Both OBC versions described thus far suggest a hybrid version embodying features of both FIG. 5 and FIG. 9. Such a hybrid cable would include a series of non-separable cable segments as in FIG. 9 that include loops as in FIG. 5 at one or both ends of the cable. The looped ends of two such cables could be joined at a sensor unit as in FIG. 8. This would allow multi-segment cable sections to be connected or disconnected along the length of a much longer OBC.

FIG. 10 also shows the connectors and the hydrophone on the end plates of the sensor tubes covered by oil-filled boots 84, 85 to prevent corrosive sea water from contacting and corroding the connectors. The oil-filled boots may be used in the senor units in FIG. 7 as well.

Although the invention has been described in detail with respect to a few preferred versions, other versions are possible. For example, a single, multi-strand stress member with two separated strands extending out the ends of each cable segment could be used instead of the endless stress member or the two side-by-side stress members described in FIGS. 7 and 10. As another example, the split outer sensor housing could be formed out of two complementary, but non-identical portions. One set of the channels could be formed entirely in a first one of the portions and covered by the other second portion and the other set of channels could be formed entirely in the second portion and covered by the first portion when the two portions are clamped together. So, as these few examples suggest, the spirit and scope of the claims are not meant to limited to the details of the preferred versions.

~~What is claimed is:~~

~~CLAIMS~~

What is claimed is:

1. An underwater cable comprising:

a plurality of cable segments including one or more stress members disposed axially along the cable segments and extending past opposite ends of the cable segments;

one or more sensor units disposed along the cable between successive cable segments, each sensor unit including:

an outer sensor housing connected at opposite end portions to successive cable segments and having an outer surface and an interior cavity;

a sensor module disposed in the interior cavity;

wherein the outer sensor housing has axial channels disposed between the interior cavity and the outer surface of the outer sensor housing for receiving the one or more stress members extending from the ends of the successive cable segments connected to the outer sensor housing.

2. An underwater cable as in claim 1 wherein the outer sensor housing further includes axially elongated openings through the outer surface extending into the interior cavity and wherein the sensor module has axially elongated vanes extending through the openings past the outer surface of the outer sensor housing.

3. An underwater cable as in ~~any preceding~~ claim 1 wherein the sensor module is mechanically isolated from the outer sensor housing.

4. An underwater cable as in ~~any preceding~~ claim 1 wherein the sensor units include a cradle fastened at opposite ends to the outer sensor housing for suspending the sensor module within the interior cavity.

5. An underwater cable as in claim 4 wherein the sensor units further include rings retained in the outer sensor housing at each end portion of the outer sensor housing at which the opposite ends of the cradle are fastened.

6. An underwater cable as in claim 4 ~~or 5~~ wherein the outer sensor housing further includes axially elongated openings through the outer surface extending into the interior cavity and wherein the sensor module has axially elongated vanes extending through the openings past the outer surface of the outer sensor housing and wherein the cradle includes slits through which the vanes of the sensor module extend.

7. An underwater cable as in ~~any preceding~~ claim 1 wherein the cable segments include an electrical cable extending out the ends of the cable segments and wherein the sensor module includes a connector at each end to which the electrical cables are connected and wherein the sensor unit further includes oil-filled boots covering the connectors.

8. An underwater cable as in ~~any preceding~~ claim 1 wherein each cable segment includes stress member loops extending past the opposite ends of the cable segment.

9. An underwater cable as in claim 8 wherein each cable segment includes a single endless stress member encased in the cable segment with a length exceeding twice the length of the segment to form the stress member loops.

10. An underwater cable as in claim 8 ~~or 9~~ wherein the axial channels are formed diametrically opposite each other in the outer sensor housing and wherein the stress member loop of the cable segment at one end of the sensor unit and the stress member loop of the cable segment at the other end reside in the same channels, with the sensor module in the interiors of the stress member loops.

11. An underwater cable as in claim 10 wherein the outer housing further includes a linking channel in each end portion of the outer housing module communicating with the diametrically opposite axial channels for receiving the distal end of the stress member loop from the cable segment in the opposite end portion.

12. An underwater cable as in ~~any of claims~~claim 1~~–7~~ wherein the one or more stress members encased in the cable segments comprise a pair of stress members running the length of the underwater cable.

13. An underwater cable as in claim 12 wherein the axial channels are formed diametrically opposite each other in the outer sensor housing and wherein each stress member of the pair resides in a different axial channel.

14. An underwater cable as in ~~any preceding~~ claim 1 wherein the outer sensor housing comprises two complementary portions.

15. An underwater cable comprising:

a plurality of cable segments having one or more vibration-damping stress members extending past opposite ends of the cable segments; and

a plurality of sensor housings housing a sensor and alternately arranged with the cable segments to form an underwater cable;

wherein the sensor housings are split along confronting faces of opposite housing portions defining paths for the stress members encircling the sensor.

16. An underwater cable as in claim 15 wherein the paths for the stress members include channels running along the length of the housing on opposite sides of the ~~housing's~~housing's centerline and opening onto the confronting faces for insertion and removal of the stress members of adjacent cable segments when the split housing is open and wherein the channels are closed when the split housing is closed

17. An underwater cable as in claim 15 ~~or 16~~ wherein the stress members extending out the ends of each cable segment form a loop at each end.

18. An underwater cable as in claim 17 wherein each cable segment includes a single endless stress member encased in the cable segment with a circumference exceeding twice the length of the segment to form the loops.

19. An underwater cable as in ~~any preceding~~ claim 15 wherein the stress members are ~~high modulus~~ synthetic fiber ropes.

20. An underwater cable segment comprising:

an endless stress member extending along the underwater cable segment and past opposite ends of the cable segment to form a loop in the stress member at each end.

21. An underwater cable segment as in claim 20 further comprising an elongated outer jacket extending along the length of the cable segment and encasing the portions of the endless stress member not forming the loops.

22. A sensor unit for an underwater cable, comprising:

an outer sensor housing having an outer surface and an interior cavity;

a sensor module suspended in the interior cavity;

axially elongated openings through the outer surface extending into the interior cavity and wherein the sensor module has vanes extending through the axially elongated openings past the outer surface of the outer sensor housing.

23. A sensor unit as in claim 22 wherein the outer sensor housing comprises complementary portions that form a clamp.

24. An underwater cable as in claim 21 ~~or 22~~ wherein the sensor unit includes a cradle fastened at opposite ends to the outer sensor housing for suspending the sensor module within the interior cavity.

25. An underwater cable as in claim 24 wherein the sensor unit further includes rings retained in the outer sensor housing at opposite ends of the interior cavity at which the opposite ends of the cradle are fastened.

Both OBC versions described thus far suggest a hybrid version embodying features of both FIG. 5 and FIG. 9. Such a hybrid cable would include a series of non-separable cable segments as in FIG. 9 that include loops as in FIG. 5 at one or both ends of the cable. The looped ends of two such cables could be joined at a sensor unit as in FIG. 8. This would allow multi-segment cable sections to be connected or disconnected along the length of a much longer OBC.

FIG. 10 also shows the connectors and the hydrophone on the end plates of the sensor tubes covered by oil-filled boots 84, 85 to prevent corrosive sea water from contacting and corroding the connectors. The oil-filled boots may be used in the senor units in FIG. 7 as well.

Although the invention has been described in detail with respect to a few preferred versions, other versions are possible. For example, a single, multi-strand stress member with two separated strands extending out the ends of each cable segment could be used instead of the endless stress member or the two side-by-side stress members described in FIGS. 7 and 10. As another example, the split outer sensor housing could be formed out of two complementary, but non-identical portions. One set of the channels could be formed entirely in a first one of the portions and covered by the other second portion and the other set of channels could be formed entirely in the second portion and covered by the first portion when the two portions are clamped together. So, as these few examples suggest, the spirit and scope of the claims are not meant to limited to the details of the preferred versions.

What is claimed is:

1. An underwater cable comprising:

a plurality of cable segments including one or more stress members disposed axially along the cable segments and extending past opposite ends of the cable segments;

one or more sensor units disposed along the cable between successive cable segments, each sensor unit including:

an outer sensor housing connected at opposite end portions to successive cable segments and having an outer surface and an interior cavity;

a sensor module disposed in the interior cavity;

wherein the outer sensor housing has axial channels disposed between the interior cavity and the outer surface of the outer sensor housing for receiving the one or more stress members extending from the ends of the successive cable segments connected to the outer sensor housing.

2. An underwater cable as in claim 1 wherein the outer sensor housing further includes axially elongated openings through the outer surface extending into the interior cavity and wherein the sensor module has axially elongated vanes extending through the openings past the outer surface of the outer sensor housing.

3. An underwater cable as in claim 1 wherein the sensor module is mechanically isolated from the outer sensor housing.

4. An underwater cable as in claim 1 wherein the sensor units include a cradle fastened at opposite ends to the outer sensor housing for suspending the sensor module within the interior cavity.

5. An underwater cable as in claim 4 wherein the sensor units further include rings retained in the outer sensor housing at each end portion of the outer sensor housing at which the opposite ends of the cradle are fastened.

6. An underwater cable as in claim 4 wherein the outer sensor housing further includes axially elongated openings through the outer surface extending into the interior cavity and wherein the sensor module has axially elongated vanes extending through the openings past the outer surface of the outer sensor housing and wherein the cradle includes slits through which the vanes of the sensor module extend.

7. An underwater cable as in claim 1 wherein the cable segments include an electrical cable extending out the ends of the cable segments and wherein the sensor module includes a connector at each end to which the electrical cables are connected and wherein the sensor unit further includes oil-filled boots covering the connectors.

8. An underwater cable as in claim 1 wherein each cable segment includes stress member loops extending past the opposite ends of the cable segment.

9. An underwater cable as in claim 8 wherein each cable segment includes a single endless stress member encased in the cable segment with a length exceeding twice the length of the segment to form the stress member loops.

10. An underwater cable as in claim 8 wherein the axial channels are formed diametrically opposite each other in the outer sensor housing and wherein the stress member loop of the cable segment at one end of the sensor unit and the stress member loop of the cable segment at the other end reside in the same channels, with the sensor module in the interiors of the stress member loops.

11. An underwater cable as in claim 10 wherein the outer housing further includes a linking channel in each end portion of the outer housing module communicating with the diametrically opposite axial channels for receiving the distal end of the stress member loop from the cable segment in the opposite end portion.

12. An underwater cable as in claim 1 wherein the one or more stress members encased in the cable segments comprise a pair of stress members running the length of the underwater cable.

13. An underwater cable as in claim 12 wherein the axial channels are formed diametrically opposite each other in the outer sensor housing and wherein each stress member of the pair resides in a different axial channel.

14. An underwater cable as in claim 1 wherein the outer sensor housing comprises two complementary portions.

15. An underwater cable comprising:

a plurality of cable segments having one or more vibration-damping stress members extending past opposite ends of the cable segments; and

a plurality of sensor housings housing a sensor and alternately arranged with the cable segments to form an underwater cable;

wherein the sensor housings are split along confronting faces of opposite housing portions defining paths for the stress members encircling the sensor.

16. An underwater cable as in claim 15 wherein the paths for the stress members include channels running along the length of the housing on opposite sides of the housing's centerline and opening onto the confronting faces for insertion and removal of the stress members of adjacent cable segments when the split housing is open and wherein the channels are closed when the split housing is closed

17. An underwater cable as in claim 15 wherein the stress members extending out the ends of each cable segment form a loop at each end.

18. An underwater cable as in claim 17 wherein each cable segment includes a single endless stress member encased in the cable segment with a circumference exceeding twice the length of the segment to form the loops.

19. An underwater cable as in claim 15 wherein the stress members are synthetic fiber ropes.

20. An underwater cable segment comprising:

an endless stress member extending along the underwater cable segment and past opposite ends of the cable segment to form a loop in the stress member at each end.

21. An underwater cable segment as in claim 20 further comprising an elongated outer jacket extending along the length of the cable segment and encasing the portions of the endless stress member not forming the loops.

22. A sensor unit for an underwater cable, comprising:

an outer sensor housing having an outer surface and an interior cavity;

a sensor module suspended in the interior cavity;

axially elongated openings through the outer surface extending into the interior cavity and wherein the sensor module has vanes extending through the axially elongated openings past the outer surface of the outer sensor housing.

23. A sensor unit as in claim 22 wherein the outer sensor housing comprises complementary portions that form a clamp.

24. An underwater cable as in claim 21 wherein the sensor unit includes a cradle fastened at opposite ends to the outer sensor housing for suspending the sensor module within the interior cavity.

25. An underwater cable as in claim 24 wherein the sensor unit further includes rings retained in the outer sensor housing at opposite ends of the interior cavity at which the opposite ends of the cradle are fastened.