1 Introduction

1.1 Scope and audience

Mathematical modeling is a fundamental discipline within the design and development of modern electro-optical (EO) sensor systems. Modeling allows systems to be readily and cheaply evaluated before they are built and allows the assessment of modifications to existing products. The performance of systems can be gauged in different scenarios: ones that are either expensive to determine through trials, or else ones that are constrained through domestic or international sensitivities. Furthermore, modeling allows a designer to develop and test their own understanding as well as identifying critical trade-offs and risks. Modeling is, therefore, a powerful design technique that sits at the heart of modern EO sensor systems engineering.

Unfortunately, the full potential of modeling is often not realized. This failure is not generally due to the technical capabilities of the modelers, but more often because the modeling capability is not correctly matched to the needs of a development project. Experience has repeatedly shown that modeling can easily become divorced from the system development, perhaps only touching the program at infrequent design reviews or as a means of providing an explanation when something has gone wrong. The specific cause of the failure varies greatly, but invariably, it is a consequence of attitudes, poor communications, and a misunderstanding of the modeling requirements and capabilities.

The scope of this Spotlight covers adopting and adapting modeling methods, validation techniques, and the engineering approach to maximize the benefits to the overall project. It is also about creating an effective modeling strategy and communicating this within the project team. Although models are often only viewed as a means of calculating system performance, they can provide much more at many different levels, including risk management and product acceptance. To fully appreciate the wider benefits, this Spotlight views modeling from the perspectives of system engineering and project management across a product's lifecycle.

The content is written for model developers, system engineers, and project managers. For the system modelers, it is hoped that they will gain an understanding of how their activities fit within the wider project picture and how they can better align what they do with the overall development program. For systems engineers, this text aims to increase their appreciation of the benefits and limitations of modeling from the component level to the overall system design, and the need to support the implementation of a coherent systems modeling process. Finally, for team leaders and project managers, they will find that supporting and encouraging a strong and coherent modeling program will help reduce the project risks, while making their roles more effective. Although it is the responsibility of the model developers to get the model right, it is the responsibility of all parties to ensure that the model is fit for purpose.