CLAIMS

1. An air lubrication system nozzle assembly, comprising:

a sea chest having an open cavity therein, wherein said sea chest includes a gas flow inlet, and an open lower boundary configured to receive a flow modulating nozzle flap;

a flow modulating nozzle flap, wherein said flap is configured to modulate a direction and flow rate of a gaseous flow;

said sea chest having at least one longitudinal engagement area, whereby said longitudinal engagement area is a rigidly fixed semi-circumferential bracket for mounting said flow modulating nozzle flap, wherein said rigidly fixed semi-circumferential bracket is affixed semi-circumferentially at a border of said open lower boundary;

said flow modulating nozzle flap is coupled to said at least one longitudinal engagement area; and

wherein said air lubrication system nozzle assembly is operable in a submerged environment.

2. The air lubrication system nozzle assembly, as recited in Claim 1, wherein said rigidly fixed semi-circumferential bracket forms an upper containment limit for said flow modulating nozzle flap.

3. The air lubrication system nozzle assembly, as recited in Claim 1, wherein said flow modulating nozzle flap is coupled to said sea chest at said at least one longitudinal engagement area, wherein said at least one longitudinal engagement area is positioned at a forward area to direct flow of water under the flow modulating nozzle

flap, and provide a surface for hydrodynamic forces to press against to close said flow modulating nozzle flap when no air is being dispensed from the opening of the nozzle assembly.

4. The air lubrication system nozzle assembly, as recited in Claim 1, wherein said flow modulating nozzle flap is removably coupled to said sea chest by a pivot hinge.

5. The air lubrication system nozzle assembly, as recited in Claim 1, wherein said flow modulating nozzle flap is coupled to said sea chest by affixing a mounting area on an upper surface of said flap to said at least one longitudinal engagement area.

6. The air lubrication system nozzle assembly, as recited in Claim 1, wherein said flow modulating nozzle flap is configured to incorporate self-closing means, whereby when not opened by the downward pressure of escaping gas, said flow modulating nozzle flap is assisted to return to a closed state.

7. The air lubrication system nozzle assembly, as recited in Claim 6, wherein said self-closing means of said flow modulating nozzle flap includes a reed valve closure, with a mounting area coupled to said rigidly fixed semi-circumferential bracket.

8. The air lubrication system nozzle assembly, as recited in Claim 6, wherein said self-closing means of said flow modulating nozzle flap is a counterweight affixed to an upper surface of said flow modulating nozzle flap, configured to pull said flow modulating nozzle flap closed when tipping under its own weight, wherein said flow

modulating nozzle flap includes a mounting area coupled to said fixed semi-circumferential bracket.

9. The air lubrication system nozzle assembly, as recited in Claim 6, wherein said self-closing means of said flow modulating nozzle flap includes a spring-assisted closure.

10. An air lubrication system nozzle assembly, comprising:

a main body having an open cavity therein, wherein said main body includes a gas flow inlet, and an open lower boundary configured to receive a flow modulating nozzle flap;

a flow modulating nozzle flap, wherein said flap is configured to modulate a direction and flow rate of a gaseous flow;

said main body having at least one longitudinal engagement area, wherein said at least one longitudinal engagement area is a rigidly fixed semi-circumferential bracket for mounting said flow modulating nozzle flap, wherein said rigidly fixed semi-circumferential bracket is affixed semi-circumferentially at a border of said open lower boundary;

said flow modulating nozzle flap is coupled to said at least one longitudinal engagement area;

wherein said air lubrication system nozzle assembly is operable in a submerged environment; and

a diffuser panel at said open lower boundary, positioned above said flow modulating nozzle flap and configured to a geometric shape of an outline of said open lower boundary, whereby said diffuser panel contains a plurality of through-holes to

allow air to pass through, while influencing the size of air particles passing through, thereby providing for smaller bubbles.

11. The air lubrication system nozzle assembly, as recited in Claim 10, wherein said diffuser panel comprises a mesh material.

12. An air lubrication system, comprising:

a superaerophilic inducing surface mounted at an underside of a hull of a marine craft for use in reducing hydrodynamic drag on said hull of said marine craft, comprising:

a functional surface; and

said functional surface having a plurality of superaerophilic inducing microscopic and nanoscopic structures constructed within said functional surface from imprinting the surface;

a nozzle assembly recessed into said hull of said marine craft and configured to disburse a gaseous supply over said superaerophilic inducing surface, wherein said nozzle assembly includes:

a main body having an open cavity therein, wherein said main body includes a gas flow inlet, and an open lower boundary, configured to receive a flow modulating nozzle flap;

a flow modulating nozzle flap, wherein said flap is configured to modulate a direction and flow rate of a gaseous flow;

said main body having a semi-circumferential flap mounting bracket affixed semi-circumferentially at a border of said open lower boundary, wherein said mounting bracket provides at least one longitudinal engagement area,

whereby said flow modulating nozzle flap is hinged to said at least one longitudinal area; and

said semi-circumferential flap mounting bracket forming an upper containment limit for said flow modulating nozzle flap; and

an engaged air layer created from said gaseous supply directed through said nozzle assembly when pressurized.

13. The air lubrication system, as recited in Claim 12, wherein each superaerophilic inducing microscopic structure of said plurality of superaerophilic inducing microscopic and nanoscopic structures of said functional surface defines a trench and a ridge geometry.

14. The air lubrication system, as recited in Claim 12, wherein 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.

15. The air lubrication system, as recited in Claim 12, wherein the functional surface is imprinted into a metallic material.

16. The air lubrication system, as recited in Claim 12, wherein the functional surface is imprinted into a polymer material.

17. The air lubrication system, as recited in Claim 12, wherein the functional surface is imprinted onto a coating on a material.

18. The air lubrication system, as recited in Claim 12, wherein said imprinting of said nanoscopic and microscopic structures of the functional surface is constructed by using laser ablation, drilling, punching, pressing, or a combination thereof into a subject material of the functional surface.

19. A method for providing air to an underside of a marine craft's submerged hull, comprising:

configuring portions of the ship's hull for air delivery to said ship's hull's lower surface by providing at least one flush-installed linear nozzle, wherein each of said at least one flush-installed linear nozzle is an air lubrication nozzle assembly;

providing said an air lubrication nozzle assembly, wherein said air lubrication nozzle assembly is capable of being immersed continuously in a liquid, wherein said air lubrication system nozzle assembly includes:

a main body having an open cavity therein, wherein said main body includes a gas flow inlet, and an open lower boundary configured to receive a flow modulating nozzle flap, wherein said open lower boundary is flush with a transverse horizontal plane of a submerged hull of a ship surrounding said open lower boundary;

a flow modulating nozzle flap movably coupled to the open lower boundary of the main body, wherein said flap is configured to modulate a direction and flow rate of a gaseous flow;

said main body having at least one longitudinal engagement area, whereby said flow modulating nozzle flap is coupled to said longitudinal engagement area;

wherein said air lubrication system nozzle assembly is operable in a submerged environment; and

wherein the main body of each nozzle in said at least one flush-installed linear nozzle is recessed up into the ship's hull.

20. The method for providing air to an underside of a marine craft's submerged hull, as recited in Claim 19, wherein said air lubrication system nozzle assembly in said step of providing said air lubrication nozzle assembly capable of being immersed continuously in a liquid, further includes a semi-circumferential bracket for mounting said flow modulating nozzle flap, forming an upper containment limit for said flow modulating nozzle flap.

21. The method for providing air to an underside of a marine craft's submerged hull, as recited in Claim 19, further comprising:

configuring portions of said ship's hull with a constructed superaerophilic surface.

22. The method for providing air to an underside of a marine craft's submerged hull as recited in Claim 19, wherein the air lubrication nozzle assembly is capable of performing the steps of:

lowering said flow modulating nozzle flap by using a flow of gas received from said gas flow inlet to lower said flow modulating nozzle flap, wherein a flow of gas disburses uniformly in the open cavity of the main body, thereby pressing on said flow modulating nozzle flap to allow air bubbles to disburse to an underside of a marine craft's hull, when air is required under said marine craft's hull; and

raising said flow modulating nozzle flap by terminating a flow of gas received from said gas flow inlet, whereby a passive lifting system is incorporated into the flow modulating nozzle flap to allow for self-closure when said air is no longer required under said marine craft's hull.

23. The method for providing air to an underside of a marine craft's submerged hull as recited in Claim 22, further comprising:

configuring said passive lifting system incorporated into the flow modulating nozzle flap to allow for self-closure when said air is no longer required under said marine craft's hull by incorporating a reed valve closure, with a mounting area coupled to a fixed semi-circumferential bracket.

24. The method for providing air to an underside of a marine craft's submerged hull as recited in Claim 22, further comprising:

configuring said passive lifting system incorporated into the flow modulating nozzle flap to allow for self-closure when said air is no longer required under said marine craft's hull by incorporating a counterweight affixed to an upper surface of said flow modulating nozzle flap, thereby configuring said counterweight to pull said flow modulating nozzle flap closed when tipping under its own weight, wherein said flow modulating nozzle flap includes a mounting area coupled to a fixed semi-circumferential bracket.

25. The method for providing air to an underside of a marine craft's submerged hull as recited in Claim 22, further comprising:

configuring said passive lifting system incorporated into the flow modulating nozzle flap to allow for self-closure when said air is no longer required under said marine craft's hull by incorporating a spring-assisted closure.

26. The method for providing air to an underside of a marine craft's submerged hull as recited in Claim 19, further comprising:

providing a diffuser panel;

configuring said diffuser panel to a geometric shape of an outline of said open lower boundary to provide smaller bubbles to an underside of a marine craft, whereby said diffuser panel contains a plurality of through-holes to allow air to pass through, while influencing the size of air particles passing through; and

positioning said diffuser panel above said flow modulating nozzle flap at said open lower boundary.