Proceedings of the 2017 Winter Simulation Conference
W. K. V. Chan, A. D'Ambrogio, G. Zacharewicz, N. Mustafee, G. Wainer, and E. Page, eds.

VALIDATION AND VERIFICATION OF SHIPYARD LOGISTICS SIMULATION SYSTEM AND ITS USE CASE IDENTIFICATION

Yong-Kuk Jeong, Hui-Qiang Shen
SeungHoon Nam, Youngmin Kim
Jong-Gye Shin

Department of Naval Architecture and Ocean Engineering
Seoul National University
1 Gwanak-ro, Gwanak-gu
Seoul 08826, Republic of Korea

Philippe Lee

PLM Research Labs.
Xinnos Co., Ltd.
641 Seolleung-ro, Gangnam-gu
Seoul 06100, Republic of Korea

Jae Ho Choi, Jong Hun Woo

Department of Naval Architecture and Ocean Engineering
Korea Maritime and Ocean University
727 Taejong-ro, Yeongdo-gu
Busan 49112, Republic of Korea

ABSTRACT

Simulation systems for analyzing the logistics process occurring in the shipyard have been studied by many researchers. However, there was a lack of research on how to verify simulation results and how to use these systems continuously. Therefore, in this study, we proposed a method to validate and verify a logistics simulation system developed in our previous research. In addition, the use cases were divided into simulation and planning aspects in order that the shipyard could use the system continuously. The verification methods and use cases proposed in this paper were studied in cooperation with large shipyards in South Korea.

1 INTRODUCTION

In shipyards, a semi-finished product is made by cutting and assembling the steel plate. The cut-ting and assembly processes take place in an independent workshop at the shipyard. Therefore, the production system of the shipyard can be divided into a unit production system that performs specific processes. Each unit production system is linked to the physical logistics flow of products and the information flow for the production process. Consequently, the production system of the ship-yard can be defined as the unit production system, and the logistics and information flow between them.

Sophisticated planning is essential to systematically manage such a complex production system. For this purpose, advanced shipyards have a production plan with a hierarchical structure. The top-level production plan establishes a long-term shipbuilding plan based on the availability of the dock for two to three years, and a production plan that plans the start and end dates of the block production process based on each ship. Due to the nature of the shipbuilding industry, it is not able to build prototypes to verify production plans; thus, a variety of simulation techniques are utilized.

However, shipyard simulation systems are mostly single-purpose simulation systems to solve specific problems. In addition, since they were not developed for the purpose of continuous use in the shipyard, utilization after project completion was low. Therefore, this study investigate a verification and validation method of shipyard logistics simulation systems, that can be used for various purposes, and identifies use cases that can utilize this system in shipyards.

2 V&V OF SHIPYARD LOGISTICS SIMULATION SYSTEM

There are various methods for verifying and validating the results of manufacturing simulation. In the case of a semiconductor or automobile manufacturing plant with high level of automation and line production, it is possible to observe the actual situation with a high level of accuracy; thus, simulation results can be validated by comparing simulation results and field conditions. However, there is a limit to precisely monitoring the situation on site at the shipyard manufacturing sites where the level of automation is low and the work progresses according to the operator's discretion. In particular, it is very difficult to verify the simulation results because the plan for logistics is not established at the stage of production planning in the case of logistics between factories.

Verification and validation methods of shipyard logistics simulation systems are proposed in this study. First, we discuss a verification method of tracking the history of a particular semi-finished product in the simulation system. If there are multiple factories in the shipyard that per-form the same work, then they will distribute the product according to predefined logic. To verify that this logic is properly reflected in the simulation model, the entire life cycle of a particular product should be traced. Second, we discuss a method to validate the result by comparing the number of WIPs (Work in progress) existing in the shipyard. In a shipyard with a high management level, it manages the current location of the semi-finished products distributed throughout the ship-yard. Therefore, the overall trend could be confirmed by comparing the number of WIPs existing on a specific date in the simulation system with the number of semi-finished products distributed throughout the shipyard.

3 USE CASE IDENTIFIACTION

The use case for the shipyard logistics simulation system can be divided into simulation and planning perspectives. In the shipyard, the management level was low for the logistics process that occurs between manufacturing processes because it mainly established and managed the production plan based on manufacturing processes. The simulation results of the logistics simulation system can be utilized to confirm the load for operating the transportation facility and load balancing can be performed for multiple transportation facilities. If the results of the logistics simulation are verified, the logistics simulation system can also be used when establishing a transportation facility dis-patch plan. It is possible to operate an efficient transportation facility by this use case. In this study, the logistics simulation system developed in our previous research (Jeong et al., 2017) was used from the simulation perspective to check the transport facility utilization load. From the viewpoint of production planning, the simulation results were used to establish allocation plans of transportation facilities.

ACKNOWLEDGEMENTS

This research was partly supported by National IT Industry Promotion Agency (NIPA) grant funded by the Korea governmnet (MSIT) (S1101-16-1020, The development of manufacturing strategy and execution simulation for shipyard mnaufacutring cost) and Korea Evaluation Institute of Industrial Technology (KEIT) grant funded by the Korea goverment (MOTIE) (10050495, Development of the simulation based production management system for the middle-sized shipbuilding companies).

REFERENCES

Jeong, Y. K., Lee, P., & Woo, J. H., 2017. "Shipyard Block Logistics Simulation Using Process-centric Discrete Event Simulation Method" *Journal of Ship Production and Design*, Vol. 33, No. 3, 1-12.