INDUSTRY FIRST INNOVATION

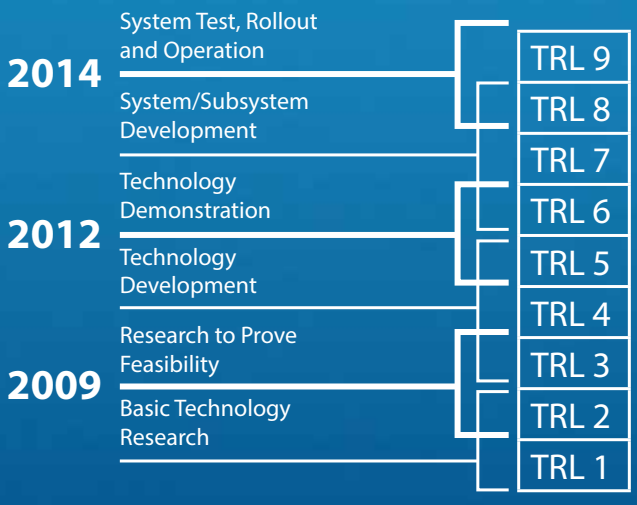
Seatooth CP

World's first subsea wireless Cathodic Protection (CP) monitoring system.

In May 2013, Stork launched an international industry first innovation named Seatooth CP in conjunction with WFS Technologies, a global organisation which delivers underwater wireless instrumentation and control solutions to the Offshore Oil & Gas and Renewables industries.

Seatooth CP underwent rigorous research and development by combining Stork's current CP capabilities and engineering teams with wireless technology from WFS. The newly established innovation monitors the effects of corrosion by measuring anode current wirelessly in "real-time" using a Seatooth S100 device and a wireless enabled ROV.

Although Seatooth CP is in the early stages of market penetration, the technological development has generated a large amount of interest with a number of major Oil and Gas Operators. The below diagram illustrates each Technology Readiness Level (TRL), a NASA approved staging process, that Seatooth CP has underwent. Now at the 'technical demonstration stage', Stork and WFS will be working closely together in 2014 to progress through to the final TRL, "System Test, Roll and Operation".



By partnering with another pioneering organisation, Stork has again produced an industry first system. No other technology currently offers this capability or the potential to gather data wirelessly in real time and therefore Seatooth CP signals a significant advance in Subsea Asset Integrity Management.

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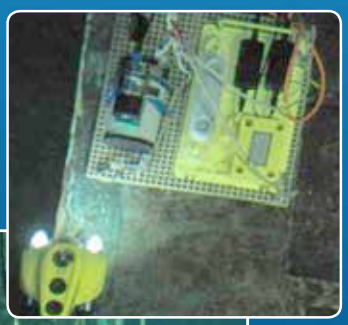
TECHNICAL SPECIFICATION

Seatooth CP

Seatooth CP takes a step away from the traditional method of data collection for passive Cathodic Protection (CP) by measuring anode current output wirelessly using an ROV. The main difference between Seatooth CP and a conventional system is that each monitoring point (node) converts the local potential to a digital stream. The digital stream is transmitted wirelessly through a networked monitoring system, minimising any cabling. This means that the total wiring burden for the system is a single cable from the anode or reference electrode. Data is collected wirelessly from the anodes by ROV without requiring wet-mate connectors or wires for data transfer and the ROV will not need to "dock" in order for transmission to take place.

The system captures potential and current density measurements at numerous points around the structure and retains the data ready for upload. The values can be recorded at regular intervals, to provide accurate performance trending information, including strategic information on anode consumption; moving away from the 'snapshot' gained from traditional methods. The data collected can then be fed in to both preventive and diagnostic activities.



The combination of anode current and continuous data collection allows an accurate calculation of the end of life of a sacrificial anode. Stork's CP Engineer can extrapolate what weight of anode material is required to provide optimum levels of CP based on actual conditions of the structure. This data is collected by mini-ROV whilst on routine maintenance flights and indicates to the Engineer when to apply the retrofit or plan the maintenance, rather than waiting for assets to corrode. The "real time" gathering of this data signals a significant advance in asset management.

When both active and passive forms of CP are employed (for example on a floating platform) a potential system imbalance may reveal a "corrosion hot spot", causing assets to corrode more quickly. Seatooth® CP assists with "balancing" and optimising the system by pinpointing the cause of the imbalance with regular and relevant data and indicating where early action is required to avoid asset deterioration.

By distributing a number of Seatooth CP units throughout a subsea field it will also be able to determine the locations of current sinks or drains. A wireless CP system has a number of advantages over a wired system. The wireless nodes can be placed in locations not accessible to ROV, giving a full view of the system being monitored and avoiding the need to hardwire these into place. Each node's field life can be extended with wireless power transfer technology and is flexible enough to be retrofit on brownfield as well as designed into greenfield sites.

All of the nodes can be read by single command making acquisition quick and efficient, and because the nodes are fixed the owner is guaranteed consistency and accuracy of each reading. Also by converting analogue values to digital values, measurement errors caused by electrical interference or water leaking into the cables are eliminated.

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System Components:
The monitoring assemblies can be located on various parts of the structure to provide a complete picture of the condition of the cathodic protection system. Every assembly in place on the structure gathers a different set of data. All of the assemblies are connected to a master module which then transfers the data to the preferred location of the operator. The transfer process is completed digitally to ensure the integrity of the data is maintained throughout the system.

Master Module:
The master module collects the data from each of the monitoring assemblies and transmits it to an onshore location. As the hub of the system, Stork designed the module with built-in redundancy to ensure it is durable and efficient. As a result the master module contains a number of innovative features.

Master Module features include:
- A source of rechargeable power for the module and each of its assemblies
- A long term and permanent data storage device
- Inductive coupling for recharging the power source
- The ability to record the time with every reading

Features:
- Sacrificial anode
- Master module
- Reference cell
- Salinity
- Datalogger
- Wireless network
- Battery

Benefits:
- Accurate cathodic protection performance data
- Extensive monitoring system life using rechargeable power source technology
- ROV friendly equipment for both fitting and data recovery
- A variety of sensors including, coupons, temperature, conductivity, oxygen, and monitoring
- Permanently deployed sensors with no wet mate connectors
- Retrofit capability makes the system suitable for brownfield or greenfield
- Wireless data management with ROVs
- Pre-configure sample rate to match condition of anode
- Battery life up to 15 years
- Wireless recharge (optional)
- Data through splash zone
- Open architecture allows for additional senor inputs