

SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)

Space Technology and System Management Practices and Tools (4)

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EXPLORING R&D INVESTMENT AS A SPACE SECTOR TECHNOLOGY MANAGEMENT LEVER

Abstract

Despite a rich legacy of impressive technological accomplishments, in recent years, the ability of government space agencies to deliver on their promises of innovation has increasingly been called into question. As space budgets become ever more strained, the imperative to use resources efficiently will only grow stronger. This need has historically translated into cost-cutting approaches that emphasize near-term operational payoffs. However, that emphasis can undervalue the importance of long-term technical sustainability, which requires continuous investment in a portfolio of RD activities. The broad question of how to efficiently invest in a portfolio of RD projects has been addressed in the extant literature using a variety of disciplinary lenses. These range from broad heuristic methods (e.g., strategic buckets) to complex methods drawn from finance (e.g., Markowitz diversification) and covering a wide middle ground (e.g., Real Options in Portfolios, Landscape search and Ranking methods).

While general portfolio approaches provide important background to this research, aspects of the space context make it inappropriate to apply these insights directly. For example, in the space sector context, technology success is inextricably linked to the operational success of particular missions, which may be contingent on multiple new technology developments, and might be delayed, re-scoped or canceled for political reasons. Additionally, mission success in this context can't be measured in traditional economic terms since space assets yield "public goods" (e.g., scientific knowledge, situational awareness). These factors add complexity to the resource allocation problem that need to be carefully considered if effective strategies are to be identified.

To that end, this paper explores the relative effectiveness of alternative portfolio approaches in the space agency context using a simplified stochastic model of a representative space agency's innovation ecosystem. The model development draws heavily on two streams of prior work: (1) detailed empirical investigation of space agency innovation dynamics (presented in past IACs by Szajnfarter and Weigel) and (2) insights from Wicht and Szajnfarter's work on investment approaches at NASA. We find that the effectiveness of potential RD allocation schemes depend not only on a technology managers ability to assess the potential of success of a particular project, but also it's interdependence with other projects in the portfolio. The implications of these findings are discussed.