Case Study: Box Coolers and Sea Chest

The Company

The company that is covered in this case study is an innovation leader within the maritime industry. Their mission is to create an industry that is more efficient and sustainable: “creating the maritime future”.

Royal IHC designs and builds a variety of standardized and custom-build vessels. Other core activities consist of the designing and engineering of specialist equipment that is used in mining, dredging, offshore and military industries. Furthermore, Royal IHC provides 24/7 high quality support to help customers maintain their fleet.

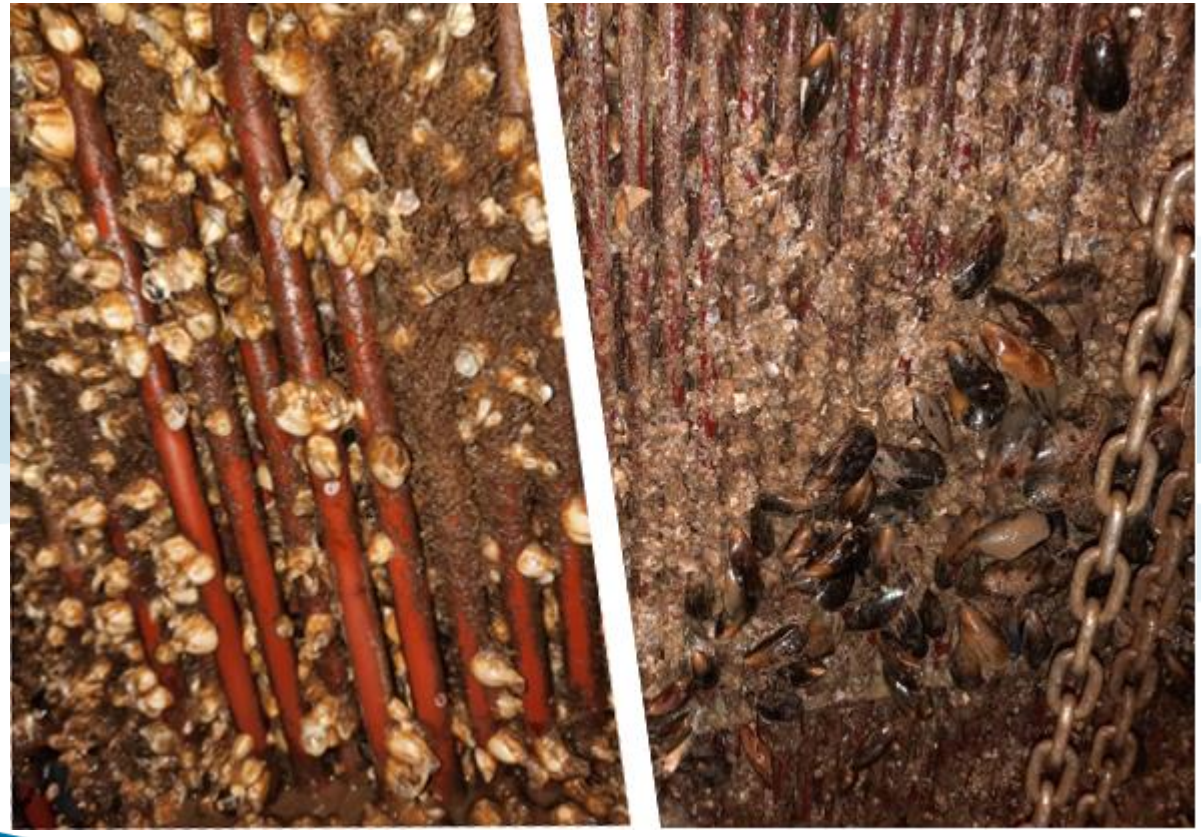
This case study describes the fouling problems Royal IHC faced with their box coolers and why they opted for LSC’s sustainable Ultrasonic Antifouling systems. Additionally it shows the results on this vessel.

The Situation

Royal IHC builds, among other vessels, standardised Trailing Suction Hopper Dredgers (TSHD). One of these lines is called the Easydredge®. The sea water cooling system that is installed on the Easydredge® 2700 uses box coolers to provide cooling for their main equipment. These coolers are at all times in direct contact with raw sea water. In order for this system to be efficient, antifouling paint cannot be applied to the cooler bundles. This would mean the heat transfer from the cooling liquid would be less optimal, as the antifouling paint would act as an insulator. Only a thin anti corrosion coating is applied.

Easydredge 2700

The Problem



Heavy fouling leading to blockages of flow between the cooler pipes. This box cooler is an example and has not been taken from one of the Royal IHC ships.

When there is no adequate antifouling method installed, these bundles are quite vulnerable to the settling of marine organisms. This biofouling, when matured enough, completely clogs up the cooler bundles to a point where flow through the cooling pipes is nearly non-existent.

This results in reduced cooling capacity which could lead to **main equipment overheating and failing**. The fouling can **decrease the life expectancy** of this main equipment significantly.

The Problem

Furthermore, the vessel isn't able to carry out its dredging activities at the maximum capacity due to the cooling problems.

Additionally, these fouling related problems could lead to **unexpected dry dock** & **downtime.** When the box coolers are clogged expensive and time-consuming maintenance is necessary to get rid of the excess fouling.

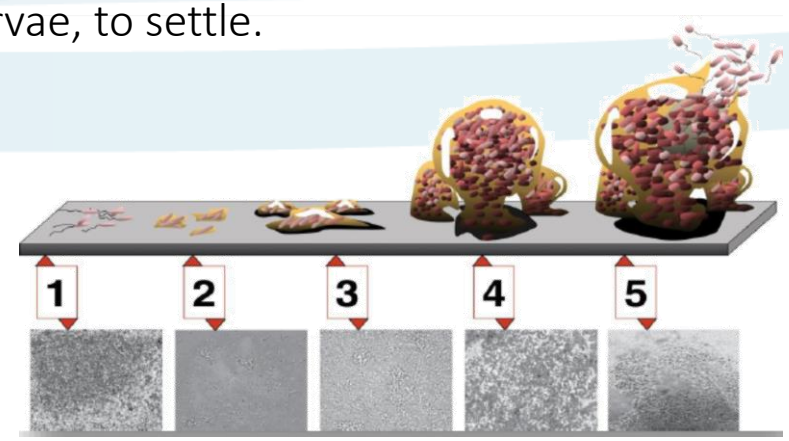
Time-consuming, heavy labour is required to clean the box cooler. This is an example and is not from a Royal IHC ship.

The Solution

The Ultrasonic system produces multiple bursts of ultrasonic energy in a range of targeted pulse frequencies. These pulses are transmitted through the material that the transducer is attached to.

The ultrasound produces a pattern of alternating positive and negative pressure on the surface of the material. Microscopic bubbles are created during the negative cycle and implode during the positive cycle.

This microscopic agitation has a cleansing effect that destroys unicellular organisms, which colonize and form the biofilm layer. Disrupting the formation of the biofilm layer makes it significantly more difficult for larger organisms, such as mussels and barnacle larvae, to settle.



5 phases of biofouling accumulating

The Solution

Sonihull8: the control unit

The SH08 control unit can be connected to both 110-240 VAC and 12-24 VDC. If both are connected the system automatically selects the VAC (shore voltage). When this is lost, the system automatically switches to the VDC. If the battery voltage becomes too low the system switches off automatically to save the battery.
The control unit is programmed in such a way that the transducers run the same program every time. As a result, the transducers produce pulses every few seconds with a range of frequencies between 20 and 60 Kilohertz that are not audible to the human ear. When this program has been completed with 20 different frequencies the program starts again.

The installation as carried out on the TSHD. On the upper right, the control unit is visible, located above some of the box coolers.

The Solution

<u>Sonihull8: the transducers</u>

The transducers consist of a piezo element that is enclosed in a housing produced by means of injection molding. The transducer is then screwed into a mounting object (pipe adaptor or transducer ring) with a coupling agent. The mounting object is installed with a two two-component epoxy.

In this case the pipe adapters and transducer rings are installed on box cooler covers, cooler inlets and the sea chests. The membrane of the transducer is not glued to this surface itself, the ring or pipe adapter is. The transducer uses this ring or PA as a grip so that it can distribute firm taps with its pulses.

This is many times stronger than a transducer that is itself glued to a surface. This results in great sound transmission. The surface is brought into resonance and induces non-inertial cavitation.

Two transducers are visible on the cooler cover. Two Pipe Adaptors can be seen in the picture, one of which has a transducer screwed into. To ensure optimal adhesion of the two component epoxy coating is removed. Following the curing of the epoxy, primer is applied to prevent corrosion around the mounting objects.

The Result

After 2 years of sailing no hard fouling is visible on the box cooler bundle. On the bottom left of the cooler some dead marine growth is attached but can easily be wiped off.

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