Antifouling System Extends Instrument Deployment by Up to Six Weeks

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ABSTRACT

Cost reduction has become a primary focus for nearly every public and private research institution. The environmental monitoring industry has not been immune to the cost-cutting efforts and seeks innovative ways to help field monitoring professionals gain efficiency. This has led to the development of new technologies that extend deployment duration and minimize costly maintenance procedures, while delivering a high level of data quality.

The TROLL® Shield Antifouling System, developed by In-Situ® Inc., was designed to inhibit biofouling of environmental monitoring instruments. An In-Situ Aqua TROLL® 200 Instrument outfitted with the TROLL Shield copper guard and nose cone was tested against a control instrument. The test compared conductivity performance and visual biofouling deposits from instruments deployed in a high-fouling environment.

The TROLL Shield technology reduced the impacts of fouling on conductivity readings by more than 50 percent over the control Aqua TROLL 200 Instrument and extended maintenance intervals by six weeks beyond the control instrument.

INTRODUCTION

Technological advances in water quality monitoring equipment have caused a paradigm shift in why users conduct site visits. New optical sensor technologies and design improvements to existing sensors minimize or eliminate inherent sensor drift—delivering better data over longer calibration cycles. Remote data acquisition platforms eliminate the need to physically connect to an instrument to download data. More efficient power management and solar powered systems allow deployments of several months without the need to replace or recharge batteries. These technological advances improve instrument performance when environmental limitations are placed on monitoring systems.

Biofouling is now the major limiting factor in monitoring many aquatic environments. This is especially true in coastal or warmer waters where the development of bio-films, or micro-fouling, can occur within hours of deployment. Macro-fouling by larger organisms has been of major concern for years in the shipping industry and also plagues environmental monitoring systems. Both types of fouling cause sensor impediment by interfering with electrodes or optical systems, restricting the flow of natural water, and decreasing the mobility of the sonde itself. These sensor limitations can significantly increase maintenance costs, reduce overall data quality, and permanently damage instrumentation.

Antifouling technologies fall within a few categories based on the mechanism of protection. These mechanisms include mechanical antifouling control methods (wipers, screens, non-stick coatings, air

blasts, and ultrasonic systems), biocides (anti-microbial coatings and use of toxic metals), and intermittent sterilization (UV exposure or chlorine solutions).

METHODS

In this test, TROLL® Shield Antifouling Systems were examined for viability on the Aqua TROLL® 200 Instrument. The TROLL Shield System is comprised of a specially formulated copper alloy sensor guard and nose cone. Three Aqua TROLL 200 Instruments were deployed in Pass Christian Harbor, Mississippi in August 2008 and programmed to log water level, specific conductivity, and temperature at 15-minute intervals. The area is known to be high in both micro- and macro-fouling—with frequent fouling by microbes and barnacles. Specific conductivity was used as the primary indicator of biofouling in this experiment, as the growth of micro- and macro-fouling on a conductivity cell typically causes reported values to be lower than true values. Visual inspections were also conducted.

Instruments were set up as follows:

- One Aqua TROLL 200 Instrument with TROLL Shield guard and nose cone (see Figure 1)
- One Aqua TROLL Instrument with TROLL Shield guard only (no nose cone)
- One Aqua TROLL Instrument without TROLL Shield System (control)

Instruments were moored to a shallow dock using a PVC frame. The instruments were carefully deployed to ensure consistent environmental exposure. No cleaning was performed on any instrument throughout the duration of the test. To prevent any inadvertent removal of biofouling due to instrument movement, all data was recovered using telemetry.

Accuracy of level data was not evaluated in this report; however the TROLL Shield nose cone did provide visible protection to the instrument's pressure sensor.

Figure 1: Aqua TROLL 200 Instrument with complete TROLL Shield Antifouling System

RESULTS

Figures 2 and 3 show the three instruments run side-by-side over an 81-day period. All three instruments initially fell within the manufacturer's stated specifications, but clearly began to deviate after approximately 42 days of deployment. Over the course of the deployment, the Aqua TROLL® 200 Instrument with complete TROLL® Shield System prevented biofouling of the conductivity sensor and improved readings by more that 50 percent over the control unit.

In addition, the TROLL Shield nose cone prevented barnacle growth on the instrument's pressure sensor. The nose cone also appeared to improve the overall effectiveness of the TROLL Shield System compared to using only the copper guard. The graph below illustrates how the conductivity sensor was able to produce consistent, high-quality data throughout the deployment period when it was protected by the TROLL Shield guard and/or nose cone.

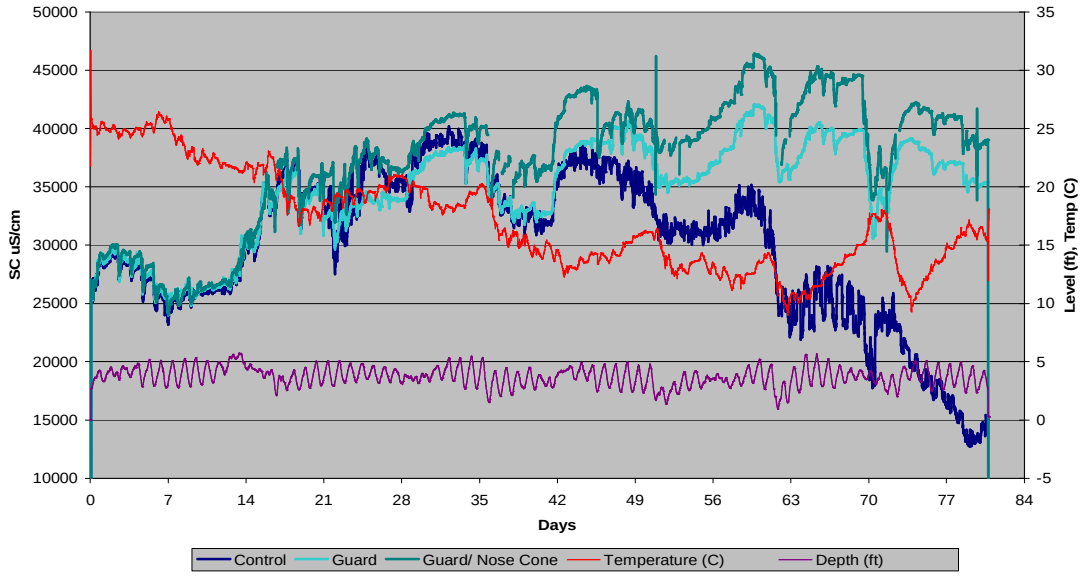

Figure 2: The control, one Aqua TROLL 200 Instrument with TROLL Shield guard, and one Aqua TROLL 200 Instrument with TROLL Shield guard and nose cone were tested side-by-side over an 81-day period.

A B C

Figure 3: Three instruments after 81-day test. ***Photo A***: Aqua TROLL® 200 control. ***Photo B***: Aqua TROLL 200 with TROLL® Shield guard and nose cone still installed. ***Photo C***: Aqua TROLL 200 with TROLL Shield nose cone in place and guard removed to show how effectively the guard protects the conductivity cell from biofouling. The conductivity cell was not cleaned.

CONCLUSIONS

As instrument fouling becomes the limiting factor for long-term deployments, the focus has turned to biofouling prevention. Reduced biofouling can directly lower customer costs by cutting back on field visits and timely maintenance procedures. The In-Situ TROLL Shield technology can increase deployment times, improve monitoring efficiency, and reduce post-corrected data errors.

This experiment clearly illustrates the superiority of data quality when using the TROLL Shield System for long-term deployments. The TROLL Shield Antifouling System provides protection of both conductivity and pressure sensors in one simple solution.

REFERENCES

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