



IN CASE OF EMERGENCY

EMERGENCY TOWING SYSTEMS BASED ON DUPONT KEVLAR® BRAND FIBER ARE MAKING
LIFE SAFER AT SEA AND REDUCING THE RISK OF OCEAN-FOULING OIL POLLUTION

It was 5 a.m. January 5, 1993. Ten miles north of Scotland's Shetland Isles, the Liberian-registered tanker Braer, en route from Norway to Canada, radioed the loss of all engine power. Undaunted by high seas and gale-force winds, helicopters airlifted all nonessential personnel from the stricken vessel.

The ship continued to drift. Crewmen from the anchor-handling vessel Star Sirius were winched aboard the Braer, but attempts to attach a heavy line failed. The Braer was abandoned. At 11:19 a.m., she ran aground on Garths Ness, an area of international environmental importance.

Thwarted by the difficult conditions, the crew and rescue services could only watch in despair as 85,000 tons of Norwegian Gullfaks crude spread out along the coastline. This was one of the world's largest oil spills, more than double the size of the Exxon Valdez disaster.

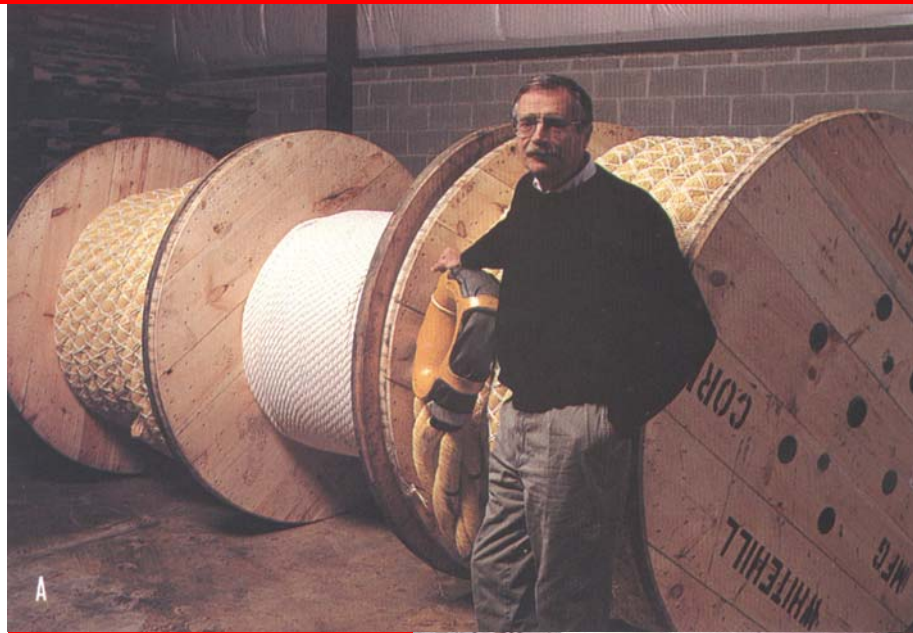
Ever since the Titanic sank in 1912, the international community has coalesced in an effort to avert such large-scale maritime disasters. The 1913 Safety of Life at Sea (SOLAS) Convention of 13 nations produced the fundamental charter for maritime safety. It introduced regulations covering navigation instruments, life saving and fire-fighting equipment, fire prevention and the structure of bulkheads. Four SOLAS conventions have followed, as well as numerous amendments.

The United Nations' desire to see a permanent policy setting and regulatory agency took concrete form when the London-based Inter-Governmental Maritime Consultative Organization - now known as the International Maritime Organization (IMO) - was set up in 1948. SOLAS was immediately integrated into IMO's regulatory structure.

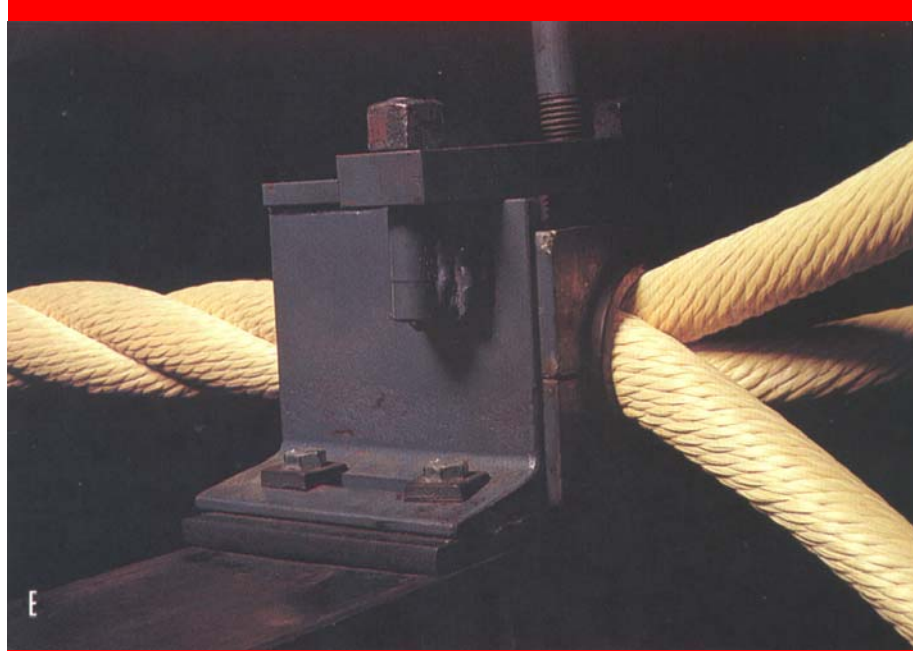
The existence of the IMO does not prevent countries from acting unilaterally. In the wake of the Exxon Valdez catastrophe, the U.S. government enacted the 1990 Oil Pollution Act. This act covers many aspects of oil exploration, shipping and refining, including a requirement for emergency towing systems to be installed on the aft deck of all ocean-going tankers. When the Braer ran aground three years later, the IMO moved to introduce emergency towing systems (ETS) at an international level, beginning in 1996. No matter which flag a ship is flying, the IMO resolution makes it mandatory for all tankers and carriers of hazardous materials of more than 20,000 dead weight tons to be fitted with a dedicated ETS either during construction or during the first dry docking. More than 4,000 tankers will be fitted out over the next three years as part of the qualification for the Certificate of Seaworthiness, which is the maritime world's mandatory "permit to set sail."

In addition to specifying the minimum working strength of the rope, the IMO regulations require that the rope can be deployed within 15 minutes, single-handedly and without additional power.

Fittingly, one of the first companies to develop an ETS was Whitehill Manufacturing Corp. of Chester, Pennsylvania. The firm was founded in 1978 specifically to manufacture custom-designed ropes made of Kevlar® brand fiber. When DuPont marked the 25th anniversary of the commercialization of Kevlar® in May 1996, Simeon Whitehill, the company's founder and president, was recognized as "a visionary pioneer... who developed a simple, optimized rope design that efficiently and cost-effectively used the



- A Whitehill Manufacturing Corp., founded by Simeon Whitehill, makes more than 500 specialty rope products with Kevlar® brand fiber.
- B The largest Whitehill Rope is a towing hawser with a rated strength of 900,000 pounds.
- C Kevlar® is such a good material for ropes because it is five times stronger than steel at equal weights.
- D Kevlar® reduces the weight of even the bulkiest fittings, making it easier - and safer - to handle them at sea.
- E Whitehill has been honored as a pioneer in the development of rope designs that take advantage of the strength of Kevlar®.
- F Emergency towing systems - stowed for convenient deck-mounting - now are mandatory aboard larger tankers and carriers of hazardous wastes.





high strength of Kevlar®."

Working with the U.S. Navy in 1987, Whitehill developed modified rope construction of Kevlar® for use as mooring lines. Today, more than half of the U.S. fleet is equipped with Whitehill-designed rope made of Kevlar®.

The Whitehill ETS unit has evolved since the first simple system was mounted on a barge a decade ago. Today, some four dozen ships sail with Whitehill ETS equipment aboard.

The Whitehill system is packed in a four-foot fiberglass cube. Inside is carefully stowed about 300 feet of rope made of Kevlar®, a lighted buoy, and 400 feet of floating pick-up line.

"Essentially, when we're doing a retrofit, each system has to be customized for the individual ship because it's tough finding a convenient mounting place on a crowded deck," explains Whitehill. "For new construction, naval architects and engineers can take the ETS into account in their designs. On many new ships, the ETS is located below deck where it's out of the way."

Whether above or below deck, says Whitehill, the distinguishing factor in his ETS is the rope of Kevlar®. At equal weights, Kevlar® is some five times stronger than steel, one of the traditional materials used in rope making. Therefore, ropes of Kevlar® in an ETS are approximately one fifth the weight of those in a comparable steel system.

"The difference in weight between a rope of Kevlar® and wire rope can't be overemphasized," he says. "When you visualize the ETS in use, you realize the significance of the weight and the impact it can have on the safety of crewmen. Once the line has been deployed from the deck of a ship in trouble, crewmen on a tugboat have got to snare the line, wrestle it aboard the tug, then attach the end to begin the tow. This is a tough enough job in calm seas, so imagine what it's like in the gale-force winds of a storm, possibly at night. The Braer might have been saved back in '93 if the tow line hadn't been so heavy.

"Wire rope is heavy, inflexible and unforgiving. From a safety aspect - which should be uppermost in any decision, in my view - the system with ropes of Kevlar® wins every time." There's an added expense for wire rope systems, points out Bill Schwindt, Whitehill product engineer. "An ETS using wire rope requires a winch drum and motor that needs periodic inspection, maintenance and lubrication. An ETS with Kevlar®, on the other hand, can be mounted on a ship and forgotten, for the most part. When total cost is considered, the system using ropes of Kevlar® is much less expensive."

Conoco, DuPont's energy subsidiary, has been installing emergency towing systems on its tankers since the Oil Pollution Act came into force in 1990.

"The decision to opt for ropes made from Kevlar® fiber was based on ease of handling, as well as the added safety factor," says Bob Lindsay, operations and engineering manager in Conoco's shipping division. "The weight reduction compared with standard ropes is quite considerable."

To learn more about Whitehill ropes of Kevlar® and the ETS system, e-mail or call 1-610-494-2378. And for more information about the use of Kevlar® in ropes, call Gordon Caldwell, DuPont market segment leader for ropes and cables, at 1-804-383-2274.