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NEW DEVELOPMENTS IN SYNTHETIC ROPE TECHNOLOGY

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## SAMSON IN ACTION UPCOMING EVENTS

### OFFSHORE

- > **Offshore Europe**  
Aberdeen, UK: September 6–8, 2011

### MOORING

- > **International Marine Purchasing Association Conference and Exhibition**  
London, UK: September 14–15, 2011

### RECREATIONAL MARINE

- > **US Sailboat**  
Annapolis, MD, USA: October 6–10, 2011

## NEWS FROM ANOTHER DIVISION: RECREATIONAL MARINE



Photo courtesy of Ainhoa Sanchez.

### Brad Van Liew Sweeps the Velux 5 Oceans Race

Brad Van Liew set sail on *Le Pingouin*, which is completely rigged with Samson lines—from the jib sheets and runners to the main halyard—on a race around the world with four other racers on October 17, 2010.

Known as The Ultimate Solo Challenge, the Velux 5 Oceans Race consisted of five gruelling ocean sprints ranging between 3,600 to 7,500 nautical miles. The race circumnavigated the planet via La Rochelle, France; Cape Town, South Africa; Wellington, New Zealand; Punta del Este, Uruguay; and Charleston, South Carolina, USA.

On May 27th, 2011, Van Liew sailed into La Rochelle, France, completing the final sprint across the Atlantic in 12 days, 23 hours and 52 minutes.

Van Liew used AS-90 made with Dyneema® fiber; WarpSpeed®, also made with Dyneema® fiber and a polyester cover; and AmSteel®Blue with Flavored ICE, a blended cover designed to take heat and abrasion while protecting the rope's core.

The combination of Samson running rigging and Van Liew's excellent tactical sailing skills led him to his second clean sweep of the race; he swept the Around Alone in 2002/03.



Photo courtesy of Dustin K. Ryan.

## BEHIND THE LION

### Samson's Logistics Coordinator Takes Skills to the City

Samson's International Logistics Coordinator Claudia Kelley recently completed a two-year term serving as a Transportation Commissioner for the City of Bellingham.

Appointed to the commission by Bellingham Mayor Dan Pike in March of 2009, Claudia was one of nine commission members to represent a range of perspectives and provide expertise focusing on the community's long-term vision for mobility options throughout the city. The Commission also works on issues such as the annual arterial pavement-resurfacing program, and finding new ways to encourage citizens to use more nonmotorized transportation options.

**ABOUT BELLINGHAM** On the shores of Bellingham Bay with Mount Baker as its backdrop, Bellingham is the last major city before the Washington coastline meets the Canadian border. Just 7 miles south of Samson's Ferndale facility, the City of Bellingham serves as the county seat of Whatcom County and is at the center of a uniquely picturesque area offering a rich variety of recreational, cultural, educational, and economic activities.



# SAMSON CUSTOM-ENGINEERED DESIGNS



## What Offshore Installation Doesn't Call for a Custom Design?

### SAMSON CAN HELP

Let us design your next project. You will get all the benefits of the Samson R&D team; proven application knowledge backed by in-depth testing, practical industry experience, and the know how to put Samson's synthetic high performance ropes to work for you.

#### EXAMPLES:

*FPSO Kwame Nkrumah,*  
Jubilee natural gas and oil field  
**Riser pull-in line:** Leaded core for quick sinking

*FPSO Stybarrow Venture,*  
Stybarrow oil field  
**Turret-buoy pull-in lines:** Tapered for use in angled flow tubes

*FPSO Nganhurra,*  
Enfield oil field  
**Riser pull-in lines:** Tapered for use in angled flow tubes



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NEW DEVELOPMENTS IN SYNTHETIC ROPE TECHNOLOGY



## Samson Synthetic Ropes Pull More Than Their Own Weight in Jubilee Field

### THE PLAYERS

**SOFEC:** A leader in the development and supply of single-point mooring systems, SOFEC is engaged in research involving new and improved tanker mooring systems and associated components. SOFEC's projects include marine terminals for product import/export, and turret and spread moorings for tanker-based floating production, storage, and offloading (FPSO/FSO) systems.

**Technip:** A world leader in engineering, technologies, and project management for the oil and gas industry. Backed by more than 50 years of experience, Technip is a key contributor to the development of technologies and sustainable solutions for the exploitation of the world's energy resources and develops platform-installation methods that reduce installation time and cost.

**Southwest Ocean Services (SWOS):** A Samson master fabricating distributor, located in Houston, Texas. SWOS has a superior understanding of splicing and end termination, and specializes in fiber rope solutions for commercial marine industries, including the offshore oil and gas industry.

**Samson:** The worldwide leader in high-performance cordage. Samson brings wire rope replacement solutions to the offshore oil and gas industry through custom-engineered solutions and adds value with The Samson Advantage.

### OVERVIEW

The Jubilee field offshore of Ghana, West Africa, is estimated to hold 1.2 trillion cubic feet of gas and 1.8 billion barrels of crude oil in recoverable reserves, making it the second largest field in the world. First oil was produced in December 2010, after risers and umbilicals were installed from the seabed at depths of between 900 and 1,700 meters to the floating production, storage, and offloading FPSO *Kwame Nkrumah*, which successfully completed the fastest ever full-scale deepwater development. Instrumental in the 11-riser installation was Samson's synthetic rope Turbo-EPX, but not before AmSteel<sup>®</sup>Blue first assisted with mooring the FPSO.

*A synthetic rope solution would simplify the winch design and allow a smaller drum diameter to be used. The synthetic rope solution would also provide the additional benefit of reducing the size of the hydraulic power unit and the deck load.*

### THE SITUATION

SOFEC was in charge of the design and installation of the riser pull-in package for the Jubilee field development. The package would be used for two projects: the anchor-chain and riser installations.

SOFEC was concerned about the limited room on the deck of the FPSO. The most efficient solution would be to use a small winch for the riser pull-in system. A synthetic rope solution would simplify the winch design and allow a smaller drum diameter to be used. The synthetic rope solution would also provide the additional benefit of reducing the size of the hydraulic power unit and the deck load.

Having worked together for more than 20 years on similar projects, SOFEC contacted SWOS, Samson's Master Fabricating Distributor located in Houston, Texas, to discuss a synthetic rope solution for the pull-in lines.



*Turbo-EPX pulls in a riser.*

## THE ROPES

Samson synthetic ropes for offshore applications are made with Dyneema® fiber, which brings high-performance characteristics such as high strength, light weight, abrasion resistance, and neutral buoyancy to innovative rope constructions and coatings.

While SOFEC was confident that Samson high-performance ropes would work well in both applications, the riser installation engineers at Technip were not so sure. Their top concern was

the level of abrasion that the rope would be exposed to while under a maximum tension of 200 tons as it moved down the I-tube.

Because of the neutral buoyancy of ropes made with Dyneema®, Technip also had concerns that the rope would catch in the propellers of the construction vessel, which would approach very close to the FPSO when the risers were transferred. Samson put application engineers to work developing a custom solution.

## MEETS THE SPECS: TURBO-EPX

SWOS and Samson engineers worked closely with SOFEC to understand all of the nuances of this particular project and equipment.

It was determined that the best combination of equipment would be a split-drum winch with a working load limit of 350 tons, loaded with 350 meters of 5-5/8" diameter Turbo-EPX, which has a minimum breaking strength of 875 tons.

Turbo-EPX is a unique jacketed construction with a 12-strand core strength member made with high-strength, low-stretch Dyneema® fiber. The jacket is made with polyester that grips the winch and hardware, and is abrasion resistant. To ensure that the rope would sink rapidly enough to avoid catching in the tugboat's propellers, a segmented-lead line was added to the center of the 12-strand braided core.

Once the customization and manufacture were complete, the line underwent extreme scrutiny. It was first break tested and witnessed by the American Bureau of Shipping (ABS). Then Technip, the project managers for the installation, commissioned a study by Bureau Veritas (BV), who found the rope to be more than adequate, with a factor of safety of 3:1.

With these certifying agencies' approval, Samson manufactured three Turbo-EPX lines for the Jubilee riser pull-in job. SOFEC planned to use one of the three Turbo-EPX lines for the anchor chain pull-in and tensioning line. This left one for the riser installation, and one for a back up.



*LEFT Perspective of the winch and Turbo-EPX.*

*RIGHT Turbo-EPX as it moves inside the I-tube.*



*AmSteel®Blue brings an anchor chain into its stopper.*

## ENTER AMSTEEL®BLUE

After further consideration of the anchor-chain pull-in job, SOFEC realized that the significant 5-5/8"-diameter of the Turbo-EPX would cause the line to bear against the cast-steel sidewalls of the chain stopper's internal cavity. Again, SOFEC contacted SWOS, who recommended a smaller diameter AmSteel®Blue to pull-in the mooring chains.

AmSteel®Blue is Samson's flagship product made with Dyneema® fiber. Size for size, AmSteel®Blue is as strong as steel, making it an excellent wire rope replacement. In addition, the 12-strand single-braid construction is 1/7th the weight of the steel wire rope it replaces while providing superior wear and flex fatigue resistance.

SWOS provided 738 feet of 3-1/4"-diameter AmSteel®Blue with a soft eye on each end. This rope is able to handle a working load limit of 100 metric tons with an approximately 400-metric-ton minimum breaking strength, equalling a 4:1 safety factor.

## THE RESULTS

**AmSteel®Blue:** In a typical FPSO mooring application, both wire and synthetic ropes are used on a split-drum winch; however, AmSteel®Blue worked in place of both. The added benefits of its easy handling and change out allowed engineers to simplify the winch-drum design, and provided flexibility overall for the nine-anchor-chain installation and tensioning. The AmSteel®Blue took quite a beating, but finished the job without failure. Once the *Kwame Nkrumah* was secured in place, the Turbo-EPX was reinstalled on the winch and the ready to pull in the risers.

**Turbo-EPX:** Only one of the three Turbo-EPX lines was used to pull the 11 total risers. According to one Technip installation engineer, the rope was still in good shape after the job was complete. Samson synthetic lines were proven without a doubt that they can perform extremely well in the tough conditions of the offshore installation world.



*A view of the anchor-chain tensioning down the internal cavity of the I-tube.*



*Samson techs were onboard for a total of six months for installation and inspection.*

## A FIRST FOR THE SAMSON ADVANTAGE

Samson is the only rope manufacturer in the world that provides the combination of experience, technology, manufacturing, products, and service, bringing to our customers what we call The Samson Advantage. While most of what makes us excellent happens behind the scene, our service is something that is observed with every purchase. The case of the Jubilee mooring chain and riser installation lines is no exception and is one of the best examples of what makes our service legendary.

Our qualified service technicians are available for installing lines, training crews on how to care for Samson lines, and inspecting and repairing lines. On this project, it was two of our best service techs that Technip relied on to oversee the performance of the AmSteel® Blue and Turbo-EPX lines to the extent that one of them was present for a total of six months while the anchor chain and riser installations were completed. This long-term deployment was at the special request of Technip and a first for Samson.

In order to provide this unprecedented service, these dedicated professionals underwent extensive training that included helicopter underwater egress training (HUET) and survival training. They also obtained transportation worker identification credentials (TWIC) that allows them unescorted access to secure areas of ports, vessels, and outer-continental-shelf facilities.



*FPSO Kwame Nkrumah is capable of processing more than 120,000 barrels of oil and producing 160 million standard cubic feet of gas per day.*

## THE APPLICATIONS

*FPSO is an acronym for Floating, Production, Storage, and Offloading, and is a floating production system that receives fluids (crude oil, water and a host of other things) from a subsea reservoir. As its name implies, the FPSO processes and stores the hydrocarbons, eventually offloading the processed hydrocarbons to shuttle tankers for transfer to port. Many FPSOs are converted from retired oil tankers. They are all anchored or moored in place, with the type of mooring determined by its environment. In calmer waters, spread mooring is often sufficient. In environments where cyclones or hurricanes occur, disconnectable turret mooring systems are used so that the vessel can be moved out of the storm's way and quickly reconnected when the storm has passed.*

*FPSOs have been serving the offshore oil and gas industry for nearly 30 years. They have proven safe and economical. Over the years, advanced mooring systems as well as advancements in subsea equipment have made FPSOs useful in deeper and rougher waters.*

*The FPSO Kwame Nkrumah MV21 is installed in approximately 1,100 meters water depth at the Jubilee Field, which is one of the largest oil fields discovered offshore West Africa in the past 10 years. The Kwame Nkrumah is capable of processing more than 120,000 barrels of oil per day, injecting more than 230,000 barrels of water per day, and producing 160 million standard cubic feet of gas per day.*

## TURRET MOORING AND ANCHOR-CHAIN INSTALLATION

Turret mooring systems can be mounted to the FPSO either internally or externally. In the case of an internal turret, it is placed within in a "moon pool" located in the hull of the FPSO. The chain table, connecting the mooring lines to the turret, can be either above or below the waterline. An external turret is fixed, with appropriate reinforcements, to the bow or stern of the ship and can be disconnected to allow the FPSO to be moved when weather or sea conditions threaten potential damage. Anchor lines are connected from anchors embedded in the sea floor to the turret buoy, and fitted to a socket on the FPSO, which allows the vessel to rotate freely around the anchor legs. The *Kwame Nkrumah* has an external turret mooring system, which provides an excellent solution for a variety of FPSO applications.

Mooring the FPSO involved nine anchor chains attached to piles embedded in the sea floor and then pulled into the chain stoppers located on the external turret. Once the chains are in their stoppers they are then pulled to full tension so the vessel is secure.

## RISER INSTALLATION

Risers are pipes or an assembly of pipes used to transfer fluids produced from the seabed to surface facilities, as well as to transfer injection or control fluids into the seabed. Riser installation is one of the final steps in oilfield development, where the prefabricated riser packages are installed by a construction vessel that assists with the procedure.

The riser is lowered from the construction vessel to the seafloor and attached to the riser base via remote operated vehicle (ROV). The riser pull-in line is then lowered into the water from a pull-in winch on the FPSO; the ROV transfers it to the deck of the construction vessel where the line is attached to the end of the riser. The riser is then lowered back into the water with the pull-in line bearing the full weight of the riser as it is pulled into place on the turret of the FPSO.



*The ROV oversees the Turbo-EPX-riser connection as the Turbo-EPX takes the full weight of the riser.*