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THE BENEFITS OF PROCESS SIMULATION AT THE SALT LAKE CITY MANUFACTURING FACILITY

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ABSTRACT

This case study highlights specific examples of discrete-event simulation modeling to aid in making critical decisions regarding production and test equipment utilization at Northrop Grumman's Salt Lake City facility. In the first example, simulation was used to provide a big picture view of the overall test equipment capacity levels across several factories. It provided recommendations of which equipment is being under-utilized and could be placed in hibernation. Second, a highly complex model was created of another product line to show the low capability of its current state and how far behind schedule it was against customer deliveries. Simulation was also used in this example to demonstrate how improvements to test equipment efficiency would benefit the overall schedule, and whether or not the factory could be successful for future product completions. These Simcad Pro® models utilize varied input data and provide a forecast of completed units within a defined time frame.

INTRODUCTION

Product manufacturing can be a highly complex process that involves a multitude of supporting systems with both independent and dependent variables. The increase in complexity will most likely lead to results which are dynamic and difficult to predict. Simulation has been used to provide guidance on critical decision-making for both internal and external customers. It can be considered an unsung process improvement tool, which has given our site guidance to execute decisions in areas of new resource and equipment investments, locations of bottlenecks, testing "what if.." improvement scenarios, to plan and blueprint a manufacturing process, and aid in optimizing manufacturing sub-processes.

Additionally, simulation offers the ability to enter multiple types of data: manufacturing and test yields, process up-time, cycle times (including set-up, run, and tear down times), and resources (with varying availability and multiple shifts). All of these ingredients are then mixed into a time sequence. The end result is a validated model, which gauges how concrete the current state is and identifies where the inefficiencies are located within the process.

This presentation discusses two projects worked in 2015 to assist the production factory in making smarter, validated decisions based on objective data, as opposed to relying exclusively on someone's gut feeling and/or static data. The first project involved providing a recommendation on what test equipment could be taken off-line, due to a decrease in demand. Is there a savings, and can future production levels be maintained with less equipment? The second project included building the entire current state and creating a future state for an upcoming new production contract. At question, can the current state deliver to the customer's new aggressive schedule? If not, what are the required changes to bring it to a desired future state?

PROJECT 1 – IDENTIFYING AND DECOMMISSIONING UNNEEDED TEST EQUIPMENT

This project had a wide scope, and utilized existing models of the different factories within the site. Due to a decrease in orders within several product lines, there is an increased demand to reduce costs and to be a more "green" facility. Since the test equipment utilizes a sizeable amount of electricity and liquid nitrogen (used primarily in the cooling and heating of test chambers), then hibernating those under-utilized stations could provide an overhead cost savings and reduce the amount of resources we consume.

In order to understand the current state, existing simulation models had to be updated with the most current test yields and work order release quantities. Next, we had to determine an approximate energy and liquid nitrogen savings per station, with the help of the Facilities Manager. Finally, we had to determine how long the equipment can be safely off-line without interrupting future production levels. Once all the information was updated and analyzed, it was presented to the Factory Manager and Test Engineer to make the final decision, whether to retire or maintain those identified test stations.

During the course of meeting with three different factory line managers and test engineers, two of the three agreed to the recommendations provided. One product line declined due to old and problematic test stations, which may prove to be difficult to bring back online when demands increase. The benefits of this project were a "green" savings of approximately $20,000/year, an unidentified savings from reducing wear and tear, and it was a positive win for simulation modeling projects at the site.

PROJECT 2- IMPROVING AND RESTARTING A MANUFACTURING PROCESS

The second project was more time-consuming and challenging and it required more work from the ground up. The factory had manufactured this product in the past and the contract was fulfilled a few years ago, but a re-design required this product line to be restarted in a short amount of time. The downside was that most test equipment was unreliable and yields were low. This called into question whether it was even possible to meet the customer's aggressive delivery schedule. How would a break-in of new equipment impact the timetable or are we setting ourselves up for failure?

Our work was definitely cut out for us with this project. First, we had to generate and validate a detailed model of the existing process. Next, fully understand the proposed future state, and when the different pieces of test equipment will be off-line and back on-line, fully functional. Finally, and most importantly, we had to measure if the two joined phases (existing current state and future state with new test equipment) would be a success for the contract requirements. Additionally, there would be different scenarios that might alter the course of the future state (i.e.: material shortages, additional equipment downtime, and etc.), and what is our strategy to handle these potential challenges.

This project was a big success since it gave a visual demonstration of what will transpire over a period of a year and a half between the current and future states. Also, the model was able to incorporate a large amount of varying data into a platform and run it through a dynamic scenario to provide specific details. Some of the challenges in developing this simulation included the discovery of a hidden factory, obtaining accurate test yields, and the constant changes to test equipment schedules. The model provided great insight for both internal and external customers, and was successful in justifying additional funding to upgrade and purchase extra test equipment. The model was showcased to various executives within Northrop Grumman which received very positive attention. Due to the nature of this project, no real savings could be determined since the model provided visibility, forecasting details, and oversight to its customers.