

## America's Elite Factories

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### AEROQUIP GROUP: A TROUBLED OHIO PLANT BECOMES AN EXEMPLAR

If there was ever a plant that pulled itself out of a morass of poor quality, declining sales, and low employee morale, it is Aeroquip Group's 47-year-old factory in Van Wert, Ohio, near the Indiana border. Once a sad sack, it has become a superman of best practices that have been adopted by many of Aeroquip's 35 other plants in the U.S. and abroad. By borrowing some of Van Wert's ideas, in fact, some of those plants have won quality leadership awards in such states as Michigan and North Carolina, as well as many other honors.

Van Wert makes products you normally don't see--metal connectors, fittings, and adapters as well as rubber hoses joined to them. They contain, control, protect, and otherwise facilitate the flow of liquids and gases: hydraulic fluids in airplanes, buses, and trucks; freon in refrigerators; even oxygen from one firefighter's pack to another's to save a life in a fire. Aeroquip hoses, hose assemblies, and quick-disconnect couplings are typically found in critical systems, where they must withstand extreme weather conditions, vibration, abrasion, corrosion, dust, and high operating pressures.

Raw steel and aluminum bars arrive at one end of the Van Wert plant, which employs 720 workers operating computer-driven and other machines in three shifts around the clock, and emerge as shiny, plated components. Like so many other plants in Main Street America, Van Wert found itself in desperate straits in the late 1980s, when international competition intensified and its customers went global. Located in a pleasant, tree-shaded town of 11,000, the plant had the advantage of a dedicated work force. There were fewer good things to say about its management's skills.

In the fast-moving new world of "lean" manufacturing, the huge 500,000-square-foot plant seemed to have gotten caught in a time warp, with excessive old-fashioned inventories blocking passageways and unhappy customers complaining about poor product quality and late deliveries. Competition, in the U.S. as well as abroad, was tough. "There were a lot of sharks out there nipping at our heels," says Donald G. Waggener, 49, who has been plant manager at Van Wert since 1992. "We needed to change the business."

The plant had some excellent products. In fact, Aeroquip during World War II had pioneered a couple of remarkable innovations. The company's founder, an immigrant German aeronautical engineer named Peter F. Hurst, had started the company in 1940 in an abandoned milk-processing plant in Jackson, Mich. Hurst had invented and patented two imaginative products designed for the aviation industry: detachable, reusable hose fittings and self-sealing couplings. Before then, when a metal fitting failed on a hose, both the fitting and the hose had to be replaced. Hurst's fittings could be replaced without discarding the hose. Aeroquip rapidly gained a foothold in aviation, and its equipment became standard on all U.S. aircraft.

When the U.S. entered World War II, Aeroquip's founder had a more difficult time than his products. Still a citizen of Germany, now an enemy country, Hurst found himself barred from the premises of his own plant, whose products were deemed critical for the war effort. He started a small shop recycling bottle caps for Coca-Cola, but by one account remained in charge of Aeroquip by sending memos back and forth from an office across the street. The military relented toward the end of 1943, allowing Hurst to return to Aeroquip as executive vice president to straighten out production problems. He became a U.S. citizen in 1945.

After the war Aeroquip began to expand beyond aviation, producing parts for motor vehicles and for refrigeration and air-conditioning equipment. The Van Wert plant, built in 1953, was the company's first

major industrial facility. Independent in its early days, Aeroquip was later absorbed by a succession of conglomerates. Eaton Corp. acquired it in 1999.

When trouble came in the 1980s, Van Wert's managers went outside for help. They recruited two university professors, Jack Muckstadt from Cornell and Dennis Severance from the University of Michigan, to execute what later became known as the Cornigan process, a contraction of "Cornell" and "Michigan." The Van Werters soon used the term Cornigan as a wry acronym for their new motto: "Clear overdues, reduce needless inventory, and give adversaries nightmares."

The professors started a long process of rejuvenation, which is still continuing. They were assisted by Van Wert plant employees, whom they organized in teams to study and change plant operations. One of the most basic changes was the establishment of "focus factories" within the big plant--collections of people and machines that concentrate on manufacturing and assembling a specific product, often for a specific customer.

Formerly, manufacturing and assembly were in separate departments. This led to confusion and misunderstandings, Waggener recalls. "We reconfigured the whole facility, and we're continuing the improvements," he says. A concept that the Van Wert managers applied is what they call cell razing, a variant of barn raising, a term common among Amish farmers in Ohio and Pennsylvania, whose families customarily gather to help neighbors build a new barn. At Van Wert, razing means building--and sometimes rebuilding--production cells in a constant search for greater efficiency.

Plant workers have participated so heavily in the transformation that today 95% of employees serve on two or more improvement teams. Waggener wants to bring participation up to 100% this year. So intimate is worker involvement that the plant now gets employee input on purchasing production machines. Operators who will work on them accompany Van Wert engineers to the machine-tool makers' plants to try them out and make certain, among other things, that they are easy to operate. This new kind of participation has helped cut cycle times drastically on both new and old machines. Parts finishing, for instance, has been reduced from eight days to 24 hours.

Employees who contribute ideas that improve productivity receive gift certificates worth up to \$25 as well as company jackets. Says Waggener, who sets great store by communication with the workers: "We recognize it's very important to let people know we appreciate their ideas."

What this has meant on the factory floor is simplifying how things are done. Take the Dynacraft cell, a focus factory dedicated to making truck parts that Dynacraft, a subsidiary of truckmaker Paccar, distributes to that company's truck plants. The cell has adopted a much simpler process for machining and assembling components for truck air-suspension systems.

Two workers are stationed at opposite sides of a gravity part rack. One attaches a nut support to the tubelike part and slides it down the rack. The other puts the part into a stamping machine. In an earlier version of this operation, there was no gravity rack, and the assembly and stamping jobs were separate. The part was dispatched to a stamping press, where it might wait in a queue for 48 hours or longer before being processed. The use of the gravity rack shows that not all improvements have to be high tech. The cell processes 1,400 parts every two shifts, vs. 100 parts before the change.

At Van Wert, "demand flow" has taken the place of pushing through product without regard for demand. Manufacturing managers have gotten the workers involved in vigilantly watching the "value stream," the flow of materials from suppliers being transformed into products for customers throughout the plant, and spotting any wasteful activities that might affect the flow.

A new scheduling system is now in place that reacts better to customer demand; the customers include a mix of distributors and original equipment manufacturers (OEMs) such as General Motors and Caterpillar. "We're now a fast-response organization that looks at how to solve customer problems," says Waggener.

The plant now makes products that customers urgently need on a "fast lane" within four hours of receiving an order.

When parts are already in stock, they move out quickly from a 210,000-square-foot Aeroquip central distribution facility that adjoins the plant. Inside that beehive of activity, which employs 280, self-propelled guided automatic vehicles ferry finished parts from the plant into the computerized warehouse, where they are stored by computer-controlled gantry cranes and rapidly retrieved for shipment. The distribution facility receives and transships components from other Aeroquip plants around the world. It also assembles some hoses.

Van Wert continues to look for new refinements of the company's manufacturing processes. In the plant's advanced manufacturing section, which employs 70 people, new computer numerically controlled (CNC) machines are tested for use in Aeroquip plants at home and abroad. For customers, the Van Wert plant develops production techniques by trying out prototype machine cells in the engineering department before installing them on the production floor. A big current project is a program for a major diesel-engine builder, which may result in an investment of as much as \$10 million by Van Wert to make a novel fuel system for trucks.

By a variety of measures, the plant has come back splendidly. Inventories of parts have been sharply reduced, from a 135-day supply in 1990 to 46 days' worth last year, and are expected to fall to 45 days in 2000. On-time delivery to customers has soared from 63% in 1990 to 96% last year, with the goal of 98% in sight this year. The return by customers of faulty component parts, as measured in parts per million, has plunged from 4,811 in 1990 to 1,863 last year. This year's target is 1,000. Most impressive of all, the plant's gross sales have increased by 25% over 1990, and operating income has rocketed 855% since 1992. (The plant does not disclose dollar figures.)

Kudos for all this should go to the employees, Waggner insists: "We like to say that anyone can buy the same equipment, but that no one can buy our kind of workers."