CLAIMS

1. An integrated probe suitable for performing cleaning, cathodic protection voltage readings, and ultrasonic testing thickness measurements at an underwater surface substantially simultaneously, comprising:

a housing having a front surface and a rear surface;

a cleaning jet tool having an orifice extending through the front surface of the housing;

an ultrasonic probe disposed within the housing, the ultrasonic probe having a transducer crystal and a flexible membrane arranged above the transducer crystal, and a couplant disposed within a gap between the flexible membrane and the transducer crystal; and

a cathodic inspection tool having one or more legs, each having an electrically conductive tip and a subsea housing containing a reference electrode, each leg extending longitudinally away from the housing and arranged about the cleaning jet tool and ultrasonic probe,

in which the one or more legs are passively adjustable in response to a force imparted when the one or more legs contact the underwater surface, and

in which the one or more legs extend away from the housing at a distance such that in a condition in which the conductive tip of the one or more legs is in contact with the underwater surface, the cleaning jet tool and ultrasonic probe are at a distance for effective cleaning and ultrasonic measuring, respectively.

2. An integrated probe according to Claim 1, in which the orifice of the cleaning jet tool is located at a central location of the housing.

3. An integrated probe according to Claim 1, in which the ultrasonic probe extends about the orifice of the cleaning jet tool.

4. An integrated probe according to Claim 1, in which the one or more legs provide a degree of flexibility that flexes to orient the cleaning jet tool and ultrasonic probe toward the underwater surface to be cleaning and inspected in a condition in which the one or more legs are in contact with the underwater surface.

5. An integrated probe according to Claim 1, in which the electrically conductive tip is made of stainless steel.

6. An integrated probe according to Claim 1, in which the one or more legs are arranged surrounding the ultrasonic probe as two pairs of diametrically opposed legs.

7. An integrated probe according to Claim 1, in which at least one degree of freedom is provided by one or more joints coupling the housing to an external carrier.

8. A method of performing a cleaning operation, cathodic protection voltage readings and ultrasonic testing thickness measurements on an underwater surface with an integrated probe having a housing having a front surface and a rear surface, a cleaning jet tool having an orifice extending through the front surface of the housing, an ultrasonic probe disposed within the housing, and at least one leg with an electrically conductive tip, comprising:

positioning a remotely operated vehicle, having at least one robotic arm with the integrated probe disposed at a free end of the robotic arm and the integrated probe coupled to an arm end effector, in proximity to the underwater surface;

contacting the underwater surface with the integrated probe such that the at least one leg with an electrically conductive tip contacts the underwater surface, in which a length of the at least one leg positions the cleaning jet tool and ultrasonic probe at a desired distance from the underwater surface for effective cleaning and measurement;

cleaning the underwater surface by causing a high pressure fluid to exit the cleaning jet tool and impact the underwater surface;

measuring, by the at least one leg, a voltage at the underwater surface; and

measuring, by the ultrasonic probe, a thickness of the underwater surface.

9. A method according to Claim 8, in which the steps of cleaning, measuring a voltage, and measure a thickness are all performed without repositioning the integrated probe.

10. A method according to Claim 8, in which the steps of cleaning, measuring a voltage, and measure a thickness are all performed during a single contacting step.