Claims:

1. A method for monitoring the condition of apparatus located at an underwater facility, comprising the steps of:

a) sensing at least one parameter associated with the apparatus,

b) providing a model of expected behaviour of said at least one parameter,

c) comparing said sensed parameter with said model, and

d) assessing the condition of the apparatus based upon said comparison.

2. A method according to claim 1, wherein steps b), c) and d) are carried out using an expert system.

3. A method according to claim 2, wherein the expert system comprises a historical database.

4. A method according to either of claims 2 and 3, including the step of providing the expert system with input from an external source, said input being used to enhance the model.

5. A method according to any preceding claim, wherein step a) includes sensing a plurality of parameters.

6. A method according to any preceding claim, wherein step a) includes collating any alarms associated with the parameter.

7. A method according to either of claims 5 and 6, wherein each parameter and/or alarm is assigned a priority rating within the model.

8. A method according to any preceding claim, wherein the method is used for umbilical electrical conductor condition monitoring.

9. A method according to claim 8, wherein step a) includes sensing at least one of: a surface LIM reading; a surface input voltage; a surface input current; an underwater input voltage; an underwater input current; and an underwater LIM.

10. A method according to any preceding claim, wherein the method is used for detection and/or monitoring of hydraulic fluid leakage.

11. A method according to claim 10, wherein step a) includes sensing at least one of: activation of a valve; flow of hydraulic fluid within the facility; an amount of hydraulic fluid leaving a hydraulic reservoir located at the surface; and a hydraulic fluid pressure at one or more points within a control system of the facility.

12. A method according to any preceding claim, wherein the method is used for detection and/or monitoring of wear or erosion within a choke valve.

13. A method according to claim 12, including the step of determining a flow rate through the choke valve.

14. A method according to claim 13, wherein the flow rate is determined by using a flow meter in the proximity of the choke valve to directly determine flow therethrough.

15. A method according to claim 13, wherein the flow rate is determined by measuring pressure and temperature characteristics of fluid at the inlet and outlet of the choke.

16. A method according to any preceding claim, wherein the method is used for detection and/or monitoring of wear within a valve actuator.

17. A method according to claim 16, comprising the step of determining the volume of fluid consumed by an actuation of the valve.

18. A method according to claim 17, wherein the volume is determined by measuring hydraulic fluid pressure at each side of the valve.

19. A method according to claim 17, wherein the volume is determined by direct measurement.

20. A method according to any of claims 16 to 19, comprising the step of monitoring the number of actuations performed.

21. A method according to claim 20, wherein step c) comprises comparing the number of actuations to known life spans of actuator components.

22. A method according to any of claims 16 to 21, comprising the step of determining the time taken to fully stroke the actuator.

23. A method according to claim 22, further comprising the step of using the determined time taken to calculate friction within the actuator.

24. A method according to any preceding claim, wherein the method is used for detection and/or monitoring of failure of electronics components for controlling apparatus at the facility.

25. A method according to claim 24, wherein step a) includes sensing at least one of: temperature; pressure; humidity; current drawn by a component; signal levels; and voltage at at least one location in the facility.

26. A method according to either of claims 24 and 25, comprising the step of determining the health of an underwater electrical connector.

27. A method according to claim 26, wherein the health of the connector is determined by obtaining at least one of: LIM measurements; hydraulic fluid flow determinations; and chemical injection flow determinations.

28. Condition monitoring means for monitoring a component of an underwater facility, comprising:

a sensor associated with the component for sensing a parameter and outputting a signal indicative of said parameter;

an expert system arranged to receive each said output signal, the expert system including a model of expected behaviour of said parameter.

29. Condition monitoring means according to claim 28, wherein the expert system includes a historical database.

30. Condition monitoring means according to either of claims 28 and 29, wherein the component comprises an umbilical and an associated umbilical termination assembly, and the condition monitoring means is adapted to monitor the condition of electrical conductors of the component.

31. Condition monitoring means according to claim 30, comprising sensors for sensing one or more of: a surface LIM reading; a surface input voltage; a surface input current; an underwater input voltage; an underwater input current; and an underwater LIM.

32. Condition monitoring means according to any of claims 28 to 31, comprising means for collating any alarms associated with the parameter.

33. Condition monitoring means according to any of claims 28 to 32, wherein the component comprises a hydraulic fluid system, and the condition monitoring means is adapted to detect and/or monitor hydraulic fluid leakage from the system.

34. Condition monitoring means according to claim 33, comprising sensors for sensing at least one of: activation of a valve at the facility; a flow of hydraulic fluid within the facility; an amount of hydraulic fluid leaving a hydraulic reservoir located at the surface; and a hydraulic fluid pressure at one or more points within a control system of the facility.

35. Condition monitoring means according to any of claims 28 to 34, wherein the component comprises a choke valve, and the condition monitoring means is adapted to detect and/or monitor wear or erosion within the choke valve.

36. Condition monitoring means according to claim 35, comprising means for determining a flow rate through the choke valve.

37. Condition monitoring means according to claim 36, wherein the flow rate determining means comprises a flow meter in the proximity of the choke valve to directly determine flow therethrough.

38. Condition monitoring means according to claim 36, wherein the flow rate determining means comprises sensors for measuring pressure and temperature characteristics of fluid at the inlet and outlet of the choke.

39. Condition monitoring means according to any of claims 28 to 38, wherein the component comprises a valve actuator and the condition monitoring means is adapted to detect and/or monitor wear within the valve actuator.

40. Condition monitoring means according to claim 39, comprising means for determining the volume of fluid consumed by an actuation of the valve.

41. Condition monitoring means according to claim 40, wherein the volume determining means comprises a hydraulic fluid pressure sensor located at each side of the valve.

42. Condition monitoring means according to claim 40, wherein the volume determining means comprises a volume sensor.

43. Condition monitoring means according to any of claims 39 to 42, comprising means for monitoring the number of valve actuations performed.

44. Condition monitoring means according to claim 43, wherein the expert system is adapted to compare the number of actuations to known life spans of actuator components.

45. Condition monitoring means according to any of claims 39 to 44, comprising means for determining the time taken to fully stroke the actuator.

46. Condition monitoring means according to claim 45, further comprising means for calculating friction within the actuator using the determined time.

47. Condition monitoring means according to any of claims 28 to 46, wherein the component comprises electronics components for controlling apparatus at the facility, and the condition monitoring means is adapted to detect and/or monitor failure of the electronics components.

48. Condition monitoring means according to claim 47, comprising means for sensing at least one of: temperature; pressure; humidity; current drawn by a component; signal levels; and voltage at at least one location in the facility.

49. Condition monitoring means according to either of claims 47 and 48, comprising means for determining the health of an underwater electrical connector.

50. Condition monitoring means according to claim 49, wherein the means for determining the health of the connector comprises sensors for obtaining at least one of: LIM measurements; hydraulic fluid flow determinations; and chemical injection flow determinations.

What is claimed is:

1. A method for monitoring the condition of apparatus located at an underwater facility, comprising the steps of:
a) sensing at least one parameter associated with the apparatus, the sensing including sensing a plurality of parameters,
b) providing a model of expected behaviour of said plurality of parameters,
c) comparing said sensed plurality of parameters with said model, and
d) assessing the condition of the apparatus based upon said comparison, wherein each parameter, each alarm of any alarms associated with the parameters, or each parameter and each alarm is assigned a priority rating within the model.

2. A method according to claim 1, wherein steps b), c) and d) are carried out using an expert system.

3. A method according to claim 2, wherein the expert system comprises a historical database.

4. A method according to claim 2, including the step of providing the expert system with input from an external source, said input being used to enhance the model.

5. A method according to claim 1, wherein step a) includes collating any alarms associated with one or more of the plurality of parameters.

6. A method according to claim 1, wherein monitoring the condition of apparatus located at an underwater facility comprises umbilical electrical conductor condition monitoring.

7. A method according to claim 6, wherein step a) includes sensing at least one of: a surface LIM reading, a surface input voltage, a surface input current, an underwater input voltage, an underwater input current and an underwater LIM.

8. A method according to claim 1, wherein monitoring the condition of apparatus located at an underwater facility comprises one or more of the following: detecting hydraulic fluid leakage and monitoring of hydraulic fluid leakage.

9. A method according to claim 8, wherein step a) includes sensing at least one of: activation of a valve, flow of hydraulic fluid within the facility, an amount of hydraulic fluid leaving a hydraulic reservoir located at the surface and a hydraulic fluid pressure at one or more points within a control system of the facility.

10. A method according to claim 1, wherein monitoring the condition of apparatus located at an underwater facility comprises one or more of the following: detecting wear or erosion within a choke valve; and monitoring of wear or erosion within the choke valve.

11. A method according to claim 10, wherein the method further comprises determining a flow rate through the choke valve by performing one or more of the following: determining a flow rate through the choke valve; using a flow meter in the proximity of the choke valve to directly determine flow therethrough; and measuring pressure and temperature characteristics of fluid at the inlet and outlet of the choke valve.

12. A method according to claim 10, wherein monitoring the condition of apparatus located at an underwater facility further comprises; one or more of the following: detecting wear within a valve actuator; and monitoring of wear within the valve actuator.

13. A method according to claim 12, comprising the step of determining the volume of fluid consumed by an actuation of the valve, wherein the volume is determined by measuring hydraulic fluid pressure at each side of the valve.

14. A method according to claim 1, further comprising the step of monitoring a number of valve actuations performed.

15. A method for monitoring the condition of apparatus located at an underwater facility, the method comprising the steps of: sensing at least one parameter associated with the apparatus,

providing a model of expected behaviour of said at least one parameter, comparing said sensed parameter with said model, assessing the condition of the apparatus based upon said comparison, and one or more of the following: detecting a failure of electronic components for controlling the apparatus at the facility; and monitoring of the failure of the electronic components for controlling the apparatus at the facility.

16. Condition monitoring means for monitoring a component of an underwater facility, comprising: a sensor associated with component for sensing a parameter and outputting a signal indicative of said parameter; and an expert system arranged to receive each said output signal, the expert system including a model of expected behaviour of said parameter, wherein the expert system includes a historical database.

17. Condition monitoring means according to claim 16, wherein the component comprises an umbilical and an associated umbilical termination assembly, and the condition monitoring means is adapted to monitor the condition of electrical conductors of the component.

18. Condition monitoring means according to claim 16, comprising means for collating any alarms associated with the parameter.

19. Condition monitoring means according to claim 16, wherein the component comprises a hydraulic fluid system, and wherein the condition monitoring means is adapted to perform one or more of the following: detecting hydraulic fluid leakage from the system, and monitoring hydraulic fluid leakage from the system.

20. Condition monitoring means according to claim 16, wherein the component comprises a choke valve, and wherein the condition monitoring means is adapted to perform one or more of the following: detecting wear or erosion within the choke valve, and monitoring wear or erosion within the choke valve.

21. Condition monitoring means according to claim 16, wherein the component comprises a valve actuator and the condition monitoring means is adapted to perform one or more of the

following: detecting wear within the valve actuator and monitoring wear within the valve actuator.

22. Condition monitoring means according to claim 16, wherein the component comprises electronics components for controlling apparatus at the facility, and wherein the condition monitoring means is adapted to perform one or more of the following: detecting failure of the electronics components, and monitoring failure of the electronics components.