



NANO FLUID SURFACE TECHNOLOGY (NFST) WHITE PAPER

All solid surfaces, regardless of how smooth they appear to the eye or to the touch, are inherently rough on a microscopic level, creating many anchor points that can pin fluids to the surface and cause them to smear across the surface.

This surface aberration, in the case of marine craft, causes algae, barnacles, mussels and other marine organisms to attach themselves to marine vessels and is commonly referred to as fouling. The extra drag on the hull raises fuel consumption, up to 40% by some estimates, raising fuel costs for all operators that totals billions of dollars annually. This loss due to fouling is further compounded by the damage done to the hulls, and the added cost of maintenance and refurbishment.

While there exist some solutions in the marketplace, most commonly used anti-fouling coatings until now, were based on organo-tin compounds and copper, with 80% of the world's shipping fleets using these modalities which are toxic to marine life. Environmental concerns have motivated many countries to ban these anti-fouling remedies. Considerable research and development is taking place in government agencies and coatings companies to find suitable alternatives.

Silicones have been identified as critical materials.

NFST is a timely and revolutionary foul release coating utilizing the combination of a proprietary hybrid polysiloxane polymer and an innovative Nano **Fluid Surface Technology** (NFST). NFST surfaces feature a stable, immobilized lubricant over-layer. Unlike solid surfaces, this liquid surface is truly smooth and extremely slippery. Fluids and biological fouling agents no longer have the microscopic rough anchor points inherent on solid surfaces, and thus slide right off.

NFST, a unique proprietary technology developed by **Liquiguard's** sister company, **Biro Technologies**, transforms the surface of a solid material into a thin, immobilized lubricant layer. **NFST** is delivered in an encapsulated form via Biro's hybrid epoxy-polysiloxane, an impervious, tough and durable clear coat with strong adhesion to practically all types of materials and surfaces. The release/lubricant oil is configured to have limited compatibility with the coating, forcing it to migrate to the coating's surface. The oil proceeds to completely cover the solid, nano porous surface of the coating and creates a smooth and slippery liquid interface. Whenever this interface is removed or displaced, it is replenished by a fresh layer of lubricant, immediately, automatically and repetitiously.

NFST system applied to a test panel was immersed in sea water for a year in Vietnam by a Netherland based company. At the end of this period the panel was almost completely free of fouling organisms. Surprisingly, a comparison panel with a **PTFE** coating, which also has very low surface energy, was completely fouled. This indicates that a coating with low surface energy is not sufficient for performance as an effective foul release surface.

NFST is a dramatic, and game changing solution for foul release solution.

The ban on polluting anti-fouling coatings for marine applications has opened up an area that is surely a logical fit for **NFST**. This may well be the largest "release" application in the world.