Preliminary Shipboard Layout of Navy Integrated Power and Energy Corridor (NiPEC)

by

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Abstract

Naval ship systems increasingly require more electricity. The Zumwalt class destroyer was the Navy's first modern fully electric ship. Through its integrated power system, the prime movers provide electric power to meet propulsion, ship service, offensive, and defensive systems requirements. The next generation destroyer, DDG(X) is also planned to be an electric ship. The ships of the future can thus be anticipated to employ upwards of 100 Megawatt (MW) or more electric power. With such a rise in electrical power comes the requirement to move electricity efficiently over compact and reliable power distribution systems.

To increase a ship's electrical infrastructure density, MIT is developing a new electrical power distribution structure called the Navy Integrated Power and Energy Corridor (NiPEC). The distribution cables, load centers, power panels, and power conditioners are all co-located into the NiPEC [1]. This allows for electrical energy to be efficiently routed through the ship and increase electrical redundancy. Individual NiPEC sections will fit into reserve-space ship locations and may use the new Navy Integrated Power Electronics Building Block (iPEBB) to control and condition power. The NiPEC will include space to accommodate future power requirements with little refit needed to the ship or the power corridor.

This thesis used a notional ship developed by Electric Ship Research and Development Consortium (ESRDC), past research into NiPEC electrical components, open source military specifications, and open source literature to build a power corridor concept 3D model within a single ship compartment. As this is the first 3D model concept, all components were based on existing technology to establish a benchmark of size and power conversion density. Once a single power corridor compartment was modeled, the components were duplicated throughout the notional ship. The 3D concept includes major power corridor elements with attention given to ease of construction, maintenance, and repair.