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SPIRAL DEVELOPMENT

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Spiral Development

Presenter: Aruna Apte, is a visiting lecturer in the department of Logistics, Graduate School of Business and Public Policy, at the Naval Postgraduate School. She received her Ph.D. in Operations Research from the School of Engineering at the Southern Methodist University in Dallas, Texas. At present, she is a lecturer at the Cox School of Business at SMU. She has successfully completed various research projects involving applications of mathematical models and optimization techniques. She has over twenty years of experience in teaching operations management, operations research, and mathematics courses at the undergraduate and graduate levels. Her research interests include application of mathematical models to real-world operational problems.

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Abstract

In the view of many, the Acquisition process for the Department of Defense is ripe for repair. Some of the signs illustrating this can be found in cost overruns, late deliveries, and unfulfilled expectations. These necessary adjustments could be due to reasons such as misunderstanding the ultimate need of warfighters and/or ever-changing budgets. Re-evaluation is especially needed in the acquisition of weapon systems and shipbuilding. A research study conducted by the researcher regarding the Phalanx Weapon System (CIWS) is the origin of this abstract.

In the past, the acquisition process predominantly used the block approach or preplanned product improvement (P3I) process to fulfill system requirements. Both these processes require the upfront knowledge of the end-product and any possible upgrades. Therefore, either the final capability took a long time to deliver, or the product had to be fielded before it was tested and ready. Frequently, during the long lead-times of development, production and testing, the end-users' needs changed. This change prompted alterations of strategy (formulated in response to the changing face of war) by Pentagon managers; these new strategies, then, invariably led to more upgrades or more modifications of systems under construction. The diversity and complexity of these intermittently overhauled systems resulted in lower operational availability. One example is the current status of the Phalanx weapon system; this system encompasses 158 ships, 308 mounts, and 6 different baselines. The different baselines for all these mounts necessitate increases in the complexity of logistics. The need for appropriate spare parts and expertise adds burden to inventory management—increasing lifecycle cost and reducing operational availability. A possible solution to this problem is a new, evolutionary approach: a process called Spiral Acquisition.

Spiral development is an integral part of an overall plan of evolutionary acquisition. Unlike P3I, spiral development is a flexible process that can be adjusted for the changing needs of warfighters and rapid innovations in technology. The evolutionary abilities are, unlike in the block approach, in incremental changes. A "spiral" is a set of acquisition activities that are incrementally incorporated in an evolving baseline. Each increment builds on the previous

spiral, increases the capability of the product, and is completed at a rapid pace. This successive and recursive set-up helps program managers control the risk of developing a product that may not meet user specifications. Lessons learned from the previous spiral help managers reduce the uncertainty of the outcome of the next spiral. Therefore, the flexibility of the process of spiral development allows managers to adapt system development to meet the evolving needs of the warfighters and keep pace with innovations in technology.

This research study focuses on the process, promise, and limitations of spiral acquisition/development. The researcher plans to describe the process using a simple model. This study is centered on the key issues that distinguish a spiral approach from the traditional approaches implemented by the DoD.

This study will describe the fundamentals of the process of spiral acquisition: 1) increments, 2) characteristics of the increments, and 3) the capabilities they deliver. The interest of this research lies in understanding the concept of spiral acquisition as it applies, specifically, to program managers. The researcher will create a simple model incorporating successive spirals with their respective capabilities and the corresponding projects that deliver them. A fully comprehensive decision model that describes the optimal policy of whether or not to employ spiral acquisition is beyond the scope of the current study. However, this research attempts to provide a template for that future model by expressing a set of rules that will help program managers articulate what it means to acquire a product or an upgrade using spiral processes. This study does not claim that spiral acquisition is appropriate for every acquisition.

A common consequence of a spiral approach may be an increase in the diversity of parts and, hence, logistics complexity. Therefore, an ambitious extension of this research would be to explore the role of modularity in spiral acquisition. The purpose of the latter part of this study, particularly, is to understand if combining modular product designs will help the DoD reduce logistics complexity and lifecycle cost for systems such as CIWS and LCS. The hypothesis is that modularity may bring in rapid sequential innovations to the warfront—thereby avoiding both an obsolescence of technology and an increase in logistic complexity.

This research, as the topic it studies, is a work in progress. Analysis so far suggests two key issues: 1) The necessity for a template or a set of rules that will aid program managers in standardizing the eluding concept of spiral development, and 2) The role of modularity in spiral development. This research plans to address these issues and provide a possible road map.

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