



Introduction:

The Northstar Aerospace facility in Bedford Park, Illinois primarily focuses on manufacturing helicopter gears and transmission components. The facility has historically operated with a high mix and low volume environment. Over the last three years, the Manufacturing Engineering and Value Stream Management team has placed substantial emphasis on documenting and evaluating product flow.

This project's scope is to develop mixed model tools and visual controls to improve control on the facility's floor level. These visual controls will be used to quickly measure the deficiencies of floor areas, further identifying if flow lanes have been selected and organized effectively.

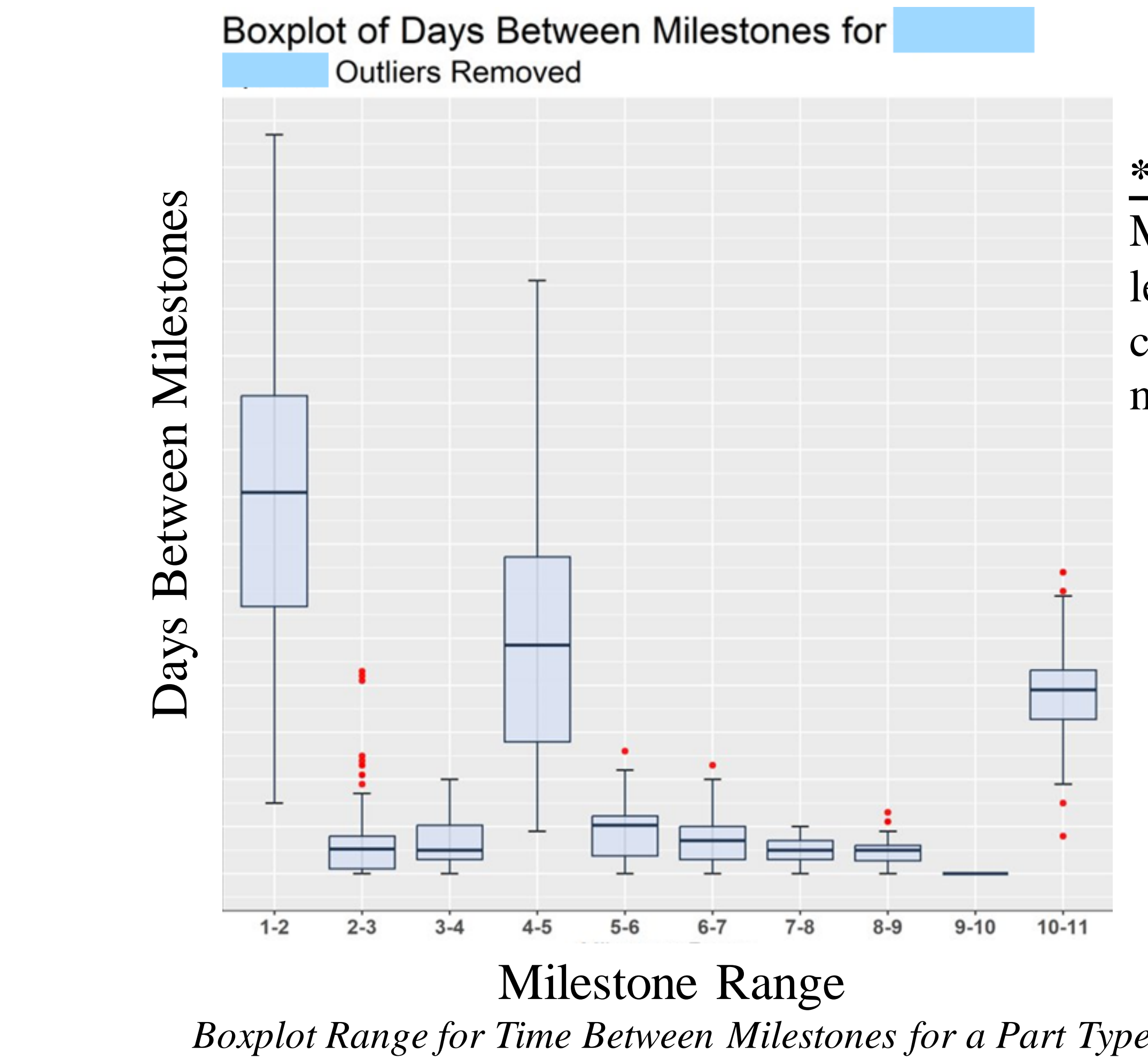
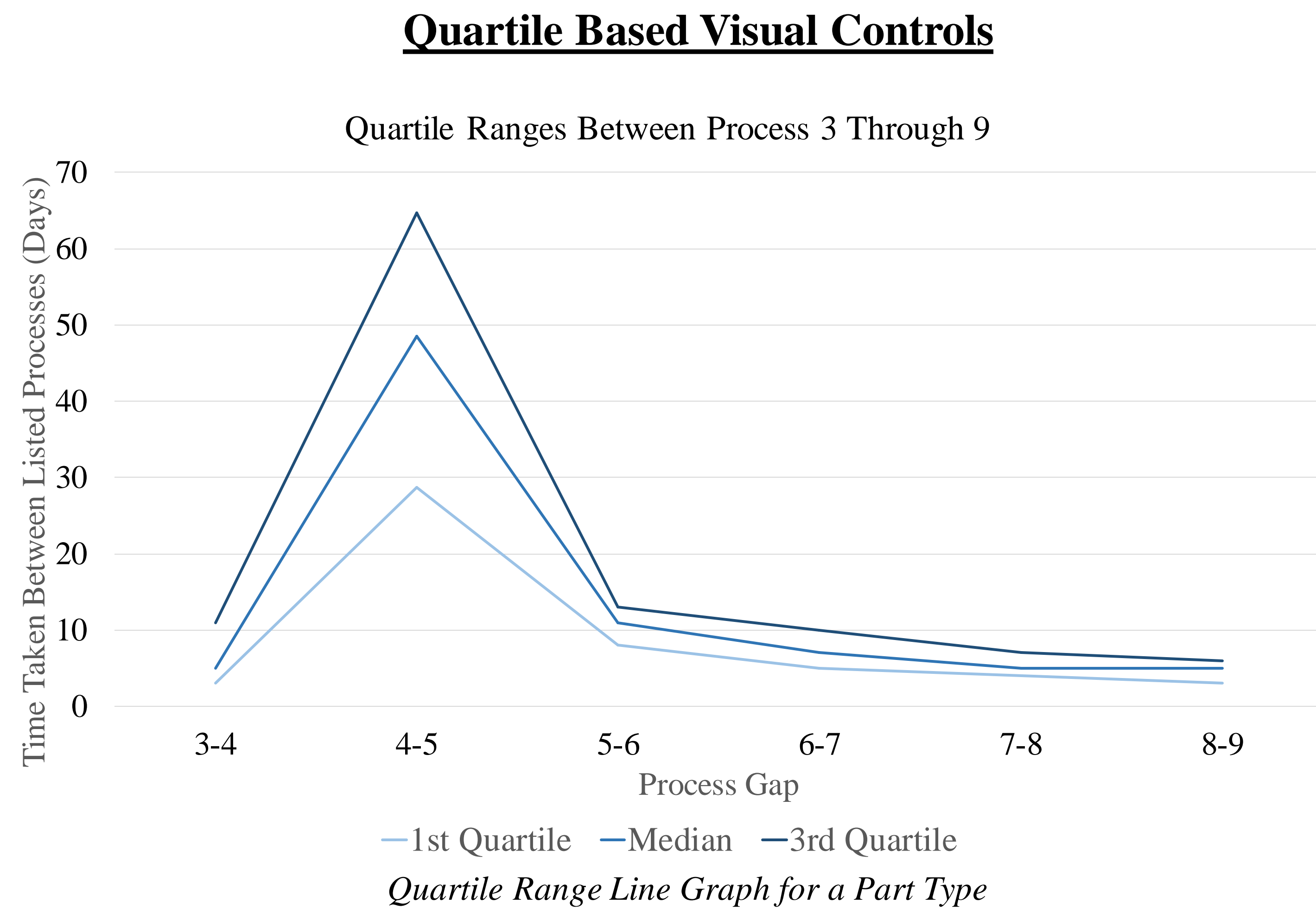


Facility Magnet Board on Manufacturing Floor

Seen above, this magnet board on the facility's manufacturing floor is an example of a visual control used to track part progress through manufacturing milestones. Part types are color coded for visual clarity.

Methodology:

- Our project contact sent us data regarding the flow of part types through the different manufacturing "milestones"
- We conducted individual statistical analyses with Microsoft Excel and the R programming language
- Balancing interpretability and effectiveness, we decided upon using visual representations of quartile ranges
- Examples of these quartile based visual controls can be seen to the right
- Medians across milestones and part types were then used with the facility's demand forecast to create production forecasts



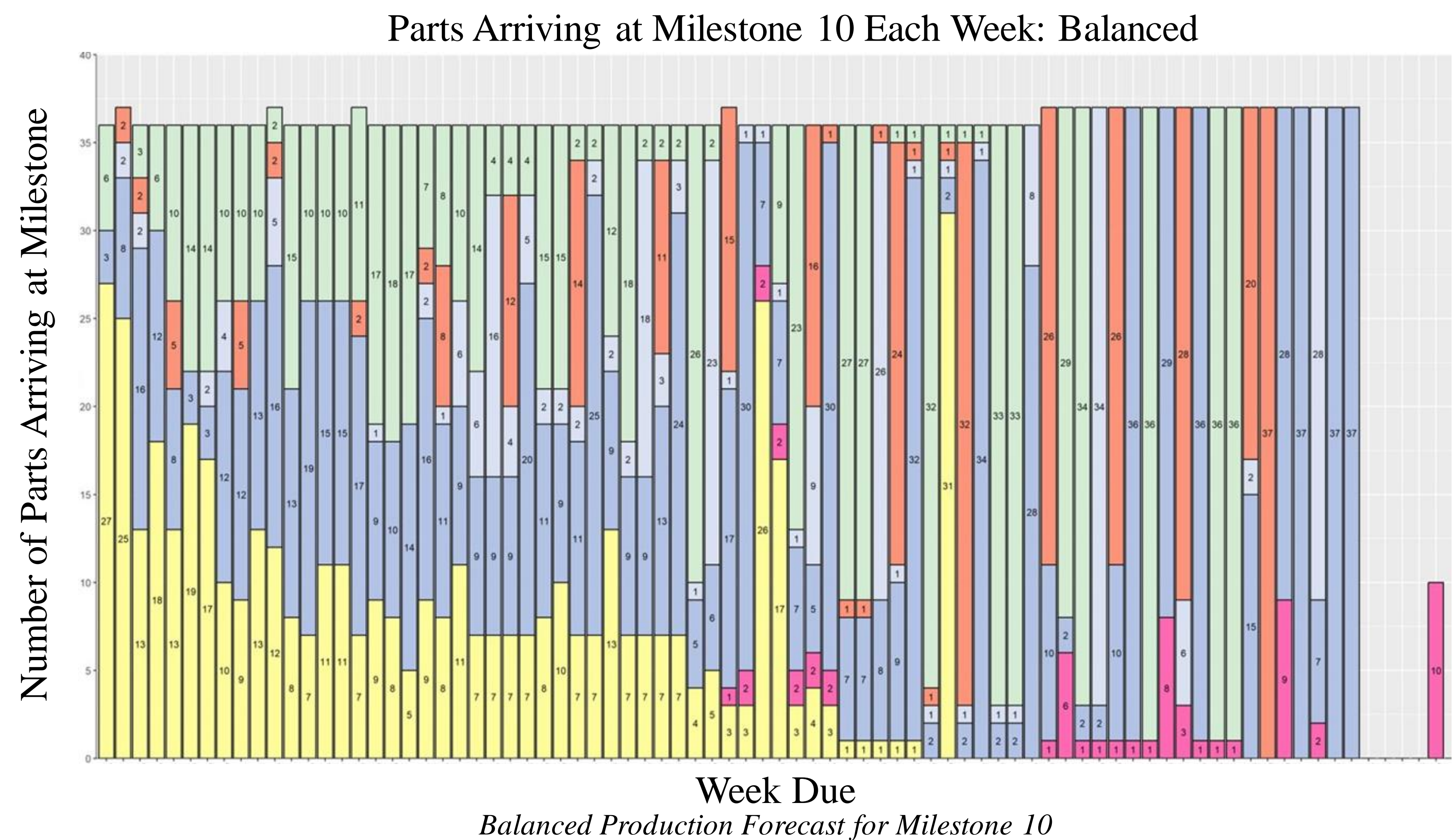
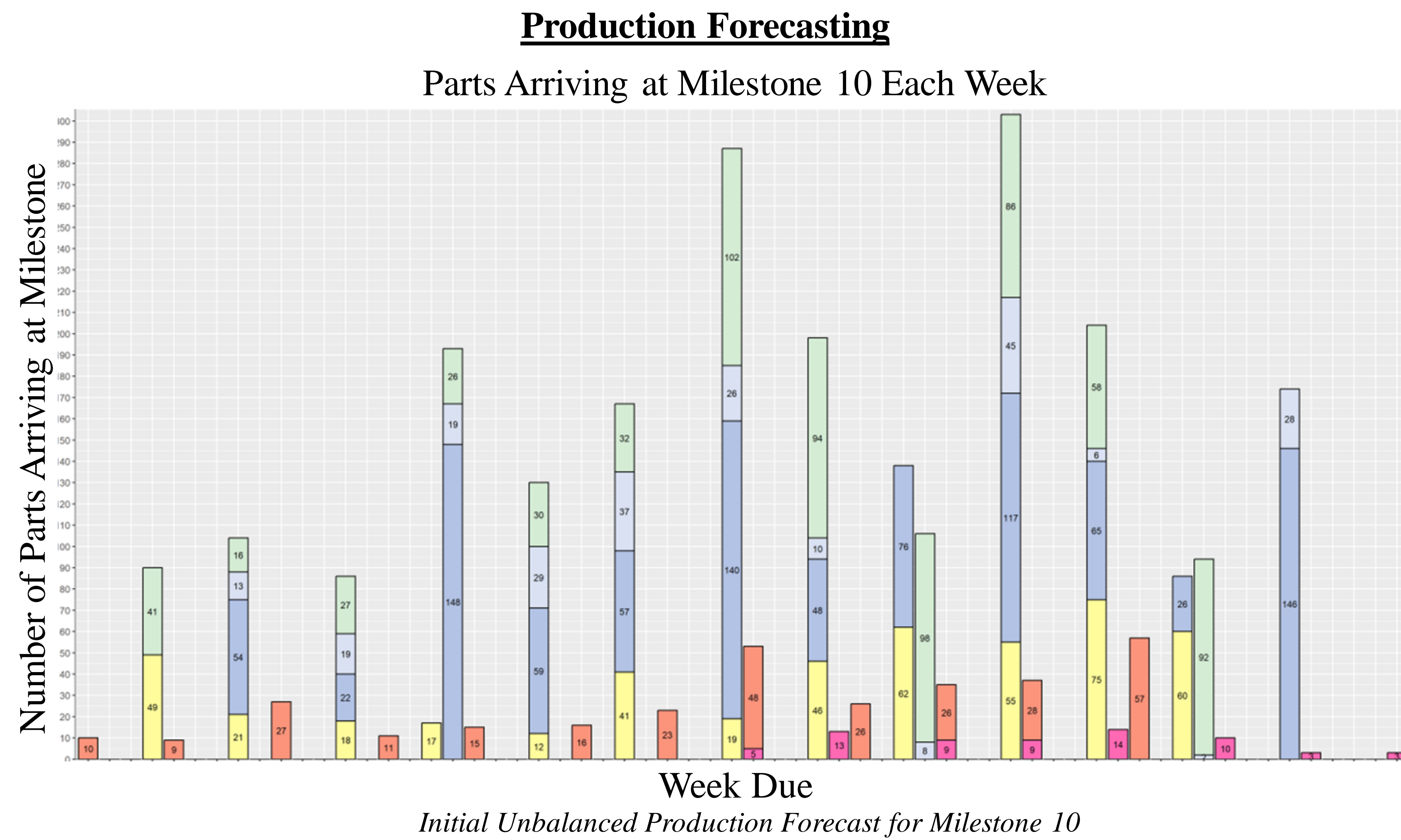
***Note on Confidentiality:**
Most titles, axes, and legends have been censored or removed to maintain confidentiality

Explanation of Results:

- We increased the readability and usability of our visual aids by removing anomalies in the data with guidance from our project champions
- Alongside several box plots, example shown above, we also developed a quartile range line graph, shown at the top of this column
- The programming language R was used to generate boxplots automatically on demand, keeping this solution applicable in the future

Scope Expansion:

Expanding the scope, our project champion tasked us with taking demand forecast data and applying our historical data analysis to make additional visual controls. These were then used to create and "level-load" production forecasts. R was used so that these visual controls, along with the boxplots, can be outputted automatically once given updates to historical data and demand data.



Conclusion:

After our final presentation, our customers at Northstar Aerospace were pleased with our solution in the form of these automatically generated figures and associated R script. We presented this solution to them on November 29th, 2022, and even directly after the presentation they were leading discussions about how they were putting our tools to use. We also confirmed with our primary project champion that the R Script would run properly on their computers and thus will also be able to be iterated upon in the future. This ensures that our solution will remain applicable.

The general manager of the facility expressed immediate interest in more intricate and detailed versions of the models and tools we built this semester. Some of the paths for improvement we see are direct integration with Northstar's database to allow the script to work in real time and the possibility of collecting more detailed data on the part mix for more granular analysis.