CLAIMS

1. A method for performing operations on underwater infrastructure at a plurality of locations using a water environment robotic system, comprising steps of:

(a) providing an underwater robotic vehicle at a position proximate the underwater infrastructure;

(b) moving the underwater robotic vehicle through the water to one location of the plurality of locations of the underwater infrastructure;

(c) performing a first operation on the underwater infrastructure at the one location of the plurality of locations;

(d) manipulating the underwater vehicle to engage with a seabed;

(e) performing a second operation on the underwater infrastructure at the one location of the plurality of locations;

(f) moving the underwater robotic vehicle through the water to another location of the plurality of locations of the underwater infrastructure;

(g) repeating steps (c) through (f) until the first and second operations are performed at all of the plurality of locations; and

(h) retrieving the underwater vehicle.

2. A method according to Claim 1, in which the first operation is a cleaning operation and the second operation is an inspection operation of the previously cleaned one location using a non-destructive sensor.

3. A method according to Claim 1, in which the underwater infrastructure is a pipeline and the plurality of locations are weld joints along the pipeline.

4. A method according to Claim 1, in which the step of manipulating the underwater vehicle to engage with the seabed includes the step of disengaging a buoyancy module from the underwater vehicle to change the buoyancy characteristics of the underwater vehicle from neutrally buoyant to negatively buoyant.

5. A method according to Claim 1, in which the step of performing a second operation includes the steps of extending a robotic arm and sensing using a non-destructive sensor

6. A method according to Claim 4, in which the step of moving the underwater robotic vehicle through the water to another location includes the step of reengaging the underwater vehicle with the buoyancy module to change the buoyancy characteristics of the underwater vehicle from negatively buoyant to neutrally buoyant and moving through the water.

7. A method for performing operations using a water environment robotic system on a target section of pipeline located in an underwater environment, the pipeline having a plurality of weld joints located at a plurality of locations along its length, comprising steps of:

(a) providing an underwater robotic vehicle at a position proximate the underwater pipeline, the underwater robotic vehicle including at least a robotic arm, treads adapted to move the underwater robotic vehicle along a seabed, a sensor, and a propulsion system adapted to move the underwater robotic vehicle by swimming through the water;

(b) deploying the underwater robotic vehicle into the water;

(c) visually inspecting the underwater environment to locate the pipeline and its plurality of weld joints using the underwater robotic vehicle;

(d) performing a cleaning operation at one of the plurality of weld joints using the underwater robotic vehicle;

(e) manipulating the underwater robotic vehicle to land and stabilize on the seabed;

(f) adjusting the position of the underwater robotic vehicle on the seabed;

(g) deploying the robotic arm to inspect the cleaned weld joint;

(h) inspecting the cleaned weld joint using the sensor to collect cathodic protection and ultrasonic testing data;

(i) stowing the robotic arm into a folded position suitable for the underwater robotic vehicle to swim through the water;

(j) causing the underwater robotic vehicle to swim through the water along the pipeline to another of the plurality of weld joints while performing a visual inspection;

(k) repeating steps (d) through (j) on multiple weld joints within the target section of the pipeline;

(l) causing the underwater robotic vehicle to swim upward; and

(m) permitting retrieval of the underwater robotic vehicle at a surface of the water environment.

8. A method according to Claim 7, in which the step of deploying the underwater robotic vehicle into the water includes deploying the underwater robotic vehicle from a surface support vessel.

9. A method according to Claim 7, in which the step of deploying the underwater robotic vehicle into the water includes deploying the underwater robotic vehicle from an onshore location and using the treads to crawl along the seabed until the underwater robotic vehicle moves to a position in which the water has a sufficient depth to permit swimming of the underwater robotic vehicle.

10. A method according to Claim 7, in which the underwater robotic vehicle is connected to a communication relay that is configured to permit aerial communication between the underwater robotic vehicle and a remote control station.

11. A method according to Claim 7, further including the step of locating the pipeline using a sonar sensor mounted below the surface support vessel.

12. A method according to Claim 7, further including the step of locating the pipeline using a sonar sensor mounted on the underwater robotic vehicle.

13. A method according to Claim 7, in which the step of performing the cleaning operation includes using at least one of a cavitation system and a brushing system.

14. A method according to Claim 13, in which the cavitation system includes a cavitation engine supported by a surface boat.

15. A method according to Claim 13, in which the brushing system includes systems having destabilization reduction means for reducing forces caused during the step of performing the cleaning operation.

16. A method according to Claim 7, in which the step of manipulating the underwater vehicle to land and stabilize on the seabed includes engaging the propulsion system to provide a downward force toward the seabed.

17. A method according to Claim 7, in which the step of adjusting the position of the underwater robotic vehicle on the seabed includes using propellers.

18. A method according to Claim 7, in which the step of adjusting the position of the underwater robotic vehicle on the seabed includes using the treads to minimize disturbance to the underwater environment.

19. A method according to Claim 7, in which the underwater robotic vehicle includes a buoyancy control module, and in which the step of manipulating the underwater robotic vehicle to land and stabilize on the seabed includes using the buoyancy control module to provide the underwater robotic vehicle a negative net buoyancy characteristic.

20. A method according to Claim 19, in which the buoyancy control module includes at least one of a releasable float device, a container in which air is capable of being compressed, and a container into which air and water are capable of being introduced and removed.

21. A method according to Claim 7, in which the underwater robotic vehicle includes a buoyancy control module, further including the step of using the buoyancy control module to provide the underwater robotic vehicle a net neutral buoyancy characteristic prior to the step of swimming through the water along the pipeline to another of the plurality of weld joints.

22. A method according to Claim 7, in which the underwater robotic vehicle has a negative net buoyancy characteristic sufficient for stabilization on the seabed and also sufficient for swimming through the water using the propulsion system.

23. A method according to Claim 7, in which the underwater robotic vehicle includes a first video camera.

24. A method according to Claim 23, in which the underwater robotic vehicle includes a second video camera supported by the robotic arm to provide improved monitoring of the inspection sensor.

25. A method according to Claim 7, in which the underwater robotic vehicle includes at least one of a proximity sensor and a sonar sensor, supported by the robotic arm.

26. A method according to Claim 7, in which the underwater robotic vehicle supports a cleaning module and an inspection module.

27. A method according to Claim 7, in which the underwater robotic vehicle includes first and second underwater robotic vehicles, in which one of the first and second underwater robotic vehicles executes the step of performing the cleaning operation at the one of the

plurality of weld joints, and the other of the first and second underwater robotic vehicles executes the step of inspecting the cleaned weld joint using the sensor to collect the cathodic protection and ultrasonic testing data.