CLAIMS

1. A system for reducing frictional drag on a hull of a marine craft, comprising:

a multi-layer air lubrication system; and

said multi-layer air lubrication system having at least three layers, wherein the at least three layers includes an outermost layer having a constructed superaerophilic inducing surface, a porous layer facilitating an exchange of a gaseous supply to said outermost layer, and a contact layer for bonding said multi-layer air lubrication system to a hull of a marine craft; and

said constructed superaerophilic inducing surface further comprises:

a metallic surface;

said metallic surface having a plurality of superaerophilic inducing microscopic and nanoscopic structures etched within said metallic surface from laser ablation;

each superaerophilic inducing microscopic structure of said plurality of superaerophilic inducing microscopic and nanoscopic structures defines a trench and a ridge geometry, wherein each ridge structure defines a protruding structure;

each superaerophilic inducing nanoscopic structure of said plurality of superaerophilic inducing microscopic and nanoscopic structures defines a trench and a ridge geometry covering all surface area of said protruding structures of each of said superaerophilic inducing microscopic structure, wherein surfaces of adjacent ridges of the microscopic structures, extending between an intermediate trench to a respective ridge top, progressively diverge away to define a V-shaped geometry; and

said metallic surface having a plurality of apertures in at least an innermost point in said trench and ridge geometry of said superaerophilic inducing microscopic structure, wherein each aperture in said plurality of apertures is configured to pass supplied air from

an interior side of said metallic structure to a wet side of said metallic structure, thereby creating an air plastron when engaged.

2. The system for reducing frictional drag on a hull of a marine craft, as recited in Claim 1, wherein said metallic surface comprises copper and used for antifouling capabilities to thereby suppressing fouling buildup.

3. The system for reducing frictional drag on a hull of a marine craft, as recited in Claim 1, further comprising:

at least one gaseous injection point in said porous layer for receiving a gaseous supply;

an air distribution and replenishment system providing said gaseous supply to said porous layer; and

said air distribution and replenishment system comprising a compressor for supplying gas at a pressure marginally above the pressure exerted from water on the air plastron to ensure continued facilitation of air disbursement.

4. The system for reducing frictional drag on a hull of a marine craft, as recited in Claim 3, wherein said gaseous supply consists of filtered carbonous gases, including at least carbon dioxide, carbon monoxide, and methane, to enhance aerophilic and hydrophobic properties of the superaerophilic surface.

5. The system for reducing frictional drag on a hull of a marine craft, as recited in Claim 4, wherein said gaseous supply is obtained from at least one of external

atmosphere, engine exhaust, black water tank fumes, bioreactor exhaust, and galley hood fumes, whereby said gaseous supply is routed through a turbocharger to a compressor input in said compressor, whereby the compressor supplies the air distribution and replenishment system.

6. The system for reducing frictional drag on a hull of a marine craft, as recited in Claim 5, further comprising a carbon filter.

7. The system for reducing frictional drag on a hull of a marine craft, as recited in Claim 6, wherein said carbon filter has at least an outer casing, a lid, an intake pipe, and an interchangeable carbon-sensitive membrane configured to allow carbon molecules to pass through said interchangeable carbon-sensitive membrane, whereby remaining gas molecules that are not able to pass through said interchangeable carbon-sensitive membrane collect and filter out through a top and around the sides to a bottom where the molecules can exit through a carbon-reduced outlet.

8. The system for reducing frictional drag on a hull of a marine craft, as recited in Claim 3, wherein said at least one gaseous injection point in said porous layer for receiving a gaseous supply further includes several smaller injection tubes to provide even disbursement throughout said porous layer.

9. The system for reducing frictional drag on a hull of a marine craft, as recited in Claim 3, further comprising:

a valve within the air distribution and replenishment system to prevent loss of pressure if air replenishment system fails.

10. The system for reducing frictional drag on a hull of a marine craft, as recited in Claim 1, wherein said contact layer is a solid material affixed to the hull of a marine craft with glue or adhesive backing.

11. The system for reducing frictional drag on a hull of a marine craft, as recited in Claim 1, wherein said contact layer includes a pressure sensitive adhesive applied.

12. A superaerophilic inducing surface for use in reducing hydrodynamic drag on a hull of a marine craft, comprising:

a metallic surface;

said metallic surface having a plurality of superaerophilic inducing microscopic and nanoscopic structures etched within said metallic surface from laser ablation;

each superaerophilic inducing microscopic structure of said plurality of superaerophilic inducing microscopic and nanoscopic structures defines a trench and a ridge geometry, wherein each ridge structure defines a protruding structure;

each superaerophilic inducing nanoscopic structure of said plurality of superaerophilic inducing microscopic and nanoscopic structures defines a trench and a ridge geometry in a sidewall of each of said superaerophilic inducing microscopic structure covering all surface area of said protruding structure, wherein surfaces of

adjacent ridges of the microscopic structures, extending between an intermediate trench to a respective ridge top, progressively diverge away to define a V-shaped geometry; and

said metallic surface having a plurality of apertures in at least an innermost point in said trench and ridge geometry of said superaerophilic inducing microscopic structure, wherein each aperture in said plurality of apertures is configured to pass supplied air from an interior side of said metallic structure to a wet side of said metallic structure, thereby creating an air plastron when engaged.

13. The superaerophilic inducing surface for use in reducing hydrodynamic drag on a hull of a marine craft, as recited in Claim 12, further comprising a porous layer configured to withstand the pressure exerted by the air plastron and water surrounding it, while maintaining its shape to allow a free flow of gasses to said plurality of apertures.

14. The superaerophilic inducing surface for use in reducing hydrodynamic drag on a hull of a marine craft, as recited in Claim 12, wherein said metallic surface comprises copper and used for antifouling capabilities to thereby suppressing fouling buildup.

15. A method of reducing frictional drag on a marine craft hull, thereby increasing its efficiency, comprising the steps of:

configuring a marine craft hull for reduced frictional drag by providing a superaerophilic inducing surface, wherein said superaerophilic inducing surface comprises a metallic surface having a plurality of superaerophilic inducing microscopic and nanoscopic structures etched within said metallic surface from laser ablation, wherein each superaerophilic inducing microscopic structure of said plurality of superaerophilic

inducing microscopic and nanoscopic structures defines a trench and a ridge geometry, wherein each ridge structure defines a protruding structure, wherein surfaces of adjacent ridges of the microscopic structures, extending between an intermediate trench to a respective ridge top, progressively diverge away to define a V-shaped geometry, and each superaerophilic inducing nanoscopic structure of said plurality of superaerophilic inducing microscopic and nanoscopic structures defines a trench and a ridge geometry in a sidewall of each of said superaerophilic inducing microscopic structure, wherein said nanoscopic structures cover all surface area of the protruding structure, and said metallic surface includes a plurality of apertures in at least an innermost point in said trench and ridge geometry of said superaerophilic inducing microscopic structure, wherein each aperture in said plurality of apertures is configured to pass supplied air from an interior side of said metallic structure to a wet side of said metallic structure, thereby creating an air plastron when engaged.

16. The method of reducing frictional drag on a marine craft hull, thereby increasing its efficiency, as recited in Claim 15, wherein the superaerophilic inducing surface in the step of configuring a marine craft hull for reduced frictional drag by providing a superaerophilic inducing surface, is applied by:

bonding at least three layers together, wherein said at least three layers comprise said outermost superaerophilic inducing surface layer, a middle porous layer, and an inner contact layer, thereby forming a functional surface assembly;

using laser ablation on the outermost superaerophilic inducing surface layer to create the superaerophilic surface, whereby superaerophilic properties are obtained by creating said microscopic and nanoscopic surface structures comprising grooves etched

into said surface, wherein said nanoscopic surface structures are constructed on all sidewall surfaces of said microscopic surfaces;

creating laser-induced period surface structures thereby adding a second layer of structure on the nanoscopic scale;

creating said plurality of apertures by perforating microscopic holes through the outermost superaerophilic inducing surface layer at regular intervals within a trough created by said trench and ridge geometry of the microscopic-scaled grooves using said laser; and

configuring at least one gaseous injection point in said middle porous layer for receiving a gaseous supply.

17. The method of reducing frictional drag on a marine craft hull, thereby increasing its efficiency, as recited in Claim 16, further comprising the step of:

applying the superaerophilic surface to said marine craft hull by engaging an adhesive affixed to said contact layer against said marine craft hull.

18. The method of reducing frictional drag on a marine craft hull, thereby increasing its efficiency, as recited in Claim 15, further comprising the step of:

providing an air distribution and replenishment system comprising a compressor for supplying gas at a pressure marginally above the pressure exerted from water on the air plastron to ensure continued facilitation of air disbursement and a system of pipes that connect a gas supply source to said compressor.

19. The method of reducing frictional drag on a marine craft hull, thereby increasing its efficiency, as recited in Claim 18, further comprising the step of:

providing a continuous gaseous supply to said at least one gaseous injection point in said middle porous layer from said air distribution and replenishment system.

20. The method of reducing frictional drag on a marine craft hull, thereby increasing its efficiency, as recited in Claim 19, further comprising the step of:

using carbonous gasses to accelerate a conversion of the laser ablated superaerophilic inducing surface, to a laser ablated superaerophilic inducing surface having enhanced aerophilic and hydrophobic properties.

21. The method of reducing frictional drag on a marine craft hull, thereby increasing its efficiency, as recited in Claim 20, further comprising the step of:

configuring said air distribution and replenishment system to receive a gaseous supply of carbon from at least one of an external atmosphere, engine exhaust, black water tank fumes, bioreactor exhaust, and galley hood fumes, whereby said gaseous supply is rerouted from said at least one of external atmosphere, engine exhaust, black water tank fumes, bioreactor exhaust, and galley hood fumes through a turbocharger to a compressor input in said compressor, whereby the compressor supplies the air distribution and replenishment system.

22. The method of reducing frictional drag on a marine craft hull, thereby increasing its efficiency, as recited in Claim 21, further comprising the step of

providing a carbon filter with at least an outer casing, a lid, an intake pipe, and an interchangeable carbon-sensitive membrane configured to allow carbon molecules to pass through said interchangeable carbon-sensitive membrane, whereby remaining gas molecules that are not able to pass through said interchangeable carbon-sensitive membrane collect and filter out through a top and around the sides to a bottom where the molecules can exit through a carbon-reduced outlet.

23. The method of reducing frictional drag on a marine craft hull, thereby increasing its efficiency, as recited in Claim 15, further comprising:

configuring said metallic surface for antifouling characteristics by selecting copper as a material of said metallic surface, thereby reducing fouling buildup and keeping said apertures clear for a gaseous replenishment and distribution.

24. A system for reducing frictional drag on a hull of a marine craft, comprising:

a multi-layer air lubrication system; and

said multi-layer air lubrication system having at least three layers, wherein the at least three layers includes an outermost layer having a constructed superaerophilic inducing surface, a porous layer facilitating an exchange of a gaseous supply to said outermost layer, and a contact layer for bonding said multi-layer air lubrication system to a hull of a marine craft;

at least one gaseous injection point in said porous layer for receiving a gaseous supply;

an air distribution and replenishment system providing said gaseous supply to said porous layer;

said air distribution and replenishment system comprising a compressor for supplying gas at a pressure marginally above the pressure exerted from water on the air plastron to ensure continued facilitation of air disbursement;

wherein said gaseous supply consists of filtered carbonous gases, including at least carbon dioxide, carbon monoxide, and methane, to enhance aerophilic and hydrophobic properties of the superaerophilic surface; and

wherein said gaseous supply is obtained from at least one of external atmosphere, engine exhaust, black water tank fumes, bioreactor exhaust, and galley hood fumes, whereby said gaseous supply is routed through a turbocharger to a compressor input in said compressor, whereby the compressor supplies the air distribution and replenishment system.

25. The system for reducing frictional drag on a hull of a marine craft, recited in claim 24, further comprising a carbon filter.

26. The system for reducing frictional drag on a hull of a marine craft, recited in claim 25, wherein said carbon filter has at least an outer casing, a lid, an intake pipe, and an interchangeable carbon-sensitive membrane configured to allow carbon molecules to pass through said interchangeable carbon-sensitive membrane, whereby remaining gas molecules that are not able to pass through said interchangeable carbon-sensitive membrane collect and filter out through a top and around the sides to a bottom where the molecules can exit through a carbon-reduced outlet.

27. A method of reducing frictional drag on a marine craft hull, thereby increasing its efficiency, comprising the steps of:

configuring a marine craft hull for reduced frictional drag by providing a superaerophilic inducing surface, wherein said superaerophilic inducing surface comprises a metallic surface having a plurality of superaerophilic inducing microscopic and nanoscopic structures etched within said metallic surface from laser ablation, wherein each superaerophilic inducing microscopic structure of said plurality of superaerophilic inducing microscopic and nanoscopic structures defines a trench and a ridge geometry, wherein each ridge structure defines a protruding structure and each superaerophilic inducing nanoscopic structure of said plurality of superaerophilic inducing microscopic and nanoscopic structures defines a trench and a ridge geometry in a sidewall of each of said superaerophilic inducing microscopic structure, wherein said nanoscopic structures cover all surface area of the protruding structure, and said metallic surface includes a plurality of apertures in at least an innermost point in said trench and ridge geometry of said superaerophilic inducing microscopic structure, wherein each aperture in said plurality of apertures is configured to pass supplied air from an interior side of said metallic structure to a wet side of said metallic structure, thereby creating an air plastron when engaged;

providing an air distribution and replenishment system comprising a compressor for supplying gas at a pressure marginally above the pressure exerted from water on the air plastron to ensure continued facilitation of air disbursement and a system of pipes that connect a gas supply source to said compressor;

providing a continuous gaseous supply to said at least one gaseous injection point in said middle porous layer from said air distribution and replenishment system;

using carbonous gasses to accelerate a conversion of the laser ablated superaerophilic inducing surface, to a laser ablated superaerophilic inducing surface having enhanced aerophilic and hydrophobic properties;

configuring said air distribution and replenishment system to receive a gaseous supply of carbon from at least one of an external atmosphere, engine exhaust, black water tank fumes, bioreactor exhaust, and galley hood fumes, whereby said gaseous supply is rerouted from said at least one of external atmosphere, engine exhaust, black water tank fumes, bioreactor exhaust, and galley hood fumes through a turbocharger to a compressor input in said compressor, whereby the compressor supplies the air distribution and replenishment system; and

providing a carbon filter with at least an outer casing, a lid, an intake pipe, and an interchangeable carbon-sensitive membrane configured to allow carbon molecules to pass through said interchangeable carbon-sensitive membrane, whereby remaining gas molecules that are not able to pass through said interchangeable carbon-sensitive membrane collect and filter out through a top and around the sides to a bottom where the molecules can exit through a carbon-reduced outlet.