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A Cost Benefit Analysis of Transitioning the USN to a Single Fuel Type

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NPS NRP Executive Summary
Cost-Benefit Analysis of a Single Type of Naval Fuel
Period of Performance: 12/01/2020 – 12/31/2021
Report Date: 12/24/2021 | Project Number: NPS-21-N030-A
Naval Postgraduate School, Graduate School of Defense Management (GSDM)

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COST-BENEFIT ANALYSIS OF A SINGLE TYPE OF NAVAL FUEL

EXECUTIVE SUMMARY

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Project Summary

Fuel distribution and its availability is key to maintain force posture during all phases of a conflict. Given the great power competition (GPC) increasing between the U.S., China, and Russia, and a shift to distributed maritime operations, it is important to assess the cost benefit of changing the fuel distribution to a single fuel type. The Naval Postgraduate School (NPS) proposes to conduct a cost benefit analysis (CBA) of switching entirely or partially to JP-5 fuel as opposed to the current multiple fuel types used on ships aircrafts and vehicles. Specifically, this research addresses these main questions: If the Navy adopted a policy allowing a 50% JP-5 and 50% F-76 mixture to be issued to surface vessels in lieu of F-76, what would be the cost benefit? Would this policy improve historical turnover rates of the Department of Defense's JP-5 inventory? What infrastructure investments are necessary to adopt a single-type Naval fuel?

We use past list purchase cost and standard sales prices for JP-5 and F-76 as our primary data sources to calculate potential savings from shifting to the SFC. Regression analysis is used to calculate the estimated purchase costs and sales costs for fuel under the current two-fuel concept. The predicted consumption figures for a single fuel concept (SFC) were used to predict the total fuel cost of JP-5 for future years as a single fuel in the fleet. We find significant cost savings by switching to a single fuel concept instead of a fuel policy mixture of using 50% JP-5 and 50% F-76. If the purchase and sales prices of JP-5 remain the same upon implementation of the SFC, there is potential for substantial savings for the government.

Keywords: *naval fuel, supply chain, cost benefit analysis, CBA, JP-5, F-76*

Background

Fuel distribution and its availability is key to maintain force posture during all phases of a conflict. Given the GPC increasing between the U.S., China, and Russia, and a shift to distributed maritime operations, it is important to assess the cost benefit of changing the fuel distribution to a single fuel type—more specifically, looking at the benefit of pooling inventory and simplifying distribution to a unique JP-5. NPS proposes to conduct a CBA of switching entirely or partially to JP-5 fuel as opposed to the current multiple fuel types used on ships aircrafts and vehicles. Fuel distribution and its availability is key to maintain force posture during all phases of a conflict.

We use past list purchase cost and standard sales prices for JP-5 and F-76 as our primary data sources to calculate potential savings from shifting to the SFC. Regression analysis is used as our prediction model to calculate the estimated purchase costs and sales costs for fuel under the current two-fuel concept. Then the predicted consumption figures for an SFC were used to predict the total fuel cost of JP-5 for future years as a single fuel in the fleet.

Findings and Conclusions

This report analyzes the feasibility of switching entirely or partially to JP-5 fuel as opposed to the current multiple fuel types used on ships aircrafts and vehicles. A CBA is provided which recommends immediate implementation of the single fuel concept in a phased rollout to cut costs, simplify the supply chain, and provide a long-term solution to a growing logistics problem.

First, we find significant cost savings by switching over to a single fuel concept instead of a fuel policy mixture of using 50% JP-5 and 50% F-76. If the purchase and sales prices of JP-5 remain the same upon implementation of the SFC, there is potential for substantial savings for the government. The cost savings for each scenario we provide (low end vs. high end of 30-year shipbuilding plan) show significant savings possible in future years by switching to an SFC. Based on our calculations, Defense Logistics Agency can procure JP-5 as a single fuel for $227M to $262M less over the next decade. Additionally, the United States Navy would subsequently save between $86M and $99M over the next decade by switching to JP-5 as a single fuel.

Second, a policy of switching over to an SFC would dramatically impact turnover rates of the Department of Defense's JP-5 inventory. Notably, the increase would take place since much of the Navy would be operating with only one fuel type (i.e., JP-5) if implemented in full. Based on the significant increase in the amount of JP-5 that would be necessary to implement the SFC, we recommend a phased rollout. This will allow time for adjustments to the supply system as well as allow time to assess unforeseen effects of an SFC on ships. The rollout plan consists of three phases held over the course of the next several years to conduct analysis, allow government-used refineries time to shift production to JP-5, and mitigate risks associated with unforeseen damages possible to ships after the switch to JP-5. Distillate fuels similar to F-76 are readily available across the world and used by other militaries as well as merchant ships. The U.S. could use these other replacement fuels as an emergency source of fuel if JP-5 as a single fuel is disrupted in the future. However, the most important fuel to protect for future operations is JP-5 given that it is the sole fuel used in our maritime aircraft.

Lastly, the 30-year shipbuilding plan lays out the current force structure and predicted future force structure. The current number of naval vessels is 296 with the goal of 321 to 372 manned vessels and 143 to 242 unmanned vessels. By increasing the number of vessels, it could cause a heavy strain on the current underway replenishments especially considering the requirement to carry both JP-5 and F-76.

Recommendations for Further Research

We recommend conducting research into the need to increase the size of the U.S. Navy's refueling fleet to support the increase in size of the fleet. The 30-year shipbuilding plan lists a small increase in fleet logistics ships, but it might not be enough to support the increased fleet size in a contested environment.

Additionally, we recommend adjusting the analysis to demonstrate the improved efficiency that is possible by utilizing the single fuel concept (SFC) on tankers.

To fully implement the SFC, the costs associated with the transition to SFC should be examined. These costs include things such as tank cleanouts onboard ships, reconfiguration of piping systems and storage tanks, changes to distribution of fuel onboard Military Sealift Command ships, and aspects of the transition that cannot be easily monetized such as unforeseen maintenance from long-term use of JP-5 on equipment previously run-on F-76.

Fuel blending is an area of research that might help increase availability of JP-5 without completely ceasing F-76 production. Research should be conducted on both the feasibility and cost impacts of doing some ratio of a fuel blend. This would provide the Navy with an alternate to the current fuel set up or the SFC.

Refineries will have to significantly increase JP-5 production to keep up with the demand from implementing an SFC. Therefore, research should be conducted into the feasibility, timeline, and costs associated with commercial refineries making the switch from diesel fuel to JP-5, as well as how these factors would affect the timeline for implementing an SFC. Additionally, any risks involved in this change to the supply chain should be examined.

Acronyms

CBA	Cost Benefit Analysis
GPC	Great Power Competition
NPS	Naval Postgraduate School
SFC	single fuel concept