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FEATURING:

Innovative Compact Winch

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Compact Marine Winch

Modern Design with Classic Structure to Improve Vessel Operations

By Joshua Eaton • James Haley

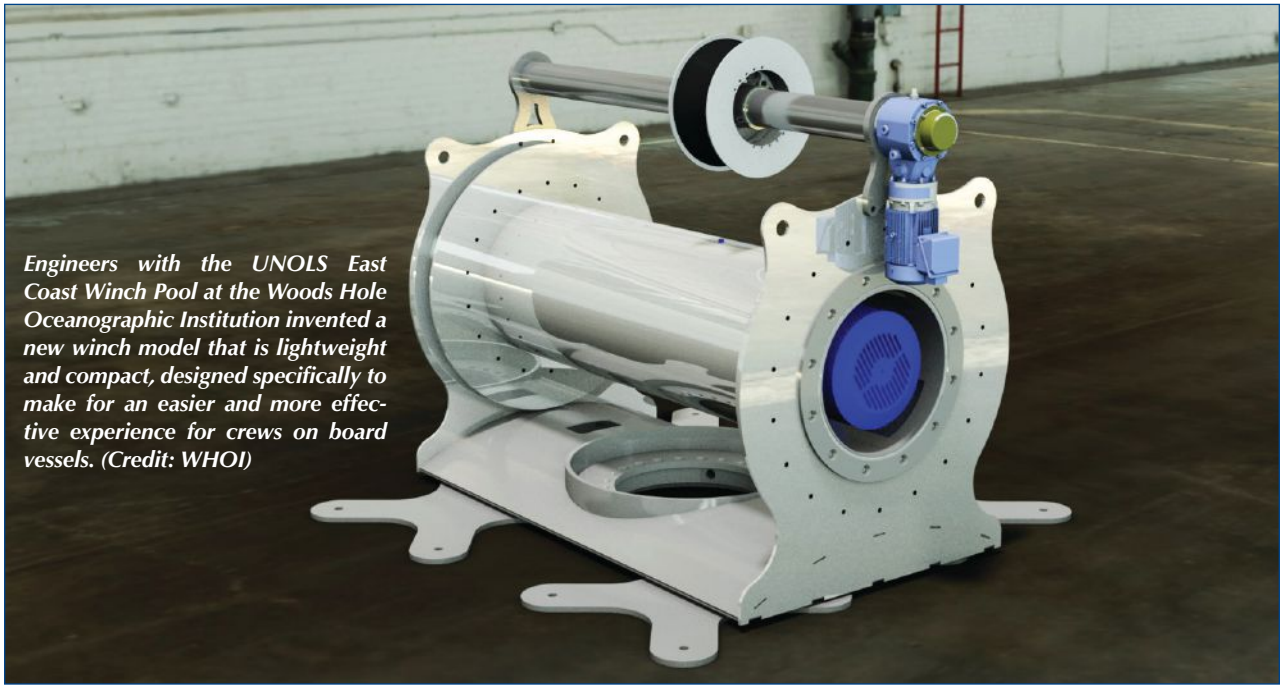
A winch is a device aboard a marine vessel that is used to hoist items to and from the deck, such as nets, vehicles and other scientific equipment. Nearly every research operation at sea requires a winch for hauling and retrieving equipment over the side of a ship.

In basic winches, the system's elements include a wide spool or winch drum mounted by a frame and rotated by a motor assembly or drive mechanism.

The motor assembly connects to the winch drum to drive rotation to haul in or pay out cables with the winch drum.

Among the challenges associated with typical marine winches are that they have large on-deck footprints, can be difficult to operate, are costly when made for a single purpose, and are used from a fixed location on the deck. Winches are often used in settings with limited real estate to place and mount the winch. For example, industrial marine winches are generally attached to the deck of a vessel and are limited to specific regions of the vessel due to size, clearances and strength of the deck. Many conventional winches are not capable of residing in limited spaces on the deck of a vessel.

With these challenges in mind, engineers with the University-National Oceanographic Laboratory System (UNOLS) East Coast Winch Pool at the Woods Hole Oceanographic Institution (WHOI) in Massachusetts saw an opportunity to contribute to the winch market and design a radical new model—created and vetted by scientists for scientists. The group spent a decade



Engineers with the UNOLS East Coast Winch Pool at the Woods Hole Oceanographic Institution invented a new winch model that is lightweight and compact, designed specifically to make for an easier and more effective experience for crews on board vessels. (Credit: WHOI)

The winch has a small footprint and is frameless. It is adaptable for a variety of marine applications. The smaller footprint saves deck space, a valuable commodity on research vessels. (Credit: Joshua Eaton, WHOI)

working on a product that offers a lightweight, compact winch, designed specifically to make for an easier and more efficient experience for crews on board vessels.

Design

Winches are universal in the science and marine community. Crews are constantly putting some form of technology or equipment over the side of a ship and bringing it back using a winch. We saw an opportunity to make a smaller, stronger and faster system that would foster the work that crews are doing each day. The innovative, patented compact winch features modern design with an original, classic structure.

During World War II, designers moved away from focusing on form design and opted for function instead, rather than melding the two as engineers did in the mid-to-late 1800s. It was considered that form was more important than function during that era; for example, looking at bridge design in comparison, classic bridges have extra curves and rivets, embodying a Gothic style that emphasizes form over function. Similarly, winches embodied that structure years ago, but seldom is a vintage approach taken in modern-day design. We prioritized a fusion of design that combines form and function for this new winch model.

The new winch was designed to have a throwback to the Victorian Age by showing all the bolt heads, nuts and welds. Drawing straight lines was purposely avoided in the design because we wanted to catch the eye of vessel crews interested in using this winch. In fact, the slip ring attachment was intended to resemble an old wooden airplane propeller.

This unique compact winch stemmed from a night of brainstorming on a whiteboard. We drew out and plotted our designs, erased and restarted over again multiple times, and analyzed the specs with each new redraw. This design started from the ground up and disregarded conventional design.

We came up with the original idea of using a ring bearing. A portable turntable using a large slewing ring bearing was designed. It opened up a whole new way of thinking about winch design and the use of space in general. All of that was made possible by the new variable-frequency drive (VFD) that enabled putting a control station anywhere and using an all-electric motor and gearbox.

A few key elements of the compact winch design are: a smaller footprint that saves deck space, a valuable commodity on research vessels; a frameless, lighter winch adaptable for a variety of marine applications; a scalable design from 1/2 horsepower to hundreds of horsepower; and a strength-to-weight ratio of 2:1 compared to traditional winches' ratio of 1:2. This model can pull twice as much as it weighs.

To reduce deck space, the compact design features a minimal frame and, for the first time ever, utilizes the drum as a structural member. The capacity of the winch drum is capable of also housing various cables needed for research and winch components. The motor-in-the-drum design was also config-

"We prioritized a fusion of design that combines form and function for this new winch model."

ured to make maintenance quick and easy. The scalable design can be adapted for user-specific needs, negating the typical requirement for customized winch solutions for every application. The winch on a turntable allows for a 360° easy hand rotation that can lock the winch into place on the base, allowing for movement when needed.

This lightweight design also improves vessels' fuel efficiency, lending itself to lower emissions and making it ideal for use aboard alternative-fuel-driven and ever-evolving green-design vessels. The compact design allows for additional equipment to be brought along, helping the ship's mission to be more productive. As it is a scalable design, it can go from a footprint of less than 4x4 to more than 10x8 ft. and lift hundreds to tens of thousands of pounds.

Applications

The compact winch is geared toward a variety of land, offshore and aquatic applications—specifically in marine environments that include deploying and retrieving mooring lines, floats, buoys and other scientific instruments. It was particularly designed with tech in mind: A key purpose is to support a heavy load on a cable such as AUVs, ROVs, human-occupied vehicles (HOVs), gliders and crates.

The compact winch is currently licensed for manufacture and sale to InterOcean Systems (IOS). Three WHOI winches manufactured under license by IOS are currently being integrated into a new University of Vermont research vessel.

To learn more about the compact winch, visit the WHOI Tech Transfer Office website at: https://techtransfer.whoi.edu. **ST**

Joshua Eaton is the UNOLS East Coast Winch Pool engineer and winch co-inventor at WHOI.

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two people must commit to participating in core events (weekly classes, biweekly site visits and workshops, showcase events, etc.) and meet a minimum of 8 hr. of mentoring time. Since startBlue is offered in person, a San Diego presence is required.

Applications are available via the startBlue website: https://startblue.ucsd.edu. Mentorship opportunities for business leaders and community members are also available.

San Diego: A Leader In Blue Tech Innovation

The defense sector and U.S. Navy presence in the San Diego area has long positioned it to be a leader in the blue economy. According to a new report published in 2022 by TMA BlueTech, San Diego's blue economy includes more than 4,320 maritime, water and blue technology establishments that generate $16.2 billion in direct revenues and provide more than 114,000 direct jobs, accounting for 5 percent of the business establishments in San Diego County and 9 percent of its total employment. In the national context, America's marine economy was worth about $373 billion as of 2018, per figures from the U.S. Department of Commerce.

San Diego is unique in terms of the resources it offers to startups, more specifically to later-stage startups who are looking for equity-based investment and to deploy a pilot. Critically, there is a lack of support for the newest startups that need to develop their go-to-market strategies, and that's where startBlue comes in. The accelerator supports those teams as they're spinning up, looking to compete for nondilutive funding and then transition into later-stage programs, such as the Port of San Diego's Blue Economy Incubator.

How to Get Involved

The startBlue program presents many generous opportunities for local business leaders and subject-matter experts to play a part in developing the future of the blue economy. Mentorship is available at different levels, including lead and secondary mentors. Lead mentors are generalists with expertise in startups. Lead mentors do not need to be experts in the blue economy or blue tech, but they need to be self-starters who are well connected and willing to share their network to help teams toward their milestones for the program. Secondary mentors are domain experts in a particular sector. Those interested in becoming mentors are encouraged to get involved in startBlue. For more information on the startBlue program, or to sign up as a mentor, visit: http://startblue.uscd.edu or email: startblue@ucsd.edu. **ST**

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