

## **Simulation Modeling and Analysis of Coal Shipping Operations**

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Computer simulations are increasingly powerful and realistic models for complex real-world scenarios, and our project applies this technology to model a coal transportation case study. Given a baseline scenario of fourteen carriers transporting coal from three U.S. locations to four international locations, we optimize operations in terms of product flow, time required for shipments, and total operation costs. Implementing the case study's factors into modular code, we introduce several potential changes to current operations and develop specific scenarios. Further, in analyzing these scenarios we test for robustness and sensitivity, by changing values such as demand and bad weather occurrences, and noting how well the model responds. We ultimately gain a better intuition of the factors at play, identify optimizations, and develop a more efficient configuration. Also, we note several areas of potential improvement and suggest several directions for future work. Finally, taking advantage of modern graphical software, we present the optimized scenario in an animated interface, including a 3D view of the model and real-time data charts. While delving into complex data to reach the desired results, our model is accessible to a broad audience and presents an intriguing glimpse into the future of computational modeling.

### *Information about the Authors:*

Raymond Finzel is a senior computer science major and is involved in VU's chapter of the Association for Computing Machinery. He hopes to work with robotics and adaptive algorithms after graduation. Timothy Goodrich is a junior computer science and mathematics double major and a member of Christ College. He hopes to continue his study of both fields in graduate school. Graeme Roberts is a junior computer science major and also a cadet in the Air Force ROTC crosstown program via Detachment 225 Notre Dame. He spends his free time involved with the Men's Ultimate Frisbee team at VU. This project stemmed from a simulation and modeling course and Rockwell's annual Arena international programming competition. The team members' interest in the project included several diverse areas, from theoretical mathematics to the programmed graphical user interface, resulting in an accessible and yet deep interdisciplinary project.

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