

## **A LOGISTICS SIMULATION MODEL REPOSITORY TO ACCELERATE SIMULATION MODELING IN THE AEROSPACE INDUSTRY**

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### **ABSTRACT**

Airbus established a digitalization strategy to enhance logistics and production processes using model-based systems engineering, including material flow simulation. To store and reuse simulation model, holdup quality standards and support logistics planning, novel to the aerospace industry, a logistics simulation repository is being developed. This is supported by presenting ongoing simulation studies.

### **1 INTRODUCTION AND RELATED LITERATURE**

Airbus decided to establish a digitalization strategy in which all logistics and production processes will be modeled by a model-based systems engineering approach. Material flow simulation (MFS) can be seen as a tool to investigate industrial logistics and production systems. To streamline simulation studies, a center of competence was initiated to support planning projects by MFS studies offered to other logistics departments. To accelerate the modeling process of simulation studies, a repository for simulation studies and model components will be established.

Existing repositories can be found in industries with a long simulation tradition like semiconductor and automotive manufacturing (Bauer et al. 2023; Simplan AG 2023). This is reasoned in a high degree of automation and data availability. Further, data-driven simulation model generation methods can be found (Reinhardt et al. 2019). Recently, simulation model generation in connection with digital twin modeling and big data approaches emerged (Greasley and Edwards 2021; Hua et al. 2022). To the best authors knowledge, no repository or comparable approaches exists in the aerospace industry.

### **2 REQUIREMENTS AND CONCEPT FOR A LOGISTICS SIMULATION REPOSITORY**

The concept development of the future logistics simulation repository of the Airbus logistics department started with gathering requirements which must be fulfilled for storing and providing full models and model

components. The repository should be able to store and provide a documentation of simulation models and a technical repository for agent-based simulation models created in the simulation software Anylogic.

The documentation should provide a user manual and developer guidelines for future utilization of simulation models and implementations of model components in subsequent studies. Therefore, general project facts like the project status or the scope of the simulated material flow systems must be documented. All developed model components must be documented for the integration in the logistics simulation repository by providing developer guidelines.

The technical repository should contain simulation models and model components, applied data, developed specific KPIs to evaluate the logistics performance and resource pools. The components should include agents and actions which form the agents' behaviors. In the Airbus logistics context agents, which represent warehouse areas like ASRS systems, entire warehouses, transport means as well as parts, delivery units or products in material flow systems must be stored in the repository. The actions represent behaviors of agents like order picking processes. Data to be stored in the repository include process parameters like velocities of transport means, warehouse layouts or material flow volumes. Specific KPIs to evaluate the logistics performance are developed KPIs which should be applied to measure the performance of different logistics systems. Resource pools can be applied to model shift plans or staff capacities at various skill levels. Furthermore, the repository must entail functionalities to apply a version control to models and their components. All revisions within this version control process must be approved by simulation architects aligning simulation studies with guidelines and standards for model quality and consistency.

### 3 ONGOING SIMULATION STUDIES

To establish the repository four simulation studies are currently in development. The first study models a greenfield planning of a future warehouse for the fulfillment of production supply to investigate picking processes and transport route utilizations. The next study investigates processes and surface utilization in a consolidation area for the provision of customized delivery units for the production. Another study optimizes the picking process organization to increase the productivity in a palette rack area. The last study investigates the processes and transport route utilization in an oversea warehouse.

### 4 CONCLUSIONS AND OUTLOOK

This work presents requirements as well as a novel and early concept for defining a logistics simulation repository in the aerospace industry. The repository concept includes a documentation of full simulation models and specific model components for reuse in future simulation studies. Further, a technical repository puts all simulation model (components) under a version control mechanism. From a practical perspective, this repository should accelerate the conduction of simulation studies and ensure guidelines and quality standards of simulation studies. From a research perspective, this concept provides an approach tested in other industries to the aerospace industry with its specific requirements on flexibility and customization.

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