Factory Physics® Case Study:
Reducing lead times by *increasing* inventory

This case deals with the Industrial Controls Division of Moog, Inc. This division designed and manufactured a variety of products for industrial applications including precision control valves, hydraulic manifold systems and electric motors and drives. They were having significant problems meeting customer due dates and losing market share to their competitors. Customers were demanding price reductions as the cost of materials and production continued to rise. Manufacturing cycle times averaged 16 weeks, while the market was demanding 2-4 week lead times.

The manufacturing process was a combined fabrication/assembly operation in a configure-to-order environment. Moog had already started a lean manufacturing initiative with help from one of their largest customers, Boeing. They had started a 5S housekeeping program, organized the floor into manufacturing cells, and begun working on reducing setup times. But the problem of poor customer service was not being resolved.

A few managers from Moog had attended a Factory Physics seminar and thought that it seemed like a good tool for understanding the principles of manufacturing and assisting with improvements. They decided to call in Factory Physics, Inc. to perform an assessment of the one of their plants. The result was a strategy to improve customer service and production efficiency based on Factory Physics principles and using Factory Physics, Inc.'s software support tools.

After a strategic analysis of the situation, the decision was made to address customer service issues first and production efficiency issues second. The idea was to insulate fabrication from assembly and test by putting an inventory/order interface between the two. Fabrication would make the component parts to stock. Assembly and test would build subassemblies from the components in stock based on customer orders. This would have the effect of reducing the lead-time to the customer to the cycle time in assembly and test.

The model was first piloted in the Torque Motor sub-assembly cell. Variability in supply and demand was buffered with an inventory of about 180 part numbers in the cell that were used to create over 1,000 unique torque motors. As the process became more stable, Moog started to lower inventory levels and change to a FIFO process. The next step was to move back to parts supply to further reduce buffers as variability was reduced. Finally, once customer service improved, we could start to focus on the problems in fabrication.

Moog used the Lean Physics Stock Optimizer tool to set inventory levels in the cell to cover demand and supply variability. The tool made it relatively easy to quantify the tradeoffs between fill rate, inventory investment and number of setups in the cell. The graph below illustrates this tradeoff plot. Here, the 3 different curves represent different number of setups. As the number of setups increases, the inventory investment needed to achieve the same fill rate decreases. This was a great help to Moog in deciding how much setup reduction was needed. Selecting a point on the plot then generated an optimal policy, which was used to set inventory order quantities and reorder points for each part number needed for the cell.

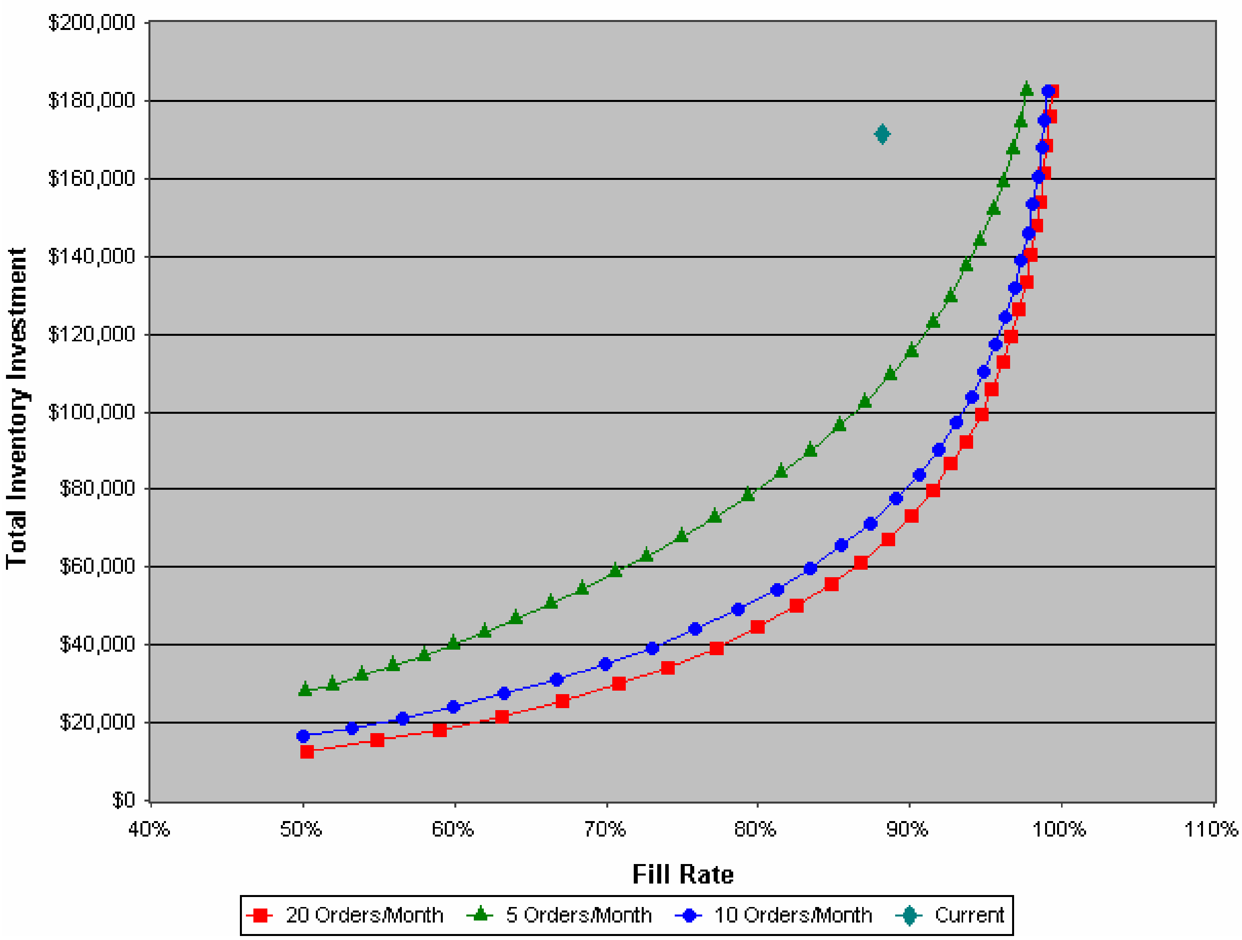

Figure 1: Stock Optimizer tradeoff plot

Employees were then trained in basic Factory Physics principles and lean manufacturing techniques during a one week Accelerated Improvement Workshop. One component of the workshop was the Factory Physics paper house exercise, which was used to help supervisors and operators understand how and why a pull system works. Following the training, operators and management actually made changes on the shop floor to prepare the cell for a pull system.

The results from the approach outlined above substantially improved customer service. Cycle times in the cell went from 12 days to 3 while improving on time from less than 50% to over 95%. Even better was an unexpected 7% boost in productivity. Although an inventory buffer had been added in the cell, the overall inventory levels dropped over 15%.

After this initial success with integrating Factory Physics and Lean, the company moved to another sub-assembly cell and repeated the process. With both sub-assembly cells using a pull system and setting inventory levels using the Stock Optimizer, cycle times to the customer went from 23 days to 6. Follow-on actions included streamlining upstream fabrication to reduce needed inventory and implementing further productivity improvements.