Executive Summary
Simio Spring 2016 Student Competition: Aerospace Manufacturing Problem

Problem Description

An aerospace manufacturer is trying to analyze their final assembly systems in order to accommodate changes for the future. In the initial state, the assembly line had multiple tasks within five different cells each with unique processing times, labor requirements, and material handling needs for two different types of planes. The system was driven based on a schedule which could cause work to be travelled to a downstream cell. A simulation model was created in order to analyze the current state and discuss future options.

Simulation Design Concept

The system design was constructed in Simio 8 University Edition. The final assembly model consists of a total of 75 planes each generated by a source every four days which runs on its own pathway through the five cells. As the plane arrives, it is assigned one of the two plane types based off a probability, and the number of planes that have entered the system is tracked. The tasks within each cell are represented by entities created by 83 different sources that are triggered to start when a plan arrives into the cell. The work is represented by add-on processes run by tokens that use four input arguments: Task Number, System Sequence Number, Cell Number, and Cell Worker. These input arguments are accessed based on a particular row-column intersection in the data table or array based state variables. First workers are seized while implementing and learning curve effects, and a delay is used to represent the time to complete the task. At the end of the cell, the tasks are combined into the plane. Tasks that are not completed within the cycle time are considered traveled work and combined at the following work cell.

Analysis of Results

An experiment was designed based off a Design of Experiment that required 2,400 conditions to be simulated. The experiment was performed, adding constraints to reduce the number of conditions. The initial phase ran with one replication that analyzed late plane arrivals. Scenarios with one or more late planes were removed from further consideration. As a further filter, the total number of workers was limited to thirty. With both responses constraining the experiment, the number of scenarios was limited to fifty-six. Finally, traveled work was added as a third response to determine the optimal number of workers. As the model and experiment were robust, it was easy to manipulate the data so that it can accommodate a future state with 100 planes consisting of three different types with a cycle time of 3.5 days.

Recommendations

After evaluating the data for the current state, it was decided that there should be a total of 25 workers, allocated as follows: 5 workers in cell one, 7 workers in cell two, 5 workers in cell three, 5 workers in cell four, and 3 workers in cell five. The current state scenario generated no late planes and had an overall average of 3 tasks that became traveled work. The future state had similar results with a total of 25 workers with 5 workers in cell one, 7 workers in cell two, 5 workers in cell three, 5 workers in cell four, and 3 workers in cell five. This future state scenario generated no late planes and had an average of 7 tasks that became traveled work for the overall system.

Overall, the current production line can handle the changes that need to be made for the future state. Although an additional shift or overtime can allow more time for production, it is not necessary with our current layout. The proposed resource allocation would improve the overall production of the final assembly line.