CLAIMS

What is claimed is:

1. An open-sea berth terminal comprising:

a platform secured to a seafloor;

a pipeline operatively coupled to the platform and in fluid communication with onshore equipment;

at least two sets of structures adjacent to the platform, each of the at least two sets of structures associated with berthing and mooring vessels; and

a storage vessel berthed and moored to a first of the at least two sets of structures, the storage vessel adapted to transfer a carrier load between a carrier vessel operatively coupled to a second of the at least two sets of structures and the storage vessel and in fluid communication with the pipeline.

2. The open-sea berth terminal of claim 1, wherein the open-sea berth terminal is an import terminal, the pipeline provides natural gas to the onshore equipment, and the carrier load is liquefied natural gas (LNG), whereby the carrier load is transferred from the carrier vessel to the storage vessel and then to the platform for delivery of natural gas into the pipeline.

3. The open-sea berth terminal of claim 2, wherein the platform comprises facilities to vaporize the LNG prior to delivery into the pipeline.

4. The open-sea berth terminal of any of claims 1-3, wherein the platform further comprises at least one of living quarters, maintenance facilities, safety systems, emergency escape and evacuation systems, logistics systems and power generation.

5. The open-sea berth terminal of any of claims 2-4, wherein the platform comprises cryogenic loading arms for transferring the LNG.

6. The open-sea berth terminal of any of claims 2-5, wherein the platform comprises cryogenic hoses for transferring the LNG.

7. The open-sea berth terminal of any of claims 1-6, wherein the platform is fixed to the seafloor by a steel truss support structure.

8. The open-sea berth terminal of claim 7, wherein the steel truss support structure comprises generally vertical legs connected by structural members.

9. The open-sea berth terminal of any of claims 7-8, wherein piles are secured by one of extending the piles through the generally vertical legs into the seafloor to pin the steel truss support structure to the seafloor and attaching the piles to the steel truss support structure with piles extending into the seafloor to pin the steel truss support structure to the seafloor.

10. The open-sea berth terminal of any of claims 1-10, wherein the platform is fixed to the seafloor by a concrete column structure.

11. The open-sea berth terminal of claim 10, wherein the concrete column structure comprises buoyancy chambers.

12. The open-sea berth terminal of claim 10, wherein piles extend through the concrete column into the seafloor to pin the concrete support structure to the seafloor.

13. The open-sea berth terminal of claim 10, wherein the concrete column comprises a skirt that sinks into the seafloor.

14. The open-sea berth terminal of any of claims 1-13, wherein the at least two sets of structures are anchored to the seafloor.

15. The open-sea berth terminal of claim 14, wherein the at least two sets of structures are positioned on opposite sides of the platform.

16. The open-sea berth terminal of claim 14, wherein each of the at least two sets of structures comprise berthing dolphins fixed to the seafloor and mooring dolphins fixed to the seafloor.

17. The open-sea berth terminal of any of claims 2-16, wherein the storage vessel is a barge having storage tanks for containing LNG.

18. The open-sea berth terminal of claim 17, wherein the storage tanks are self-supporting prismatic tanks.

19. The open-sea berth terminal of claim 17, wherein the storage tanks are spherical tanks.

20. The open-sea berth terminal of claim 17, wherein the storage tanks are membrane tanks.

21. The open-sea berth terminal of claim 17, wherein the storage tanks are modular tanks.

22. The open-sea berth terminal of claim 17, wherein the barge comprises facilities for vaporizing the LNG and a transfer system for delivering vaporized LNG from the barge to the platform.

23. The open-sea berth terminal of claim 22, wherein the barge further comprises at least one of living quarters, maintenance facilities, safety systems, emergency escape and evacuation systems, logistics systems and power generation.

24. The open-sea berth terminal of any of claims 17-23, wherein the barge comprises maneuvering and propulsion systems for deberthing the barge.

25. The open-sea berth terminal of claims any of 2-24, wherein the storage vessel is an LNG carrier with tanks and accommodations for marine operation.

26. An open-sea berth LNG import terminal for offshore delivery of imported liquefied natural gas (LNG) comprising:

a platform fixed to a seafloor;

a pipeline operatively coupled to the platform and in fluid communication with onshore equipment;

at least two sets of structures associated with the platform and configured to berth and moor vessels;

a storage vessel berthed and moored to a first of the at least two sets of structures and adapted to store LNG, the storage vessel adapted to transfer LNG between a carrier vessel berthed and moored to a second of the at least two sets of structures and the storage vessel; and

facilities on at least one of the platform or the storage vessel, wherein the stored LNG is vaporized by the facilities prior to delivery to the pipeline.

27. The open-sea berth LNG import terminal of claim 26, wherein the storage vessel comprises a barge.

28. The open-sea berth LNG import terminal of claim 27, wherein the barge comprises maneuvering and propulsion systems for deberthing operations.

29. The open-sea berth LNG import terminal of any of claims 27-28, wherein the barge comprises the facilities.

30. The open-sea berth LNG import terminal of any of claims 26-29, wherein the LNG is stored in self-supporting prismatic tanks.

31. The open-sea berth LNG import terminal of any of claims 26-30, wherein the LNG is stored in spherical tanks.

32. The open-sea berth LNG import terminal of any of claims 26-31, wherein the LNG is stored in membrane tanks.

33. The open-sea berth LNG import terminal of any of claims 26-32, wherein the facilities are disposed on the platform along with a transfer system for delivering vaporized LNG from the storage vessel to the platform.

34. The open-sea berth LNG import terminal of claim 33, wherein the facilities further comprise at least one of living quarters, maintenance facilities, safety systems, emergency escape and evacuation systems, logistics systems and power generation.

35. The open-sea berth LNG import terminal of any of claims 26-34, wherein the platform comprises cryogenic loading arms for transferring the LNG.

36. The open-sea berth LNG import terminal of any of claims 26-35, wherein the platform comprises cryogenic hoses for transferring the LNG.

37. The open-sea berth LNG import terminal of any of claims 26-36, wherein the platform is fixed to the seafloor by a steel truss support structure.

38. The open-sea berth LNG import terminal of any of claims 26-37, wherein the platform is fixed to the seafloor by a concrete structure.

39. The open-sea berth LNG import terminal of any of claims 26-38, wherein the at least two sets of structures are anchored to the seafloor.

40. The open-sea berth LNG import terminal of claim 39, wherein each of the at least two sets of structures comprises berthing dolphins fixed to the seafloor and mooring dolphins fixed to the seafloor.

41. The open-sea berth LNG import terminal of any of claims 26-40, wherein the first and the second of the at least two sets of structures are located on opposite sides of the platform.

42. The open-sea berth LNG import terminal of any of claims 26-41, wherein the storage vessel is an LNG carrier having tanks to store the LNG and accommodations for marine operation.

43. A method for importing liquefied natural gas (LNG) using an open-sea berth import terminal fixed to a seafloor and associated with at least two sets of structures used for berthing and mooring vessels and in fluid communication with a pipeline coupled to onshore facilities, the method comprising:

berthing and mooring an LNG carrier at a first of at least two sets of structures;

berthing and mooring a storage vessel at a second of the at least two sets of structures;

offloading LNG from the LNG carrier to the storage vessel using cryogenic cargo transfer equipment;

vaporizing the LNG from the storage vessel using facilities; and

delivering the vaporized LNG to the pipeline.

44. The method of claim 43, wherein each of the at least two sets of structures comprise berthing dolphins fixed to the seafloor and mooring dolphins fixed to the seafloor.

45. The method of claim 44, further comprising:

deberthing the LNG carrier after the LNG carrier unloads; and

maintaining the storage vessel at the second of the at least two sets of structures.

46. The method of claim 45, further comprising deberthing the storage vessel in the event of adverse weather.

47. The method of claim 46, wherein the storage vessel is a barge and deberthing the storage vessel comprises moving the barge via maneuvering and propulsion systems disposed on the barge.

48. The method of claim 47, wherein the deberthing further comprises utilizing other vessels to move the barge.

49. The method of any of claims 47-48, wherein the storage vessel is another LNG carrier and deberthing the storage vessel comprises moving the another LNG carrier using a marine operation propulsion system disposed on the LNG carrier.

50. The method of claim 49, wherein deberthing further comprises assisting the movement of another LNG carrier utilizing other vessels.

51. The method of any of claims 44-50, wherein the facilities are on the platform and wherein the method comprises transferring LNG from the storage vessel to the facilities using the cryogenic cargo transfer equipment.

52. The method of any of claims 44-51, wherein the facilities are on the storage vessel, and wherein the method further comprises delivering vaporized LNG from the storage vessel to the platform using the transfer system and delivering the vaporized LNG to the pipeline.

53. The method of any of claims 44-52, wherein the storage vessel is a barge having tanks, the offloading further comprising filling the tanks with LNG using the cryogenic cargo transfer equipment.

54. The method of any of claims 44-53, wherein the storage vessel is another LNG carrier having tanks, the offloading further comprising filling the LNG carrier tanks with LNG using the cryogenic cargo transfer equipment.

55. A method for importing liquefied natural gas (LNG) comprising:

berthing and mooring a first LNG carrier at a first structure associated with an open-sea berth import terminal fixed to a seafloor and coupled to a pipeline in fluid communication with onshore facilities;

offloading LNG from the first LNG carrier to the open-sea berth import terminal using cryogenic cargo transfer equipment;

vaporizing the LNG from the first LNG carrier at the open-sea berth import terminal;

delivering the vaporized LNG to the pipeline;

berthing and mooring a second LNG carrier to a second structure associated with the open-sea berth import terminal to prepare cryogenic cargo transfer equipment for offloading while the first LNG carrier is offloading at the first structure;

initiating the offloading of LNG from the second LNG carrier after offloading of the LNG from the first LNG carrier is complete; and

preparing the first LNG carrier for deberthing while the second LNG carrier is offloading.

56. A method for importing liquefied natural gas (LNG) comprising:

berthing and mooring a first LNG carrier at a first structure associated with an open-sea berth import terminal fixed to a seafloor and coupled to a pipeline in fluid communication with onshore facilities;

berthing and mooring a second LNG carrier at a second structure associated with the open-sea berth import terminal;

transferring LNG from the first LNG carrier to the open-sea berth import terminal using cryogenic cargo transfer equipment;

vaporizing the LNG from the first LNG carrier at the open-sea berth import terminal; and

performing other offloading operations with the second LNG carrier concurrently with the transfer of LNG from the first LNG carrier.

57. The method of claim 56, further comprising delivering the vaporized LNG to the pipeline, while the second LNG carrier is performing other offloading operations.

58. The method of claim 57, wherein the other offloading operations comprise connecting, cooling down and disconnecting cryogenic cargo transfer equipment.

59. The method of any of claims 57-58, further comprising:

completing the offloading operation of the first LNG carrier; and

vaporizing the LNG from the second LNG carrier at the open-sea berth import terminal.

60. The method of claim 59, further comprising delivering the vaporized LNG from the second LNG carrier to the pipeline.

61. The method of claim 60, further comprising:

deberthing the first LNG carrier from the first structure; and

berthing and mooring another LNG carrier at the first structure, while the second LNG carrier is transferring LNG.

CLAIMS:

1. An open-sea berth terminal comprising:

a platform secured to a seafloor, the platform comprising:

facilities configured to vaporize LNG,

cryogenic loading arms for transferring LNG, and

cryogenic hoses for transferring LNG,

a pipeline operatively coupled to the platform and in fluid communication with onshore equipment, the pipeline adapted to deliver vaporized LNG to the onshore equipment;

at least two sets of structures adjacent to the platform, each of the at least two sets of structures used for berthing and mooring vessels and the at least two sets of structures are anchored to the seafloor, said at least two sets of structures comprising berthing dolphins fixed to the seafloor and mooring dolphins fixed to the seafloor, and

a storage vessel berthed and moored to a first of the at least two sets of structures and in fluid communication with the pipeline,

a carrier vessel operatively coupled to a second of the at least two sets of structures, wherein:

the storage vessel is adapted to transfer a carrier load between the carrier vessel and the storage vessel, and

wherein the storage vessel comprises a barge having storage tanks for containing LNG.

2. The open-sea berth terminal of claim 1, wherein the open-sea berth terminal is an import terminal, the pipeline provides natural gas to the onshore equipment, and the carrier load is liquefied natural gas (LNG), whereby the carrier load is transferred from the carrier vessel to the storage vessel and then to the platform for delivery of natural gas into the pipeline.

3. The open-sea berth terminal of claim 1 or 2, wherein the platform further comprises at least one of living quarters, maintenance facilities, safety systems, emergency escape and evacuation systems, logistics systems and power generation.

4. The open-sea berth terminal of claim 1, wherein the platform is fixed to the seafloor by a steel truss support structure.

5. The open-sea berth terminal of claim 4, wherein the steel truss support structure comprises generally vertical legs connected by structural members.

6. The open-sea berth terminal of claim 4, wherein piles are secured by one of extending the piles through the generally vertical legs into the seafloor to pin the steel truss support structure to the seafloor and attaching the piles to the steel truss support structure with piles extending into the seafloor to pin the steel truss support structure to the seafloor.

7. The open-sea berth terminal of claim 1, wherein the platform is fixed to the seafloor by a concrete column structure.

8. The open-sea berth terminal of claim 7, wherein the concrete column structure comprises buoyancy chambers.

9. The open-sea berth terminal of claim 7, wherein piles extend through the concrete column into the seafloor to pin the concrete support structure to the seafloor.

10. The open-sea berth terminal of claim 7, wherein the concrete column comprises a skirt that sinks into the seafloor.

11. The open-sea berth terminal of claim 1, wherein the at least two sets of structures are positioned on opposite sides of the platform.

12. The open-sea berth terminal of claim 1, wherein the storage tanks are self-supporting prismatic tanks.

13. The open-sea berth terminal of claim 1, wherein the storage tanks are spherical tanks.

14. The open-sea berth terminal of claim 1, wherein the storage tanks are membrane tanks.

15. The open-sea berth terminal of claim 1, wherein the storage tanks are modular tanks.

16. The open-sea berth terminal of claim 1, wherein the barge comprises facilities for vaporizing the LNG and a transfer system for delivering vaporized LNG from the barge to the platform.

17. The open-sea berth terminal of claim 16, wherein the barge further comprises at least one of living quarters, maintenance facilities, safety systems, emergency escape and evacuation systems, logistics systems and power generation.

18. The open-sea berth terminal of claim 1, wherein the barge comprises maneuvering and propulsion systems for deberthing the barge.

19. The open-sea berth terminal of claim 2, wherein the storage vessel comprises an LNG carrier with tanks and accommodations for marine operation.

20. An open-sea berth LNG import terminal for offshore delivery of imported liquefied natural gas (LNG) comprising:

a platform fixed to a seafloor, the platform comprising:

facilities configured to vaporize LNG,

cryogenic loading arms for transferring LNG, and

cryogenic hoses for transferring LNG,

a pipeline operatively coupled to the platform and in fluid communication with onshore equipment, the pipeline adapted to deliver vaporized LNG to the onshore equipment;

at least two sets of structures associated with the platform and configured to berth and moor vessels and the at least two sets of structures are anchored to the seafloor, said at least two sets of structures comprises berthing dolphins fixed to the seafloor and mooring dolphins fixed to the seafloor;

a storage vessel berthed and moored to a first of the at least two sets of structures and adapted to store LNG, the storage vessel adapted to transfer LNG between a carrier vessel berthed and moored to a second of the at least two sets of structures and the storage vessel; and

a transfer system for delivering vaporized LNG from the storage vessel to the pipeline; wherein:

the storage vessel comprises a barge.

21. The open-sea berth LNG import terminal of claim 20, wherein the barge comprises maneuvering and propulsion systems for deberthing operations.

22. The open-sea berth LNG import terminal of claim 20, wherein the barge comprises the facilities.

23. The open-sea berth LNG import terminal of claim 20, wherein the LNG is stored in self-supporting prismatic tanks.

24. The open-sea berth LNG import terminal of claim 20, wherein the LNG is stored in spherical tanks.

25. The open-sea berth LNG import terminal of claim 20, wherein the LNG is stored in membrane tanks.

26. The open-sea berth LNG import terminal of claim 20, wherein the LNG is stored in modular tanks.

27. The open-sea berth LNG import terminal of claim 20, wherein the facilities further comprise at least one of living quarters, maintenance facilities, safety systems, emergency escape and evacuation systems, logistics systems and power generation.

28. The open-sea berth LNG import terminal of claim 20, wherein the platform is fixed to the seafloor by a steel truss support structure.

29. The open-sea berth LNG import terminal of claim 20, wherein the platform is fixed to the seafloor by a concrete structure.

30. The open-sea berth LNG import terminal of claim 20, wherein the first and the second of the at least two sets of structures are located on opposite sides of the platform.

31. The open-sea berth LNG import terminal of claim 20, wherein the storage vessel comprises an LNG carrier having tanks to store the LNG and accommodations for marine operation.

32. A method for importing liquefied natural gas (LNG) using an open-sea berth import terminal fixed to a seafloor and associated with at least two sets of structures used for berthing and mooring vessels and in fluid communication with a pipeline coupled to onshore facilities, the method comprising:

berthing and mooring an LNG carrier at a first of at least two sets of structures, which are anchored to the seafloor;

berthing and mooring a storage vessel at a second of the at least two sets of structures;

offloading LNG from the LNG carrier to the storage vessel using cryogenic cargo transfer equipment;

transferring LNG from the storage vessel to the facilities using the cryogenic cargo transfer equipment;

deberthing the LNG carrier after the LNG carrier unloads,

maintaining the storage vessel at the second of the at least two sets of structures,

vaporizing the LNG from the storage vessel using facilities; and

delivering the vaporized LNG to the pipeline, wherein:

the open-sea berth import terminal comprises facilities,

the storage vessel is a barge having tanks, and

the offloading further comprising filling the tanks with LNG using the cryogenic cargo transfer equipment, and

each of the at least two sets of structures comprise berthing dolphins fixed to the seafloor and mooring dolphins fixed to the seafloor.

33. The method of claim 32, further comprising deberthing the storage vessel in the event of adverse weather.

34. The method of claim 33, wherein the storage vessel is a barge and deberthing the storage vessel comprises moving the barge via maneuvering and propulsion systems disposed on the barge.

35. The method of claim 34, wherein the deberthing further comprises utilizing other vessels to move the barge.

36. The method of claim 33, wherein the storage vessel is another LNG carrier and deberthing the storage vessel comprises moving the another LNG carrier using a marine operation propulsion system disposed on the LNG carrier.

37. The method of claim 36, wherein deberthing further comprises assisting the movement of another LNG carrier utilizing other vessels.

38. The method of claim 32, wherein the facilities are on the storage vessel, and wherein the method further comprises delivering vaporized LNG from the storage vessel to the platform using the transfer system and delivering the vaporized LNG to the pipeline.

39. The method of claim 32, wherein the storage vessel is another LNG carrier having tanks, the offloading further comprising filling the LNG carrier tanks with LNG using the cryogenic cargo transfer equipment.