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## Born Again

By THOMAS K. GROSE/SHREWSBURY

A V-12 Rolls-Royce diesel engine, nearly the size of a Smart car, sits on a support stand. Probably built about 15 years ago to power a British military fighting vehicle, it has run out of life. Within two days, it will be completely dismantled by a two-person crew, and each piece — every bolt, nut, spring and valve — will be vetted to see which ones are salvageable. Most will pass the test: 95% will be cleaned or otherwise refurbished. Then, with a handful of new parts added to the mix, the engine will be reassembled. After it's passed strict tests to ensure it meets standards, the "remanufactured" engine will spend another four to five years in service before it's ready for another makeover. Thanks to remanufacturing, its life could total 45 years. Welcome to Caterpillar's Remanufacturing Services plant in Shrewsbury, England, where dead vehicle parts are resurrected.

"Reman," as it's called in the trade, "is the rebirth of a product," says Nabil Nasr, a reman expert at the Rochester Institute of Technology in New York. It's not the same thing as repairing a broken part, which is often a short-term fix. In reman, once the disassembled bits are cleaned and reassembled, the result is as good as new. It's not a recent concept; Reman's roots go back around 100 years to the advent of the auto industry. And vehicle parts still comprise around 75% of the global market. But the industry is diversifying and picking up steam. "The growth potential for remanufacturing is enormous," says Günther Seliger, an engineer at the Technical University of Berlin. The entire reman industry is too sprawling and amorphous to be accurately tracked — it includes products as diverse as copiers, medical equipment, compressors, single — use cameras and mobile phones. But, according to the Cologne office of the Automotive Parts Remanufacturers Association (APRA), the European remanufactured auto-parts sector alone is expected to grow from \$5.2 billion in 2005 to \$9.7 billion by 2015.

An array of capital equipment and heavy machinery conglomerates such as Remy, TRW and Bosch have realized they can extract healthy profits from sickly parts, but Caterpillar is reman's top dog. It's estimated that sales for the Peoria Illinois, farm and construction manufacturer's reman division were \$1 billion in 2005 — a small share of the \$36 billion in total revenues the company generated that year. Nevertheless, remanufacturing is one of Cat's fastest-growing units and it is expected to continue expanding by 12-15% a year through 2010. Steven L. Fisher, who heads Caterpillar's reman division, says Europe offers particularly alluring growth opportunities because, unlike in the

Americas, its market is highly fragmented, "with no dominant players." Christophe Decaix, manager of the reman program for auto-parts supplier Bosch, agrees: "There is definitely room for consolidation." Indeed, Cat recently acquired two rival operators: Wealdstone Engineering in Rushden, England, and France's Eurenov. Asia, meanwhile, may one day prove to be equally fertile territory, as the concept of remanufacturing is only just catching on there.

Its three-year-old plant in England's West Midlands was Cat's first European facility. Each month, it processes 15,000 worn-out, grime-encrusted engines and parts. Caterpillar has moved beyond remanufacturing just its own diesel engines and components; 40% of the automotive, truck, rail and marine motors and parts remanufactured in Shrewsbury were originally built by other companies. Fisher calls reman a "nicely profitable business." How profitable? Cat does not break out the figures, but Fisher says the returns are "above average," and Nasr notes that profit margins for some reman goods are double those of new products.

Remanufacturing is such a money spinner because of the low cost of the materials and energy it uses. Materials represent 70% of costs for a new product, but only 40% for a remanufactured one. And because there's less casting and smelting, a particularly power-hungry aspect of production processes, energy costs are up to 85% lower than in manufacturing new products. Consumers benefit, too. Remanufactured goods are equal in quality to new ones, but they're often 50-60% cheaper.

The environmental arguments for reman are equally compelling. The amount of raw materials saved annually worldwide by remanufacturing is 14 million tons, according to a University of Bayreuth study, or enough to fill 230,000 railroad cars — that's a train 1,860 miles (3,000 km) long. And while current European Union regulations dictate that only 15% of an auto can wind up in a scrapyards, that percentage will drop to 5% in 2015 — a requirement that should boost the industry's growth, since remanufacturers need a steady supply of broken-down goods for the process to work efficiently.

Not that Caterpillar is waiting for regulators to drive its business. To attract old parts otherwise headed for the junkyard, the company has devised a trade-in scheme that gives customers an incentive to return worn-out goods to its distributors. If the part is deemed remanufacturable, the customer gets an already remanned replacement at a fraction of the cost of a new one. Cat is also a service provider, advising other manufacturers how to set up a similar system, or in some cases actually running their reman efforts for them. In Europe, for instance, Cat helps Land Rover manage its remanufacturing operations.

Reclaiming new life from old also requires advanced technologies: software systems that can detect metal tolerance, for example, and state-of-the-art blasters that literally blow old paint, grease and oil from parts. Consider the flame spray machine Cat uses at Shrewsbury. Inside a tightly sealed booth, a nozzle attached to a robotic arm shoots out a constant spray of what look like white-hot sparks — picture a particularly robust Roman candle — onto a row of four cylinder heads. What it's actually spraying, however, is molten metal, adding a new 1-mm-thick layer of chrome or nickel to the head. Each time a cylinder goes through remanufacturing, a milling machine shaves a fraction of a

millimeter off the cylinder's head to remove pitting. After a few shaves, however, a head can weaken. The extra layer applied by the flame spray rebuilds the cylinder head's tolerance so it can be milled two or three more times in the future.

Rochester's Nasr says new technologies coming to market now will allow remanufacturers to work with more complex electronic components, things like automotive navigation systems and dvd players that people now tend to throw away when they get old or break. Cars can easily last 10 years, he says, but many gadgets are obsolete within two. He envisions automakers taking cars returned after their two- or three-year leases expire and "refreshing" them with more up-to-date remanufactured components before they're put on sale in the preowned market.

Caterpillar's reman business is also influencing the design of the company's original parts. The firm's reman engineers now work closely with designers to produce components that will be easy and profitable to revitalize years later. "That's an absolute key," says Fisher. "It's designing for several life cycles." Take those cylinder heads, for instance. When they're first cast, they're now given a slightly thicker layer of metal on top in expectation that they will ultimately be milled down several times. Fisher says that makes the original manufacturing a bit more expensive, but it's a cost that's more than recouped by the two or three extra lives it gives a part.

Hefty profit margins are the main driver of Caterpillar's enthusiasm for remanufacturing and its ongoing expansion into Europe. But reman's practitioners also relish the challenge of giving clapped-out parts new leases on life. "It's all about taking back old stuff in mass quantities and doing something with it," Fisher says. That waste-not ethic is evident on the shop floor of the Shrewsbury complex. Tim Baker, the plant's operations manager, says employees get excited about coming up with new ways to salvage. "Our people are very passionate about not throwing things away," says Baker. "It's like tossing away money." And you don't become the industry's fat Cat doing foolish things like that.

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