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**ANNEX 1 to STATEMENT RINA N.° 15/NA/1239**



Naples, 30/06/2015

Italian Naval Registry  
Naples

**DECLARATION**

We hereby declare that the components used for the test prove the effectiveness of the system

The following are the ANFORA on the Potone ANTELIO:

Control Unit    Model    AF MU 600

Transducer    Model    AF TP 50

Bushing        Model    AF BS 16

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Roberto Longó  
Amministratore Unico



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ANNEX 2 to Statement RINA N.° 15/NA/1239



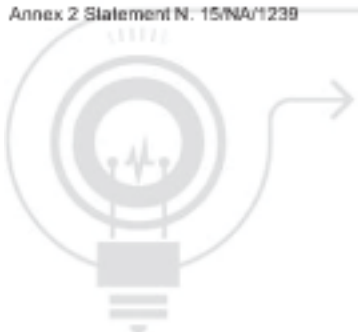
# AN.FO.R.A.

Anti Fouling Repulsion Application



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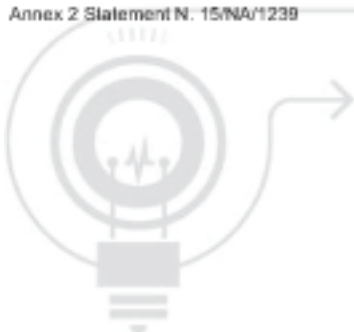
**AN.FO.R.A.**  
Electronic Anti-fouling System  
Description

Napoli, 23/03/2015



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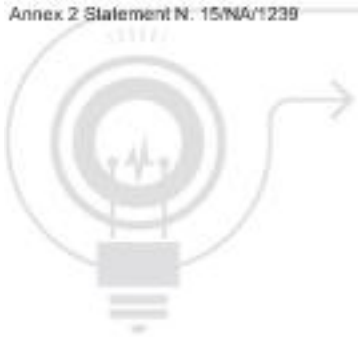
## 01- AN.FO.R.A. System, description

**AN.FO.R.A.** is an electronic system designed and manufactured by Starlight Italia which is able to ensure the cleanliness and constant maintenance of the hydrodynamic performance of chains, hindering the attachment of animal and plant species that normally thrive in abundance on bodies immersed in seawater.

his technology, already used for years in military submarines and for recreational boating, is now used to prevent the excessive accumulation of organic material on the metallic and non-metallic hulls of boats.

This technology is used in a powerful and reliable manner in the AN.FO.R.A. system, shaving been designed, developed and tested exclusively for the professional and deep sea sectors.





## 02 - Functioning Principle



The **AN.FO.R.A.** system is based on the generation of ultrasounds that propagate like elastic waves and radiate uniformly to the entire external area of a boat.

This energy, which spreads over the hull, generates an anti-habitat for micro marine organisms which makes it very difficult for them to attach themselves to surfaces.

Elastic waves are produced and transmitted to the hull by particular high-powered piezoelectric transducers that convert electrical energy generated by a power supply into mechanical energy, switching to the solid state controlled by a microprocessor. The energy density, in other words power per surface unit, is fairly small ( $<5-10$  Watt /  $mt^2$ ) so there is absolutely no risk of mechanical damage to the metal structure (keel, load bearing structures, etc.) it is applied to or disruption to marine creatures. Suffice it to say that the ultrasonic emission of a normal echo sounder is hundreds of times more intense than the emissions generated by the AN.FO.RA system.

The transducers are applied to a hull from the inside and secured to it by means of stainless steel blind threaded sleeves welded to the surface.

The peculiarity of the system is that it is not in direct contact with the sea water, since the welding of the support sleeve is carried out on the inner side and absolutely without drilling the hull.

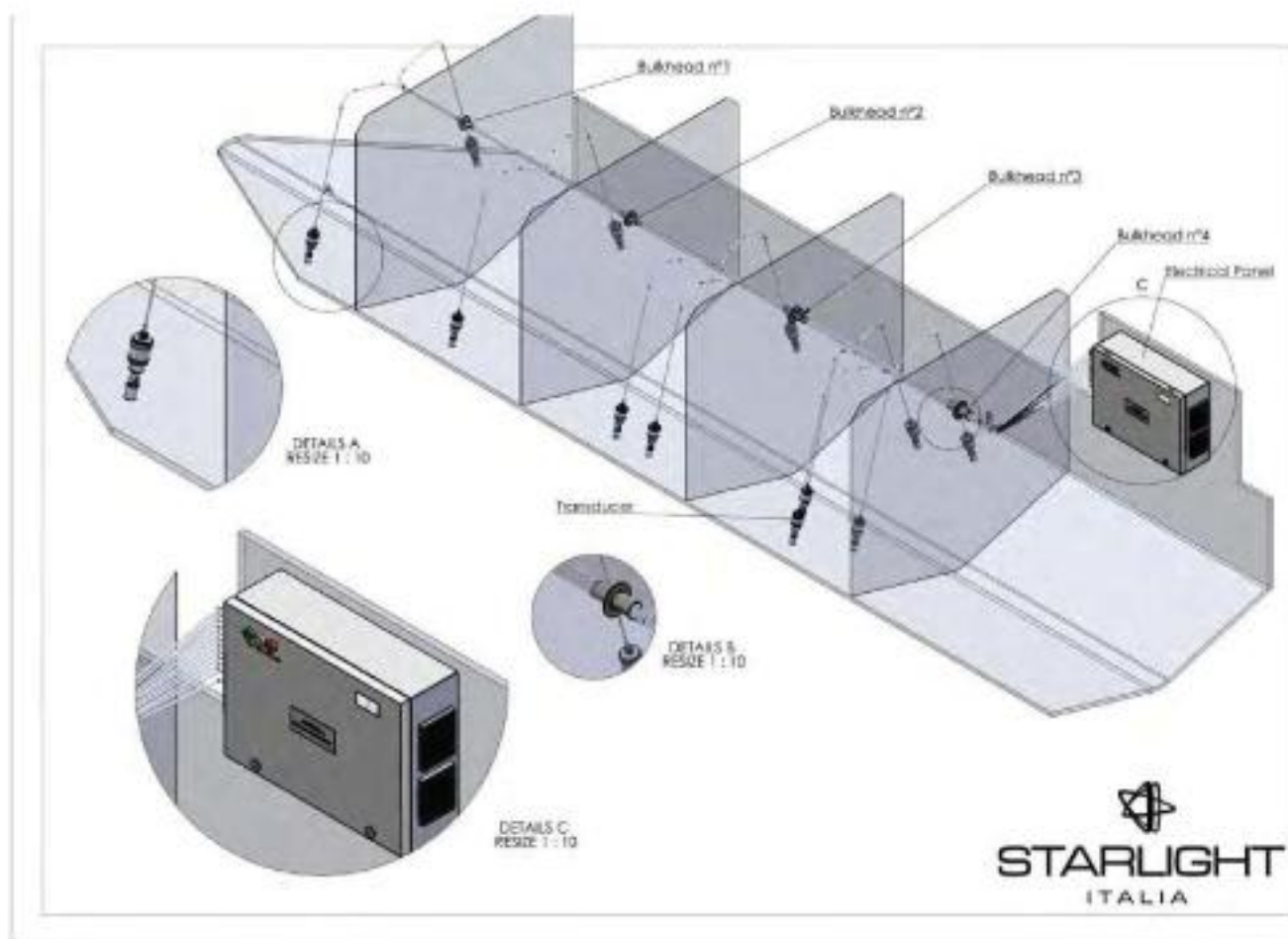
Therefore, the installation may be performed from the inside even when a ship is in use.

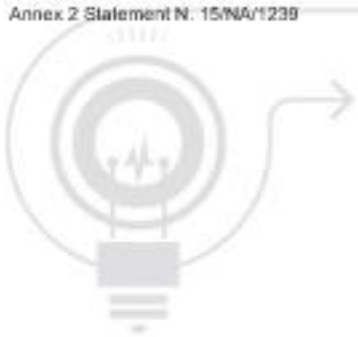
Ultrasonic waves, sent along the surfaces where the transducers are applied, create an anti-habitat for marine flora and fauna, greatly reducing their ability to develop.

## 03 - The System's Components

The system is composed of a network of transducers whose type, number and power depends on the characteristics and the size of the ship that is to be protected, which are connected via cables to an electronic generation unit that supplies them.

In the figure you can see a classic example of the bulbs transducers (sonotrodes) layout inside the hull.





The electronic generation unit is supplied with alternating current at 220 volts, and it has quite contained power consumption which in any case does not exceed the kw limit for each individual system.

The generator is normally placed in an electric cabinet with adequate IP protection, which also contains all the security and self-diagnostics equipment.

It is also equipped with forced ventilation for heat dissipation.



## 04- Experimental Installations - Bilton Motor ship- Capitan Morgan s.r.l.



The beneficial effects of this electronic antifouling system are visible even in the event of non-continuous operation over a period of 24 hours, as shown by experiments already conducted on-board a vessel, where the use of the system was limited only to daily working hours, in any case achieving excellent results.

This is the case of the first installation carried out in 2013 on the Bilton motor ship, where a system was installed with only 4 transducers positioned in the vicinity of the transom in the locker containing the hydraulic steering system. The results were excellent. In fact, after eight months of being held in the dock, on a first dock inspection the motor ship appeared spotless. A double check was also performed, uninstalling the system after one year of operation. The results can be seen in the photo report on the pages below.

**Below are photos of the transducers installed in the hull.**

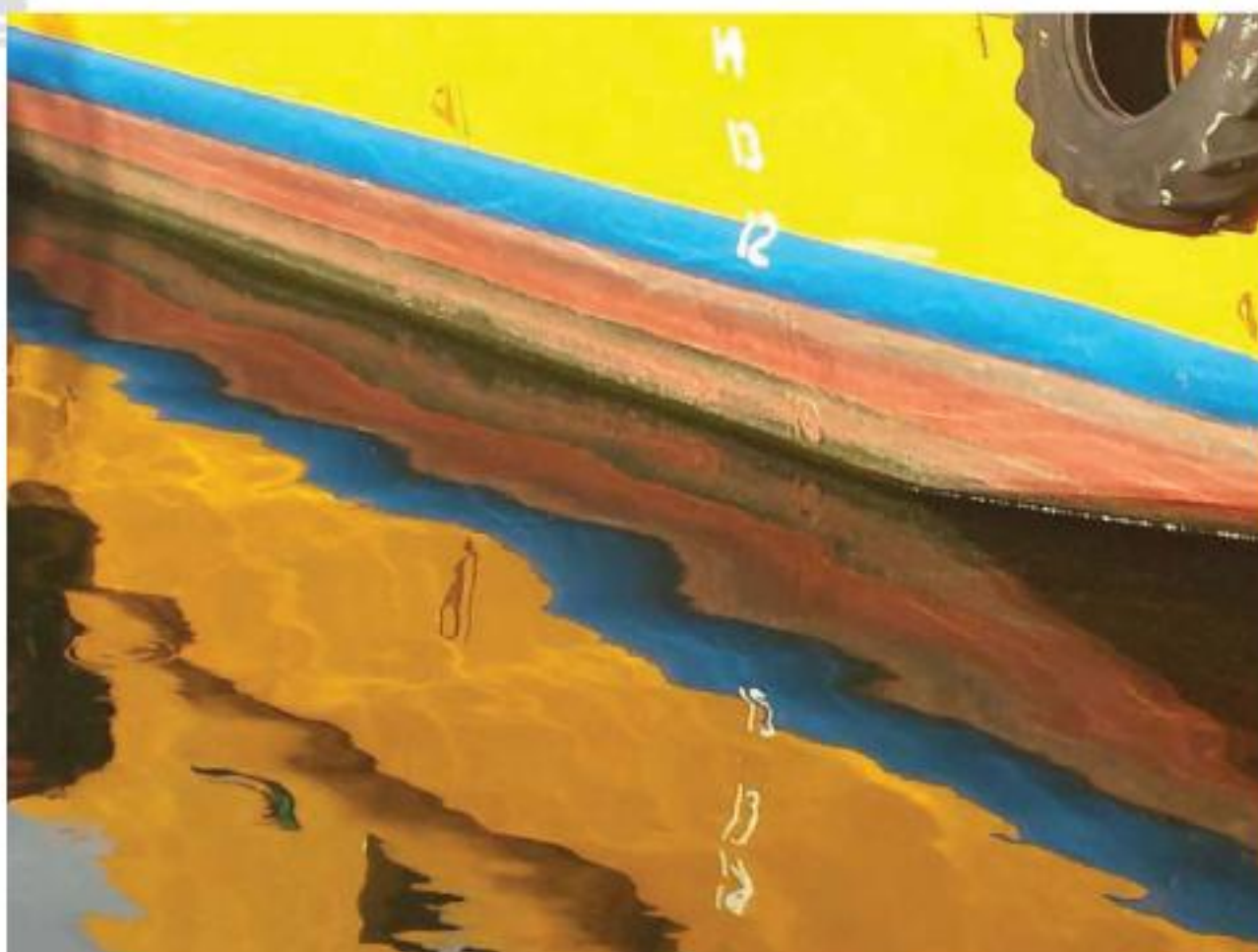






The above photos show the hull's features photographed after seven months of holding the motor ship in the dock for repairs. Note the absence of vegetation along the waterline and on the transom, made visible thanks to a momentary load variation of the vessel.

  
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Same details of the waterline two months after deliberately deactivating and removing the AN.FO.RA system

**The vegetation formed on the waterline can be clearly seen.**

  
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## - Pontone Antelio Comparison System

In order to test the effectiveness of the AN.FO.RA antifouling system by eliminating all possible variables, an experiment aboard the Pontoon Antelio of the Naples Ferry Terminal company was performed with the collaboration of the Italian Naval Register.

The experiment consisted in placing two steel plates of identical thickness, 8 mm, and dimensions of 2.5 m x 1m, at a distance of 20 m from one another, one equipped with the antifouling system and a transducer and the other, used for control purposes, without a transducer.

The photos below show the other side of the pontoon with two winches and both plates suspended underwater.



**Control plate without a transducer**

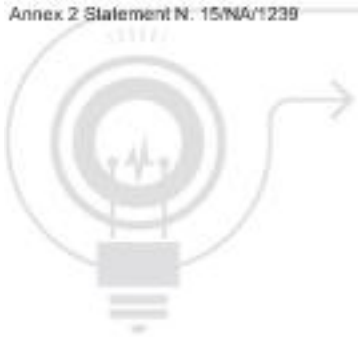


**with a transducer plate**



**Feature of the winch**



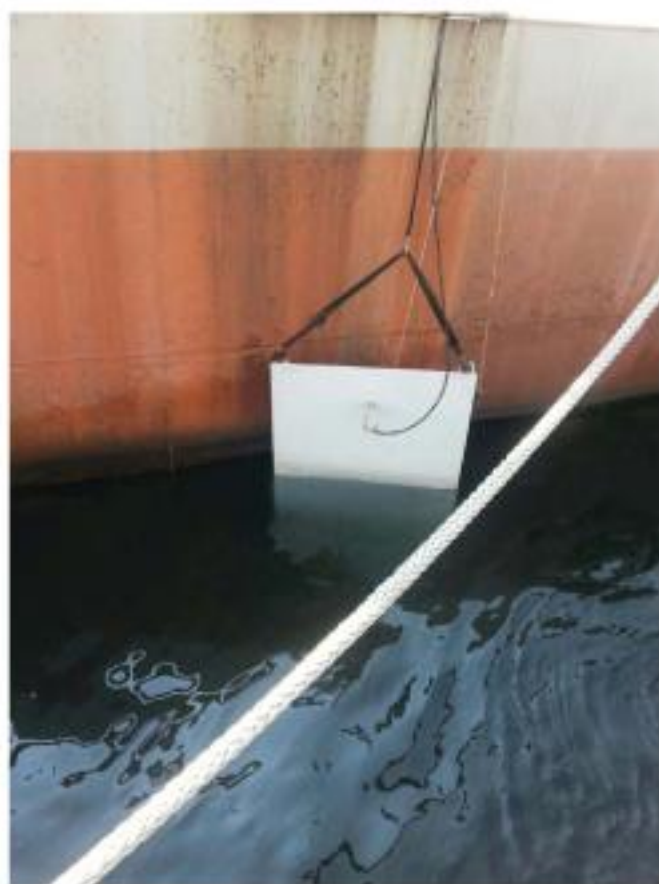


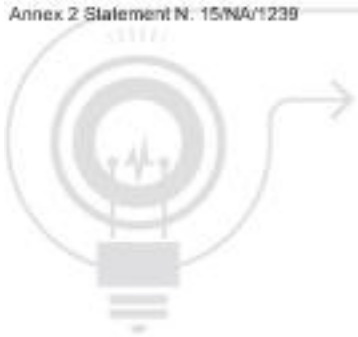
The test began on 9 August 2014 and ended on 9 March 2015.

The two plates were both kept under water for 3/4 of their length by means of two pulleys positioned outboard of the pontoon.

Below you can see a sequence of photos depicting the results of the experiment during the 7 month period.

### 10 August 2014 – Start of the Test



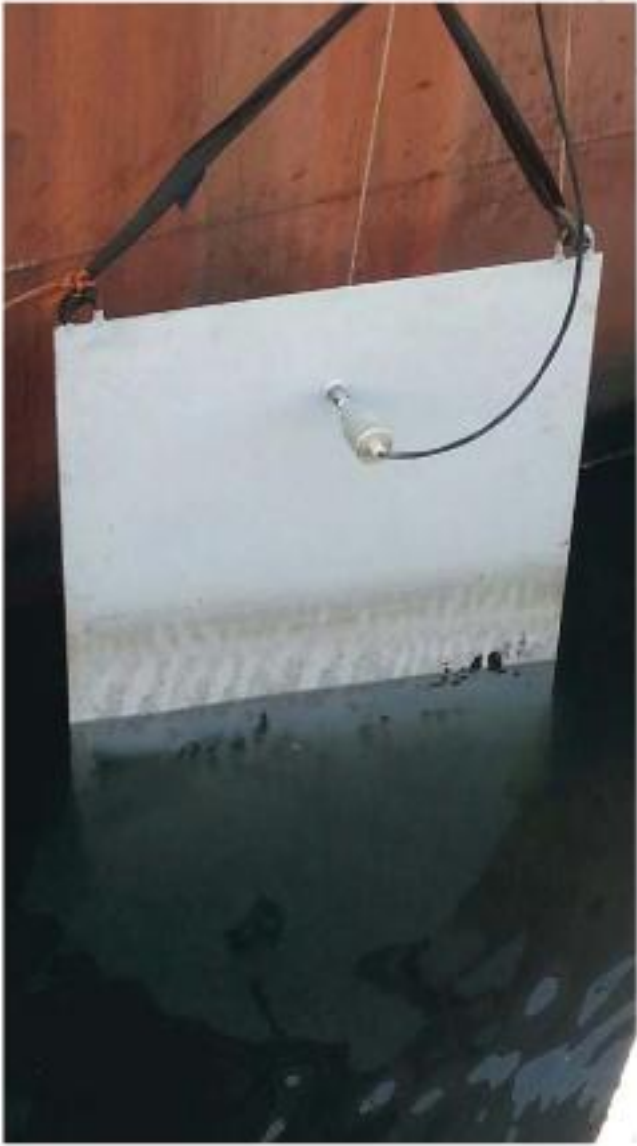
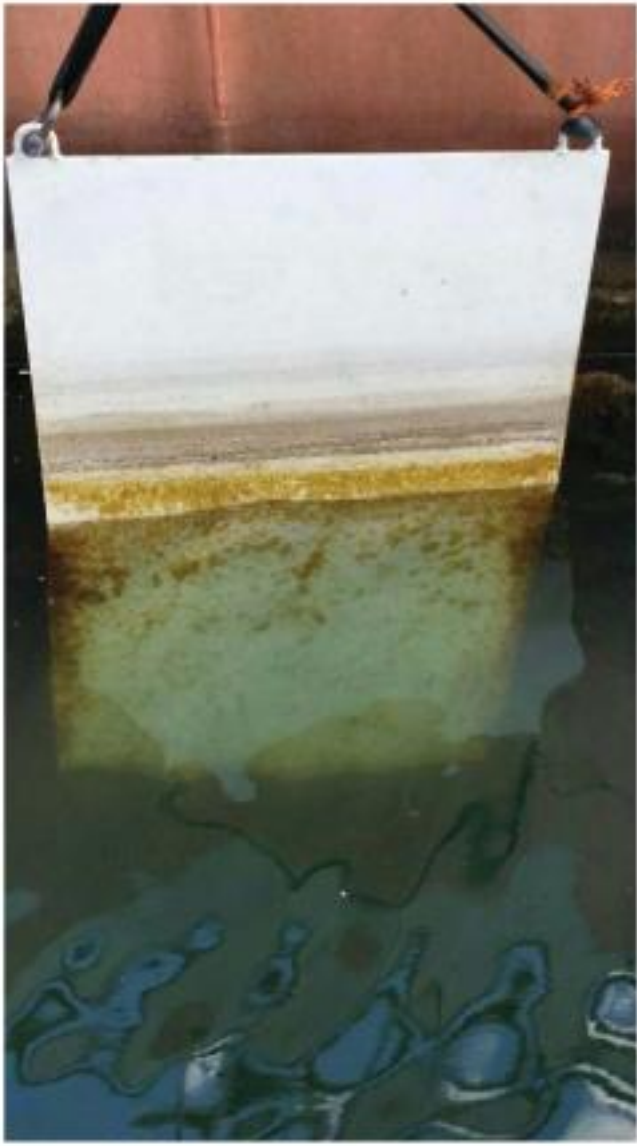


**13 August 2014**



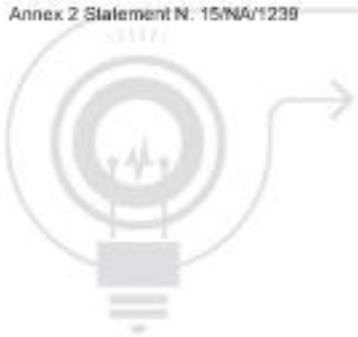


03 September 2014



  
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**07 October 2014**







**03 November 2014**





05 December 2014



  
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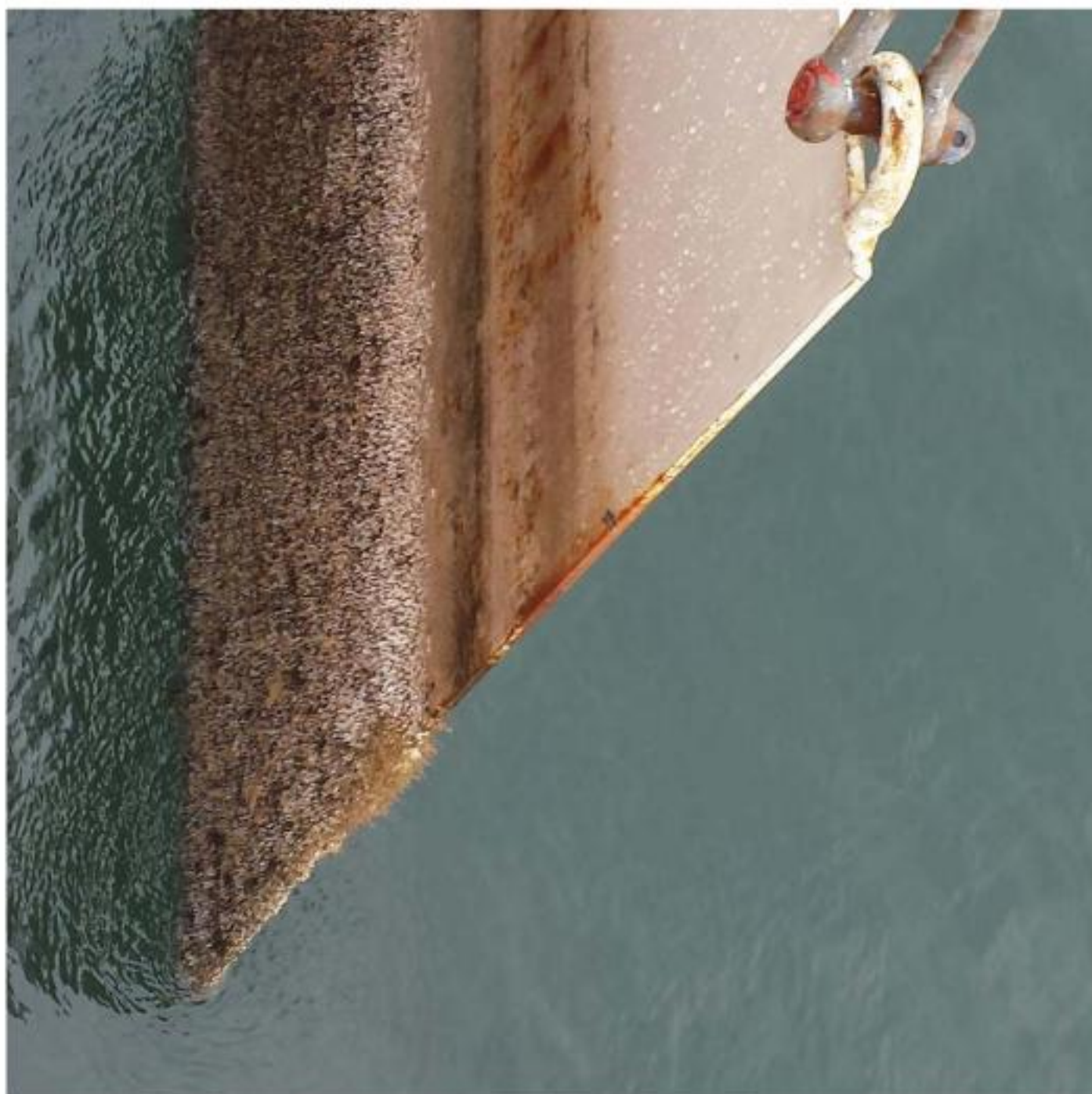




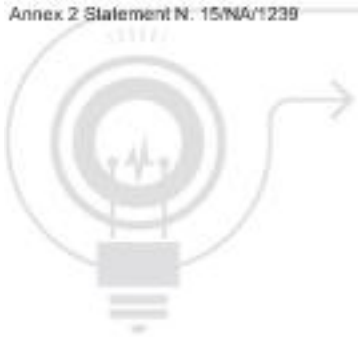
### 09 March 2015 – End of the Test



**09 March 2015 – End of the Test  
(Magnified feature of the control plate without a transducer)**



Note the thickness of the proliferated fouling



**09 March 2015 – End of the Test  
(Magnified feature of the plate with a transducer)**



Note the presence of rust and the almost total absence of fouling



Plates removed and placed side-by-side for comparison





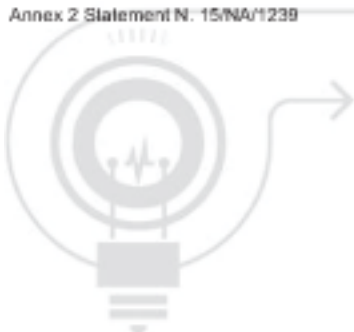


  
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## 05 – Completed Installations

### **1. BILTON MOTOR SHIP (50 m)**

Shipowner: Morgan s.r.l

### **2. BRIDGE MOTOR SHIP (112 m)**

Shipowner: Arab Ship Management

### **3. PARKAPALAN MOTOR SHIP (48 m)**

Shipowner: Dkb Singapore

### **4. CARLO FORTE MOTOR SHIP (55 m)**

Shipowner: SNAP Ponza

### **5. PONTONE "ANTELIO" (permanent installation)**

Shipowner: Naples Ferries Terminal