

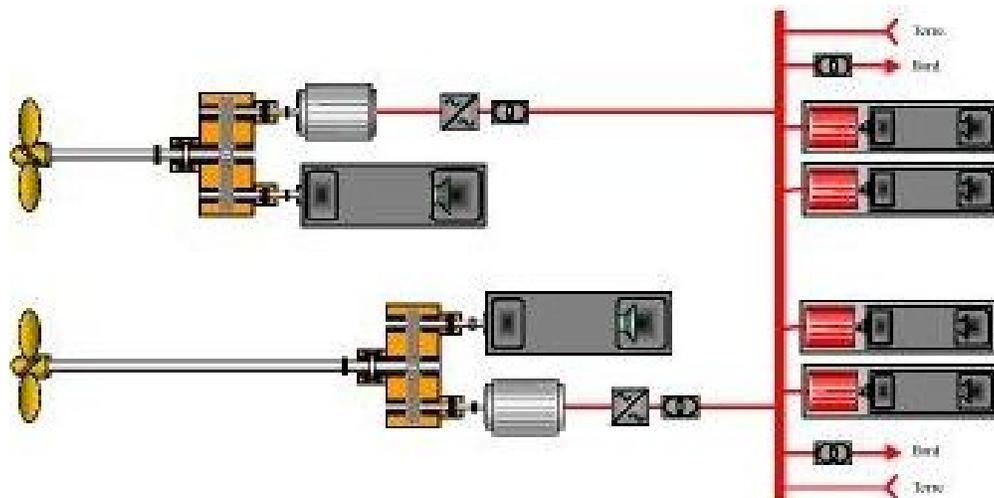
DDG 51 Modified repeat with a Hybrid Power and Propulsion System

LT Chad N. Tidd, USN, LTjg Dimitrios Laskos, HN

Executive Summary

Future high energy weapon systems will require electric power beyond what is currently generated on U.S. Navy warships. Future ships will also need to be more energy efficient and cost less to operate than current ships in the fleet. This paper is a study of one option for generating greater electric power at higher efficiency while reducing overall operational costs on a DDG-51 Class destroyer.

The strategy used in this study to improve power generation performance was to combine electric power generation and mechanical propulsion into a hybrid system. This allows the propulsion plant to be configured in a way that maximizes the benefit of both technologies. Combinations of four different electric propulsion motors and eight different gas turbines were considered in two different hybrid configurations: COGLOG (COmbined Gas turbine eLEctric Or Gas turbine) and COGLAG (COmbined Gas turbine eLEctric AND Gas turbine). A figure of merit analysis of the variants resulted in the selection of a COGLAG configuration using two 3.7MW LHD-8 Alstom electric propulsion motors, two Roles Royce MT30 Gas Turbine Motors (GTM) as dedicated propulsion turbines and four General Electric LM500 Gas Turbine Generators (GTG).



A summary table which compares significant attributes of the original DDG-51 CLASS Flight IIA ship and the converted ship (Flight IIB) is shown below:

Attribute	Flight IIA	Flight IIB
Full Load Displacement (MT)	9,433	9,674
Light Ship Displacement (MT)	7,226	7,466
Sustained Speed (kts)	29.9	29.3
Maximum Electric Power (MW)	6.75	15.1
Maximum BHP (MW)	78.3	72.6
GTG SFC (kg/KWh) (100% BHP)	0.31	0.28
GTM SFC (kg/KWh) (100% BHP)	0.23	0.20

This study concludes that a COGLAG configuration is a technically feasible option to power DDG-51 Class ships and recommends its use to provide sufficient power at greater efficiency for current and future weapon systems.