

Undersea Explorers Discover Multiple Advantages of DuPont™ Kevlar®

Protecting against the ravages of the sea

The world's oceans present significant challenges for those attempting to explore their depths. At surface level, powerful wave motion threatens offshore rigs and capsizes ships. At maximum depths, near-freezing water temperatures and Mt. Kilimanjaro-height distances from surface to floor combine to make exploration challenging and hazardous for both humans and equipment.

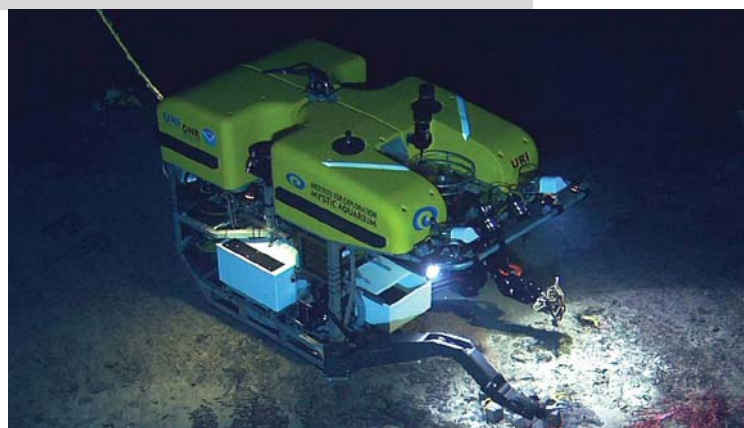
The Norway division of Nexans, the worldwide leader in cabling systems serving the infrastructure, industry, and building markets, has made its reputation by developing undersea cable rugged and flexible enough to support its customers' exploration success. Nexans' cables are known for their robustness and are tested every day in some of the harshest ocean environments known to humankind. Consequently, the company maintains a presence at every level of oil and gas production, providing a wide range of energy and telecom cables for onshore and offshore prospecting, production, and distribution, as well as for refinery and petrochemical infrastructure.

To manufacture cables rugged enough to protect delicate fiber optic lines against the drag force exerted by kilotons of salt water, Nexans makes extensive use of DuPont™ Kevlar®, an aramid material five times stronger than steel at equal weight basis. Well known in personal-protection apparel and demanding aerospace applications, the combination of strength, lightness, and flexibility of Kevlar® has also proven to be an ideal solution for reinforcing cables against the ravages of the sea.

An Evolving Relationship

Nexans' relationship with DuPont scientists perfectly complements the company's goal of continuous improvement.

"We use Kevlar® in many applications today, but we are constantly challenging DuPont scientists to help us create even better results for our customers," said Jon Seip, Nexans Marketing Manager for Oil and Gas. "As the world's demand



for petroleum products continues to grow, our customers will require even more innovative solutions to support their exploration. We have an excellent business relationship with DuPont and we expect them to be a key partner as we develop new cables to adapt to an ever-changing sea."

Nexans first used Kevlar® in 1993, to reinforce a cable tethered to its own Capjet trenching machine—the first trencher to use high-pressure water to dig sea-bottom cables and pipelines.

Since then, Kevlar® has become an integral component of four different types of Nexans offshore cable applications: remotely operated vehicle (ROVs) tethers, seismic survey sensor cabling, air gun umbilicals, and dynamic riser cabling systems.

Umbilical Communication Cables for Remotely Operated Vehicles

Remotely Operated Vehicles (ROV) are unoccupied devices, widely used for underwater exploration in hazardous environments. They generally contain video cameras, still cameras, and sometimes a remotely controlled gripping arm, all of which are operated by ship- or platform-based personnel.



Kevlar.

ROVs are controlled by signals transmitted through fiber-optic lines, bundled in a protective umbilical cable that runs between the ROV and either a surface vehicle or to an underwater Tether Management System (TMS)—essentially a submerged ROV “garage.”

To depths of 4000 meters, steel can be used to reinforce the umbilical cables. But at greater depths—the 6000 meter level, which is much more interesting for oil and gas exploration—steel is much too heavy and inefficient to be practical. For these deep-water applications, Nexans has found that umbilical cables reinforced with Kevlar® provide better protection than steel at a fraction of the weight and, as the material surrounding the core member, Kevlar® is an important component in reducing the diameter of the umbilical cable while maintaining its strength.

“Making a steel tether with a reasonable diameter “neutral” in water would be an impossible design job,” said Nexans’ Jon Seip. “The strength-to-weight ratio of Kevlar® makes it not only possible but practical.”

Nexans now manufactures and supplies these umbilicals to the world’s leading oil and gas companies.

Marine Seismic Survey System Cables

Energy companies often perform seismic surveys to explore potential oil fields on the ocean floor, sometimes at a distance of more than three miles (~ 4.8 kms) below the surface. Nexans supports such exploration with two types of cable products reinforced with Kevlar® that help their customers save time and minimize maintenance.

Nexans’ riser cables connect surface vehicles to bottom-laid seismic systems along the ocean floor. Kevlar® armoring provides the stability, protection and strength to counteract a drag force that can be the equivalent of a World War II Sherman tank (30 metric tons).

Nexans’ airgun cables are thin, light, pneumatic tubes reinforced with Kevlar® through which compressed air is exploded underwater, with the explosion’s effect measured by sensors on the surface. Kevlar® helps ensure that Nexans’ airgun cables are sufficiently robust to support repeated contractions and to operate flawlessly at any depth.

Dynamic Risers, Linking Surface to Seabed

To streamline production, oil and gas companies sometimes use Floating Production, Storage and Offloading (FPSO) vessels to store oil and begin the refining process.



In some instances, a moving, seabed-based device is connected to an FPSO, using a dynamic riser cable that can withstand the ocean’s hydraulic forces. Nexans has found that cables reinforced with Kevlar® offer an ideal combination of strength and flexibility required to support the multi-directional motion.

Kevlar®: The Lightweight Champion

Just as flexibility enables a willow branch to withstand high winds, undersea cables reinforced by light, flexible Kevlar® stand a far greater chance of survival under stress than cables whose strength is dependent on their weight.

First on land (with personal protection equipment), then in the sky (aircraft wings and space shuttle components), now in the sea—DuPont™ Kevlar® has been shown to be one of the most useful and adaptable high performance materials.

www.kevlar.com

www.poweredbyscience.dupont.com

www.nexans.com

Product safety information is available upon request.

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