

Swoosh and Boom



Q U A R T E R L Y

Proof of Concept: Lean “Cells” Produce Better-Than-Expected Manufacturing Efficiencies

by Allie Buzzell
Adeptus Associates

The Indian Head Division, Naval Surface Warfare Center (IHDIV/NSWC) is known as a pioneer in converting from batch processing to continuous processing of energetic materials. A parallel and equally significant development is IHDIV/NSWC’s groundbreaking application of lean manufacturing principles to convert from batch assembly to single piece flow in energetics manufacturing.

In September 2004, the CAD Lean Manufacturing Team within the CAD/PAD Manufacturing Division successfully demonstrated for the first time that lean manufacturing concepts yield remarkable labor efficiencies in the production of cartridge-actuated devices (CADs). These concepts produce the potential for significant cost savings, while maintaining or elevating the level of safety and quality of the product.

By the end of 2004, completion of a similar demonstration by the Cartridge Lean Manufacturing Team is expected to show that lean concepts will also bring cost-saving labor and motion efficiencies to the fabrication of cartridges.

Lean manufacturing is a set of principles that improve the manufacturing process, making it more efficient and less expensive by producing a higher quality product in less time. Lean concepts have been used in the automobile industry and other manufacturing settings for years, but have never been applied in a military production environment where operators handle energetic materials as part of the fabrication process.

The initial groundwork for the CAD/PAD lean cell demonstrations was a study by the Center for Energetic Concepts Development (CECD), a cooperative program between IHDIV/NSWC and the University of

Maryland’s Mechanical Engineering Department. A team led by Professor Jeffrey Herrmann studied the application of lean manufacturing principles to the fabrication of the M21 cutter, a CAD used to release cargo from aircraft.

Many of the concepts addressed in the CECD study were later incorporated into the two demonstration projects within the CAD/PAD Manufacturing Division. According to Director Darrin Krivitsky, both demonstrations involve manufacturing two product lots in a lean “cell.”

A lean cell is a collection of workstations that physically tie together in a single location all the equipment, materials, and tools used in the fabrication process of a given item. Rather than assembling a complete unit, each operator working in the cell instead performs one or a series of discrete steps in the assembly process. As each step or series is completed, the unit is passed from one operator to the next until all the components have been assembled.

The CAD Lean Manufacturing Team demonstration involved the assembly of one lot of 436 M25A1 thrusters, devices that use explosives to eject the canopy off the T-38 training aircraft in an emergency. The assembly of CADs for

Lean Cells

Lean Cells

Lean Cells

Lean Cells

Lean Cells

Lean Cells

Lean Cells

Lean Cells

Lean Cells

Lean Cells

Lean Cells

Lean Cells

Lean Cells

Page 3



Employees working at the lean cell. The operators report the cell is comfortable, promotes interaction, improves morale, and inhibits fatigue.

aircrew escape systems, and other uses, requires experienced operators and the highest commitment to quality control.

In fact, the lives of our warfighters depend on the fail-safe functioning of the devices, according to Nick Scalfaro, manager of the CAD/PAD Manufacturing Branch. It is imperative in the lean cell demonstrations to maintain, or even improve, the safety of the manufacturing process and the quality of the product being produced.

For the CAD Lean Manufacturing Team demonstration, Project Engineer Steve Possehl designed the lean cell from both off-the-shelf and custom components. The cell is just 15 feet long—extremely small by traditional manufacturing standards. “What we do in a large, functionally-organized manufacturing bay can be done in a much smaller space designed to handle the entire assembly process,” said Possehl.

The cell design is based on sound ergonomic principles, with the operators sitting side-by-side, close enough to hand a unit to the next operator without leaning or overreaching. A bright overhead light provides excellent illumination to prevent eyestrain. The operators report that the lean cell is comfortable, promotes interaction, improves morale, and inhibits fatigue.

The cell accommodates three operators seated at assembly stations, and two or three other operators handling other tasks, including hardware and materials supply, x-ray inspection, packaging, labeling, and cleanup.

Each operator is proficient in all of the tasks performed in the cell, so that when someone takes a break or is absent, the work continues uninterrupted.



◀ **The CAD Lean Manufacturing Team (from left to right): Kathleen (Kitty) Hart, Steve Possehl, Frances Makle, Sadie Cobey, Christine Butler, Ester Adams.**

One of the principal goals of the lean cell concept is to reduce the unnecessary movement of materials. In a lean configuration, everything required for assembly is either built into the cell or moved there prior to the start of production.

Conversely, in the traditional manufacturing configuration, materials and components must be moved to the equipment, sometimes traveling hundreds of feet multiple times within a manufacturing bay, or from building to building.

Set-up and cleanup times are reduced, making it possible to convert the production line to begin fabrication of a new item in just one hour. The space utilization principles underlying the cell design also allow operators to find a tool in one minute or less, thus expediting the setup process.

The CAD lean manufacturing cell demonstration showed that potential savings in time, motion, and labor are much greater than anticipated. The lean cell reduced the time it takes to manufacture the CAD product from 1,000 hours in six weeks to 550 hours in six days, representing a 46 percent reduction in labor. The

goal for the demonstration was a 15 percent labor reduction.

The CAD Lean Manufacturing Team has processed two lots on the manufacturing line to date. The M25A1 thruster program and the M53 initiator program, both Air Force programs, have utilized the lean cell manufacturing line. Initial results from the M25A1 thruster and M53 initiator efforts have led to 49 and 20 percent cost savings, respectively, totaling approximately \$53,000 in savings.

The attendant cost savings will emerge later, after the CAD/PAD Manufacturing Division reinvests and retools to convert other programs to lean cells. According to Krivitsky, before the end of fiscal year 2005, the CAD/PAD Manufacturing Division plans to transition 80 percent of its cartridge and cartridge-actuated products from the batch manufacturing process to lean cells.

According to Scalfaro, these developments will make IHDIV/NSWC's CAD/PAD manufacturing capabilities more price-competitive, allowing the division to bring in more work, and ultimately to introduce greater levels of safety and reliability to the products on which our warfighters depend. ✨