



Client Background

1984: Lockheed Martin's Greenville, South Carolina facility opened for sustaining C-130 and P-3 aircraft.

2019: F-16 production began in Greenville

2023: First flight of a Greenville produced F-16 (block 70)

Today: Greenville has grown into a key manufacturing hub, requiring updated production systems and greater operational efficiency.



F-16 Main Production Area

Problem Statement

Lockheed Martin's facility in Greenville lacks inter-departmental communication, a consistent production schedule, warehouse inventory, accurate span times, and well documented workflow/op-card precedence. This results in engineering teams not accurately forecasting tooling and workforce needs as well as Subassembly supervisors being unable to efficiently schedule technicians based on their skill sets. This leads to longer learning curves for technicians and unknown production capacities which will cause delays further down the production line when at a higher rate.

Project Scope

Tool Tracking: Gathering existing data on tooling in Subassembly Facility and creating a model to determine quantities of each tool required to meet desired rate.

Capacity Analysis: Providing analysis of rate capacity from number of tools and labor available comparable to rate demands.

General Approaches

Data Discovery and Validation: We began by identifying existing data sources and verifying tool-related information through interviews and site visits. This included reviewing engineering records, op-cards, and span times while cross-checking tool lists maintained by different departments.

Model Design and Development: We built a dynamic forecasting tool that connects tooling usage with op-card data, technician availability, and scheduling needs. This allows real-time analysis of production readiness at current and future rates.

Scalability and Implementation Strategy: The tool was built with adaptability in mind, allowing easy updates and expansion to other production areas, giving Industrial Engineers a consistent method of assessing tooling and labor capacity site-wide.

Notable Changes

Scheduling: Without a schedule for performing op-cards, our team would not be able to provide a recommendation on tools needed to meet rate at the lowest cost to the company. Our tool provides a scheduling recommendation to optimize tool usage.

Platform: Moved the tool to excel following a discussion with LM employees where we learned that our previous platform would not be implemented due to certain packages.

Tool Summary

Goals:

1. Minimizing Tooling Requirements
2. Reducing Makespan
3. Consistent Production Output

Inputs:

- Operation Precedence,
- Labor & Tooling constraints
- Calendars

Outputs:

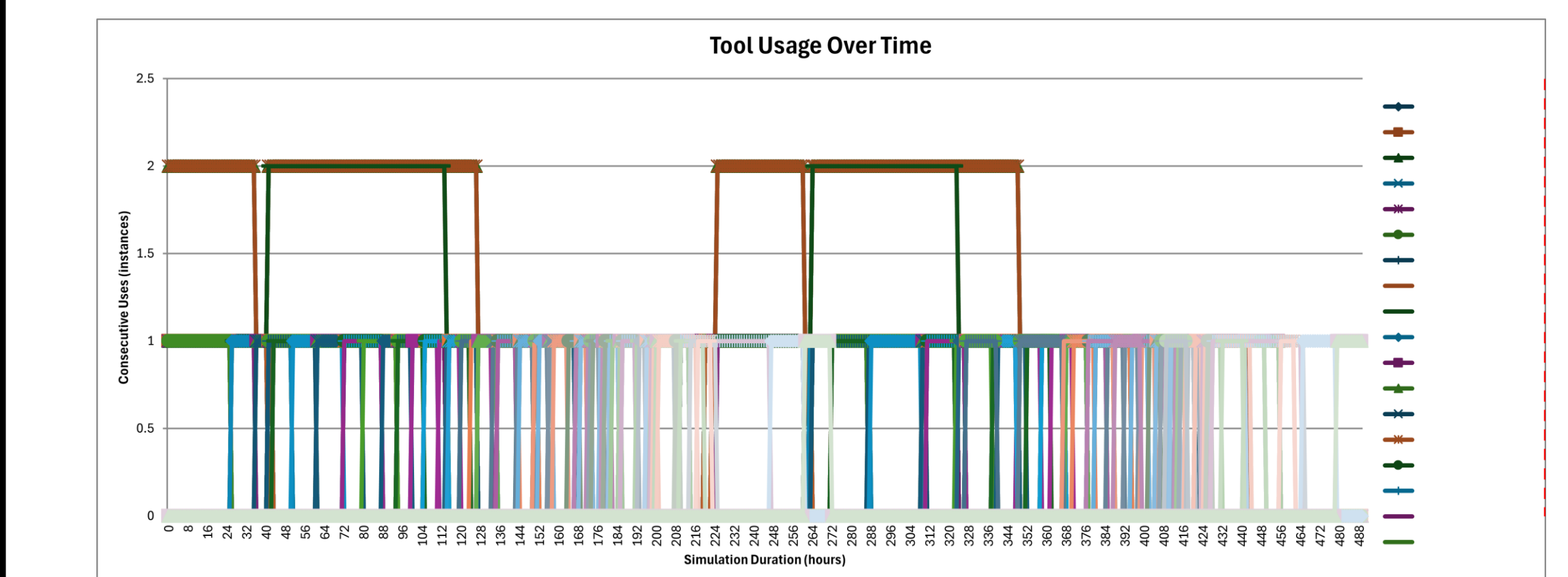
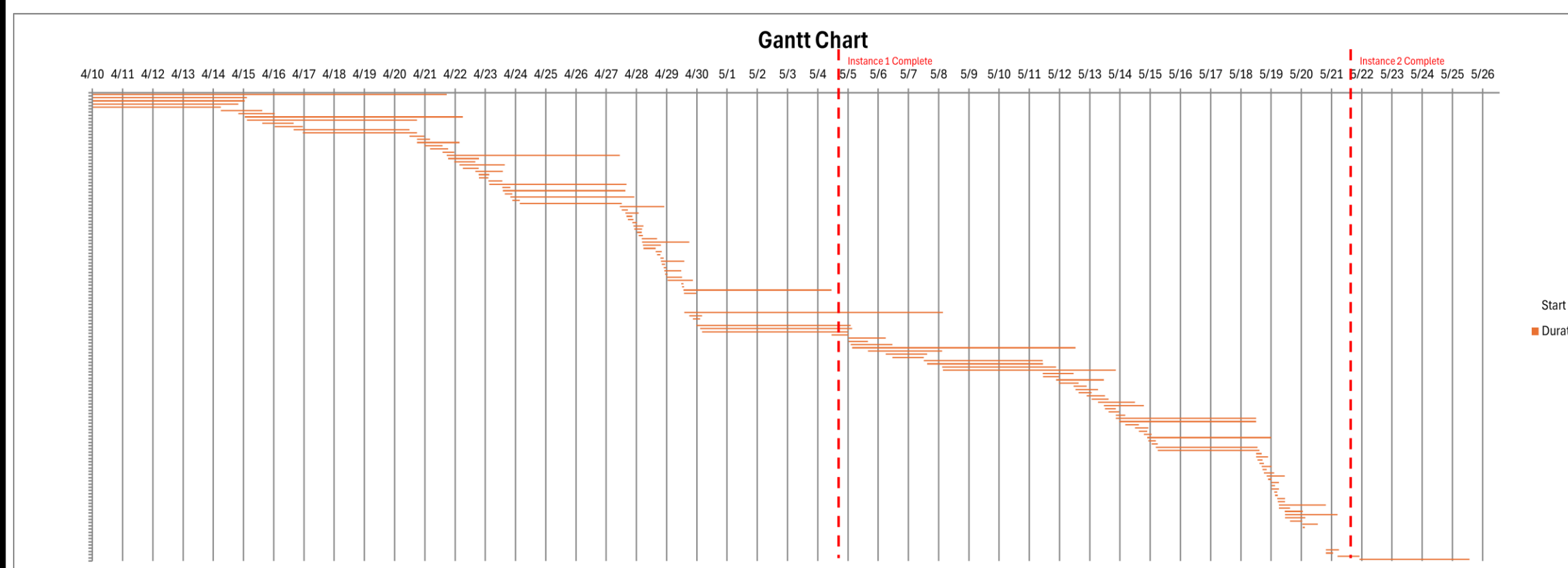
- Tool Use Data
- Model Schedule

Tool Demo

Subassembly Production:

Example utilization from an F-16 subassembly process

Output:



Conclusions:

- Current Capacity for Production
- Critical Tools
- Optimal Schedule
- Labor Requirements

References

<https://www.lockheedmartin.com>

Return on Investment

Contracts (profit)

- Retain current contracts – 140+ jets contracted as of 2024
- Get new contracts – multibillion dollar contracts

Throughput (profit)

- Improved throughput and efficiency in Subassembly with increased tooling and scheduling recommendations

Tool Costs (investment)

- Varying costs and lead times

Increased Labor Force (investment)

- Additional labor is necessary to support a higher rate of production

Stakeholders + Implementation

Industrial Engineers

- Previously identified tooling as a major issue in 'ramp to rate' efforts
- Easily identify what tools are necessary to meet specific production rate goals
- Contribute to rate risk analysis project

Operations Engineers

- Tooling data for workstation design kaizens

Production Supervisors

- Optimized scheduling recommendations based on tools and labor available

Next Steps

Warehousing: Currently using just in time. Scrap later down the line causes subassembly to remake parts on demand as there is nothing in the warehouse - preventing accurate scheduling and ability to meet rate goals

Facility Layout: Subassembly is severely limited by space and needs to be re-designed or moved into a larger building to accommodate tooling necessary to meet rate