Special Issue: Modeling of Defense Logistics and Supply Chains

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Letter from the Special Issue Editors

The historical approach to military logistics was to bring everything that might be required to where it was required. This "iron mountain" approach to logistical support required sufficient time and transportation resources for the support buildup. However, logistics support of the future must provide just enough support, just in time for its application, by highly mobile forces, working in dynamic environments. Decision makers in these time- and resource-constrained situations must have tools to analyze data on past performance, models that use this data to support critical decisions, and simulations of the future consequences of candidate decisions.

Data on past system performance in the dimensions of time, cost, and resource usage are plentiful in the era of modern information systems. These data help characterize parameters in critical logistics areas including transportation, maintenance, inventory, and mobility operations. Visibility of the current status of a military logistics network provides decision models and decision makers with up-to-date information on the location of important assets, the state of support resources, and important decisions that are pending. The archiving of these data creates an available source of historical information that can be mined for model synthesis and analysis purposes.

Decision models based on simulation and optimization, or other frameworks, can generate options that examine criteria in one or more performance dimensions. These models can be elaborate and designed to give precise solutions within a reasonable scope of logistics activities and performance measures. With accurate estimates of parameters related to time, cost, and resource usage, these models can make accurate trade-offs and precisely represent constraints. The results of these models must represent the expected performance, as well as the possible risk of potential actions.

Finally, decision support environments should allow further evaluation of the solutions suggested by one or more restricted models by considering performance in a number of dimensions. "What-if" scenarios must be available, and overriding of some parameters based on forecasts of future conditions must be possible. These environments must also allow relatively quick synthesis of models, using available data, to respond to dynamically evolving network structures, force locations, and resource availabilities. Simulation is a critical component of the evaluation of decisions in very realistic conditions because of its innate flexibility and ability to realistically model uncertainty. But the innate complexity of simulation model building and analysis must be moderated by decision support environments that allow users other than expert operations research analysts to utilize them.

The effective combination of all three of these components—data, models, and decision support environments—is critical to achieving logistics networks that successfully operate in just-in-time, dynamically evolving scenarios. This special issue is devoted to examining the modeling and simulation of military logistics and supply chain systems particularly as those systems evolve to support future force requirements.

In the first paper, "Building the Mobility Aircraft Availability Forecasting (MAAF) Simulation Model and Decision Support System," authors Frank Ciarallo, Raymond Hill, Sriram Mahadevan, Vikrant Chopra, Patrick Vincent, and Christopher Allen discuss the development and potential use of a simulation-based decision support system for examining logistics infrastructure limitations on the ability of the Air Mobility Command to meet air delivery requirements. This research provides an appreciation of the complexities involved in examining worldwide

transport and delivery and an improved methodology for modeling military transport aircraft.

In the second paper, "Decision Support System for Logistics Systems Analysis Using Image Theory and Work Domain Analysis," authors Todd Kustra, Subhashini Ganapathy, Amanda Muller, and S. Narayanan present a human-centered approach to developing an interactive decision support system for an airbase logistics management domain. Experimental results comparing computer-support efforts to actual practice supported the viability of the human-centered approach adopted.

The third paper is "Quantifying the Effect of Transportation Practices in Military Supply Chains," authored by Joshua McGee, Manuel Rossetti, and Scott Mason. This research employed a simulation model of the Air Force multi-echelon inventory system across a system of bases to examine local inventory and local repair strategies.

The final paper is "An Object-Oriented Architecture for the Simulation of Networks of Cargo Terminal Operations," authored by Reejo Mathew, James Leathrum, Saurav Mazumdar, Taylor Frith, and Joseph Joines. This paper describes the architecture built for simulating the flow of military cargo through cargo terminals located in the United States and at various overseas port locations. The authors provide an example scenario and demonstrate the scalability of the architecture to accommodate realistic system modeling.

The suite of papers, all of which include graduate student project efforts, provide a snapshot look into the myriad issues associated with defense logistics and supply chains. These efforts cover a range of issues from those at a single airbase to those involving a system of airbases as well as cargo movement issues using land, sea, or air assets. The papers also include modeling approaches spanning purely analytical to human-based, interactive simulation modeling approaches. Thus, our collective group of editors, reviewers, and authors trust you will gain a greater understanding of defense logistics and supply chains after examining the papers in this issue. We further hope that the work in this issue, as well as the work in past issues, motivate you to look to *the Journal of Defense Modeling and Simulation: Applications, Methodology, Technology* for your continued professional reading and development and as an outlet to publish your own work in defense modeling and simulation.