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THE WORLD'S

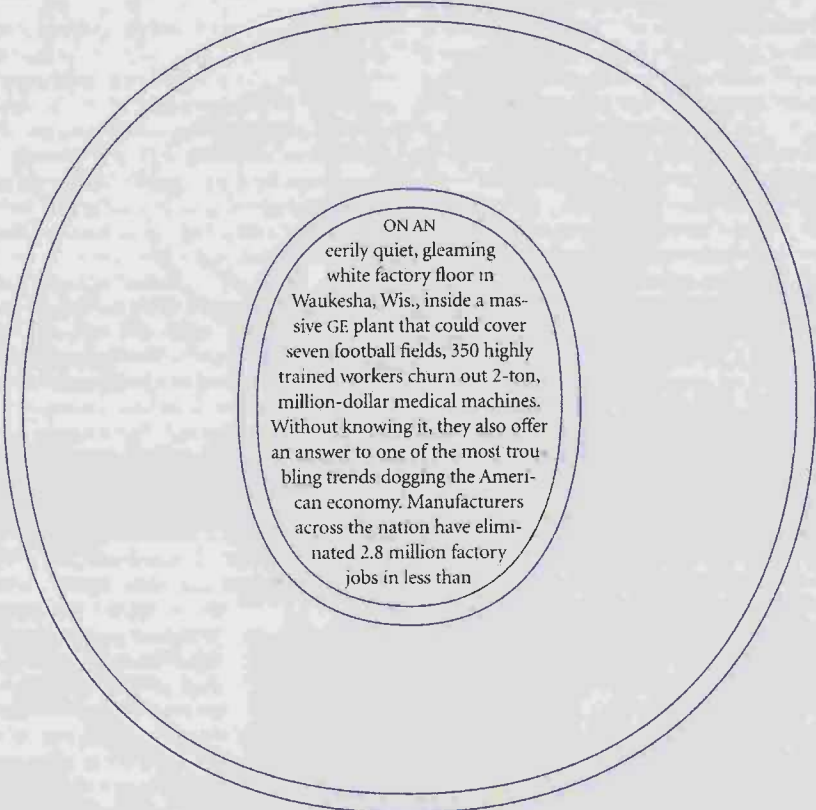
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ON AN
cerily quiet, gleaming
white factory floor in
Waukesha, Wis., inside a mas-
sive GE plant that could cover
seven football fields, 350 highly
trained workers churn out 2-ton,
million-dollar medical machines.
Without knowing it, they also offer
an answer to one of the most trou-
bling trends dogging the Ameri-
can economy. Manufacturers
across the nation have elimi-
nated 2.8 million factory
jobs in less than

Made in **America**

Millions of manufacturing jobs are headed overseas.
So how is it that, in the U.S., GE's medical-gear
factories are thriving? By Kerry A. Dolan

PHOTOGRAPHS BY TIM EVANS FOR FORBES



Ever better:
Productivity at
GE Healthcare's
Waukesha, Wis.
plant is up 25%
since 2001.

graduates with better skills in software and electromechanical troubleshooting. Once a grad is hired at GE, he gets an additional two weeks of on-the-job training to man the testing stations for things like computed tomography (CT) scanners and magnetic resonance imaging (MRI) machines. Most workers on the assembly line start with a high school degree and two weeks of new training. All workers get another two hours a month of training in manufacturing methods and environmental health and safety. Pay at the Waukesha factory, where workers are unionized, ranges from \$16 to \$25 an hour. These jobs breed loyalty: Average tenure is 25 years, and the turnover rate is a low 4%.

To reduce factory injuries and keep productivity up, design teams work to improve the ergonomics of assembly each time a new product is in development. They track how many times an assembly worker has to lift something above the shoulders or below the hips, altering the design to reduce the strain. On its latest CT machine, the LightSpeed Pro, such lifting was reduced 70%—helpful when one component is a 250-pound X-ray tube. As a result of moves like this the number of injuries at GE Healthcare's plants dropped 40% last year. So far this year the injury rate is down 50% from the year-ago period; this helps keep productivity improving.

The U.S. is still a fount of new technology, and GE Healthcare takes full advantage of it. Vendors in the U.S. (and GE's own U.S. sites) account for 65% of what GE Healthcare spends on tech for its newest products. Of the 150 suppliers to GE's mobile "C-arm" X-ray plant in Salt Lake City, 80% are domestic. Even some foreign suppliers have set up here. Barco, a Belgian-based supplier of liquid crystal display (LCD) screens and graphics cards used in GE machines, produces cards at a small facility in Beaverton, Ore., where it also houses a research team.

For all the high-tech wizardry inside the machines, GE also uses the latest inside the factory. A year ago the Waukesha plant started using e-tags, sophisticated radio-frequency ID tags about the size of your index finger. The e-tags are attached to carts that transfer parts to various stations along the assembly line; each tag identifies which parts are on board. Antennas relay the data to GE tracking software as the cart leaves an off-site warehouse and as it enters the factory. A few times a day an employee drives a cart around the factory to refill it with the right parts. "Assemblers can spend the day assembling instead of looking for, or waiting for, parts," says Stephen Leonard, a GE Healthcare general manager. "They're much more efficient."

To better align design and assembly, GE Healthcare has the top engineers on a product work on-site with assembly workers. For each new product GE assembles a team from eight departments,

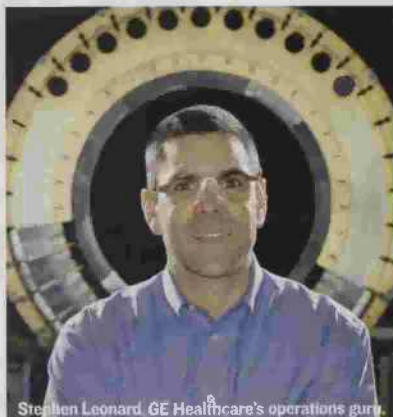
including engineering, manufacturing, service, marketing and regulatory. For the LightSpeed 16 CT scanner, 86 people came together, 85 of them based in the Milwaukee area. The team followed a 450-step process that included answering questions to ensure the new model not only delivered the right features but also was cheaper to build and service. The final design involved 300 suppliers and 800 unique parts, 40% fewer parts than in the previous model. It used components from 16 different internal GE "feeder lines," such as an X-ray tube from GE's Electric Avenue facility in Milwaukee, a circuit board from another GE plant nearby and padded-plastic patient tables from GE in China.

Two years ago GE Healthcare adopted "lean" manufacturing, the obsessively efficient approach pioneered by Toyota in Japan that encompasses just-in-time delivery, low inventory and plants that churn out several different products. Previously parts were stored on the factory floor, and workers would go find what they needed when they needed it. Now the parts are gathered at a warehouse 20 miles from the Waukesha factory and put into production "kits" for each of the six stations along the CT assembly line. The kits are delivered to the Waukesha plant for final assembly on an as-needed basis. Signs above the assembly stations ("Power Supply," "Drive Handle") make it obvious what goes where.

When lean manufacturing was introduced, Leonard says, his team erred by trying to make the assembly line move before the parts delivery system was perfected. "For a month the line was physically stopped more than it was moving, stalling for up to three hours, he says. "We were losing 20% to 30% of the available time during the day. The fact is, we were losing that time before. We just didn't know it." One benefit of lean, he says, is that it highlights the inefficiencies. After a month the assembly line was running smoothly again.

Design innovations on a new model can be radical. For the latest CT machine, workers suggested attaching the base to the 4,000-pound machine at the beginning of assembly rather than at the end. This eliminated the need for a 15-foot crane to flip the doughnut-shaped rotating body of the CT machine from a horizontal to a vertical position so it could be placed on the base. That freed up more room on the factory floor: The new line takes up half the footprint of the old one, plus 35% less assembly time. It also cuts back on inventory: The new CT line has only 5 chassis on the floor, down from 12. "Once you fix this, productivity improvements start to happen automatically," Leonard says.

An entire CT is assembled in two days. Then it endures four days of around-the-clock testing. Before the plastic cover is added, the machine is loaded inside a 20-foot-tall metal cage for spinning



Stephen Leonard, GE Healthcare's operations guru

"Assemblers can spend the day assembling. They're much more efficient."

