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General Cable is a worldwide manufacturer and top producer of wire and cable products, with a variety of different product lines in the energy, communications, and industrial specialty fields. General Cable Altoona represents the automotive division. The difference between wire and cable production for General Cable as a whole and the Altoona plant specifically is how the plants handle the wire. The majority of General Cable's businesses manufacture from core wire and cable to produce bulk wire; Altoona receives bulk wire from a sister plant for conversion into ignition wire sets and single leads. The Altoona plant's products are sold to end users in the retail automotive aftermarket.

General Cable's market position is that of a vertically-integrated ignition wire supplier, primarily in private brands, offering both a high level of customer service and a better value product than its competitors. The company's market direction is aftermarket consolidation – as the automobile manufacturing moves in a certain direction, the actual demand for ignition wire sets will decline due to changing technology. General Cable Altoona wants to consolidate that aftermarket and become the lead supplier of ignition wire sets. Customers now are primarily in the US, and the company is pursuing expansion of sales and business into Mexico, South America, Europe, East Asia and turkey. There are currently some sales in Canada.

The Altoona plant has about 200,000 square feet, half devoted to manufacturing operations, and the other half to warehouse distribution operations. Its 250 associates are members of an IUE bargaining unit (International Union of Electronic, Electrical Salaried Machine and Furniture Workers of America). Its basic manufacturing process is to take a bulk wire, cut it to length, strip the wire, tuck the core, apply a terminal to the end, and add insulators.

An overall manufacturing excellence strategy outlined by corporate headquarters provides guiding principles for the pursuit and implementation of lean, with safety as a first priority, followed by housekeeping, formal systems, and preventive maintenance procedures, among others. There are three specific areas of importance to Altoona: *the customer demand management system, continuous improvement,* and *supplier integration.*

The *customer demand management system* is lean applied to the office. The traditional manufacturing method of giving a forecast to the plant, producing to that forecast, putting the product into inventory and hoping it all sells is gone. Instead, General Cable Altoona's sales forecast is used strictly for capacity-planning purposes. The forecast provides the Altoona plant's suppliers the numbers the suppliers need in order to access the appropriate materials and convert them per Altoona's demand and need. The sales forecast also identifies monthly sales and operational planning needs, allowing for the rotation of associates into different cells to meet specific demand, and hiring needs. A detailed breakdown of the sales forecast for differ-

ent products is applied to assembly cell capacity planning and is used for establishing goals. The actual production orders are based on customer demand and are intended to replenish the finished goods inventory that has dropped to a reorder point because of direct sales to the customer. Customer demand is entered daily, based on triggers established throughout the demand management system.

In General Cable Altoona's environment, flexibility is needed primarily because the plant serves the retail market. *Continuous improvement* processes allow the plant to achieve this flexibility through partnerships with outstanding suppliers, a cross-trained workforce that moves into different cells effectively and efficiently to produce different types of orders, quality improvement efforts. and a combination of lean and lean-six sigma tools.

Altoona's manufacturing process lean evolution is perhaps best represented by its conversion from batch processing to single-piece flow. Initial operations had people sitting down at large conveyor lines and instead of cutting 300 leads of number 1, associates would cut 1000+ of every lead, then change over and produce 1000+ leads, and so on. Production transitioned through various stages to the ultimate stage of the associate moving around the cell, limiting product handling in a rabbit-chase assembly cell. Each operator handles a complete set. Instead of waiting for 1,000 sets to be produced in sequence, a finished set can be taken and immediately handed to a packer or customer.

Supplier integration **–** five suppliers now represent 94 per cent of Altoona's raw material expenditures. Rather than every year competitively bidding the price for each part, Altoona has one supplier base that the plant works with to develop and meet ongoing needs in terms of delivery, price and ongoing price reductions. Suppliers were skeptical at first, but have since come to recognize the benefits in terms of the committed volume received.

Suppliers own and manage the inventory on-site; monthly invoicing is based on consumption. A pull system replenishes based on that usage and min/max levels. Not only does this help from an overall WIP standpoint, but it assures that materials are always available, and only in quantities needed. Altoona provides lean training to its suppliers – the common language and techniques further strengthen the partnership and improve performance.

General Cable Altoona holds an annual supply chain conference where its core suppliers and major customers meet. It is an excellent forum for communicating and strategizing. Awards are presented based on a quarterly report system, a system that has been influential in evaluating suppliers in terms of quality, delivery, inventory and productivity.

Prior to implementing lean, General Cable was a batch processing operation, with traditional manufacturing's move and store mentality, long cycle times, poor work order compliance, and quality errors. One of its first lean steps was to introduce kaizens to eliminate the batch assembly and introduce single-piece flow, with a single piece defined as one ignition set. The next step was to eliminate the batch cutting operation with the introduction of linear cutters to the cell. Then the cutting and assembly operations were linked, thereby removing additional several steps.
The plant also became involved in poka yoke by changing some of their confusing part numbers, and looking at some of the problems inherent in plant processes. Associates developed a wire barcode scanning process, and made modifications to a terminal press. Visual management tools were put to use, too. Andon lights, tool boards, and 'look-alike' insulator parts boards are in each of the work stations – all part of the lean and continuous improvement process. Once orders are prepared, based on the demand management system, a pull system is used to place orders into specific bins representing the assembly cells that produce those orders. "Hot" orders (that need to be shipped within the next two days) are printed on colored paper for easy recognition of their priority in the order flow.

The maintenance crew developed into a design-and-build team, taking manual and ergonomically unsafe and inefficient operations out of the process. A team of hourly associates became directly involved in the orientation and training of new hires in lean techniques and later, lean-sigma techniques. The team developed a route sheet training program and a methods instruction sheet training program. QWPs – Quality Work Procedures – outlined the quality plan and checks associated with each product (what requirements are critical to the customer or critical to the process). New stop tag procedures improved the consistency of root cause investigations in determining the cause and identifying the solutions. Quality improvement became a corporate-wide bold objective.

General Cable Altoona's success has been recognized by IndustryWeek (a Top Ten Plants award winner in 2003) and by its customer base (Autozone, Honeywell, O'Reilly). It was also General Cable's plant of the year in 2003. The plant continues to receive corporate and customer annual performance awards. The rewards go even further with an increase in business. Improvements derived from lean implementation translate to better customer service, improved quality, and increased capacity within the constraints of the existing physical plant and resources. Customers know the plant can take on additional business and handle the demand.

Constant competition from international competitors, a restricted market, and, in the last few years, economic pressure are all areas that have to be addressed not only to thrive, but in some cases, just to survive. No matter how good the effort, no matter the accomplishment, the group at General Cable Altoona remains committed to continuing its lean journey.