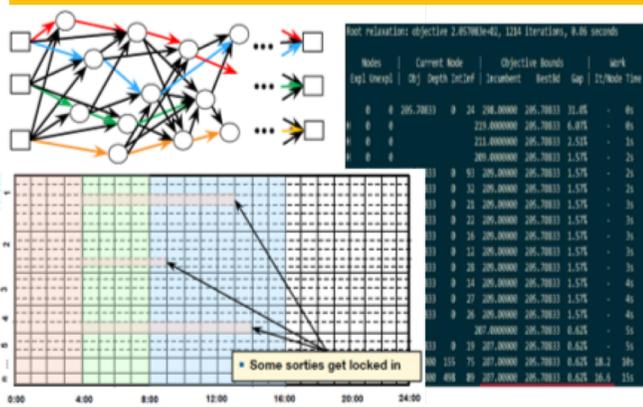
Optimization takes planning from digital maps to real-time navigation

✓ **GOAL:** Provide capability within Jigsaw for planners to quickly develop a feasible and optimized aerial refueling scheduling, accounting for a host of constraints and planner judgement.

✓ **APPROACH:** Use commercial off-the-shelf optimization algorithms with a customized "translator" interface that communicates with Jigsaw and processes inputs/outputs.

✓ **PROGRESS:** The tool re-planned a year of aerial refueling schedules to test algorithm effectiveness compared to Jigsaw. These results indicate Pythagoras should increase scheduling efficiency by **10%**, while reducing planning time to roughly 10 minutes.

✓ **EFFICIENCY IMPLICATIONS:** A **10% increase** in scheduling efficiency would support an average requirement of **4.5M pounds** of fuel offload with approximately 5 fewer tanker taskings per day. With 5 fewer daily taskings, dozens of tails and crews could be re-assigned to other missions or avoid deployment.

WHY IT MATTERS

With a digitized tanker planning process, the CENTCOM CAOC currently realizes a **3.6%** increase in aerial refueling efficiency and a significant reduction in planning time.

The added capabilities of Pythagoras are estimated to increase schedule efficiency by approximately **10%** from Jigsaw's baseline, or the equivalent of removing ten tankers from the average ATO. Realized efficiencies enable the Air Force to maintain the same combat sortie rate while decreasing fuel consumption, reducing the number of required deployed tankers, and enabling reallocation of crews.

Deputy Assistant Secretary of
AIR FORCE OPERATIONAL ENERGY

OUR MISSION

To enhance combat capability and mitigate operational risk to the warfighter through energy-informed solutions.

OUR VISION

To create an energy optimized Air Force that maximizes combat capability for the warfighter.

OPTIMIZING OPERATIONAL ENERGY LEADS TO:

INCREASED
Combat Capability

INCREASED
Aircraft Lifespan

LOWER
Aircraft Maintenance Costs

MORE
Training Opportunities

$5-7 BILLION
is spent on Air Force aviation fuel **ANNUALLY**

81% of the Air Force **ENERGY BUDGET** is spent on aviation fuel

2 BILLION
GALLONS of aviation fuel used by the Air Force **ANNUALLY**

8,000
additional sorties fueled from a **1% EFFICIENCY INCREASE**

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