

## **Current Trends in M&S ROI Calculation**

an addendum to

“Calculating ROI Investment for US DoD M&S”

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The need to establish the value of modeling and simulation (M&S) remains. This is especially important in the Department of Defense (DoD) where budgets are projected to drastically shrink over the next decade. Throughout the DoD, we continue to hear officials calling for acquisition executives and program managers to “get the most bang for the buck” and “justify each requirement” - in this process M&S consistently comes under the microscope. While in some specific instances, like emergency procedure training and experimentation, M&S is clearly seen as worthy; however, within the wide range of its application, how to optimize its use is unclear: and in all cases, hard, factual, quantitative evidence of results are needed. The request for such specificity is now often called articulating the “Value Proposition” and is often sought in response to Congressional inquiries or management directives to justify expenditures on M&S.

Yet, what is being sought is often bi-polar. On the one hand, return on investment (ROI) is increasingly seen as including results or mission oriented terms that explicitly contain factors that are not monetary, e.g., readiness, task proficiency, etc. However, on the other hand, ROI is also being used as a stand in for “constant benefit” or least cost analysis. In that scenario, which has been seen in training applications, the benefit side of the ROI equation is held constant (meaning for instance, that all soldiers trained to a certain level are equivalent). While most people believe that in reality this is not the case, much of the difficult calculations of subjective, qualitative factors occur in the benefit side. By holding these constant and only analyzing the cost factors, it makes the task of determining ROI significantly easier and less costly. We have seen examples of this approach in analyzing training systems and determining the costs avoided by simulation (e.g., costs avoided by reducing flight hours through using flight simulators and ammunition costs avoided by using simulator marksmanship trainers). Although some of these analyses are seen as the first step in a complete ROI study, they are currently being used to examine the costs of simulator training systems.

Additionally, we are increasingly seeing the desire to place M&S ROI on a time continuum, for example, the return over the life-cycle of a system. While this increases the complexity of the calculations, it allows for a more complete assessment of the value of a system. Considering the life-cycle of the system amortizes research and development (R&D) costs and accounts for the long-term benefits that may occur in the out years. However, life-cycle calculations increase uncertainty. Predicting out-year costs, life-span of a system, out-year performance, potential upgrades, and necessary enhancements is a difficult task and not one that is even close to an

exact science. Currently, while we have heard and been involved in discussions along this topic, we are unaware of any studies that involve the life-cycle ROI of an M&S system.

Another concept that also increases the complexity of ROI calculations, yet has the potential to yield additional insights, is that of projecting a set of alternative futures, each with their own likelihood and results, and seeking to maximize aggregate ROI. In such an approach, which is in some ways similar to a response surface methodology, many inputs or explanatory variables are related to a set of outcomes or results. In that way, individual alternatives or branches can be examined within the context of other outcomes and it may be possible to determine the overall ROI of a set of alternatives that is robust across a wide-range of future contingencies. For example, fire team simulator trainer A has the ability to link with a helicopter simulator so the team can call for close air support if needed. Additionally, the helicopter simulator links with other close air support simulators and a controller call for fire simulator. Therefore, simulator A allows very robust inter-service scenarios. Fire team simulator trainer B does not have the capability to link with the helicopter or other close air support simulators, but is able to link with other ground unit simulators, and has the capability to easily add or modify weapons as new weapons are developed. Simulator B then allows a more robust ground scenario within a service and is more easily modifiable to adapt to changing environments. Examining critical paths and choices allows for an ROI calculation that will account for future alternatives.

In terms of applying current ROI techniques, the need continues to develop a stable set of applicable metrics. However, these metrics continue to be specific to stakeholder perspective, application domain, and scope of interest. General measurement categories are useful as a starting point and guideline to developing specific metric sets, but these sets must be developed in the context of a specific application. For example, calculating the ROI for an M&S training system will necessitate metrics that measure trainee and perhaps team performance. In the case of a DoD application, this may lead to a metric which measures the percentage of bombs on target in a flight simulator, or bullets on target in a marksmanship simulator. However, in a medical M&S system, this may translate to the closeness of a biopsy needle to the abnormal tissue. All measures are similar in nature, but result in different instantiations in their application domains. Additionally, metrics vary depending upon the scope or viewpoint of the stakeholder. Metrics to measure effectiveness for the M&S Coordination Office would encompass measures that account for impact across the entire DoD. Contrast this to metrics that measure the effectiveness of M&S applied to an acquisition program which looks at outcomes only from the viewpoint of that program, and may be specific to a particular service and branch within that service (infantry for example).

There continues to be organizations with committees and sub-committees dedicated to the business practices of M&S. These committees fall under the names “Economics of M&S,” “Business Practices of M&S,” and sometimes “ROI of M&S.” The most recent, and newest, addition to this group is a committee of the National Modeling and Simulation Coalition (NMSC) on the business practices of M&S. At the inaugural kick-off of the NMSC on 6 Feb,

60+ people from a variety of application domains (manufacturing, health-care, education, DoD, and entertainment gaming to name a few) met to discuss business practices that relate to M&S in each respective domain space. While the initial meeting was brief, the plan is to conduct a series of subsequent meetings (the first one occurring on 22 March) to agree upon an agenda, relevant topics, and envisioned products. The Simulation, Interoperability, and Standards Organization (SISO) has a standing study group on the Economics of M&S. Over the past few years they have discussed such topics as software re-use, intellectual property, and International Trade in Arms regulations, all topics which impact M&S. Attendance at these meetings has varied, with some bringing in small crowds and others garnering significant interest and audience participation.

Although the emphasis here is on the DoD, we think it is important to note that M&S ROI analysis is gaining traction in other areas, especially those also projecting overall resource reductions. This may be most clearly seen in healthcare, but it is true in other market sectors as well. In healthcare, for instance, discussions are ongoing regarding the formation of a panel or committee to investigate the ROI of M&S in healthcare as part of one of the general M&S or healthcare specific simulation societies.

As mentioned above, there are a few ROI projects that are on-going. The USMC is performing studies on the cost avoidance of all of their training systems. The results of this study will be used to justify the expense of operating and maintaining simulator systems. The Department of Health Services has commissioned a Small Business Innovative Research (SBIR) project for the development of an ROI calculator for medical M&S. There are several Phase I awards with the research on-going at this time.

As we look ahead, the methodology in “Calculating ROI Investment for US DoD M&S” remains sound and we see the potential for many more uses both within DoD generally and within specific domains as M&S continues to expand. As budgets shrink, the ROI of a project or system should be a crucial question asked by acquisition executives, and we envision an appetite for more studies on the ROI and efficiency of M&S. We see growth in the medical M&S field generally and distinct interest in measuring the efficiency and cost effectiveness of simulation as it applies to medical education and training. While effectiveness is not necessarily an ROI calculation, parts of our methodology can be applied to rank medical M&S options, determining the one best suited for the task or concept being taught. Additionally, with the lack of expansion in medical training budgets (overall and within the DoD), determining the ROI for different healthcare training systems is increasingly of interest. Finally, as the NMSC is established and the Business Practice committee lays a foundation, we are eager to see established and innovative ROI techniques expanded and applied to additional applications such as manufacturing, automotive, pharmaceutical, communications, infrastructure, and more.