

Operational Profiling and Statistical Analysis of Arleigh Burke-Class Destroyers

by

Travis J. Anderson

Submitted to the Department of Mechanical Engineering
on May 10, 2013 in Partial Fulfillment of the Requirements for Degrees of

Naval Engineer
and
Master of Science in Mechanical Engineering

ABSTRACT

Ship operational profiles are a valuable tool for ship designers and engineers when analyzing potential designs and ship system selections. The most common is the speed-time profile, normally depicted as a histogram showing the percent of time spent at each speed. Many shortcomings exist in the current Arleigh Burke (DDG 51)-class operational profiles. The current speed-time profile is out of date, based on another ship class, and does not depict the profile in one-knot increments. Additional profile data, such as how the engineering plant is operated and a mission profile, do not exist. A thorough analysis of recent DDG 51 operations was conducted and new and improved profiles were developed. These profiles indicate the ships tend to operate at slower speeds than was previously predicted with 46% of the time spent at 8 knots and below as compared to the previous profile with 28% for the same speeds. Additionally, profiles were developed to show the amount of time spent in each engineering plant line-up (69% trail shaft, 24% split plant, 7% full power) and the time spent in different mission types (69% operations, 27% transit, 4% restricted maneuvering doctrine). A detailed statistical analysis was then conducted to better understand the data used in profile development and to create a region of likely speed-time profiles rather than just a point solution that is presented in the composite speed-time profile. This was accomplished through studying the underlying distributions of the data as well as the variance.

Thesis Supervisor: Franz Hover
Title: Finmeccanica Associate Professor