Innovation Pathways in National Security Space

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Motivation

Despite a rich legacy of delivering impressive technological solutions, government space acquisitions are increasingly underperforming (fig. 1). Multiple blue ribbon panels have been convened (fig. 2.) and many recommendations made:
- Leverage members’ vast experience, leading to similar proposed solutions (i.e., “back to basics”)
- Need for external theory and insight to identify/address fundamental issues limiting innovative performance

Context Extension to NSS

- Organizational view combines policy documentation with interviews and program documentation
- Enables analysis of differences between NASA and other technology-intensive govt. organizations

Problem Framing

Problem: Technology infusion into government acquisition programs is viewed as a cost, schedule, and capability risk by program managers. A key challenge is aligning stakeholders in the identification of the critical architectural level for integration.

Complication: Current stage-gate conceptualization of technology readiness fails to capture this interaction between technology development and application.

The technology innovation pathway is an analytical construct to capture the linkage between a technology and its insertion opportunity.

Research Questions for Innovation Pathways:
1. What is the structure of the National Security Space innovation system?
2. How do new capabilities traverse the innovation system as they are matured, and infused into flight projects?
3. Are there patterns of innovation mechanisms, important across multiple innovation pathways?

Research Questions for Modularity and Flexibility:
1. How can organizations effectively plan for technology insertion at the appropriate architectural level in an uncertain acquisition environment?
2. How can modularity be implemented in a system’s architecture to mitigate programmatic impacts of changes such as technology insertion?

Toward Generality and Prescriptive Research

Recognize that transitions are commonly observed as the result of a shock unburdened during early technology development

Additional research planned outside the space vehicle context

Preserve flexibility and adaptability in technology development to enable more effective and less costly transitions

How can an organization architect for modularity in path-dependent technology intensive systems?

Establishing and articulating across the timeline: what, when, and how

OBSERVATIONS CAPTURED IN EPSHOCK MODEL

1. Process is not usually controllable through funding allocation and gate decisions whereas transition shocks between epochs are known in advance.
2. The valley of death cannot be overcome without a strong feedback mechanism to ensure that the technology shock is indeed a shock.
3. Shocks need to be as a matter of keeping the team intact on a question of nonviability.

PREDICTIONS FOR CONTEXT-EXTENSION STUDIES

1. Technology shocks are the stage-gate boundaries during development.
2. Transitions result from efforts that were able to capitalize on an unforeseen transition opportunity.
3. Transitions shocks are not under the control of technology developers.
4. Successful transitions will involve high-level government or contractor employees who continue to pursue the technology development.

Future Directions

1. Interview and document data from example technology infusion cases
2. Context-specific descriptive process model

Descriptive

Current FY: FY2011

Future FY: FY2012

Descriptive in NASA Context

Compare impact of technology infusion across space agency regions

Prescriptive

Factor pathways of technology such that its insertion pathway is calculable to avoid unanticipated transition shocks

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