

Conversion of a FLT I DDG into an Ice Capable Ship

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Increases of global temperatures in recent years have brought about receding levels of ice in the Arctic, opening up previously inaccessible and unnavigable areas, resulting in a significant increase in maritime activity. The sea ice has been declining at a rate of 13% per decade in the summer and 3% per decade in the winter. The U.S. Navy's Arctic strategy identified the need for ready forces in maintaining maritime defense and power projection within the Arctic region, and in the coming years the Navy will seek to increase its presence, operational experience, and infrastructure in this region to preserve U.S. national interests. One method to achieve these goals is to modify the existing Arleigh Burke Class Guided Missile Destroyer (DDG 51) to operate in an arctic environment.

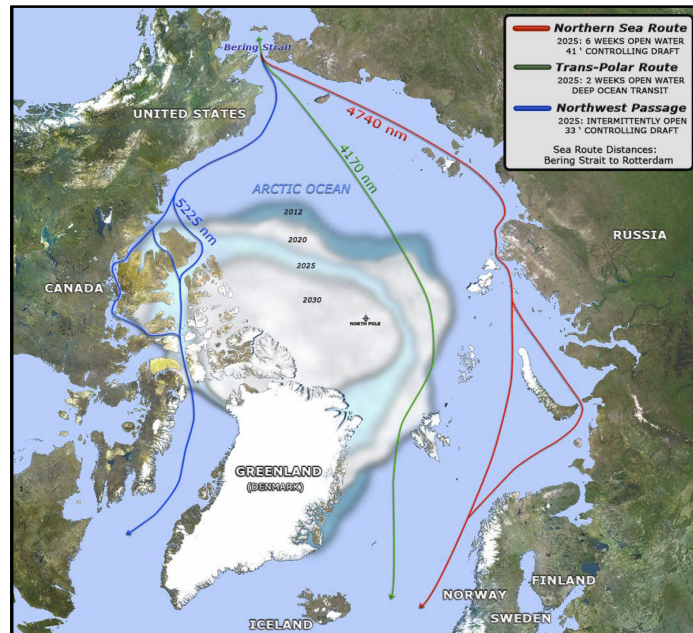


Figure 1: 2025 Projection of Open Water Conditions

Our investigation documents the process of converting and modernizing a Flight I Guided Missile Destroyer DDG 51 (FLT I DDG) to support the Navy's strategic outlook in the Arctic region. The project defines what arctic capabilities can be added to the ship for the cost of \$100 million, and further examines what capabilities can be added for a total cost of \$200 million. This design concept was conducted using a tradespace evaluation based on the U.S. Navy's strategic requirements for Arctic operations chosen through literature reviews, analysis of previous arctic conversion and design projects, and discussions with subject matter experts (SMEs). The Analytic Hierarchy Process (AHP) was used to explore the design tradespace and determine the optimal solution for enhancing arctic capabilities while minimizing costs. From a budgetary standpoint, the project focuses on ship conversion funding allocation. Variant costs include estimates based on tax-exempt material and man-hour labor, but exclude facilities costs such as shipyard services and daily expenses. The decided concept is a feasible design, adding the necessary capability for sustainable operation in the Arctic region with appropriate mitigations to minimize overall risk while meeting the sponsor's cost threshold requirements.

The final recommendation is to utilize the \$100 million threshold variant as the test platform to directly enhance the Navy’s strategic advantage in the Arctic region. The design concept achieves this by possessing a durable hull capable of withstanding contact with ice formations up to a foot in thickness, a crew outfitted for extreme weather conditions, and the systems infrastructure to combat known environmental degradations while minimizing current operational impacts.

Attribute	\$100M Concept Characteristic	\$200M Concept Characteristic
Fundamental Modifications	General de-icing equipment & HAZMAT, ice rescue equipment, topside equipment covers, antenna de-icing system, electrical system battery mitigation, anti-exposure clothing, compartment ventilation conditioning upgrade, mechanical fluid system heaters	
Hull Mounted SONAR	Degraded SONAR due to polar class bow strengthening requirements	
Towed Array	Remove TACTAS and replace with Multi-Functioning Towed Array (MFTA) (AN/SQR-20)	Remove TACTAS and replace it with Multi-Functioning Towed Array (MFTA) (AN/SQR-20), and Variable Depth System (VDS) (AN/SQS-62). AN/SLQ-25 Nixie upgrade
Ship’s Hull	D0 Polar Class Ice Belt	
Mechanical Systems	Reinforced manganese-alloy propeller assembly	
RADAR	Install SIGMA S6 ice detection RADAR	
Life Rafts	Seventeen 25-person arctic capable, Viking life rafts and containers and rack installation	
Small Boats	Two 11-meter arctic boats, cradle replacement, and Davit replacement	
Command, Control, Communications, Computers, Combat Systems, Intelligence, Surveillance, and Reconnaissance (C5ISR)	No change from baseline configuration	Upgrades: Cooperative Engagement Capability (CEC), Exterior Communications suite, Advanced EHF Terminal, AN/UPX 29 IFF and TACAN, Integrated Bridge Navigation System
Total Variant Cost	\$ 90.17	\$ 199.09

Table 1: Final Characteristics & Cost