CLAIMS

1. A displacement vessel (1) with an air lubrication system, comprising:
- a hull (11) where the design draught (D) of the hull increases from the bow (12) to the stern (13) of the hull (11) such that the bottom surface (15) of the vessel is non-horizontal,
- first air outlets (31) arranged in the bottom surface (15) of the hull (11),
wherein the first air outlets (31) are in fluid communication with one or more compressors (41) and are configured to release air bubbles on the bottom surface (15) of the hull (11),
wherein the vessel further comprises:
- at least two bubble guiding surfaces (21), arranged symmetrically on opposing sides of a centre line (C) of the hull on the bottom surface (15) of the hull (11) and extending along a portion of the length of the hull (11),
wherein the bubble guiding surfaces (21) are protruding away from the bottom surface (15) of the hull (11),
wherein the bubble guiding surfaces (21) and the first air outlets (31) define an air bubble distribution region (A1) on the bottom surface (15) of the hull (11).

2. The vessel (1) according to claim 1, wherein the bottom surface (15) of the hull (11) is inclined at a bottom angle (α) from a horizontal plane, wherein the bottom angle (α) is between 0.2 and 5 degrees, preferably between 0.5 and 1 degrees.

3. The vessel (1) according to claim 1, wherein the ship hull has a single propeller (P) and a single skeg (Sk).

4. The vessel (1) according to claim 1, wherein the ship hull has twin propellers (P) and twin skegs (Sk).

5. The vessel (1) according to claim 1, wherein the depth of the bubble guiding surfaces (21) is not constant along the length of the hull (11).

6. The vessel (1) according to anyone of claims 1 to 5, wherein the lower edge of the bubble guiding surfaces (21) at any point along the length of the hull (11) extends below the bottom surface (15) of the hull (11).

7. The vessel (1) according to claim 4, wherein at least portions of the bubble guiding surfaces (21) are aligned with the skegs (Sk) to guide the air from the bottom surface (15) of the hull (11) to the space between the skegs (Sk).

8. The vessel (1) according to claim 1, wherein one or more air outlets (31) are arranged in the bottom surface (15) of the forward part of the hull (11).

9. The vessel (1) according to claim 1, wherein further second air outlets (32) are arranged in the bottom surface (15) of the hull (11) at a point closer to the stern than the air outlets (31).

10. The vessel (1) according to claim 1, wherein one or more sensors (43) are arranged on the hull (11) to detect air layer thickness (Tf), wherein the sensors (43) are positioned on the bottom surface (15) of the hull (11) in the air bubble distribution region (A1).

11. The vessel (1) according to claims 1 and 10, wherein the vessel (1) comprises a control system (45) configured to control the compressor (41) and the first air outlets (31) and/ or further at least second air outlets (32).

12. The vessel (1) according to claim 11, wherein the control system (45) is configured to regulate separate air outflow for individual air outlets (31, 32).

13. The vessel (1) according to any of the preceding claims, comprising a suction sail (50), wherein air inlets of the suction sail (50) are in fluid communication with the one or more compressors (41).

14. A computer-implemented method for operating an air lubrication system for a displacement vessel (1) according to claim 1, comprising:
- receiving data representing air layer thickness (Tf) of a hull (11) measured by one or more sensors (43) placed on the bottom surface (15) of the hull (11) in the air bubble distribution region (A1) arranged to detect air layer thickness (Tf),
- receiving data representing power consumption of the one or more compressors (41),

- determining the distribution of air layer thickness (Tf) in the air bubble distribution region (A1),
- producing data to control the control system (45) to adjust the air flow of the one or more compressor (41) and release of air bubbles through each of the air outlets (31, 32) to achieve an even distribution of air layer thickness (Tf) in the air bubble distribution region (A1) .

15. The computer-implemented method according to claim 14, further comprising:
- receiving data representing actual velocity (V) of the vessel (1) and/ or airflow of the one or more compressors (41) and/ or actual trim angle (β) and/ or draft of the vessel (1), and
adjusting one or more of the vessel parameters being velocity of vessel, trim angle of vessel and draft of vessel or of the airflow of the one or more compressors to optimize the air distribution layer thickness and power consumption used for the vessels voyage and forward thrust.

16. The computer implemented method according to claim 14 or 15, further comprising the step of
- determining the water drag on the air bubbles (Fd) and the forward thrust (Fft) of the air bubbles due to inclined bottom surface (15) of the hull (11) on the air bubble distribution region (A1),
- producing data to control the control system (45) to adjust the air flow of the one or more compressor (41) and release of air bubbles through each of the air outlets (31, 32) to achieve an even distribution of air layer thickness (Tf) in the air bubble distribution region (A1).

17. A machine-learning model for operating an air lubrication system for a displacement vessel (1), in particular for use in the method of any one of claims 14 - 16, comprising producing data to control the control system (45) to adjust the air flow of the one or more compressor (41) and release of air bubbles through each of the air outlets (31, 32) to achieve an even distribution of air layer thickness (Tf) in the air bubble distribution region (A1) and optionally to adjust of one or more of the vessel parameter being velocity of vessel, trim angle of vessel and draft of vessel.

18. A computer-implemented method of training a machine-learning model for operating an air lubrication system for a displacement vessel (1), in particular the machine-learning model of claim 17, comprising:
- receiving an input training dataset comprising data from previous voyages of the

displacement vessel (1), and

- producing data to control the control system (45) to adjust the air flow of the one or more compressor (41) and release of air bubbles through each of the air outlets (31, 32) to achieve an even distribution of air layer thickness (Tf) in the air bubble distribution region (A1).

19. Use of the method according to any of the claims claim 14 to 16 for at least one of:

- adjusting parameters for the air lubrication system for a displacement vessel (1),
- optimizing the energy consumption of the air lubrication system for the displacement vessel (1),
- minimizing the fuel consumption for the displacement vessel (1) by adjusting the parameters of the air lubrication system for the displacement vessel (1).

20. A data processing apparatus (46) comprising means for carrying out the steps of the method of any one of claims 14-16 and 18.

21. A computer program comprising instructions which, when the program is executed by a computer, cause the computer to carry out the method of any one of claims 14-16 and 18.