[0005] According to a first aspect of the present disclosure, there is provided a system including: a first interface configured to receive sensor output indicative of a positional displacement of a self-elevating vessel; memory; and one or more processors communicatively coupled to the memory and the first interface, wherein the one or more processors are configured to execute program instructions stored in the memory for causing the one or more processors to: obtain data of first and second sets of conditions corresponding to the self-elevating vessel, determine a first permissible operating range of the self-elevating vessel based on a first structural analysis of the self-elevating vessel under the data of the first set of conditions, the first permissible operating range corresponding to a first hull draft level of the self-elevating vessel, determine a structural utilization ratio of the self-elevating vessel based on a second structural analysis of the self-elevating vessel under the data of the first and second sets of conditions, determine it is safe to lower the self-elevating vessel from an elevated state having a positive airgap to the first hull draft level that eliminates the positive airgap as a first stage in a coming off location operation of the self-elevating vessel when the structural utilization ratio is less than a predetermined value, obtain first positional displacement data from the first interface subsequent to the one or more processors determining that it is safe to lower the self-elevating vessel to the first hull draft level, the first positional displacement data separate from the structural utilization ratio of the self-elevating vessel and corresponding to the positional displacement of the self-elevating vessel while the self-elevating vessel is at the first hull draft level, present the first positional displacement data in relation to the first permissible operating range of the self-elevating vessel, and indicate it is safe to lower the self-elevating vessel from the first hull draft level to a second, deeper, hull draft level as a second stage in the coming off location operation of the self-elevating vessel when the first positional displacement data separate from the structural utilization ratio of the self-elevating vessel indicates that the positional displacement of the self-elevating vessel while at the first hull draft level is within the first permissible operating range.

[0006] According to a second aspect of the present disclosure, there is provided a non-transitory computer readable recording medium having a computer readable program stored thereon that is executable by one or more processors to perform operations including: receiving sensor output indicative of a positional displacement of a self-elevating vessel; obtaining data of first and second sets of conditions corresponding to the self-elevating vessel; determining a first permissible operating range of the self-elevating vessel based on a first structural analysis of the self-elevating vessel under the data of the first set of conditions, the first permissible operating range corresponding to a first hull draft level of the self-elevating vessel; determining a structural utilization ratio of the self-elevating vessel based on a second structural analysis of the self-elevating vessel under the data of the first and second sets of conditions; determining it is safe to lower the self-elevating vessel from an elevated state having a positive airgap to the first hull draft level that eliminates the positive airgap as a first stage in a coming off location operation of the self-elevating vessel when the structural utilization ratio is less than a predetermined value; obtaining, subsequent to determining that it is safe to lower the self-elevating vessel to the first hull draft level, first positional displacement data separate from the structural utilization ratio of the self-elevating vessel and indicative of the positional displacement of the self-elevating vessel while the vessel is at the first hull draft level; presenting the first positional displacement data in relation to the first

permissible operating range of the self-elevating vessel; and indicating it is safe to lower the self-elevating vessel from the first hull draft level to a second, deeper, hull draft level as a second stage in the coming off location operation of the self-elevating vessel when the first positional displacement data separate from the structural utilization ratio of the self-elevating vessel indicates that the positional displacement of the self-elevating vessel while at the first hull draft level is within the first permissible operating range.

[0007] According to a third aspect of the present disclosure, there is provided a self-elevating vessel including: a hull adapted to float; a plurality of legs extending substantially perpendicular to the hull; and a multi-stage coming off location system, including: a positional displacement sensor that senses a positional displacement of the self-elevating vessel; memory; and one or more processors communicatively coupled to the memory, wherein the one or more processors are configured to execute program instructions stored in the memory for causing the one or more processors to: obtain data of first and second sets of conditions corresponding to the self-elevating vessel, determine a first permissible operating range of the self-elevating vessel based on a first structural analysis of the self-elevating vessel under the data of the first set of conditions, the first permissible operating range corresponding to a first hull draft level of the self-elevating vessel, determine a structural utilization ratio of the self-elevating vessel based on a second structural analysis of the self-elevating vessel under the data of the first and second sets of conditions, determine it is safe to lower the self-elevating vessel from an elevated state having a positive airgap to the first hull draft level that eliminates the positive airgap as a first stage in a coming off location operation of the self-elevating vessel when the structural utilization ratio is less than a predetermined value, obtain first positional displacement data from the positional displacement sensor subsequent to the one or more processors determining that it is safe to lower the self-elevating vessel to the first hull draft level, the first positional displacement data separate from the structural utilization ratio of the self- elevating vessel and corresponding to the positional displacement of the self-elevating vessel while the self-elevating vessel is at the first hull draft level, present the first positional displacement data in relation to the first permissible operating range of the self-elevating vessel, and indicate it is safe to lower the self-elevating vessel from the first hull draft level to a second, deeper, hull draft level as a second stage in the coming off location operation of the self-elevating vessel when the first positional displacement data separate from the structural utilization ratio of the self-elevating vessel indicates that the positional displacement of the self-elevating vessel while at the first hull draft level is within the first permissible operating range.

Brief Description of the Drawings

[0008] FIG. **1** shows, in profile view, a self-elevating vessel in an elevated state in accordance with one or more embodiments.

[0009] FIG. **2** shows, in profile view, a self-elevating vessel in a transition state after having commenced a coming off location operation in accordance with one or more embodiments.

[0010] FIG. **3** shows, in profile view, a self-elevating vessel in an afloat state in accordance with one or more embodiments.

[0011] FIG. **4** shows, in block diagram form, a control system in accordance with one or more embodiments.

Claims

1. A system comprising:

a first interface configured to receive sensor output indicative of a positional displacement of a self-elevating vessel;

memory; and

one or more processors communicatively coupled to the memory and the first interface, wherein the one or more processors are configured to execute program instructions stored in the memory for causing the one or more processors to:

obtain data of first and second sets of conditions corresponding to the self-elevating vessel,

determine a first permissible operating range of the self-elevating vessel based on a first structural analysis of the self-elevating vessel under the data of the first set of conditions, the first permissible operating range corresponding to a first hull draft level of the self-elevating vessel,

determine a structural utilization ratio of the self-elevating vessel based on a second structural analysis of the self-elevating vessel under the data of the first and second sets of conditions,

determine it is safe to lower the self-elevating vessel from an elevated state having a positive airgap to the first hull draft level that eliminates the positive airgap as a first stage in a coming off location operation of the self-elevating vessel when the structural utilization ratio is less than a predetermined value,

obtain first positional displacement data from the first interface subsequent to the one or more processors determining that it is safe to lower the self-elevating vessel to the first hull draft level, the first positional displacement data separate from the structural utilization ratio of the self-elevating vessel and corresponding to the positional displacement of the self-elevating vessel while the self-elevating vessel is at the first hull draft level,

present the first positional displacement data in relation to the first permissible operating range of the self-elevating vessel, and

indicate it is safe to lower the self-elevating vessel from the first hull draft level to a second, deeper, hull draft level as a second stage in the coming off location

operation of the self-elevating vessel when the first positional displacement data separate from the structural utilization ratio of the self-elevating vessel indicates that the positional displacement of the self-elevating vessel while at the first hull draft level is within the first permissible operating range.

2. The system according to claim 1, wherein the one or more processors are further configured to obtain second positional displacement data from the first interface, the second positional displacement data corresponding to the positional displacement of the self-elevating vessel while the self-elevating vessel is at the second hull draft level or is being lowered from the first hull draft level to the second hull draft level.

3. The system according to claim 2, wherein the one or more processors are further configured to:

determine a second permissible operating range of the self-elevating vessel based on the first structural analysis of the self-elevating vessel under the data of the first set of conditions, the second permissible operating range corresponding to the second hull draft level,

present the second positional displacement data in relation to the second permissible operating range of the self-elevating vessel, and

indicate it is safe to maintain the self-elevating vessel at the second hull draft level when the second positional displacement data indicates that the positional displacement of the self-elevating vessel while at the second hull draft level is within the second permissible operating range.

4. The system according to claim 3, wherein the one or more processors are further configured to automatically maintain the self-elevating vessel at the second hull draft level when the second positional displacement data indicates that the positional displacement of the self-elevating vessel is within the second permissible operating range.

5. The system according to claim 3 or 4, wherein the one or more processors are further configured to indicate that the self-elevating vessel be raised from the second hull draft level to a

higher elevation when the second positional displacement data indicates that the positional displacement of the self-elevating vessel is not within the second permissible operating range.

6. The system according to claim 5, wherein the one or more processors are further configured to automatically raise the self-elevating vessel from the second hull draft level to the higher elevation when the second positional displacement data indicates that the positional displacement of the self-elevating vessel is not within the second permissible operating range.

7. The system according to any one of claims 1 to 6, wherein the one or more processors are further configured to automatically lower the self-elevating vessel from the elevated state having the positive airgap to the first hull draft level that eliminates the positive airgap when the structural utilization ratio is less than the predetermined value.

8. The system according to any one of claims 1 to 7, wherein the one or more processors are further configured to automatically lower the self-elevating vessel from the first hull draft level to the second hull draft level when the first positional displacement data indicates that the positional displacement of the self-elevating vessel while at the first hull draft level is within the first permissible operating range.

9. The system according to any one of claims 1 to 8, wherein the one or more processors are further configured to indicate that the self-elevating vessel be raised from the first hull draft level to a higher elevation when the first positional displacement data indicates that the positional displacement of the self-elevating vessel while at the first hull draft level is not within the first permissible operating range.

10. The system according to claim 9, wherein the one or more processors are further configured to automatically raise the self-elevating vessel from the first hull draft level to the higher elevation when the first positional displacement data indicates that the positional displacement of the self-elevating vessel while at the first hull draft level is not within the first permissible operating range.

11. The system according to any one of claims 1 to 10, wherein the first interface is configured to receive the sensor output that indicates surge and sway motion of the self-elevating vessel.

12. The system according to any one of claims 1 to 11, further comprising one or more motion reference units for determining the positional displacement of the self-elevating vessel based on a center of floatation of the vessel.

13. The system according to any one of claims 1 to 12, wherein a first one of the one or more processors is located at a land-based remote monitoring center and a second one of the one or more processors is located on-board the self-elevating vessel.

14. The system according to any one of claims 1 to 13, wherein each of the first and second sets of conditions include at least one of site conditions, vessel conditions, orientation conditions, and metocean conditions of the self-elevating vessel, wherein the site conditions include at least one of soil properties of seabed on which the self-elevating vessel is stationed, water depth where the self-elevating vessel is stationed, and an initial leg penetration depth indicative of how deep into the seabed legs of the self-elevating vessel penetrate, wherein the vessel conditions include at least one of hull draft level, hull inclination, elevating system stiffness, number of legs of the self-elevating vessel that are fully stuck in seabed, and structural capacity of one or more of the legs, hull and the elevating system of the self-elevating vessel, wherein the orientation conditions include at least one of a heading direction of the self-elevating vessel and wave energy directions, wherein the metocean conditions include at least one of wave energy spectrum, wave period, wave height, wind speed, and current speed.

15. The system according to any one of claims 1 to 14, wherein the structural analysis of the self-elevating vessel includes at least one of a finite element analysis and a hydrodynamic analysis of the self-elevating vessel.

16. The system according to any one of claims 1 to 15, wherein the one or more processors are further configured to display a first watch circle for visually representing the first permissible operating range of the self-elevating vessel to a user, wherein the one or more processors are

further configured to broadcast the first watch circle representing the first permissible operating range to a portable electronic device.

17. The system according to any one of claims 1 to 16, further comprising one or more sensors that sense as-measured orientation conditions and metocean conditions corresponding to the self-elevating vessel as the second set of conditions.

18. The system according to claim 17, wherein the system is portable.

19. A non-transitory computer readable recording medium having a computer readable program stored thereon that is executable by one or more processors to perform operations comprising:

receiving sensor output indicative of a positional displacement of a self-elevating vessel;

obtaining data of first and second sets of conditions corresponding to the self-elevating vessel;

determining a first permissible operating range of the self-elevating vessel based on a first structural analysis of the self-elevating vessel under the data of the first set of conditions, the first permissible operating range corresponding to a first hull draft level of the self-elevating vessel;

determining a structural utilization ratio of the self-elevating vessel based on a second structural analysis of the self-elevating vessel under the data of the first and second sets of conditions;

determining it is safe to lower the self-elevating vessel from an elevated state having a positive airgap to the first hull draft level that eliminates the positive airgap as a first stage in a coming off location operation of the self-elevating vessel when the structural utilization ratio is less than a predetermined value;

obtaining, subsequent to determining that it is safe to lower the self-elevating vessel to the first hull draft level, first positional displacement data separate from the structural utilization ratio of the self-elevating vessel and indicative of the positional displacement of the self-elevating vessel while the vessel is at the first hull draft level;

presenting the first positional displacement data in relation to the first permissible operating range of the self-elevating vessel; and

indicating it is safe to lower the self-elevating vessel from the first hull draft level to a second, deeper, hull draft level as a second stage in the coming off location operation of the self-elevating vessel when the first positional displacement data separate from the structural utilization ratio of the self-elevating vessel indicates that the positional displacement of the self-elevating vessel while at the first hull draft level is within the first permissible operating range.

20. A self-elevating vessel comprising:

a hull adapted to float;

a plurality of legs extending substantially perpendicular to the hull; and

a multi-stage coming off location system, comprising:

a positional displacement sensor that senses a positional displacement of the self-elevating vessel;

memory; and

one or more processors communicatively coupled to the memory, wherein the one or more processors are configured to execute program instructions stored in the memory for causing the one or more processors to:

obtain data of first and second sets of conditions corresponding to the self-elevating vessel,

determine a first permissible operating range of the self-elevating vessel based on a first structural analysis of the self-elevating vessel under the data of the first set of conditions, the first permissible operating range corresponding to a first hull draft level of the self-elevating vessel,

determine a structural utilization ratio of the self-elevating vessel based on a second structural analysis of the self-elevating vessel under the data of the first and second sets of conditions,

determine it is safe to lower the self-elevating vessel from an elevated state having a positive airgap to the first hull draft level that eliminates the positive

airgap as a first stage in a coming off location operation of the self-elevating vessel when the structural utilization ratio is less than a predetermined value,

obtain first positional displacement data from the positional displacement sensor subsequent to the one or more processors determining that it is safe to lower the self-elevating vessel to the first hull draft level, the first positional displacement data separate from the structural utilization ratio of the self-elevating vessel and corresponding to the positional displacement of the self-elevating vessel while the self-elevating vessel is at the first hull draft level,

present the first positional displacement data in relation to the first permissible operating range of the self-elevating vessel, and

indicate it is safe to lower the self-elevating vessel from the first hull draft level to a second, deeper, hull draft level as a second stage in the coming off location operation of the self-elevating vessel when the first positional displacement data separate from the structural utilization ratio of the self-elevating vessel indicates that the positional displacement of the self-elevating vessel while at the first hull draft level is within the first permissible operating range.