CLAIMS

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

a probe carrier having an electrically conductive portion disposed at a periphery of a front surface of the probe carrier for performing the cathodic protection voltage readings of the underwater surface while contacting the underwater surface;

one or more magnets embedded within the probe carrier;

a flux concentrator embedded within the probe carrier, supported by the one or more magnets, and adjacent to the electrically conductive portion;

a flexible membrane seated in a centre of the front surface of the probe carrier;

a sleeve housing;

an ultrasonic probe for performing the ultrasonic testing thickness measurements of the underwater surface while the electrically conductive portion contacts the underwater surface, the ultrasonic probe having a transducer crystal, the ultrasonic probe being partially disposed within the sleeve housing and extending through the probe carrier to be adjacent to the flexible membrane, the flexible membrane being arranged about the transducer crystal, the electrically conductive portion being arranged about the flexible membrane; and

a spring coupled to a free end of the sleeve housing and configured to provide two degrees of freedom to the probe carrier in response to a force imparted when the electrically conductive portion contacts the underwater surface.

2. An integrated probe system according to Claim 1, in which the electrically conductive portion comprises three or more electrically conductive tips extending away from the front surface of the probe carrier.

3. An integrated probe system according to Claim 1, in which the electrically conductive portion comprises a serrated rim.

4. An integrated probe system according to Claim 1, in which the flux concentrator is a ring-shaped layer of magnetically conductive material.

5. An integrated probe system according to Claim 1, in which the flux concentrator comprises one or more magnetically conductive rods embedded within the probe carrier.

6. An integrated probe system according to Claim 1, in which the flux concentrator is made of iron.

7. An integrated probe system according to Claim 1, in which the sleeve housing is a hollow, cylindrically-shaped tube.

8. An integrated probe system according to Claim 1, further comprising a couplant disposed within a gap between the flexible membrane and the transducer crystal.

9. An integrated probe system for performing cathodic protection voltage readings and ultrasonic testing thickness measurements of an underwater surface substantially simultaneously, comprising:

an outer gimbal shaped as a hollow ring and having one or more coupling points disposed at an inner surface of the outer gimbal and one or more coupling points disposed at an outer surface of the outer gimbal;

an inner gimbal coupled to the outer gimbal at the one or more coupling points of the inner surface of the outer gimbal, the inner gimbal having an electrically conductive portion disposed at a periphery of a front surface of the inner gimbal for performing the cathodic protection voltage readings of the underwater surface while contacting the underwater surface;

one or more magnets coupled to the inner gimbal;

a flexible membrane seated in a centre of the front surface of the inner gimbal;

an ultrasonic probe for performing the ultrasonic testing thickness measurements of the underwater surface while the electrically conductive portion contacts the underwater surface, the ultrasonic probe having a transducer crystal, the ultrasonic probe being partially disposed within and extending through the inner gimbal to be adjacent to the flexible membrane, the flexible membrane being arranged about the transducer crystal, the electrically conductive portion being arranged about the flexible membrane; and

in which the outer gimbal and the inner gimbal are coupled via the one or more coupling points of the inner and outer surfaces of the outer gimbal to provide two degrees of

freedom of movement to the inner gimbal in response to a force imparted when the electrically conductive portion contacts the underwater surface.

10. An integrated probe system according to Claim 9, in which the electrically conductive portion comprises three or more electrically conductive tips extending away from the front surface of the inner gimbal.

11. An integrated probe system according to Claim 9, in which the electrically conductive portion is further disposed at a front surface of the outer gimbal and comprises four or more electrically conductive tips each extending away from the front surface of either the inner gimbal or the outer gimbal.

12. An integrated probe system according to Claim 9, in which the electrically conductive portion comprises a serrated rim.

13. An integrated probe system according to Claim 9, further comprising one or more magnets coupled to the outer gimbal.

14. An integrated probe system according to Claim 9, in which the outer gimbal is configured to couple to a modular frame at an end effector of a robotic arm via the one or more coupling points of the outer surface of the outer gimbal.

15. An integrated probe system according to Claim 9, further comprising a couplant disposed within a gap between the flexible membrane and the transducer crystal.

16. An integrated probe system according to Claim 9, further comprising a modular frame coupled to the one or more coupling points of the outer surface of the outer gimbal.

17. An integrated probe system according to Claim 9, in which the inner gimbal is sized and shaped to define two or more ingresses.

18. An integrated probe system according to Claim 17, in which two or more of the electrically conductive tips are disposed on the outer gimbal and configured to extend through the two or more ingresses.