

Cost-Benefit Analysis of Converting Wasp Class Landing Helicopter Dock (Lhd) Steam Propulsion Plants to Hybrid Propulsion



NAVAL
POSTGRADUATE
SCHOOL

Abstract

The purpose of this thesis is to conduct a cost-benefit analysis of converting steam-powered propulsion plants on-board Wasp-Class Landing Helicopter Dock (LHD) hulls 1 through 7 to hybrid propulsion. The objective of this research was to evaluate the net present value of conversion by weighing the cost-savings benefits of fuel savings, in-port utility consumption, and manpower against the cost of conversion. The results of the analysis conclude that LHDs 5 and 7 have a positive net present value; therefore, their conversion is recommended. LHD 6 can have a positive net present value with recommended complex overhaul schedule changes. Recommendations are made to maximize benefits to the Navy, considering potential changes in force structure and follow-on studies.

Methods

- Literature review performed on historical conversion data proposed on LHD 7
- Cost-benefit analysis (CBA) performed using Office of Management and Budget's Circular A-94 at a 3.6% discount rate
- The four primary benefits identified as underway fuel economy, not underway (auxiliary steaming) fuel economy, pier-side utility consumption, and manning, while the principle cost is incurred from the conversion process
- Fuel costs modeled at high, reference, and low price values using Energy Information Administration's (EIA) Annual Energy Outlook and adjusted for the fully burdened cost of fuel
- Costs and benefits analyzed for each hull individually based on OPNAV N953 Complex Overhaul (COH) timeline result in a Net Present Value (NPV) for conversion
- Norfolk and San Diego analyzed separately due to differences in utility rates
- Navy VAMOSOC database used for historical cost

Results

Reference Fuel Price – San Diego	
LHD	NPV
1	-\$209,129,373.53
2	-\$187,016,624.62
3	-\$199,489,726.19
4	-\$44,414,440.49
5	\$18,957,041.59
6	-\$176,455,535.28
7	\$11,106,573.55

Reference Fuel Price - Norfolk	
LHD	NPV
1	-\$233,559,472.84
2	-\$213,130,241.27
3	-\$222,445,233.65
4	-\$95,336,163.77
5	-\$42,789,476.89
6	-\$200,240,883.97
7	-\$46,912,947.68

- The results for the CBA using a 3.6% discount rate conclude that LHD 5 and 7 have a positive NPV for conversion when homeported in San Diego
- Norfolk does not yield a positive NPV at a 3.6% discount rate
- LHD 6 would have a positive NPV if the conversion and overhaul can be accelerated and its homeport remains in San Diego
- LHD 1-4 have a negative NPV for conversion due to both remaining service life as well as the proposed COH timeline

Conclusions

- Convert LHD 5 and 7 to hybrid propulsion
- Homeport steam powered ships on the East Coast due to reduced steam costs as compared to San Diego – Homeport shift hybrid powered ships to San Diego
- Optimize the schedule for LHD 6, shifting the current overhaul date from FY 2037 to FY 2023 or 2025, to allow for a positive NPV of conversion
- Consider future demand for big deck amphibious ships following the 2019 Force Structure Assessment and 355-ship plan:
 - Reduced demand for LHD/LHA class ships may negate the benefits of conversion if lifetime extensions are not required
 - Increased/sustained demand for LHD/LHA class ships results in favorable benefits for conversion