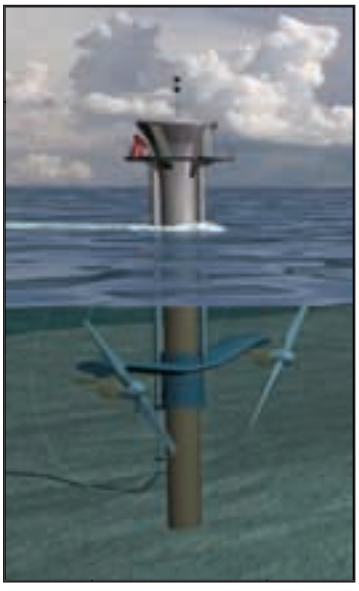
Gearboxes Go Underwater to Turn Tide's Energy into Electricity

Off the British coast, a U.K. company has been testing for three years a prototype 300-kilowatt, underwater turbine that converts tidal energy into electricity and is preparing to install a second prototype, an underwater turbine able to generate more than one megawatt of electricity.



Marine Current Turbines Ltd. is preparing to install its one-megawatt prototype for testing its ability to convert tidal energy into electricity.

Turbines fitted with rotors have been used for decades to convert wind energy into electricity, but they're now being adapted for offshore use underwater, to take advantage of another renewable energy source: tidal currents.

The U.K. company developing these prototypes is Marine Current Turbines Ltd., based in Bristol, England, but the company developing the latest prototype's gearboxes is Orbital2 Ltd. of Llangammarch Wells, Wales. Orbital2 is a gear consultancy for wind turbine, aerospace, automotive, industrial and marine applications. It specializes in epicyclic gear transmissions, as reflected in its one-megawatt turbine gearboxes.

Each of the new prototype's two gearboxes has a first-stage epicyclic transmission consisting of eight planetary spur gears and a second stage consisting of four planetary spur gears, followed by a parallel shaft output stage. All the gears are DIN 6 or better in quality.

Orbital2 created the gearboxes using a flexible pin design for ensuring equal load sharing between the transmission's planetary gears and across the tooth face widths and for providing uniform planet bearing loads. Frank Cunliffe, Orbital2's managing director, sees the flexible design as a virtue in marine turbines because: "You can't build infinitely stiff assemblies."

Also, input speed is 14.3 rpm, and output is 1,000 rpm. Cunliffe expects the turbine to run seven days a week, for about 20 hours a day: eight or nine hours in one direction and 11 or 12 in the opposite direction.

Each gearbox, generator and rotor combination will be mounted on a winglike extension of the turbine's monopile, which will be set in a hole drilled in the seafloor and will extend above sea level. Each generator will be able to create more than 500 kilowatts of electricity, and the axial-flow rotors will be able to turn via flow in either direction.

Though underwater, the extensions will be part of an assembly that can move up and down the monopile, allowing the rotors and generators to be lifted out of the water for maintenance. Marine Current Turbines has started shore-based testing of the new prototype and plans to install it in October in Northern Ireland's Strangford Lough. The turbine will be connected to an electricity network, and MCT expects it will be able to supply energy to about 800 houses.

MCT has designed its tidal turbines for erecting in water with depths of 20–30 meters, but the company has ideas for installations in deeper waters, in places with sufficiently fast, continuous ocean currents.

"We've stayed in 20–30 meters to prove the technology," says Joe Verdi, MCT's commercial director. Verdi is responsible for developing the company's technology for commercial use.

Proving the technology started in May '03, when MCT installed and began testing its 300-kilowatt prototype off the coast of Lynmouth, Devon. Verdi says the turbine's power coefficient (C_P) is on the order of 0.45.

A C_P is a measure of the fraction of power in the fluid flow that's extracted by the turbine. An amount of energy is lost due to natural forces, such as friction, so the turbine never extracts all the power. In the wind energy industry, for example, wind turbines rarely achieve a C_P of more than 0.50, meaning they rarely extract more than 50 percent of the wind's power and convert it into rotating energy to power their generators.

MCT's 300-kilowatt turbine is a simpler design than its one-megawatt turbine, though. The 300-kilowatt machine uses a single rotor, which operates with the tide in only one direction. The one-megawatt's two rotors will operate with tidal flow in either direction.

The twin-rotor system is the one MCT is bringing to the fore. The company plans for its turbines to be commercially available

Orbital2's gearboxes for the one-megawatt prototype feature eight planetary spur gears in the first-stage transmission, with four planetary spurs in the second stage, followed by a parallel shaft output stage.

in 2009 and plans to install twin-rotor turbines in locations around the world to develop the technology in other markets. Verdi says MCT is interested in France, North and South America, Southeast Asia, Australia and New Zealand.

Created in 2000, MCT was formed to develop cost-effective, reliable marine turbines to generate electricity in large-scale commercial developments: tidal farms. In line with that purpose, MCT is developing plans for a 10-megawatt tidal farm to generate electricity for about 5,500 homes.

MCT has received significant financial support from the U.K. Department of Trade and Industry, the European Commission and the German government.

However, the payoff could be significant, too: a new source of considerable energy, a source that's also reliable. "Tidal flows are consistent," Verdi says. "They are very predictable."

Bison CEO Appointed to National Education Commission

Ron Bullock

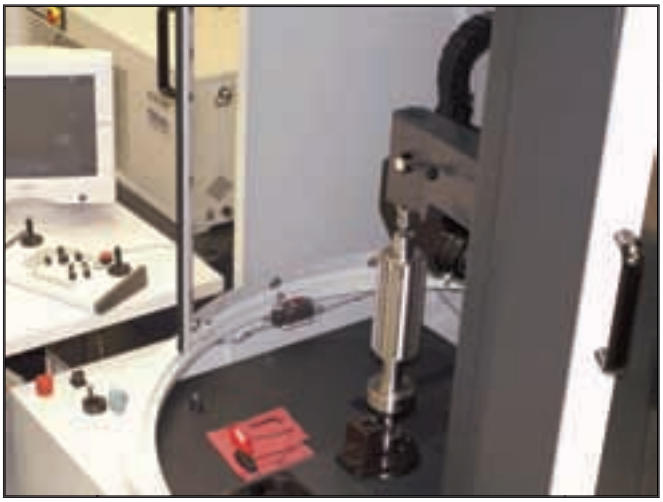
Ron Bullock, chairman and CEO of Bison Gear and Engineering, has been appointed a member of the Commission on 21st Century Education in Science, Technology, Engineering and Mathematics.

Testimony delivered before the National Science Board on K-16 STEM education led to an invitation to serve on this commission. The commission makes recommendations to the nation, via the National Science Board, for a new national action plan to address weaknesses in K-12 STEM education.

According to the company's press release, Bison has been recognized for its research to develop a high efficiency motor under a grant awarded by the National Science Foundation.

Bullock has held various positions with Bison since 1981, in R&D, engineering, marketing, operations and management. He has served on the Industry Advisory Council on Electronic Motors at Underwriters Laboratories, was a past director of the American Gear Manufacturers Association, led a research team for the Instrumented Factory for Gears at the Illinois Institute of Technology and served as president and trustee of the Gear Research Institute.

LMT Fette Opens Midwest Hob Facility



LMT-Fette established a new precision manufacturing facility in Libertyville, IL.

The first phase of the new plant will handle production of hobs from 8 DP to 30 DP. Hob re-sharpening and re-profiling services are available for hobs up to 9" in diameter.

Fette offers hobs in a full range of pitch sizes in premium powdered metal, solid carbide and indexable hobbing solutions.

Overton Gear and Klingelnberg Form Strategic Alliance

Klingelnberg GmbH and Overton Gear and Tool Corp. have formed a strategic alliance for manufacturing and supplying high quality, large spiral bevel gears for the worldwide market.

Customers should continue to contact their current sales representatives for ongoing and future business.

Overton Gear manufactures custom gears for the marine, off-shore, locomotive, mining, wind energy and construction industries. Located in Addison, IL, the company acquired Illinois Gear Corp. in May 2005.

The Klingelnberg Group develops, manufactures and sells gear production machinery and related equipment. Klingelnberg products are used in the automotive, truck, aircraft, agriculture, construction, power tool and marine industries. The company has operations in Zürich, Switzerland; Hückeswagen and Ettlingen, Germany; Györ, Hungary; and sales and service offices throughout Europe, North and South America and the Asia-Pacific region. Klingelnberg, along with Liebherr-Verzahntechnik, is part of the Sigma Pool international gearing partnership.

LMT Opens Automotive Support Center for North America in Detroit Area

The Leitz Metalworking Technology (LMT) Group officially opened its North American automotive support center June 8 in Auburn Hills, MI, a Detroit suburb.

"Our customers are looking for local support," said Dieter Brucklacher, executive chairman of the Leitz Group, who spoke at the center's opening ceremony. Brucklacher added that customers rated local engineering support as important as the product itself.

The new center offers engineering, service and tool management support. The facility was created to support the auto and machine tool industries with LMT's know-how in cutting materials and precision tools. To that end, the center is connected via an internal broadband network for real-time access to other LMT companies and to the LMT engineering center in Oberkochen, Germany. The network also allows for real-time video conferencing.

LMT will also provide training at the center for employees of auto, machine tool and die-and-mold manufacturers. Practical training will be carried out on the center's machine tools, which are also used for customer tests and tool demonstrations. The machine tools include a regrinding machine for refurbishing and modifying tools.

Photo courtesy of Daniel Lippitt.

Dieter Brucklacher, Leitz Group executive chairman.

In a press release, LMT described the facility as "a central element of the growth strategy with which the LMT Group aims to substantially increase sales in the North American market over the next few years." LMT has spent more than $2 million to enhance its service capabilities for the American market.

"LMT Fette already has a substantial presence in the

U.S.," Brucklacher said, referring to the LMT company that manufactures precision milling and gear cutting tools. LMT Fette's U.S. operation is located in Cleveland, OH, and includes customer service via a gear solution center.

Besides Fette, Brucklacher also mentioned another LMT company, Onsrud Cutter, which is based in Libertyville, IL, and produces end-milling cutters for the high-speed machining of aluminum, plastics and composite materials for the aerospace industry.

LMT plans to open other automotive support centers with comparable services in China, India and Brazil.

The LMT Group consists of six companies—Belin, Bilz, Boehlerit, Fette, Kieninger and Onsrud Cutter—and employs 3,000 people worldwide. The group manufactures precision tools for processes used to cut metal and plastics.

Getrag Group and Getrag Ford Transmissions Combine Under Single Brand

Fourteen individual companies in the Getrag Group and Getrag Ford Transmissions, all specializing in transmission systems, drivetrain components and engineering services, will be combined under the umbrella of the Getrag Corporate Group.

"Our aim in repositioning ourselves is to strengthen our market position in the global competitive environment and, in doing so, to create the conditions for further expansion," says Tobias Hagenmeyer, president of the Getrag Corporate Group. "We are planning a significant expansion of our activities across the world in the area of dual clutch transmissions. We are forecasting production volumes of up to 2.4 million dual clutch transmissions and total output of around 5.5 million transmissions by 2015."

Getrag also announced that Getrag Jianxi Transmission Co. Ltd., the joint venture between Getrag and the Jiangling Motor Co. Group in Nanchang, China, begins operations later this summer, as soon as the contract review process has been completed. Approximately 2,400 workers at the three production sites in Nanchang, Ganzhou and Yudu in southeast China will produce some 240,000 transmission. One million of the transmission components for the Chinese markets are anticipated as well.

Do you have news? Send it to: Robin Wright, Assistant Editor, *Gear Technology*. P.O. Box 1426, Elk Grove Village, IL 60007, Fax (847) 437-6618 or e-mail *robin@geartechnology.com*