

Executive Summary

Anticipating increasing electric load requirements for surface combatants, the Navy's present primary challenge is incorporating medium voltage AC (MVAC) power generation with the Zonal Electrical Distribution System (ZEDS) distribution system into future surface combatant's. The need for integrated power systems (IPS) will increase in the coming decades (Figure 1-1) due to the increased electric load demand projected by propulsion and ship-service power demands. This is because of anticipation for future combatants to be armed with advanced sensors and future high-energy weapons such as rail guns and lasers.

The purpose for the All-Electric Surface Combatant concept is two-fold. First, it was important to come up with an all-electric ship design that incorporates the MVAC with ZEDS providing a feasible platform for both propulsion and weapons deployment. AESC can effectively function in similar roles defined for existing U. S. multi-functional surface combatants, designed to operate as an integral element in a carrier battle group, independently, or as an amphibious, logistics force, or MCM group escort, in multi-threat environments that include air, surface, and subsurface threats. It will have tactical employment in both contingency and wartime operations. Second, the AESC is a flexible reference ship design that can be used in further integrated power system design studies.

The design process was fundamentally the same as for conventional ship design. However, several different techniques were explored due to the added flexibility introduced by using an IPS. The process included indentifying and specifying design requirements and determining the concept of operations. This information was used to size the IPS and determine fuel requirements. The selected IPS was then integrated into a clean sheet ship design using several design tools and methods guided by traditional "spiral" design techniques. The design was put through a series of structural and stability analyses along with various sea keeping scenarios to determine the AESC's sea worthiness and mission effectiveness. A simplified cost analysis based on SWBS ratios was performed comparing the costs of the AESC to those of the DDG-1000.

The outcomes from this study verify that using the AESC as a basis for future integrated power system studies is a feasible solution. The results also demonstrate that the AESC can perform the mission of present surface combatants with minimal operational restrictions.