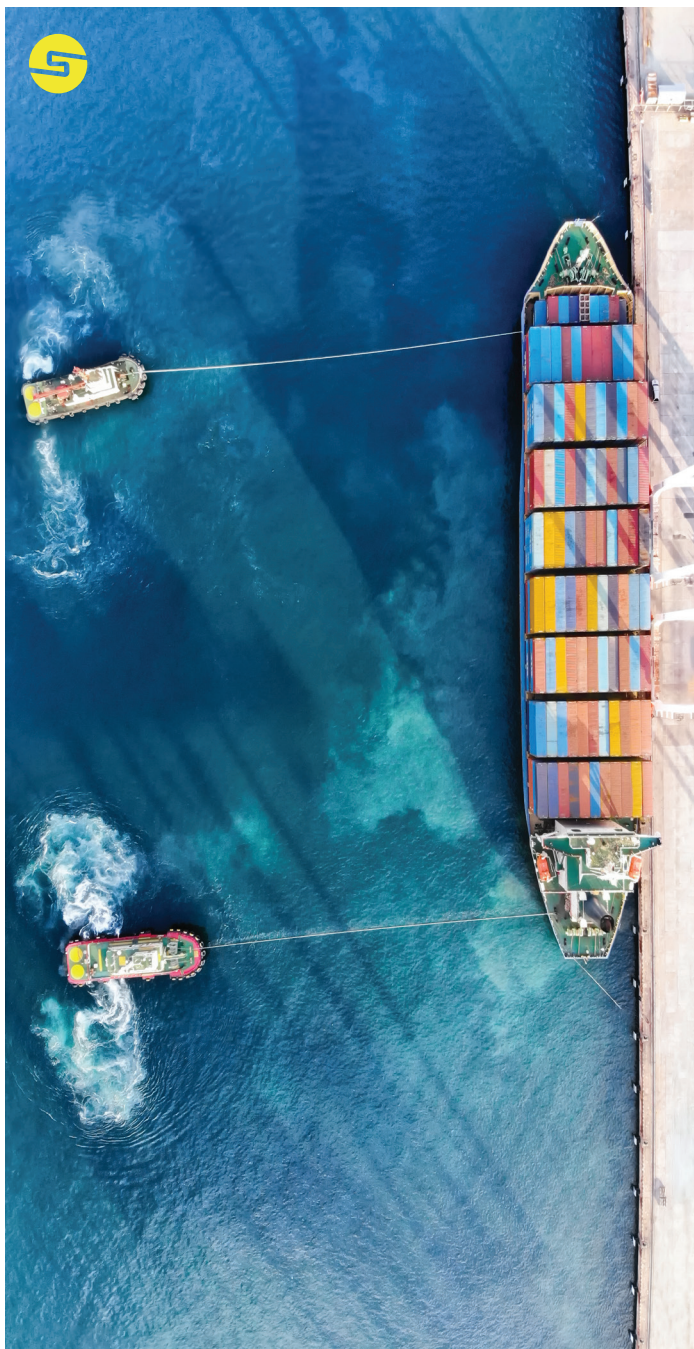




WIRELESS, REMOTE-HELM TECHNOLOGY AND THE TOWBOAT INDUSTRY



SEA-MACHINES / SM200



TUGBOATS HAVE BEEN PLYING THE HARBORS AND WATERWAYS OF THE WORLD FOR MORE THAN 200 YEARS.

During that time, improvements to vessels and operations have been slow to materialize. It took around 50 years to move from steam-powered paddlewheel tugs to steam-powered screw (propeller) driven tugs. Imagine a world today where we are still powered by steamboats! By the early 1900s, diesel engines were introduced, and in the mid-late 1900s through the early 2000s, the industry saw advances in propulsion systems, increasing the power and maneuverability of tugs.

As of recent years, autonomy and autonomous command are generating a significant amount of coverage and discussion. For tugboats operators, this concept is no longer Si-Fi. Today, already on the market, tugboat automation systems can be controlled by operators remotely and can manage pre-planned and dynamically charted missions. They have been developed, tested, approved for use by regulatory agencies and classification societies, and prepared for commercial and government applications.

Similarly available and growing in use today in the tug and towboat industry is wireless, remote-helm technology. It allows captains to take their wireless controls with them to operate their tugs from anywhere on the boat, or from the vessel being pushed or towed, or from a nearby vessel or dock. Whatever gives the operator the best sightlines and ability to evaluate operating conditions **in real-time**.

Wireless, remote-helm technology is truly a game-changer for companies, as it improves safety and solves several operational and financial challenges.



LIMITED SIGHTLINES

Tugboat operators are often challenged by limited sightlines from the wheelhouse. This is most often the case when moving large barges, particularly those with large cranes and other machinery on deck, multiple barges tethered together and other large floating superstructures. Some captains also need to navigate into notches in the sterns of certain types of barges to make a precise connection and lock the tug and barge together.

Tugs face operation-specific sightline challenges as well, including:

ARTICULATED TUG-BARGE OPERATIONS

Articulated tug-barges (ATBs) typically consist of a tank vessel (barge) and a large, powerful tug positioned in a notch in the stern of the barge, which enables the tug to propel and maneuver the barge. ATBs have an articulated or “hinged” connection system between the tug and barge that allows movement in one axis, or plane, in the critical area of fore and aft pitch.

One of the more common connection systems is made by Intercon. It consists of a pair of port and starboard rams installed in a structural support module on the tug. Each ram has a toothed “helmet” at the outboard end that engages a continuous rack of teeth on the barge notch wall, thus establishing a transverse, fixed horizontal axis about which the tug can pitch independently of the barge. The tooth pattern in the notch on the barge matches the tooth pattern on the tug, allowing for unlimited draft choices on either vessel.

A limited line of sight and other objects obstructing the view from the wheelhouse present a real challenge and operational risk for captains trying to maneuver the tug back into the notch of the barge’s stern and getting the port and starboard rams appropriately]connected. To make a safe, optimum connection, they must rely on hand signals and radio communications from deckhands, often the least experienced crewmembers on the boat.



PUSH BOAT OPERATIONS

Push boats, also referred to as towboats, are characterized by a square bow, a shallow draft and typically have knees, which are large plates mounted to the bow for pushing barges of various heights. Operators of these boats are often challenged with moving multiple barges lashed together through winding rivers and tricky currents with limited visibility. A full tow could consist of more than 40 barges, each about 200 feet long and 36 feet wide, all lashed together in an overall configuration of over 1,214 feet long and 200 feet wide. The sheer size of this immense apparatus severely compromises the line of sight to navigate it through rivers and narrow passes safely.

Small push boats, including those under 26 feet that do not require a licensed operator, are used primarily to move small deck and hopper barges, and engage in marine construction work. In many cases operators cannot see over what they are pushing.

DOCKING WITHOUT ASSIST TUGS

Depending on circumstances and location, tugboats moving barges in and out of terminals may do so without an assist tug. The decision is ultimately left to the mariner's judgement. When this happens, the tug operator must rely on hand signals and radio communications from deckhands to safely guide the barge into the dock.

OPERATING DECK MACHINERY AND SYSTEMS IN ADVERSE CONDITIONS

Tugboats are typically outfitted with a various mechanized deck equipment such as winches, anchors, cranes, fire monitors, ATB tug pins, and more. All can be operated by a crew from the wheelhouse, which can sometimes be a challenge as they may have to manage glare from the sun, rain, snow, fog, icy conditions, and the like.



In all these examples, a reliable remote-helm technology allows the operator to move freely outside the wheelhouse to whichever position provides the best vantage point for the task at hand. This freedom of movement eliminates the need to rely on communications from a secondary crewmember, awkwardly lean outside a window, or guess about the accuracy of the operation. Captains can also operate the tug from another vessel, including the vessel being pushed or towed or from a shore, if the operations are nearby.

SAFETY IN VOLATILE SITUATIONS

Many modern tugboats have significant firefighting (Fi-Fi) capabilities, offering supplementary protection for the vessels and ports they serve. Some also include equipment such as boom and skimmers for spill response. As a result, tugs are often called upon to respond to emergencies. Those could include vessel fires, near shore fires, oil spills on the water, and vessels in distress with people in the water. Tugs may also tow volatile cargoes such as nuclear submarines, old naval mines, fuel and chemical barges, and vessels on fire.

Whatever the hazard, the safety of the mariners on those tugs and other support vessels involved in the emergency response must be a priority.

Wireless, remote-helm technology allows the tug operator and crew to control the tug from a secondary mothership or from shore. As a result, the unmanned or reduced crew tug can maneuver closer to a hazard while limiting or completely removing people from the risk. And with more sophisticated remote helm technology, operators can control all the payload functions on the boat, including Fi-Fi water cannons, winches, anchors, onboard cranes, and more.



COSTLY OPERATING AND CAPITAL EXPENDITURES

CREWING

The maritime workforce is aging and recruiting and retaining new workers is a constant challenge. The average age of captains, mates, and engineers aboard tugboats, is about 55 and there is a noticeable dearth in the 32-to-42 age range. The high turnover in entry-level positions creates a gap when older mariners retire. As a result, tug operators are facing higher labor and training costs.

CAPITAL EXPENDITURES IN A LOW-MARGIN BUSINESS

Historically, improving visibility and safety for tugboat operators has involved constructing a second upper wheelhouse or controls out on the bridge wing. Unfortunately, both scenarios require considerable investment – typically \$100,000 and up depending on any additional superstructure that needs to be added.

In some cases, remote helm technology can allow operators to eliminate or reduce the number of mariners on board, as a shoreside person or person located on a second boat can control the tug without their involvement. Additionally, outfitting a tug with even the most sophisticated wireless controls available today costs less than retrofitting/building and wiring secondary or multiple bridge control locations.



A LOOK AT REMOTE-HELM SYSTEMS TODAY

Remote helm systems come in different shapes and sizes, and levels of complexity. On the more basic end of the spectrum are handheld remote controls that fire the engines backwards and forwards and bow and stern thrusters to move the boat left and right.

The most sophisticated remote helm systems consist of belt pack consoles with monitors and controls for virtually everything on the boat, including deck machinery.

Some remote helm systems offer a joystick wired to the console that allows an operator to move the boat forward, from side to side, and in a pivoting circular motion. It is worth noting that these products don't interface with engine controls; instead, they gain access to the transmission with a separate controller/joystick. If equipped, the only way to get a boat to accelerate beyond idle without an interface is to use trolling valves.

Other remote controls can operate hydraulic and electrical equipment on board ships, port operations, dockside, and the open sea. They may offer a wireless portable remote-control system as an alternative to fixed additional control stands like a bridge wing or flybridge console.

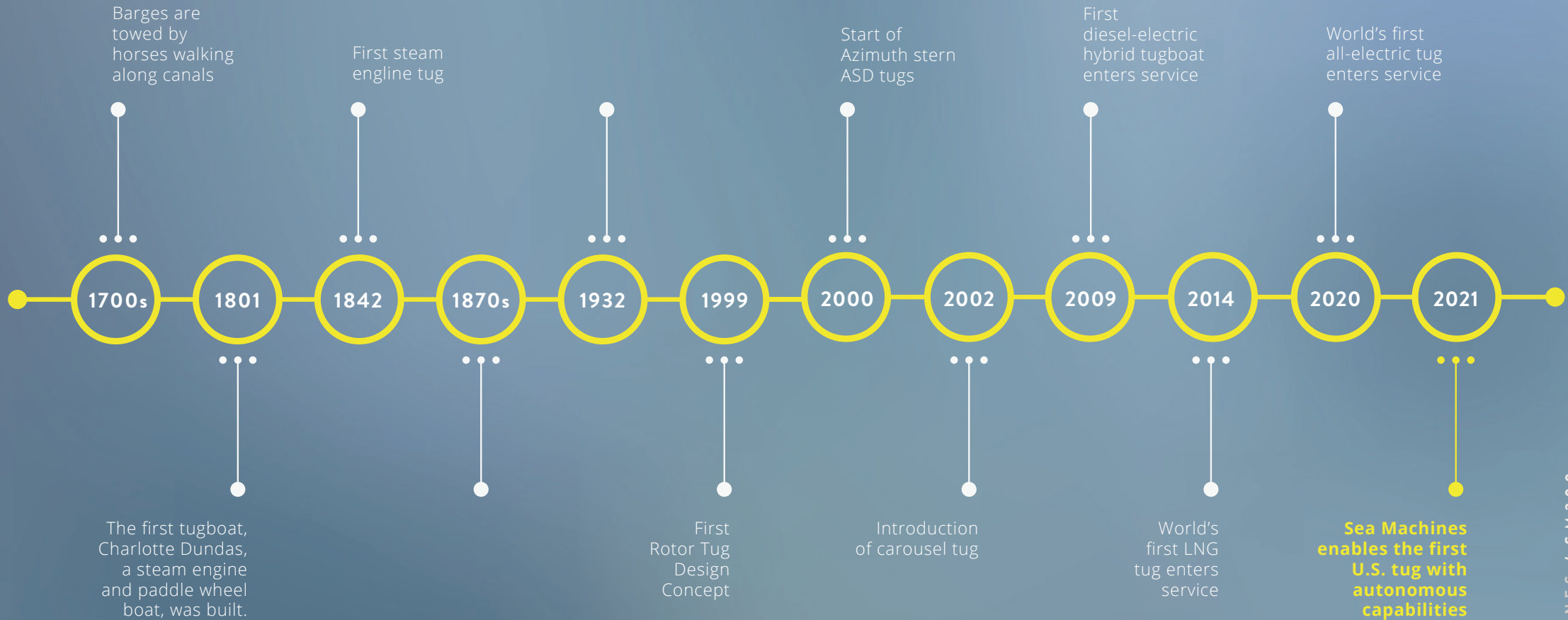
The most advanced systems provide complete control, entirely away from the wheelhouse. For example, the SM200 is a wireless, remote-helm control system that allows mariners to control the vessel from personal locations that offer improved communications, greater visibility, and increased safety. In addition, vessel operators using the SM200 belt pack console have both propulsion and steering control in their hands, as well as remote control of auxiliaries and payload equipment and monitors displaying navigational information, fuel, and electric consumption and engine system alarms. Built primarily for the commercial workboat industry, mariners can control their vessels from anywhere within a kilometer of the operation. This range of operation means they can not only operate from any vantage point on their vessel, but also from the vessel or superstructure being pushed or towed, or from a support boat or dock nearby.

This technology has been approved for use in certain vessels by the U.S. Coast Guard and the American Bureau of Shipping (ABS). In addition, it is currently in use on several U.S.-flag ATBs. The SM200 is also being used on Foss Maritime's newest harbor tug, Rachael Allen, which is the first U.S.-Flag harbor tug to integrate full autonomous command and control systems in real-world commercial operations. In the Netherlands, Herman Sr. BV plan to add the SM200 wireless, remote-helm control system to one of its Shoal buster 23-meter tugboat Teddy to increase productivity and operational safety during offshore operations.

TECH ADVANCEMENTS IN TUG DESIGNS

THROUGH THE YEARS

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FUTURE TECH FOR TUGS

Like the large merchant ships industry, tugboat operators should benefit from **Augmented Reality (AR)**, which is being developed and demonstrated on bridges of ships to enhance situational awareness. AR will improve safety and productivity for tug masters by offering accurate distances to ships to be assisted and other hazards in the harbor via enhanced projections on bridge windows or other specially designed monitors.

Smart marine ecosystems are also being developed. Port operations are becoming more integrated, with tug operations being further interconnected with ship arrivals and departures and shoreside activities. It is envisioned that increasingly automated management of tugs and pilots will become better optimized and integrated with vessel arrivals and departures and terminal and port operations.

The **Industrial Internet of Things (IIoT)** has helped commercial shipping predict the failure of machinery and track containers. It may also make its way into the tug and towing industry for monitoring conditions, tracking machinery, and optimizing maintenance. For example, sensors and machine-to-machine communications from tug systems would enable various parameters to be measured and data transmitted to a central storage server for analysis. Tug operators can then use the data to gauge machinery performance and predict failures.



REMOTE HELM SYSTEMS

Remote helm systems will become even more sophisticated with improved ergonomics, controls with neutral detents, updated controls to align with new propulsion methods, and throttles that can be held together or used separately to either match or purposely mismatch RPM on a dual-engine vessel.

Just as today mariners can't think of operating tugs without dynamic positioning, GPS, and autopilot, soon crews won't operate them without wireless helm and varying degrees of autonomous command technology.

Autonomous systems allow operators to remotely command and monitor multiple autonomous vessels aboard a ship or shore-based center. The technology is proven to increase productivity, predictability, and efficiency while reducing operational risk on the water.

The next level of autonomy is AI-powered advanced perception technology. This technology brings together long-range computer vision and multi-sensor fusion to augment crew perception. The benefit is a fuller understanding of a vessel's operating domain with supplemented audible and visual warnings that alert of any threats in the surrounding area. Additionally, for full compliance with ColRegs, the vision-based AI is the only technology capable of detecting and classifying objects. Much like the human eye, computer vision allows detecting color, texture, reading text, and understanding context. The fusion of visual detection with conventional sensor data will dramatically increase targeting confidence and, therefore, operational capabilities.



INTRODUCING SEA MACHINES ROBOTICS

Headquartered in the tech hub of Boston and operating globally, Sea Machines is unlocking the potential of marine operations with revolutionary autonomous control systems and supporting advanced technologies. The company's technology is built for work and is proven to increase productivity, predictability, and efficiency while reducing operational risk through remote control and command.

When it comes to wireless remote helm technology, Sea Machines developed and launched the SM200 focused on operational excellence and safety. The state-of-the-art SM200 beltpack and joystick offers full wheelhouse control, at the best vantage point, for mariners who expect the best in terms of experience, functionality, and design in their technology.



KEY FEATURES INCLUDE:

REMOTE-HELM CONTROL
FROM OUTSIDE THE WHEELHOUSE,
ANOTHER VESSEL OR SHORE

REMOTE VESSEL MONITORING

SECURE RADIO LINK WITH
1,000 METER RANGE

COMMAND AND CONTROL PAYLOADS



Importantly, the SM200 has achieved regulatory approval by the USCG and ABS and has been deployed successfully on numerous vessels.



SM200 TUGBOAT APPLICATIONS

The SM200 allows the tug's master to take the wheelhouse to the best vantage point for the operation at hand.

Wireless, full-bridge control not tied to the wheelhouse, enables:

OPERATIONAL EXCELLENCE

A new way of operating outside the wheelhouse creates new capabilities for the crew and tugboats.

INCREASED PRODUCTIVITY

Reduces human limitations like stop-work periods and crew changes or conditions in which humans cannot operate.

DIRECT COMMUNICATION

The wireless helm operator is directly engaged in the action and in earshot of the crew, minimizing radio communications and misunderstandings

SAFETY

Remote helm gives operators command and control of the vessel from safer remote locations in otherwise hazardous or dangerous marine conditions.

DECREASED SPEND

The option to minimize manpower can reduce operational expenses.

REAL-TIME DATA

Critical real-time data streamed on the SM200 through the networked system, including engine telemetry.

GREATER CONTROL

The SM200 is first in market for navigating rudders and on-board equipment, from shore.

FULL INTEGRATION WITH SM300

The SM200 could be integrated with Sea Machine's SM300, the world's leading autonomous command and control system for commercial vessels.

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Foss is leveraging sea machines' cutting-edge technology to take on the routine work and allow crew to focus on higher-level tasks and improve safety, while also increasing productivity and efficiency during harbor operations. Foss prides itself on always offering customers safe and innovative solutions, and this is one more way that we are delivering on that promise.

WILL ROBERTS

FOSS PRESIDENT AND CEO

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No longer bound to a fixed control station, our crew will use Sea Machines' wireless helm to monitor operations from the tugboat's upper decks or wherever visibility is greatest, a valuable capability that increases both productivity and safety. This system is intuitive to use and, once installed, will be valuable to our crews as they operate our vessel Teddy during challenging projects, such as large and overweight offshore tows.

ERWIN VAN DODEWAARD

HERMAN SR.'S OPERATIONS MANAGER

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The way we see automation at the maritime administration is as a potential enabler to a safer, more efficient, and more competitive mode of water transportation that provides more and better jobs for America's highly trained and dedicated mariners. We need to 'future-proof' the skills of our newgraduates so that they can ride with and profit from technological advances, and as a community ensure the livelihoods of those workers who might be displaced by using their skillsets in new ways as technology changes.

RICHARD BALZANO

MARAD ADMINISTRATOR

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Improving visibility and at-sea safety is a game-changer for any marine operator, but it is especially true for Herman Sr., which operates in challenging offshore conditions that include reduced visibility, waves and weather. Working conditions that fall into the 'dull, dirty and dangerous' category are ideally suited for our systems, as they support crews with new, innovative capabilities that deliver greater productivity, reliability and safety.

FRANK RELOU

SEA MACHINES' EUROPEAN BUSINESS DEVELOPMENT MANAGER

GET ONBOARD



Discover the leading vessel intelligence systems that enable modern mariners to work smarter.

SEA-MACHINES.COM/SM200 | SALES@SEA-MACHINES.COM