THAT CLAIMED IS:

1. A riser management system for maintaining a selected range of tension on a plurality of risers extending between subsea well equipment and a moored floating vessel, the riser management system comprising:

a mono-buoyancy can platform operably coupled to a plurality of risers extending between subsea well equipment and a moored floating vessel and configured to be at least partially submerged and positioned to provide tension to each of the plurality of risers to compensate for a relative vertical offset between the plurality of risers and the floating vessel, the relative vertical offset defining a first factor; and

a plurality of tensioner units each connected to a top portion of a separate one of the plurality of risers to provide tension to each of the plurality of risers to compensate for one or more additional factors other than the first factor, each of the plurality of tensioner units comprising a plurality of cylinders having a first end portion operably coupled to a riser connector for a respective one of the plurality of risers and a second end portion operably coupled to the mono-buoyancy can platform.

2. The system as defined in Claim 1, wherein the mono-buoyancy can platform and the plurality of tensioner units are configured to simultaneously provide tensioning responsive to a change in the relative vertical offset in conjunction with a change in the one or more additional factors.

3. The system as defined in Claim 1,

wherein a mono-buoyancy can platform comprises a plurality of buoyancy cans;

wherein each of the plurality of buoyancy cans is operably coupled together to form the mono-buoyancy can platform; and

wherein the plurality of risers each extend through interstitial space between the plurality of buoyancy cans of the mono-buoyancy can platform, each of the plurality of risers being de-coupled from movement of the floating vessel through coupling with the mono-buoyancy can platform.

4. A riser management system for maintaining a selected range of tension on a plurality of risers extending between subsea well equipment and a moored floating vessel, the riser management system comprising:

a plurality of buoyancy cans operably coupled to a plurality of risers extending between subsea well equipment and a moored floating vessel, each of the plurality of buoyancy cans operably coupled together to form a mono-buoyancy can platform configured to be at least partially submerged and positioned to provide tension to each the plurality of risers to compensate for a relative vertical offset between the plurality of risers and the floating vessel, the relative vertical offset defining a first factor; and

a plurality of tensioner units each connected to a top portion of a separate one of the plurality of risers to provide tension to each of the plurality of risers to compensate for one or more additional factors other than the first factor, each of the plurality of tensioner units comprising a plurality of cylinders having a first end portion operably coupled to a riser connector for a respective one of the plurality of risers and a second end portion operably coupled to the mono-buoyancy can platform,

the plurality of risers each extending through interstitial space between the plurality of buoyancy cans of the mono-buoyancy can platform and operably coupled to the respective plurality of tensioner units, each of the plurality of risers being de-coupled from movement of the floating vessel through coupling with the mono-buoyancy can platform,

the mono-buoyancy can platform and the plurality of tensioner units being configured to simultaneously provide tensioning responsive to a change in the relative vertical offset in conjunction with a change in the one or more additional factors.

5. The system as defined in Claim 4,

wherein the buoyancy can platform is decoupled from the vessel so as to allow vessel movement relative to a position of the buoyancy can platform; and

wherein the additional factors result in a riser tensioning requirement for one of the plurality of risers that is substantially different than the tensioning requirement of one or more other of the plurality of risers.

6. The system as defined in Claim 5, wherein the additional factors comprise a change in riser initial length, riser initial weight, riser initial pre-tension, riser thermal growth, subsea wellhead and surface tree spacing distance, and pressure differentials between risers.

7. The system as defined in Claim 5, wherein the plurality of tensioner units is a plurality of short-stroke tensioner units, and wherein each of the plurality of cylinders have a stroke length of no less than approximately two feet and no more than approximately eight feet.

8. The system as defined in Claim 5, wherein each of the plurality of tensioner units functions independently of each other of the plurality of tensioner units.

9. The system as defined in Claim 5, wherein the vessel comprises a non-vertically restrained floating platform positioned in water deeper than approximately 2000 feet.

10. The system as defined in Claim 4,

wherein the plurality of tensioner units is a plurality of short-stroke tensioner units, and wherein each of the plurality of cylinders have a maximum stroke length of approximately eight feet;

wherein each of the plurality of buoyancy cans is a cylindrically shaped buoyancy can; and

wherein each of the plurality of risers are at least partially housed within a corresponding plurality of riser conductors, each of the plurality of riser conductors extending substantially vertically through the mono-buoyancy can platform, each interleaved between a different set of the plurality of cylindrically shaped buoyancy cans.

11. A method of maintaining a selected range of tension on a plurality of risers extending between subsea well equipment and a moored floating vessel, the method comprising the steps of:

coupling a plurality of risers to a corresponding plurality of tensioner units configured to adjust stroke length in response to movement of the respective riser in relation to a mono-buoyancy can platform;

coupling the plurality of tensioner units to the mono-buoyancy can platform, the mono-buoyancy can platform adapted to maintain tension on the plurality of risers within a certain range of tension values, the mono-buoyancy can platform decoupled from the vessel so as to allow vessel movement relative to a position of the mono-buoyancy can platform; and

maintaining tension applied to each of the plurality of risers, tension being applied by a combination of both the plurality of tensioner units and the mono-buoyancy can platform to thereby account for both relative vertical offset between the plurality of risers and the vessel and additional factors.

12. The method as defined in Claim 11,

wherein the mono-buoyancy can platform is decoupled from the vessel so as to allow vessel vertical movement relative to a position of the buoyancy can platform; and

wherein the step of maintaining tension applied to each of the plurality of risers includes the step of: simultaneously applying tensioning responsive to a change in the relative vertical offset in conjunction with a change in the one or more additional factors.

13. The method as defined in Claim 12, wherein step of maintaining tension applied to each of the plurality of risers includes the following steps:

the mono-buoyancy can platform primarily applying tensioning responsive to the change in relative vertical offset; and

each of the plurality of tensioner units separately applying tensioning to its respective riser responsive to the change in the one or more additional factors affecting the respective riser associated therewith.

14. The method as defined in Claim 13, wherein the additional factors result in a riser tensioning requirement for at least one of the plurality of risers that is substantially different than the tensioning requirement of one or more other of the plurality of risers.

15. The method as defined in Claim 14,

wherein the step of separately applying tensioning by the plurality of tensioning units includes primarily applying tensioning responsive to the change in the one or more additional factors affecting the respective riser associated therewith; and

wherein the additional factors comprise a change in riser initial length, riser initial weight, riser initial pre-tension, riser thermal growth, subsea wellhead and surface tree spacing distance, and pressure differentials between risers.

16. The method as defined in Claim 15, wherein the plurality of tensioner units is a plurality of short-stroke tensioner units each comprising a plurality of tensioning cylinders having a stroke length of between approximately two feet and eight feet.

17. The method as defined in Claim 11,

wherein each of the plurality of buoyancy cans is operably coupled together to form the mono-buoyancy can platform; and

wherein the plurality of risers each extend through interstitial space between the plurality of buoyancy cans of the mono-buoyancy can platform, each of the plurality of risers being de-coupled from movement of the floating vessel through coupling with the mono-buoyancy can platform.

18. The method as defined in Claim 11,

wherein each of the plurality of tensioner units comprises a separate plurality of tensioning cylinders, each tensioning cylinder comprising a first end portion defining a piston adapted extend and retract to maintain tension on the plurality of risers within a certain range of tension values and comprising a second end portion defining a barrel configured to receive substantial portions of the piston during retraction thereof; and

wherein each of the plurality of tensioner units is connected between the mono-buoyancy can platform and one of the plurality of risers according to one of the following configurations so that the respective piston of the respective tensioning cylinder is oriented to extend and retract responsive to changes in the one or more additional factors:

the barrel is fixedly operably connected to the mono-buoyancy can platform and the piston is fixedly operably connected to the respective riser, and

the piston is fixedly connected to the mono-buoyancy can platform and the barrel is fixedly operably connected to the respective riser.

19. The method as defined in Claim 18, wherein the step of coupling the plurality of tensioner units to the mono-buoyancy can platform includes the step of: connecting the barrel of each of the plurality of tensioner units to a support frame connected to a top portion of the mono-buoyancy can platform so that the barrel is substantially positioned below an upper surface of the support frame.

20. The method as defined in Claim 18, wherein the step of connecting the barrel of each of the plurality of tensioner units to a support frame connected to a top portion of the mono-buoyancy can platform further includes the step of connecting the barrel of each of the plurality of tensioner units so that each respective barrel is positioned above a lower surface of the support frame.

CLAIMS

What is claimed is:

1. A riser management system for maintaining a selected range of tension on a plurality of risers extending between subsea well equipment and a moored floating vessel, the riser management system comprising:

a mono-buoyancy can platform operably coupled to a plurality of tensioner units, configured to be at least partially submerged, and positioned within and circumscribed by substantial portions of a passageway extending through submerged portions of a hull of a moored floating vessel to provide tension to each of a plurality of risers extending therethrough and between subsea well equipment and the moored floating vessel to collectively compensate for a relative vertical offset between the plurality of risers and the floating vessel during sustained operational employment of the riser management system, the relative vertical offset defining a first factor, the mono-buoyancy can platform being substantially laterally constrained within at least the substantial portions of the passageway extending through the submerged portions of the hull of the moored floating vessel;

the plurality of tensioner units each connected to a top portion of a separate one of the plurality of risers to separately adjust stroke position and to separately provide tension within a preselected range of tension values to each separate one of the plurality of risers to compensate for differential effects of one or more additional factors other than the first factor on one or more of the plurality of risers during sustained operational employment of the riser management system,

each of the plurality of tensioner units comprising a plurality of cylinders having a first end portion operably coupled to a riser connector for a respective one of the plurality of risers and a second end portion operably coupled to the mono-buoyancy can platform,

each of the plurality of risers coupled to a corresponding different one of the plurality of tensioner units to thereby move independently within an internal structure of the mono-buoyancy can platform.

2. The system as defined in claim 1,

wherein the mono-buoyancy can platform and the plurality of tensioner units are configured to simultaneously provide tensioning responsive to a change in the relative vertical offset in conjunction with a separate change in the one or more additional factors separately affecting one or more of the plurality of risers; and

wherein the mono-buoyancy can platform is at least substantially decoupled from the hull of the moored floating vessel to allow independent vertical movement therewithin.

3. The system as defined in claim 1,

wherein a mono-buoyancy can platform comprises a plurality of buoyancy cans;

wherein each of the plurality of buoyancy cans is operably coupled together to form the mono-buoyancy can platform; and

wherein the plurality of risers each extend through interstitial space between the plurality of buoyancy cans of the mono-buoyancy can platform, each of the plurality of risers being de-coupled from movement of the floating vessel through coupling with the mono-buoyancy can platform.

4. A riser management system for maintaining a selected range of tension on a plurality of risers extending between subsea well equipment and a moored floating vessel, the riser management system comprising:

a plurality of buoyancy cans operably coupled to a plurality of tensioner units, each of the plurality of buoyancy cans operably coupled together to form a mono-buoyancy can platform configured to be at least partially submerged and positioned within and

circumscribed by substantial portions of a passageway extending through submerged portions of a hull of a moored floating vessel to provide tension to each a plurality of risers extending therethrough and between subsea well equipment and the moored floating vessel to collectively compensate for a relative vertical offset between the plurality of risers and the floating vessel during sustained operational employment of the riser management system, the relative vertical offset defining a first factor, the mono-buoyancy can platform substantially laterally constrained within at least the substantial portions of the passageway extending through the submerged portions of the hull of the moored floating vessel, the mono-buoyancy can platform being at least substantially decoupled from the hull of the moored floating vessel to allow independent vertical movement therewithin; and

the plurality of tensioner units each connected to a top portion of a separate one of the plurality of risers to separately adjust stroke position and to separately provide tension within a selected range of tension values to each separate one of the plurality of risers to compensate for differential effects of one or more additional factors other than the first factor on one or more of the plurality of risers during sustained operational employment of the riser management system,

each of the plurality of tensioner units comprising a plurality of cylinders having a first end portion operably coupled to a riser connector for a respective one of the plurality of risers and a second end portion operably coupled to the mono-buoyancy can platform,

the plurality of risers each extending through interstitial space between the plurality of buoyancy cans of the mono-buoyancy can platform and operably coupled to and a respective different one of the plurality of tensioner units,

each of the plurality of risers being de-coupled from movement of the floating vessel through coupling with the mono-buoyancy can platform via the corresponding plurality of tensioner units,

the mono-buoyancy can platform and the plurality of tensioner units being configured to simultaneously provide tensioning responsive to a change in the relative vertical offset in conjunction with a change in the one or more additional factors.

5. The system as defined in claim 4,

wherein the buoyancy can platform is decoupled from the vessel so as to allow vessel movement relative to a position of the buoyancy can platform without affecting the tension on the plurality of risers; and

wherein the additional factors result in a riser tensioning requirement for one of the plurality of risers that is substantially different than the tensioning requirement of one or more other of the plurality of risers.

6. The system as defined in claim 5, wherein the additional factors comprise one or more of the following: a change in riser initial length, riser initial weight, riser initial pre-tension, riser thermal growth, subsea wellhead and surface tree spacing distance, and pressure differentials between risers.

7. The system as defined in claim 5, wherein the plurality of tensioner units is a plurality of short-stroke tensioner units, and wherein each of the plurality of cylinders have a stroke length of no less than approximately two feet and no more than approximately eight feet.

8. The system as defined in claim 5,

wherein each of the plurality of tensioner units functions independently of each other of the plurality of tensioner units; and

wherein the hull comprises a middeck section and a lower deck section, one or more of the middeck section and the lower deck section including submerged portions of the passageway circumscribing substantial portions of the mono-buoyancy can platform, the vessel being moored to portions of a subsea floor, the mono-buoyancy can platform being

laterally constrained within the submerged portions of the passageway extending through one or more of the middeck section and the lower deck section.

9. The system as defined in claim 5, wherein the vessel comprises a non-vertically restrained floating platform positioned in water deeper than approximately 2000 feet.

10. The system as defined in claim 4,

wherein the plurality of tensioner units is a plurality of short-stroke tensioner units, and wherein each of the plurality of cylinders have a maximum stroke length of approximately eight feet;

wherein each of the plurality of buoyancy cans is a cylindrically shaped buoyancy can; and

wherein each of the plurality of risers are at least partially housed within a corresponding plurality of riser conductors, each of the plurality of riser conductors extending substantially vertically through the mono-buoyancy can platform, each interleaved between a different set of the plurality of cylindrically shaped buoyancy cans.

11. A method of maintaining a selected range of tension on a plurality of risers extending between subsea well equipment and a moored floating vessel, the method comprising the steps of:

coupling a plurality of risers to a corresponding different one of a plurality of tensioner units each configured to individually adjust stroke length in response to movement of the respective riser associated therewith in relation to a mono-buoyancy can platform during sustained operational employment thereof, the plurality of risers free to move independently within an internal structure of the mono-buoyancy can platform;

coupling the plurality of tensioner units to the mono-buoyancy can platform, the mono-buoyancy can platform adapted to maintain tension on the plurality of risers within a certain range of tension values via the coupling with the plurality of tensioner units, the

mono-buoyancy can platform positioned within and circumscribed by substantial portions of a passageway extending through submerged portions of a hull of a moored floating vessel, the mono-buoyancy can substantially laterally constrained within at least the substantial portions of the passageway extending through the submerged portions of the hull of the moored floating vessel, the mono-buoyancy can being decoupled from the vessel so as to allow vessel movement relative to a position of the mono-buoyancy can platform; and

maintaining tension applied to each of the plurality of risers within a preselected range of tension during sustained operational employment thereof, tension being applied by a combination of both the plurality of tensioner units and the mono-buoyancy can platform via the coupling with the plurality of tensioner units to thereby both collectively account for relative vertical offset between the plurality of risers and the vessel and to separately account for differential effects of one or more additional factors on one or more of the plurality of risers.

12. The method as defined in claim 11,

wherein the mono-buoyancy can platform is decoupled from the vessel so as to allow vessel vertical movement relative to a position of the buoyancy can platform; and

wherein the step of maintaining tension applied to each of the plurality of risers includes the step of: simultaneously applying tensioning responsive to a change in the relative vertical offset in conjunction with a change in the one or more additional factors.

13. The method as defined in claim 12, wherein step of maintaining tension applied to each of the plurality of risers includes the following steps:

the mono-buoyancy can platform primarily applying tensioning responsive to the change in relative vertical offset; and

each of the plurality of tensioner units separately applying tensioning to its respective riser responsive to the change in the one or more additional factors affecting the respective riser associated therewith.

14. The method as defined in claim 13, wherein the additional factors result in a riser tensioning requirement for at least one of the plurality of risers that is substantially different than the tensioning requirement of one or more other of the plurality of risers.

15. The method as defined in claim 14,

wherein the step of separately applying tensioning by the plurality of tensioning units includes primarily applying tensioning responsive to the change in the one or more additional factors affecting the respective riser associated therewith; and

wherein the additional factors comprise one or more of the following: a change in riser initial length, riser initial weight, riser initial pre-tension, riser thermal growth, subsea wellhead and surface tree spacing distance, and pressure differentials between risers.

16. The method as defined in claim 15, wherein the plurality of tensioner units is a plurality of short-stroke tensioner units each comprising a plurality of tensioning cylinders having a stroke length of between approximately two feet and eight feet.

17. The method as defined in claim 11,

wherein each of the plurality of buoyancy cans is operably coupled together to form the mono-buoyancy can platform; and

wherein the plurality of risers each extend through interstitial space between the plurality of buoyancy cans of the mono-buoyancy can platform, each of the plurality of risers being de-coupled from movement of the floating vessel through coupling with the mono-buoyancy can platform via the corresponding plurality of tensioner units.

18. The method as defined in claim 11,

wherein each of the plurality of tensioner units comprises a separate plurality of tensioning cylinders, each tensioning cylinder comprising a first end portion defining a piston adapted extend and retract to maintain tension on the respective riser within a certain range of tension values and comprising a second end portion defining a barrel configured to receive substantial portions of the piston during retraction thereof; and

wherein each of the plurality of tensioner units is connected between the mono-buoyancy can platform and one of the plurality of risers according to one of the following configurations so that the respective piston of the respective tensioning cylinder is oriented to extend and retract responsive to changes in the one or more additional factors:
the barrel is fixedly operably connected to the mono-buoyancy can platform and the piston is fixedly operably connected to the respective riser, and

the piston is fixedly connected to the mono-buoyancy can platform and the barrel is fixedly operably connected to the respective riser.

19. The method as defined in claim 18, wherein the step of coupling the plurality of tensioner units to the mono-buoyancy can platform includes the step of: connecting the barrel of each of the plurality of tensioner units to a support frame connected to a top portion of the mono-buoyancy can platform so that the barrel is substantially positioned below an upper surface of the support frame.

20. The method as defined in claim 19, wherein the step of connecting the barrel of each of the plurality of tensioner units to a support frame connected to a top portion of the mono-buoyancy can platform further includes the step of connecting the barrel of each of the plurality of tensioner units so that each respective barrel is positioned above a lower surface of the support frame.