Deep Ocean Research
Custom solutions that meet the challenges posed by harsh environments, hydrostatic pressures, and high mechanical stresses

Approximately 70% of the earth’s surface is covered by the oceans, and only a very small percentage has been explored. The average depth of the ocean is approximately 2.3 miles (3,700 meters) with the deepest part being the Challenger Deep in the Mariana Trench at approximately 6.8 miles (11,000 meters).

The deep ocean is an environment completely unfriendly to mankind; with pressures too great for traditional exploration methods, demanding alternative approaches for deep ocean research. Exploring the ocean requires many different talents: biologists, chemists, technicians, programmers, physicists, engineers, geologists, etc. It also requires new cable and umbilical technology and a proven track record of success.

This is where Cortland has assisted the research community, and where we have designed products to work and survive in this very demanding environment. Data collected by the various scientific research institutions require equipment that can track and monitor changing conditions. Equipment used to collect this data has to meet the considerable challenges posed. This requires innovative cable and rope designs, improved quality control, and specialist materials; as opposed to the general designs and products manufactured by the more standard suppliers.

Deploying the latest extrusion equipment and techniques, and using the highest quality materials, Cortland designs and manufactures cores of the smallest possible diameter with working voltages up to 7.4kV. Cores can be further enhanced to provide a temperature rating of 257°F (125°C). In addition, our design team has a vast range of expertise and experience in fiber optic cable technology, and we offer field proven fiber optic solutions using either stainless steel tube technology or our Ruggedized Fiber Optic (ROC) cable.

We can provide solutions for synthetic fiber ropes and a range of dynamic, steel armored or synthetic reinforced, electrical and optical cable solutions to accommodate depths of up to 6.2 miles (10,000 meters) for this environment, offering not only the smallest possible diameters but also the highest strength.
Solutions built for deep water demands

Unlike other fabricators that build and stock standard off-the-shelf components, Cortland designs and manufactures custom solutions to the specific requirements of each individual project.

Solutions designed for oceanographic working environments need to withstand factors such as cold temperatures, flexing, bend cycling, tension cycling, corrosion, fish bite, marine abrasion and compression. The engineering teams at Cortland work directly with customers to design solutions specific to their application. We carefully consider performance characteristics such as safe working load, torque balance, elongation under load, compression due to operating depth, buoyancy and corrosion resistance.

With decades of experience, knowledge of deep water environments, and history with material sciences we deliver solutions that achieve superior strength, durability and efficiency for deep water applications.
Deep Water Armored Research Cables
Our armor packages are produced using the highest grade tensile steel wires, which due to the specialist manufacturing methodology provide excellent ductility, achieving the highest possible tensile strength. Due to our proven armor package design Cortland can ensure reduced torque and very low extension, all under full load conditions. Our armor package is enhanced with highly efficient corrosion inhibitors with a proven track record.

Deep Water Synthetic Fiber Reinforced Cables
Cortland’s synthetic fiber reinforced cables use strength members that incorporate high performance fiber materials; i.e. Vectran® and Kevlar®, which are applied as servings or braided designs, and together with a selection of extrusion materials that enhance cable capability and ensure full function in a demanding environment. Cortland’s deep water and long length capability has produced cable solutions that have a strong track record of success, from tsunami buoy warning systems to ultra-long CTD cables for research.

Deep Water Synthetic Fiber Ropes & Grips
Cortland produces highly engineered fiber rope products utilizing an extensive range of fibers, constructions, and coatings to maximize performance during the lifetime of a product. Fiber rope performance ranges from dynamic applications such deep water lifting and lowering applications with heave compensations as well as permanent mooring, fastening, and station keeping solutions.
Cortland has designed and manufactured a number of low rotation armored cables suitable for the deep ocean research community, which now frequently uses direct drive winches in place of traction winch systems to save space on vessels. This winch change has identified a weakness in some existing cable designs, but due to our design and manufacturing techniques, is not experienced with Cortland cables. Our cables work well on both traction and direct drive winch systems, while conforming to the standard UNOLS’ diameters and bend radii.

**CTD Cables**
Cortland CTD cables sense conductivity, temperature, and depth to aid in determining the physical properties of sea water. Utilizing a selection of materials balanced for strength and durability, we design cables that provide the physical connection for real-time and reliable connectivity from a vessel to CTD sensors deployed to full working sea depth.

**Hydrophone Cables**
Hydrophone cables are used in detecting and recording various types of underwater signals. Understanding the needs in hydrophone studies, Cortland hydrophone designs use specialized conductor and coax components integrated with strength member braiding and outer sheathing to provide complete cable assemblies which offer durability and strength in underwater exposure.

**Magnetometer Cables**
Cortland magnetometer cables for oceanographic mapping surveys offer a wide operating temperature range for shallow or deep water use. Whatever the specific requirements we can design and develop lightweight, small diameter, high-strength cables which offer low elongation at varying depths.
Oceanographic Mooring Systems

Cortland’s deep water Oceanographic Mooring Line Systems are responsible for holding many of the world’s most important data collection buoys in place. From offshore tsunami warnings to meteorological observations, our custom buoy mooring systems are designed and constructed to stay in position in harsh marine environments.

Cortland Oceanographic Mooring systems can be custom engineered to ensure full functionality and secure placement of the attached buoy. Sections of the mooring system can be constructed to any length necessary using a wide array of traditional or high performance synthetic materials incorporating high strength, low stretch, and high modulus performance characteristics. Individual sections can also be positively buoyant or weighted using a lead core. Our exclusive extruded jacket technology can also be added to reduce strumming or provide fish bite protection.

Special Cables

Our technical and manufacturing teams are not limited to these cables; we are committed to offering cables beyond the standard norm.

Applications

- Ocean observing systems
- Tsunami warning
- Whale monitoring
- Monitoring surface currents and up welling
- Surface buoys
- High current areas
- Meteorological observation
- Data collection for global warming
- El Nino data collection
Synthetic Coring Ropes

The need for accurate and undisturbed seafloor core sampling and testing is important for research and studying the environment. Coring equipment has become increasingly sophisticated, heavier, and deployed at greater depths. In addition, this equipment is being deployed in some of the most challenging regions ranging from extreme high and low temperatures to 6.2 miles (10,000 meters) water depth.

Cortland engineers its products with both high performance and standard fibers to offer customers the proper solutions. High performance fibers are generally limited to three major types, HMPE, liquid crystal polymer (LCP) and Aramids.

HMPE has excellent fatigue and robustness properties; however it suffers from low heat tolerance. LCP provides good fatigue properties with excellent creep resistance. Aramids have excellent heat and creep resistance properties but do not perform as well in abrasion resistance, tension-tension and bend fatigue.

Cortland has utilized the advantages of both HMPE and LCP to develop Plasma® fiber, and BOB® (Braid Optimized for Bending) rope. These solutions lead the way in deep water lifting applications where serious fatigue is induced by AHC (active heave compensation) units.

Both Cortland’s Plasma HiCo and BOB 12 and 12x12 strand synthetic ropes reduce weight, improve speed, and overall boost vessel operational efficiency of coring operations when compared with steel wire rope. Cortland specializes in building and delivering custom designed coring rope solutions that are high strength, long length, low weight, and have a proven track record in the most challenging global conditions.

Value-added components that provide seamless integration with data collection methods
**Fairings**
Cortland was the first manufacturer to develop the braided Hair Fairing Cable to reduce cable noise and drag without affecting winch or sheave performance. In addition we offer our extruded “shakedown” jacket which provides the same performance characteristics when a braided option is not required or feasible.

All of our braided rope and cable products are offered with either the hair fairing or shakedown options. A full selection of material blends and 1 to 4 take-outs around the circumference are available to achieve the best results for the intended application and environment.

**Inline Attachment or Lifting Points**
Synthetic cable grips are used to grip many types of cables and ropes with multiple surface materials, from large hydraulic umbilicals and synthetic ropes to small fiber optic cables. Synthetic cable grips are designed to minimize any external damage with non-metallic content.

They can be used as a “quick fit” temporary attachment, or as a permanent attachment, and can be retrofitted without the need to gain access to the end of the cable. This allows for inspections and maintenance on equipment or cables and ropes while deployed.

In addition to standard cable grips, custom designed spliced hold back points can also be utilized on our braided synthetic ropes.
Our design team listens to your requirements and develops a solution to match your expectations.

**Our Manufacturing Capabilities**
- Thin wall insulation for high voltage applications
- Custom electrical / optical core cable assemblies
- Synthetic fiber strength braids and servings; wide range of materials, technical and processing experience gained from our combined cable/rope engineering teams
- Continuous long length capability for ocean depth requirements
- Buoyant extrusion solutions using proprietary compounds, and achieving a specific gravity of 0.78
- Abrasion resistant sheath material solutions for harsh environment applications
- Full range of steel wire armoring
- 12 strand braided synthetic fiber ropes up to 7.87" (200 mm) in diameter
- Braided and faired jackets up to 3.94" (100 mm) in diameter
- Extruded jackets up to 2.36" (60 mm)

**Terminations**
Cortland has a wide capability for mechanical, electrical and optical terminations which can be tailored to meet the full spectrum of water depths required for this environment.

**Testing Capabilities**
- Standard electrical characteristics tests (e.g. IR, CR, etc.)
- Optical tests
- Mechanical tests
  - Tensile tests
  - Fatigue cycle tests
  - Tension/tension tests
  - Cycle bend over sheave (CBOS) tests
  - Elongation tests
- Crush tests
- Bend stiffness tests
- Rotation tests
- Torque tests
- D:d testing

- Buoyancy tests
- Hyperbaric pressure tests
- Third party witness and approval (by key industry authorities)
Few companies offer the understanding of oceanographic research methods, the dynamics of the ocean environment, and extensive materials experience with electrical / mechanical / optical components and strength member fibers as Cortland. We are in the unique position to offer unrivalled technical solutions where cable and rope systems are used side by side.

**Solutions**
- Small diameter cables / umbilicals with minimum bend diameters
- Fiber ropes that are easy to inspect and repair
- High voltage and thin wall insulated cores up to 7.4kV
- Armor packages with low torque and low extension under full load
- Multiple surface options to reduce drag and strumming

We provide solutions which feature accurate current ratings and voltage regulation calculations, at operating temperatures up to 257°F (125°C). We use the highest tensile steel packages with full ductility; with proven armor wire corrosion inhibitors (eco-based, if required).

Additionally, we provide solutions for braided synthetic ropes or fiber strength components for composite solutions. These high performance materials provide high strength-to-weight benefits, improve safety and boost operational efficiency.

Extensive and relevant mechanical and thermal testing is also available.

Whatever your particular challenge, Cortland welcomes the opportunity to solve it. Email us at cortland@cortlandcompany.com, or visit us online at cortlandcompany.com.
Cortland is driven by innovative thinking, use of high technology materials and attention to detail. Our in-depth understanding of demanding operational environments means we can deliver trusted, proven solutions to our customers worldwide.

Today, Cortland provides innovative, efficient and lightweight rope, slings, cables and umbilicals; along with mooring design, analysis and installation services to the oil and gas, heavy marine, subsea, ROV, seismic, defense, aerostat and medical markets. Cortland is a part of Actuant Corporation (NYSE: ATU), a diversified industrial company with operations in more than 30 countries. cortlandcompany.com