PURDUE UNIVERSITY | School of Industrial Engineering

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TEAM 18

TESLA MEGAPACK PRODUCTION LINE SIMULATION

MINSUK KANG, ARJITH JEGANNATHAN, YIYANG ZHAO, SAMIR TOMEH, VALERIE BAESSA, MANSHA CHIMNANI

PROJECT INTRODUCTION

Tesla wants to increase the production of its Megapacks and intends to streamline the production process to keep up with anticipated demand. As of today, Tesla's production capabilities for the Megapack at the Lathrop Megafactory are not optimal. The team has been tasked with constructing a discrete event simulation of their Megafactory and has split the project into 3 phases

Phase 1
Preliminary model

This includes building a basic model with the exact process and current parameters. This is mainly to understand the current process, production capacity, and constraints

Phase 2
Bottleneck Analysis

In this stage, the data provided will be used first to find the bottleneck and then analyze how it can be overcome. Propose multiple solutions and alternate approaches to overcome the bottleneck

Phase 3
Future State

This state is when we consider the other sensitive factors affecting the total production time and suggest improvements for future changes in demand as well as growth

Understand the process flow → Cycle Time and other data collection for all stations → Simulation -Model Building → Identify & Study stations with high utilization → Provide recommendations

PROJECT SCOPE

Challenges

- Producing Megapacks as efficiently as possible with minimal bottlenecks
- Meeting demand target of 45 to 50 Megapacks produced in a week
- Minimal to no budget or space to make production changes

Project Requirement

Identifying production issues using real-time results, and visualizations for each machine in the system. Use the simulation results to implement changes within the model to produce 45 to 50 Megapacks/week.

Process to Recommendation

FlexSim Simulation – Create and simulate the production process using real-time machine data and cycle times

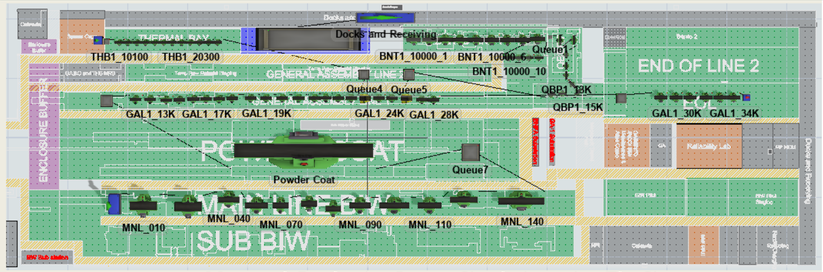
Metric Dashboard – Develop dashboard metrics on throughput, output, and state bars

Bottleneck Analysis – Analyze which machines require a lower cycle time or cause delays in order to meet demand

Impact

Improved production, efficiency, and quality within Tesla's Gigafactory

METHODS & RESTRICTIONS



Megapack Production Layout Simulation using FlexSim

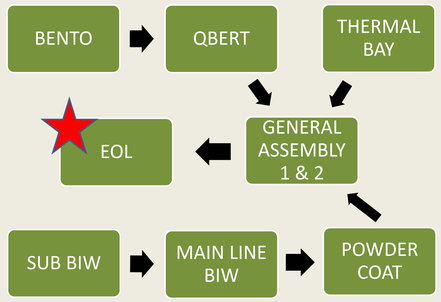
Method: Model was created on FlexSim using the CAD drawing of the facility layout. Based on the statistical data and constraints input, the simulation showed the number of units produced, and collected in each sink. Those units were fed to the source of the next production line. Finally, every part is assembled and then tested in the EOL.

FlexSim Restriction: 30 block model limit.
Solution: The model was separated into parts based on the colors of the model. The production line simulation was integrated using the sources and sinks.

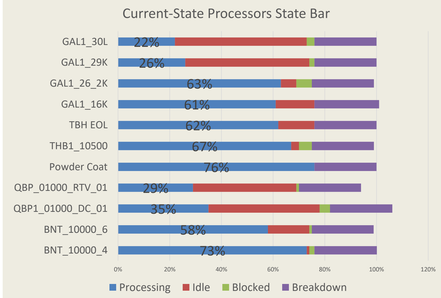
Client Restriction: Budget and space constraints limited.

Solution: Incorporated future growth and analyzed the bottlenecks to eliminate waste idle time make the cycle time shorter and increasing productivity.

CURRENT STATE



Megapack Production Process Flow

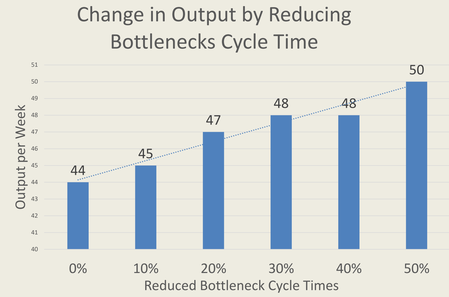


Processors Utilization Percentage

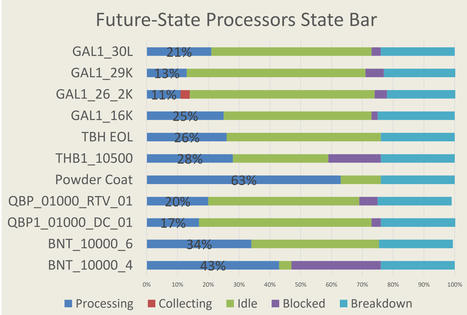
- Less than 205 minutes cycle time per asset
- 44 assets per week
- Multiple Bottlenecks (Less than 50% utilization)
- Processors are in series
  - Increased change of Mean Time Between Failure
  - Increased bottleneck processors
- Uneven distribution of cycle times among processors
- Space constraints
  - Cannot add more processors

RECEOMMENDATIONS

Optimize the number of Megapacks produced each week by finding the optimal reduction percentage for the Bottleneck cycle time.



- Analyzing how the final output is affected by reducing the cycle time of the Bottleneck stations
- By reducing cycle time of the stations by 50% the Megafactory can produce 6 more Megapacks



Processors	Bottleneck Processing Percentage Improvement
BNT_10000_4	41%
BNT_10000_6	41%
QBP1_01000_DC_01	51%
QBP_01000_RTV_01	31%
Powder Coat	17%
THB1_10500	58%
TBH EOL	58%
GAL1_16K	59%
GAL1_26_2K	83%
GAL1_29K	50%
GAL1_30L	5%

- After reducing the cycle time by 50%, the processing time for each bottleneck station was also reduced.
- The processing time improved for each station by up to 83%

Overall, to have a significant production increase per week it is recommended that the cycle time for each of the bottleneck stations is decreased by half. A possible solution to reduce the time is by adding a parallel station to each bottleneck.

CONCLUSIONS

Next Step

- Improve production efficiency by further reducing cycle time
- Test possible solutions using the simulation model
- Analyze the economic aspect of adding parallel stations

Takeaways

- Conduct production line simulation using FlexSim
- Bottleneck and Cycle Time Analysis
- Make recommendations based on technical and economic aspects

TESLA