Design and Analysis of US Navy Shipbuilding Contract Architecture

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The US shipbuilding industry accounts for over 36 billion dollars annually, and US Navy shipbuilding is a large piece of that business. Contracting for US Navy ship procurement is complex due several factors such as budgetary and political concerns, sole or near sole source environments, and long lead-time construction. In the current climate of shrinking budgets, it is especially important to set programs up for financial success. One potential area for cost management improvement in acquisition programs is with the initial contract and incentive structure. If shipbuilding contracts could be described in engineering architectural terms, then perhaps that architecture could provide better clarity of contract options. Further, if contracting can be described as an engineering architecture, then perhaps that architecture could be optimized for a given result. These are the central questions of this thesis. To answer them, interviews were conducted with several experienced individuals from both industry and the government, including two former Commanders of Naval Sea Systems Command, the President of Irving Shipbuilding (Halifax, Nova Scotia) and a senior contracting expert from the Office of the Assistant Secretary of the Navy (Research, Development and Acquisition.) The successful Virginia Class Submarine (VCS) procurement strategy and program as well as Canada's new National Shipbuilding Procurement Strategy (NSPS) and recently signed build contract for the Arctic Offshore Patrol Ship (AOPS) were studied for insights into the contracting process. These insights were then used to form a contract architecture concept in accordance with the Tradespace engineering paradigm, first introduced by MIT's Adam Ross and Daniel Hastings in 2005. From the concept definition came the design vector definition. The design vector includes variables such as shareline definition, incentives, and contracted profit percentage. The tradespace was then populated by manipulating the design vector parameters. The Palisade tool @Risk was used to conduct the design vector manipulation and tradespace population. @Risk is an excel plug in that allows uncertain variables to be defined by probability distributions. The output values are then sampled at random from the input probability distributions. Each set of samples is an iteration, and many iterations are performed, resulting in output distributions and statistics. The tradespace of contract outcomes is then evaluated against utilities such as cost, profit, and risk. Although the factors affecting the contracting environment are complex, and not all are modeled, quantitative modeling allows the architect to roughly evaluate different approaches, vice just basing the contract on past models. It also gives the government the ability to check whether shipbuilder furnished predicted costs are reasonable for a given contract structure.

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