

# Economies of Space: Developing a Lean Manufacturing Framework for Work Center Floorspace Reduction



## BUSINESS PROBLEM

The main problem Boeing's Interiors Responsibility Center South Carolina (IRC SC) is trying to solve is the fully allocated production floorspace. This limitation prevents the addition of new product lines and hinders preparation for potential increases in production rates for the 787 Dreamliner Program. The goal is to eliminate wasted floorspace while increasing production capacity and efficiency without expanding the facility's physical footprint.

## DATA SOURCES

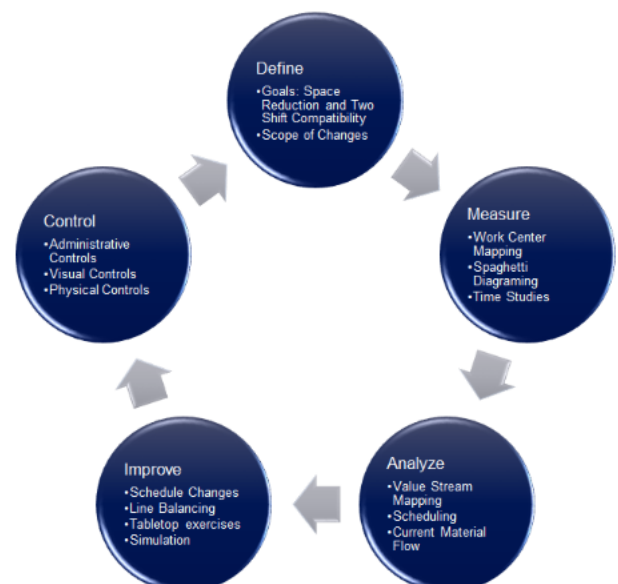
The data in this thesis includes detailed observations, time studies, and value stream maps from IRC SC. These data were collected through direct measurements, spaghetti diagramming, and discrete event simulation. The sources include Boeing's internal systems, process plans, and input from manufacturing technicians and industrial engineers.

## Data Types and Format

Data formats included Excel spreadsheets, manufacturing execution system production data, CAD models, Simio simulation models, and Visio documents.

## APPROACH

We developed a lean manufacturing framework using the DMAIC methodology which employed lean tools like spaghetti diagramming and value stream mapping to identify and eliminate wasted space. The framework was tested on a single IRC SC work center and recommended changes were validated using discrete event simulation.



## IMPACT

The developed framework resulted in 25% reduction in floorspace and a 55% decrease in product throughput time in the studied work center. The lean manufacturing principles and scheduling optimizations discussed is expected to be applied to other work centers within IRC SC to further economize floorspace and streamline production processes in advance of potential rate increases. Additionally, discrete event simulation validated the proposed changes, ensuring they would achieve the desired improvements. The simulation demonstrated that the new system could perform satisfactorily even at higher production rates. This provides confidence that the framework can support future increases in production rates without compromising efficiency or quality. Overall, the impact addresses both immediate operational challenges and long-term strategic goals. By optimizing floorspace, improving efficiency, enhancing worker conditions, and supporting higher production rates, the framework positions IRC SC for continued success and growth in the competitive aerospace manufacturing industry.

### DRIVERS



Boeing's IRC SC supports the 787 Dreamliner program and needs to be able to meet any potential new production or aftermarket demands. As such, the facility needs to perform advanced planning for such increases. Additionally, new product lines may be needed to meet supply chain priorities or regulatory requirements, and the facility needs to free up space on the production floor for these lines.

### BARRIERS



Detailed data for high-confidence process time is not well captured in the manufacturing execution system. data collection required manual time-study data collection. Additionally, internal and regulatory requirements regarding product designs and materials constrained the possible changes to the work centers and processes.

### ENABLERS



IRC SC provided broad access to personnel with in-dept knowledge of studied product lines as well as internal systems which contained information on processes, standards, and historical production data. IRC SC also ensured access to production floor and interaction with production teams.

### ACTIONS



Actions taken to implement the solution included coordination with tooling department to support new equipment requirements, development of transition plans for floorspace and scheduling changes, as well as presentation of project methodology to the Lean Manufacturing and Industrial Engineering for further work in IRC SC and other Boeing facilities.

### INNOVATION



This project developed innovative discrete scheduling methods to level-load daily production times. We also developed and constructed new solutions to integrate work-in-progress (WIP) storage that reduced the need for independent shelving and allowed segregation of production materials between shifts.

### IMPROVEMENT



This project achieved major reductions in floorspace and product throughput times for the studied work center. Additionally the project achieved a lean framework for IRC SC to apply to other work centers to reclaim additional floor for future production needs.

### BEST PRACTICES



Inclusion of production team in floorplan and process changes leads to improved and more sustainable outcomes. Consolidate of curing times when possible to reduce the amount of touch-days a product requires. Shift production scheduling from batch-and-queue to single part flow to reduce through-put time and WIP storage requirements.

### OTHER APPLICATIONS



The framework outlined in this thesis should be applicable in most manufacturing contexts, especially in cases where production is carried out manually at movable workstations rather than on moving production lines.