



Pit Crews cut final assembly time in half, giving FMC Energy Systems “The Racer’s Edge.”

By Thayer Bennett

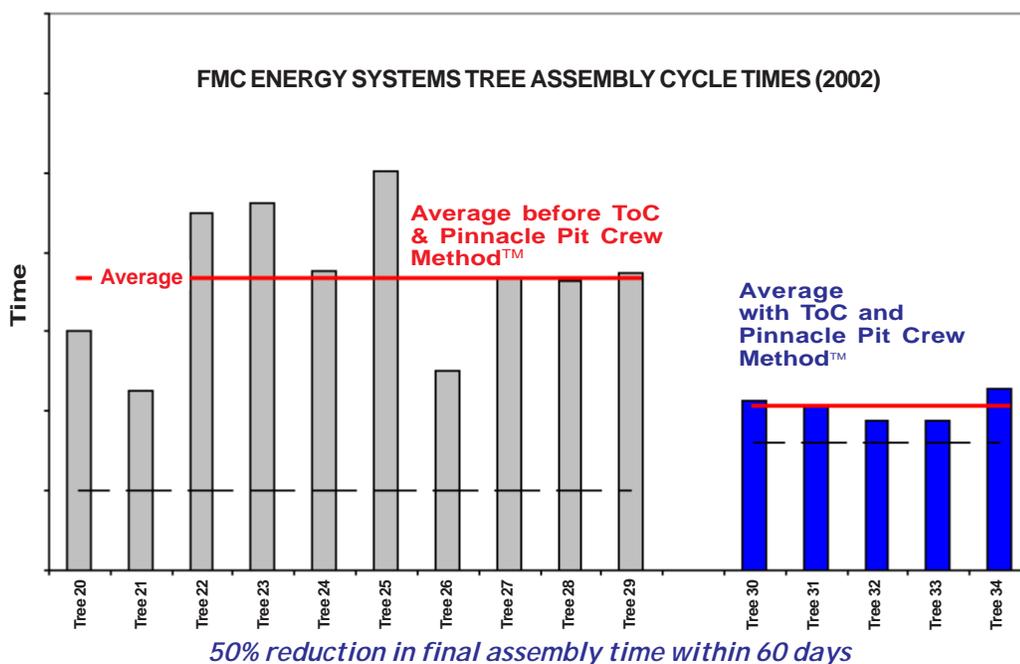
Forget the greasy stereotype and think about the neat, sharply synchronized pit crews of today. They represent optimum speed, precise timing and meticulous attention to detail. Those same benefits can be driven right onto the factory floor, giving the manufacturer a competitive workflow advantage that’s hard to beat. As part of their “Plan for Manufacturing Excellence,” Pinnacle Manufacturing Consulting harnessed a pit crew analogy (The Pinnacle Pit Crew MethodSM) to demonstrate and facilitate successful Critical Chain Management (CCM). The

innovative idea proved itself by turning in an outstanding performance in a recent application at FMC Energy Systems, an engineer-to-order manufacturer of complex capital equipment in Houston.

When demand outpaced capacity at FMC Energy Systems, it was imperative to ramp up production. The company hired the Pinnacle team to identify areas where immediate improvement was possible, then formulate and initiate solutions. Pinnacle complied, coupling considerable experience implementing Critical Chain projects

with their “pit crew” technique and other innovative strategies. The outcome was impressive. Pinnacle CEO Mark Woepel reports that the project resulted in a 50% reduction in test duration and final assembly time for the products FMC Energy Systems made for Shell Oil and substantial improvement overall including an increase in labor productivity of 15 to 30 percent — all without capital investment — all within 60 days.

Driller demand for



FMC Energy Systems' subsea trees (the huge under-ocean structures that interface between wellheads and flow lines) increased dramatically as the call for oil grew worldwide and surged in the U.S. Of all of the means utilized by the company to increase speed to market (physical expansion of the plant, increased standardization, quality initiatives, etc.), Pinnacle's Critical Chain implementation that incorporated the development of pit crews for the manufacturing operation proved to be "most significant," according to Kendall Turner, FMC Energy Systems Assembly Process Engineering Manager. By relating the tree assembly process to a racecar making a pit stop, the method of working was changed so that workers were "at the ready" with the right parts at the right time. Relating the process to a pit stop also provided a rationale for talking in already-familiar terms and consequently, downtime associated with the learning curve that might have come from introducing a "Critical Chain" vocabulary was completely avoided. The end result of using



these methods was that problems were acted on immediately and the time it took to build the final product was cut in half. The shift in methodology was one of moving from problem solving after the fact to clearly defined anticipation and the proactive execution of needed procedures.

Subsea trees are very large (three or more stories tall in the case of some vertical tree structures) and extremely complex, made up of literally thousands of parts. There is a need to create many redundant systems and in order to meet emerging customer needs engineering is necessarily ongoing during production. The manufacture of these multi-million dollar pieces of equipment is a daunting task requiring superb process coordination and control. When Pinnacle entered the scene, the existing FMC Energy Systems situation was one of such record sales demands that assembly was pushed to the limits. Lead

times were too long, completion times were too variable and defect rates were unacceptable. "Based on initial analysis," said Pinnacle Project Manager and Senior Consultant Bruce Nelson, "our immediate objective was to increase the production rate by reducing assembly time." The large majority of the time the product was in production, it sat idle waiting to be worked on or waiting for decisions to be made. Assemblers were often out of the



area chasing down parts, tools, fixtures, materials handling equipment and approvals and consequently, they were functioning like drivers without a car. A change in emphasis from keeping people moving to keeping the product moving was necessary. Pinnacle recom-

mended that careful identification and pre-staging of parts and equipment needed for each "lap" in FMC Energy Systems' subsea tree assembly "race" would eliminate a great deal of down time. A comparison to a racecar making a pit stop helped workers see that time previously wasted in assembly slowdowns and stoppages, thought to be inherent in the process, could be recovered.

"Pinnacle's Scott Button," said Nelson, "helped create a breakdown structure, sequencing all of the assembly tasks in proper order and setting up a load path. Once FMC Energy

Systems workers could see what was coming up three to five days in advance, they were able to make all the preparations that were needed before the part actually entered their segment of the assembly process." Nelson continued, "We equated it to knowing which lap a car is going to come into the pit and working ahead to put new tires on rims and make sure they're inflated to the proper pressure in order to insure quick action to get the car moving again — action that could begin the second the car stopped. Simple as it sounds, changing the way the workers viewed their process had a huge impact. Without the need to hire more workers or invest in more equipment, FMC Energy Systems' production capacity doubled."

Pinnacle's plan to reduce assembly lead-time while maintaining or improving product quality was comprehensive. The strategy was to create activity that was "event" rather than "date" driven. In the process of

analyzing the work and executing the strategy, they utilized parallel work paths, measured daily progress, demanded accountability, and left no detail to chance. A network of specific tasks was created, optimum task sequence was determined, time durations were plotted, resource requirements were identified and a workable schedule was shaped.

Early in their implementation, the Pinnacle Manufacturing Consulting team conducted exhaustive on-site testing to determine the locations of bottleneck and/or constraint operations within the assembly area. A race leader was appointed and the pit crew was assigned the task of isolating and understanding any current issue stopping or hampering assembly. The crew was also charged with providing, with the help of management-mandated support from Production Control, Engineering, Quality Control or Purchasing, on-the-spot remedies to quickly get the assembly process moving again. In order to function at optimal level, the initial pit crew was made up of seasoned personnel chosen, not just based on experience, but on the possession of a “pioneering” mindset.

Accountabilities were changed to give the race leader primary responsibility for on-time delivery, product lead-time and organizational responsibility for the assembly pit crew. The pit crew had responsibility for both “proactive” and “reactive” functions. The proactive duties included planning and organization of scheduled work tasks, making sure tools, equipment, service providers and procedures had been reviewed and tested and were ready for use. Reactive functions involved problem solving using techniques such as root cause analysis to get to the bottom of recurring dilemmas. Creation of the race team with its pit crew also served to temper the inevitable culture shock that comes when workers are required to change from working from a list of functions to working within a closely guided plan. No longer something to react to, problems were now being anticipated (three to five tasks ahead) and the future was becoming predictable and manageable.

Once the FMC Energy Systems “race team” was in place it was time to roll out the rest of the Pinnacle implementation strategy. New scheduling processes were unveiled, then a measurement system. Organizational behaviors that could be used to support a more seamlessly continuous assembly of trees were identified. Improvements to the process were put into action and then reviewed in terms of impact on reduction of overall lead times. Management skills were honed. Finally, an additional team to “cross pollinate” advantages to other assembly areas within the Houston plant was developed.

All along the way, the implementation was solidly structured down to the detail level, such as in providing for the handling of problems that could not be resolved by the pit crew.

Fundamental changes with huge impact

Pinnacle Manufacturing Consulting identified the most significant and pivotal opportunities to improve assembly methods and practices at FMC Energy Systems. How even a single change can reap impressive results is exemplified by the efficiency gained when the manufacturing line was reconfigured. Pinnacle recommended that, rather than using all available bays to build trees, a quarter of them be reallocated to allow for the building of tubing hangers in parallel. The resulting gain in speed provided a solid benchmark in performance improvement.

Another particularly important stride was taken when Pinnacle introduced the posting of “critical measures” on



the FMC Energy Systems shop floor by using a “dashboard” that gave everyone an at-a-glance picture of performance, such as the tracking of the amount of buffering built into a schedule. Because workers in different categories needed different reports and statistics, information was provided on a variety of levels. Posted measurements included the schedule status of what jobs were on time, behind or ahead and they were refreshed daily as data was collected from the pit crew leader and others. Lead-time performance was also posted. The information made it easy to enforce accountability, which, in turn, proved invaluable in bringing previously hidden obstacles into view so they could be resolved.

“To sum it up,” explained Pinnacle CEO Mark Woepfel, “implementing improvement successfully isn’t about changing everything, it’s about knowing how to

apply the right change in the right way, but the most important ingredient of all is working with a great company that's committed to supporting a carefully conceived and executed plan for manufacturing excellence. FMC Energy Systems is just that kind of company."

Presenting the FMC Energy Systems perspective, Robert (Bob) Houlgrave, the company's Shell Alliance Manager stated, "Mark Woepfel's group [Pinnacle Manufacturing Consulting] came in, analyzed our problems, and within just a few days, gave us a recommendation and started the process on the very next [subsea] tree [product] in our assembly line. We cut almost 50% out of the cycle time of that tree assembly and we managed to hold onto that gain and continue to improve. That was impressive and we did it in just a matter of weeks."♦

FMC Energy Systems in Houston, Texas, maker of Energy Production and Processing Systems, is one of the businesses of FMC Technologies, Inc. (www.fmctechnologies.com), a global leader in mission-critical technology solutions. FMC Energy Systems produces Subsea Systems, Measurement Systems, Fluid Control Equipment, Loading Systems, Floating Systems, Blending and Transfer Systems, Surface Products and Material Handling Systems. For more information, contact them at 281-591-4000.

For particulars on **Pinnacle Manufacturing Consulting** and how their Constraint Management, Lean Manufacturing and exclusive signature methods improve the bottom line, call 972-491-1333 or visit www.mfgexcellence.com on the internet. Pinnacle works with companies involved in manufacturing and project-based production organizations. Their primary specialties are: supply chain strategy and optimization, production scheduling, manufacturing operations strategy and scheduling, business process reengineering, project management and Critical Chain.

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