

Analysis of Consistently Poor Work Estimates in U.S. Submarine Availabilities  
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Abstract

The maintenance of a warship requires an involved combination of scheduling, funding, and execution. For one finite maintenance period, known as an “availability,” a small setback in one of these areas can have a significant deleterious effect on the availability as a whole. Compounded and obscured by complexity, the root causes of such setbacks may remain unresolved and recur within the same availability or in one that follows, resulting in cumulative cost increases and schedule delays.

The United States Navy has a strong incentive to better understand availability execution. In support of that objective, this thesis investigates man-hour cost data from 57 submarine availabilities across all four public naval shipyards, spanning 315 ship systems, from December 2006 to December 2017.

The results of this thesis are best understood in two parts: the first is an observation of system population characteristics, and the second is a multiple linear regression analysis. The first part identifies nine specific submarine systems for which work is consistently over- or underestimated in a majority of availabilities, and also partitions the data to gain insights about the performance of categorical subsets, such as a particular shipyard, availability type, or period in time, compared to the aggregate. These results include a “tier ranking” of the systems whose improvement would yield the greatest benefit for cost. The second part yields two different multiple regression models of the data to create revised estimates for what is known as “New Work,” which is unexpected work whose scope is notoriously difficult to predict. Both models result in significantly higher error than that which exists without them, invalidating multiple linear regression analysis as a path to gaining insights about availability performance.