



- (51) International Patent Classification: Not classified
- (21) International Application Number:
PCT/GB2013/050243
- (22) International Filing Date:
1 February 2013 (01.02.2013)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
1201811.5 2 February 2012 (02.02.2012) GB
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- (81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,

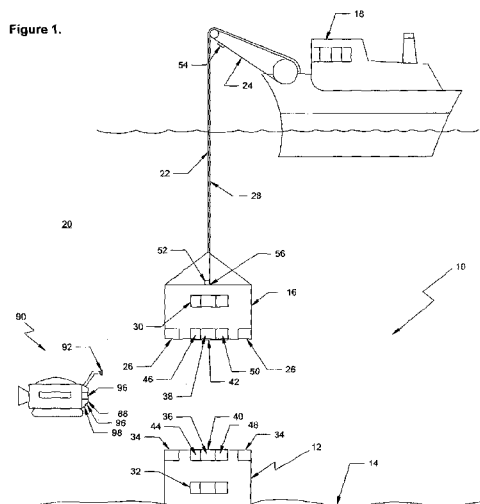
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,
NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU,
RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ,
TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA,
ZM, ZW.

- (84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished
upon receipt of that report (Rule 48.2(g))*

(54) Title: IMPROVED SUBSEA INSTALLATION DEPLOYMENT



- (57) Abstract: A subsea deployment system comprising a first part of a subsea installation, the first part being at a fixed location relative to the sea bed; a second part of a subsea installation, the second part being deployed from a further location to land relative to the first part; an underwater vehicle, the vehicle being located in proximity to the first part; the first part and the vehicle each having a wireless transceiver for transmission of signals between them; and wherein at least one sensor is arranged on the first part to assist in guiding the second part onto the first part and data from the at least one sensor is transmitted via the wireless transceivers to the vehicle.



IMPROVED SUBSEA INSTALLATION DEPLOYMENT

The present invention relates to monitoring of subsea installations and in particular, though not exclusively, to a subsea deployment system based on a wireless
5 monitoring system for use in the controlled deployment of a portion of a subsea installation onto a fixed subsea structure.

As energy requirements increase, technology is being developed to find and exploit new energy sources in our oceans. Offshore wind farms are being constructed and
10 tidal power generators are seeing a resurgence in interest. Oil and gas exploration and production is also venturing further into deeper waters. As a result large numbers of subsea installations are being constructed. In many instances control modules are located upon the installations together with process sensors, to control and operate the facilities once constructed. Large umbilicals connect the sensors
15 and control systems to the surface while delivering power to the installation.

Many subsea installations are constructed in sections, due to the weight and manoeuvrability of the sections. Additionally, further sections may be required at different instances in the lifetime of the installation for example, in workovers where
20 the installation is a subsea oil or gas well. During such deployment, communication by umbilical is only available to the new section being 'landed' upon the fixed construction. Typically cameras are used to relay images of the fixed structure to assist in 'docking' the new section upon the fixed structure. Stabbed connections are then used to provide communication through the entire subsea structure when
25 deployment is complete.

There are many disadvantages in using a camera based system. Deployment of the new section must be slow to ensure that the image is detected and analysed before the new section meets the fixed structure. Optical images are difficult to see and
30 interpret through sea water. Additionally any silt kicked up around the structure will interfere with the image. This severely limits the range at which optical guidance can be used. In deep water, environmental indications of pressure and temperature can only be acquired from sensors mounted on the new section. Similarly gyros, inclinometers and accelerometers only provide measurements on the new section,

so that any movement of the fixed structure is unknown and cannot be compensated for.

WO2011/114152 to the present Applicant's describes a wireless auxiliary system for monitoring and control of an underwater installation. Data and control signals are sent between a lower stack in a hydrocarbon drilling or production facility and an associated riser assembly. Data is collected by locally powered sensors on the fixed lower stack and transmitted via an umbilical to surface. Additionally, the data is sent from a first transceiver located on the stack to a second transceiver located on the riser assembly by electromagnetic signals. This allows wireless transfer to occur between the lower stack and the riser assembly after the riser assembly is detached or just prior to reattachment. Such detachment and reattachment is required during periods of bad weather when the riser assembly can move significantly due to its attachment to a topside floating rig or vessel. This arrangement provides an advantage in that for a state of operation where the riser is disconnected, the ability to compare the last known state of the lower stack and the state immediately prior to reconnection provides information regarding any state change that might have been implemented in the period during which the riser was disconnected.

WO2011/114152 provides for the transmission of sensor data during detachment and reattachment of a riser assembly to a lower stack on an operating subsea well. It does not assist in the speed or guidance of the detachment or reattachment. Yet further it is limited to transferring data only during detachment and reattachment.

It is an object of the present invention to provide a subsea deployment system based on a wireless monitoring system for the controlled deployment of a portion of a subsea installation onto a fixed subsea structure.

According to a first aspect of the present invention there is provided a subsea deployment system comprising a first part of a subsea installation, the first part being at a fixed location relative to the sea bed; a second part of a subsea installation, the second part being deployed from a further location to land relative to the first part; an underwater vehicle, the vehicle being located in proximity to the first part; the first part and the vehicle each having a wireless transceiver for transmission of signals

between them; and wherein at least one sensor is arranged on the first part to assist in guiding the second part onto the first part and data from the at least one sensor is transmitted via the wireless transceivers to the vehicle.

- 5 In this way, sensor data can be collected from the fixed part of the installation to assist in guiding the second part onto the first part.

Preferably, the second part includes a wireless transceiver and the data from the at least one sensor is transmitted from the vehicle to the second part. In this way, the
10 data can be relayed up the umbilical from the second part to the surface for analysis. Alternatively, the data may be relayed directly from the vehicle to the surface.

Preferably, the transceivers collect data from sensors or detectors located on the respective part. Preferably also sensors are located on the underwater vehicle. The
15 sensors and detectors are preferably those required for positioning and guidance. The detectors may comprise cameras. The sensors may comprise gyroscopes, inclinometers or accelerometers. In this way, deployment can be quicker and more accurately achieved with sensors on the fixed first part and also on the underwater vehicle. Cameras on the underwater vehicle will provide a side view of the mating of
20 each part.

Preferably, the underwater vehicle is a mobile underwater vehicle. In this way it can be steered around the first and second part to capture images from any desired position to assist in guiding the deployment. More preferably, the underwater vehicle
25 is an autonomous underwater vehicle (AUV). More preferably, the underwater vehicle is a remotely operated vehicle (ROV). Such vehicles are already used in a subsea environment and can be guided to a wellhead or other subsea location of a well.

30 Preferably, the data is transmitted as an electromagnetic and/or magneto-inductive signal. Signals based on electrical and electromagnetic fields are rapidly attenuated in water due to its partially electrically conductive nature. Propagating radio or electromagnetic waves are a result of an interaction between the electric and magnetic fields. The high conductivity of seawater attenuates the electric field. Water

has a magnetic permeability close to that of free space so that a purely magnetic field is relatively unaffected by this medium. However, for propagating electromagnetic waves the energy is continually cycling between magnetic and electric field and this results in attenuation of propagating waves due to conduction losses. The seawater provides attenuation losses in a workable bandwidth which provides for data transmission over practical distances.

The data may be compressed prior to transmission. Compression allows the occupied transmission bandwidth to be reduced. In this way, increased data rates can be transmitted over equivalent distances.

Optionally, the data is compressed in combination with use of a lower carrier frequency. The lower carrier frequency leads to lower attenuation. This in turn allows data transfer through fluids over greater transmission distances. In this way the data compression and carrier frequency can be adjusted as the parts are brought together so that increased data is transmitted at closer distances.

Preferably, the data is also transmitted by an acoustic signal. Acoustic signals can best carry low data rates over large distances. Thus when the first part is initially deployed into the sea, acoustic signals may transmit data between the vehicle and the parts to provide guidance and positioning data across thousands of metres to both assist in deploying the second part and in steering the underwater vehicle to the first part. When the parts and vehicle are less than about 10 metres apart, the signals can be switched over to electromagnetic and/or magneto-inductive signals to increase the data rate. Both signals may operate for a period with the data being compared to provide error correction and analysis for improved reliability.

Preferably the signal is also transmitted by an optical signal. Optical signals offer large data rates but are effective only across short ranges. Preferably the optical signals are used at distances of less than 5 metres but most preferably at a few centimetres and below through seawater. Thus as vehicle can be moved between the first part and the second part, optical signals can stored at the vehicle for transfer to the second part when the vehicle is moved. Electromagnetic and/or magneto-

inductive signals and optical signals may operate with the data being compared to provide error correction and analysis for improved reliability.

By using combinations of signal types, data transmission can be achieved regardless
5 of the quantity of data and the data rate required for the type of sensor being used.

Preferably, the data transmission is bi-directional. In this way, command and control signals can be transferred between the vehicle and the parts. Advantageously, at least the first part includes a local battery. In this way, transceiver(s), sensors and
10 detectors, on the first part do not require an umbilical connection to surface.

Preferably, each transceiver has an electrically insulated magnetic coupled antenna. Alternatively, each transceiver has an electric field coupled antenna. The antenna may be a wire loop, coil or similar arrangement. Such antenna create both magnetic
15 and electromagnetic fields. The magnetic or magneto-inductive field is generally considered to comprise two components of different magnitude that, along with other factors, attenuate with distance (r), at rates proportional to $1/r^2$ and $1/r^3$ respectively. Together they are often termed the near field components. The electromagnetic field has a still different magnitude and, along with other factors, attenuates with distance
20 at a rate proportional to $1/r$. It is often termed the far field or propagating component. Such a transceiver is manufactured by the Applicant, WFS Technologies.

Preferably each transceiver also comprises an acoustic transceiver. A transponder may also be included to receive and send an acoustic pulse for positioning
25 information. Such acoustic transceivers are manufactured by a number of companies including Nautronix, Sonardyne and Kongsberg.

Preferably each transceiver also comprises an optical transceiver. Such an optical transceiver is manufactured by Ambalux.

30

Preferably, power is transmitted by magnetic coupling between the first and second transceivers when the second part is landed on the first part. In this way, there is no need for direct electrical conductive contact between the parts once deployed. More preferably, each transceiver includes a circular coil structure surrounded by a flux

guiding enclosure that inductively couples energy from a primary coil in the second transceiver to a secondary coil in the first transceiver. Preferably, the transferred energy is used to power the transceivers, sensors and detectors so that they may be operational once the parts are deployed.

5

Without the need for electrical conductive contact between the parts, data may be transmitted between transceivers when the parts have been deployed. In this way, stabbed connectors, wet-mate connectors and jumpers are not required on the subsea installation. Once deployed, the signals are preferably optical or
10 electromagnetic/magneto-inductive.

The subsea installation may be one of a group comprising: a rig, a blow-out preventor, a lower stack, a wellhead, a Christmas tree, a drilling unit, a wind power generator support, a wave power generator, a separator, a pump, a manifold and a
15 compressor.

Further sensors may be located on at least one part and the sensor data transmitted between the transceivers on each part once deployed. The ability to wirelessly transmit data when the parts are deployed removes the requirement for stab
20 connectors, wet-mate connectors or jumpers. Alternatively, such connectors may be used with the wireless connection being used in the event of failure. These further sensors are measurement devices and may be selected from gauges, valves, sampling devices, a device used in intelligent or smart well completion, temperature sensors, pressure sensors, flow-control devices, flow rate measurement devices,
25 oil/water/gas ratio measurement devices, scale detectors, actuators, locks, release mechanisms, equipment sensors (e.g., vibration sensors), sand detection sensors, water detection sensors, data recorders, viscosity sensors, density sensors, bubble point sensors, composition sensors, resistivity array devices and sensors, acoustic devices and sensors, other telemetry devices, near infrared sensors, gamma ray
30 detectors, H₂S detectors, CO₂ detectors, downhole memory units, downhole controllers, and locators.

In an embodiment, the second part of the subsea installation may include an additional transceiver and a further transceiver may be located at surface. Data

transmission between the additional and further transceivers would provide a back-up in the event of failure in the umbilical. In this embodiment the second part may also include a local battery.

- 5 Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings of which:

Figure 1 is a schematic illustration of a subsea installation during deployment according to an embodiment of the present invention;

10

Figure 2 is a block diagram of a transceiver for use in a system of the present invention; and

Figure 3 is a block diagram of an antenna for use in the transmitter or receiver of the
15 transceiver of Figure 2.

Reference is initially made to Figure 1 of the drawings which illustrates a subsea installation, generally indicated by reference numeral 10, comprising a first part 12 located on the seabed 14 and a second part 16 being deployed from a surface
20 vessel 18 according to an embodiment of the present invention.

In Figure 1, the subsea installation 10 is illustrated schematically, but it may be any structure such as a rig, a blow-out preventor, a lower stack, a wellhead, a Christmas tree, a drilling unit, a wind power generator support, a wave power generator, a
25 separator, a pump, a manifold and a compressor. While the second part 16 is shown as being deployed from a surface vessel 18, for larger structures a rig may be constructed. As known, the second part 16 is lowered through the sea water 20 on a cable 22 from a crane 24 on the vessel 18. The position of the first part 12 is known by the vessel 18, and the second part is lowered until cameras 26 sight the first part
30 16. The cameras 26 are operated via an umbilical 28 which transmits power and data. The camera images are used to guide the second part 16 to land on the first part 12. Control of the second part 16 is arranged from the vessel 18 by making adjustments to the crane 24.

Sensors 30 located on the second part 16 can operate during deployment by connection via the umbilical 28. These sensors 30 can be those required for positioning and guidance such as gyroscopes, inclinometers or accelerometers. Alternatively, the sensors 30 may monitor environmental conditions such as temperature and/or physical conditions such as tension on the cable 22 and /or umbilical 28. It is noted that sensors 32 located on the first part 16, typically do not operate until power and data transmission connections are made to the second part 16, so that they can transmit via the umbilical 28. When landed, the power and data connections are formed by stabbed connectors and jumpers which are typically of the wet-mate variety due to the subsea environment.

For the present invention, a transceiver 36 is located on the first part 12 and a further transceiver 88 is located on an ROV 90 located in proximity to the first part 12. The transceiver 36 is connected to the sensors 32 and cameras 34 on the first part 12. With local power made available on the first part 12, data and images can be wirelessly transferred via the transceivers 36,88 to the ROV 90. The data and images may then be transferred to surface via a tethered umbilical on the ROV 90 (not shown) or can be wirelessly transferred to a transceiver 38 on the second part 16 for transfer up the umbilical 28 to the vessel 18. In this way, additional information can be gathered for use in guiding the second part 16 into position or additional environmental and physical characteristic data can be transmitted to surface. Sensors 32 may be similar to sensors 30 or are more likely to be measurement devices and may be selected from gauges, valves, sampling devices, a device used in intelligent or smart well completion, temperature sensors, pressure sensors, flow-control devices, flow rate measurement devices, oil/water/gas ratio measurement devices, scale detectors, actuators, locks, release mechanisms, equipment sensors (e.g., vibration sensors), sand detection sensors, water detection sensors, data recorders, viscosity sensors, density sensors, bubble point sensors, composition sensors, resistivity array devices and sensors, acoustic devices and sensors, other telemetry devices, near infrared sensors, gamma ray detectors, H₂S detectors, CO₂ detectors, downhole memory units, downhole controllers, and locators.

Additional sensors 92 are located on the ROV 90. Sensors 90 may advantageously be cameras to provide a side view of the first 12 and second 16 parts docking. The

image data from the sensors 92 is transmitted from the transceiver 88 on the ROV 90 to the transceiver 38 on the second part 16.

In an embodiment, the transceivers 36,38,88 transmit wirelessly by an
5 electromagnetic and/or a magneto-inductive signal. Reference is now made to Figure 2 of the drawings which illustrates parts of each transceiver 36,38,88. In transceiver 36,88 the sensor interface 56 receives data from the measurement systems in the sensors 32,92 which is forwarded to data processor 58. Data is then
10 passed to signal processor 60 which generates a modulated signal which is modulated onto a carrier signal by modulator 62. Transmit amplifier 64 then generates the desired signal amplitude required by transmit transducer 66. In the transceiver 38, there is a control interface 68 which interfaces with the vessel 18 via the umbilical 28 and sends command signals to the data processor 58 which are
15 transmitted by the above described path. The command signals can be used to detect the location of the wireless transceiver 88 and the ROV to determine if the transceivers 36,88 and 88,38 are within proximity or range to transmit data.

The transceivers 36,38,88 also have a receive transducer 70 which receives a modulated signal which is amplified by receive amplifier 72. De-modulator 74 mixes
20 the received signal to base band and detects symbol transitions. The signal is then passed to signal processor 76 which processes the received signal to extract data. Data is then passed to data processor 58 which in turn forwards the data to control interface 68. For the transceivers 36,88 there is also a memory 78 which can store data for onward transfer if the transceivers 36,38,88 are too far apart. The control
25 interface 68 in transceiver 38 passes the data up the umbilical 28 to the vessel 18 for analysis and use in guiding the second part 16 onto the first part 12.

Figure 3 shows an example of an antenna that can be used in the transmitter and receiver of Figure 2. This has a high permeability ferrite core 80. Wound round the
30 core are multiple loops 82 of an insulated wire. The number of turns of the wire and length to diameter ratio of the core 80 can be selected depending on the application. However, for operation at 125 kHz, one thousand turns and a 10:1 length to diameter ratio is suitable. The antenna is connected to the relevant transmitter/receiver assembly parts described in Figure 2 and is included in a sealed housing 84. Within

the housing the antenna may be surrounded by air or some other suitable insulator 86, for example, low conductivity medium such as distilled water that is impedance matched to the propagating medium 20. The antenna can also be used to magnetically couple energy between the transceivers 36,38,88. In this regard the housing acts as a magnetic flux guide and the multiple loops 82 with the ferrite core 80 provide a transformer when a pair of transceivers are brought together. In order for successful energy transfer the two transceivers must be arranged close together, there being an acceptable gap of only 1-2cm. Thus the range for power transfer is much smaller than the range for data communication. Coupling efficiency reduces as frequency increases because of leakage inductance effects. Eddy current losses increase with frequency so also act to reduce the bandwidth available for data transmission. Data and power transmission can be separated in frequency to allow simultaneous operation of the two functions. Transfer efficiency is more critical for power transfer than for data communication applications so a higher frequency will usually be assigned to the data communication signals. While a transceiver 36,38,88 is described with a common antenna for transmit and receive, separate antennas may be used. Additionally, a separate transmitter coil arrangement can be provided solely for power transfer.

In use, the first part 12 is a fixed structure located on the seabed 14. The second part 16 is a further structure required to be landed upon the fixed structure 12. The structures may, for example, be a fixed structure of a BOP and stacks at an offshore well, with the further structure being a drilling control unit being brought in for additional drilling work. An ROV 90 is located in proximity to the first part 12. Transceivers 36,38,88 are as described herein before and mounted to each part 12,16 and the ROV 90. The second part 16 is lowered off the vessel 18 by crane 24, as is known in the art. The transceivers 36,38,88 can provide a locating signal to identify itself to the other and determine that they are in range. The signal will be a low data rate signal passed at a low carrier frequency to give maximum range for detection. Once each has detected the other, data from the sensors 32 can be transmitted via a relay from transceiver 36 to transceiver 88 and on to transceiver 38. This data will be compressed to reduce the transmission bandwidth and allow the data to be transmitted over a low carrier frequency. As the data is relayed via the ROV 90, data can be detected at large separation distances. Additionally, the ROV

- may steer closer to the first part 12 and collect data which it stores on board. The ROV can then be steered closer to the second part 16 to transmit the data to transceiver 38. Data from the sensors 92 on the ROV 90 is also transmitted to the transceiver 38 on the second part. As the parts 12,16 draw closer, being guided by
- 5 the data being sent, the data rate can be increased as the signal will suffer less attenuation through the lower volume of seawater 20. As the transceivers 36,38,88 can transmit and receive, feedback controls can be set-up to guide the second part 16 onto the first part 12, particularly if motors are connected to the second part 16 to provide steering. When the parts 12,16 are within visible range, camera 34,92
- 10 images can be compressed and transmitted via the transceivers 36,38,88 to the vessel 18 to provide visual clarification of the position and mating of the parts 12,16. This greatly increased data rate transfer will need to be compressed and carried at a relatively low carrier frequency.
- 15 Once the second part 16 is deployed and landed on the first part 12, wet mate connections and jumpers can be avoided as the transceivers 36,38 can transmit data directly between the parts 12,16. Additionally, at such close proximity, power can be transferred to the sensors 32 for use or to recharge their batteries.
- 20 In a further embodiment, the transceivers 36,38,88 aside from having an electromagnetic/magneto-inductive transceiver 40,42,94 respectively, include an acoustic transceiver 44,46,96 respectively, and an optical transceiver 48,50,98 respectively.
- 25 In use, when the second part 16 is initially deployed and the distance between the parts 12,16 is greatest, data is transmitted between the transceivers 36,38,88 acoustically. Acoustic signals carry low data rates, but can travel great distances. The data initially just requires to be positioning data to ensure that the second part 16 is being moved towards the first part 12. Acoustic transceivers 44,46,96 to
- 30 achieve this are available from a number of companies such as Nautronix, Sonardyne and Kongsberg.

As the distance between the parts 12,16 is reduced the electromagnetic/magneto-inductive transceivers 40,94 and 94,42 will detect each others presence. Data rates

can be increased, an increased quantity of data from the sensors 32,92 can now be relayed to surface, the quantity of feedback data can also be increased or can now be implemented. This electromagnetic/magneto-inductive transmission can be introduced at separation distances between the parts 12,16 and the ROV 90 of
5 around 10 metres.

Visual detection will occur next as the distance is further decreased. Cameras 92 on the ROV 90 will pick-up each part 12,16 for steering purposes. Cameras 26, can be operated continuously via the umbilical 28 to alert the crew to the first visible
10 detection of the fixed structure 12. Control signals can then be transmitted to the cameras 34,92 to begin operation and allow close monitoring of the final stages of landing viewable from both parts 12,16.

When the separation distance drops further, data can be transmitted via the optical
15 transceivers 48,50,98. These provide high bandwidth transmission so that large quantities of data can be transmitted between the transceivers 36,38,88. The separation distances are now preferably a few centimetres if desired. At this separation the transceivers 36,38 can transmit directly between the parts 12,16 and the ROV 90 is no longer required or may be used as a back-up.

20

The transceivers 36,38,88 can be switched between each mode of signaling i.e. acoustic, electromagnetic/magneto-inductive and optical. Alternatively transmission can be maintained on two or three modes. The control interface can then compare the data between modes to provide for error correction. When the second part 16
25 has landed, wireless communication from the sensors 32 can still be maintained over any desired mode of signaling.

In a yet further embodiment a fourth 52 and fifth 54 wireless transceiver is present. Transceiver 52 is located at a first end 56 of the umbilical 28 and the transceiver 54
30 is located at the crane 24, being effectively at a second end of the umbilical 28. Transceivers 52,54 provide a back-up in the event that damage is done to the umbilical and data transmission is lost. Any mode of signaling can be used by the transceivers 52,54, but if the umbilical 28 is long, then repeaters will be required along the length of the umbilical 28.

The principle advantage of the present invention is that it provides a subsea deployment system in which sensor data can be collected from the fixed structure and an accompanying ROV to improve the guidance as a second part is landed on a
5 first part.

A further advantage of at least one embodiment of the present invention is that it provides a subsea deployment system in which data can be transferred from both the parts over the entire deployed range. This allows for quicker deployment so that
10 temporary installations can be more rapidly installed in a more cost effective manner.

A yet further advantage of at least one embodiment of the present invention is that it provides a subsea deployment system which does not require wet-mate connectors to join the parts when landed, as this can be maintained wirelessly.
15

It will be appreciated by those skilled in the art that various modifications may be made to the invention herein described without departing from the scope thereof. For example, while one or three signal modes have been described it will be realized that any number of signaling modes and equivalent transceivers can be
20 used. Additionally, while the example describes the second part being deployed from surface, deployment could be the moving of a second part onto a first part where the second part is initially at another underwater location. It will also be realised that communication techniques such as acoustic, radio or optical link can be used to transmit signals from the underwater to surface or to a remote repeater. Yet
25 further, real time navigation is realised if a camera with 'cross-hairs' or 'bulls-eye' is directed at a target on a part and standard video recognition software is used.

Claims

1. A subsea deployment system comprising a first part of a subsea installation, the first part being at a fixed location relative to the sea bed; a second part of a subsea installation, the second part being deployed from a further location to land relative to the first part; an underwater vehicle, the vehicle being located in proximity to the first part; the first part and the vehicle each having a wireless transceiver for transmission of signals between them; and wherein at least one sensor is arranged on the first part to assist in guiding the second part onto the first part and data from the at least one sensor is transmitted via the wireless transceivers to the vehicle.
2. A subsea deployment system as claimed in claim 1 wherein the second part includes a wireless transceiver and the data from the at least one sensor is transmitted from the vehicle to the second part.
3. A subsea deployment system as claimed in claim 1 wherein the data is relayed directly from the vehicle to the surface.
4. A subsea deployment system as claimed in any preceding claim wherein the transceivers collect data from sensors or detectors located on the respective part.
5. A subsea deployment system as claimed in any preceding claim wherein sensors are located on the underwater vehicle.
6. A subsea deployment system as claimed in any proceeding claim wherein the sensors and detectors are sense data relating to positioning and guidance.
7. A subsea deployment system as claimed in any proceeding claim wherein the underwater vehicle is a mobile underwater vehicle.
8. A subsea deployment system as claimed in any proceeding claim wherein the data is transmitted as an electromagnetic and/or magneto-inductive signal.

9. A subsea deployment system as claimed in any preceding claim wherein the data is compressed prior to transmission.

10. A subsea deployment system as claimed in claim 8 or 9 wherein the data is
5 also transmitted by an acoustic signal.

11. A subsea deployment system as claimed in any one of claims 8 to 10 wherein the data is also transmitted by an optical signal.

10 12. A subsea deployment system as claimed in any preceding claim wherein the data transmission is bi-directional.

13. A subsea deployment system as claimed in any preceding claim wherein each transceiver has an electrically insulated magnetic coupled antenna.

15

14. A subsea deployment system as claimed in any preceding claim wherein power is transmitted by magnetic coupling between the first and second transceivers when the second part is landed on the first part.

20 15. A subsea deployment system as claimed in any preceding claim wherein the second part of the subsea installation includes an additional transceiver and a further transceiver may be located at surface.

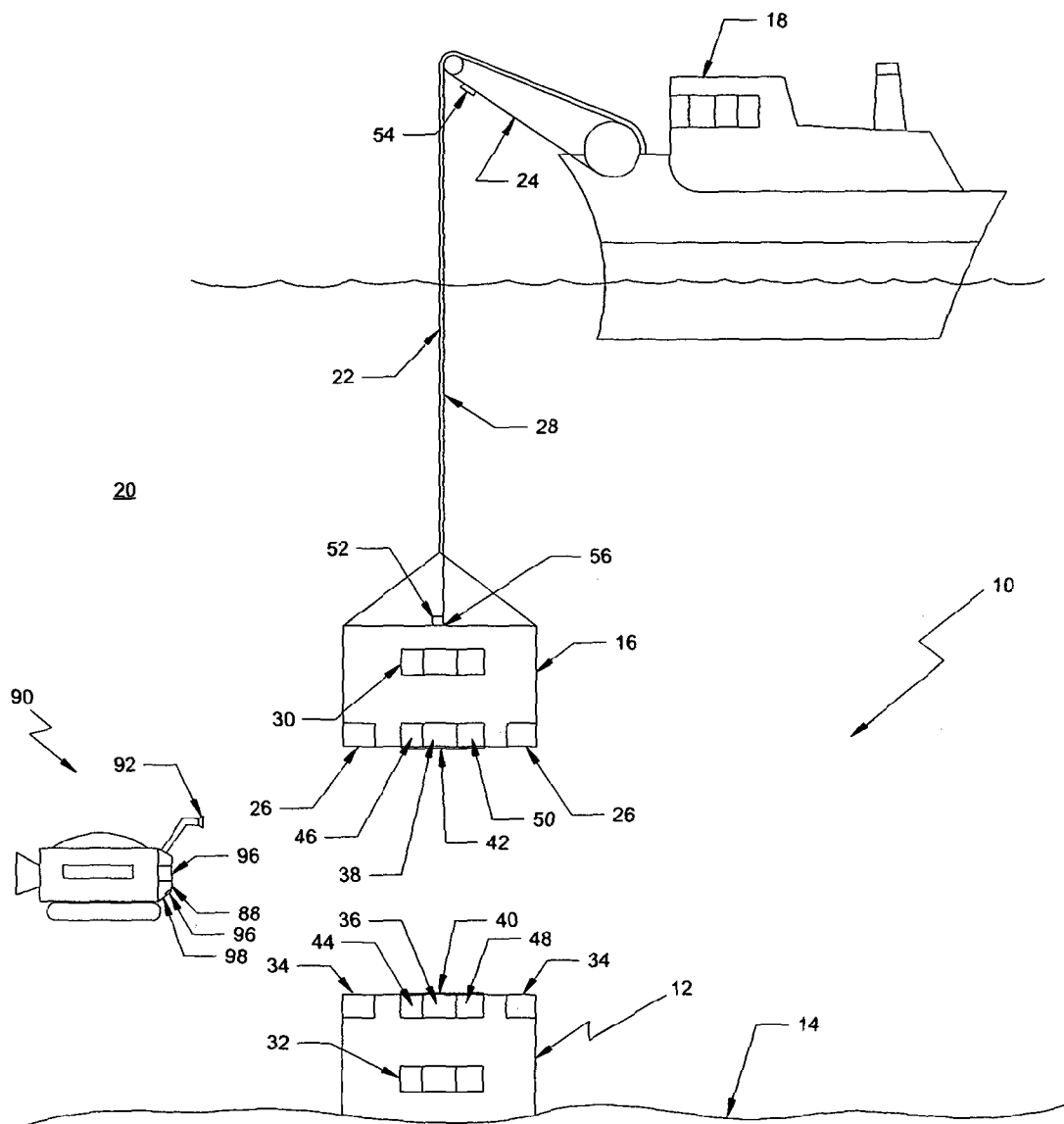
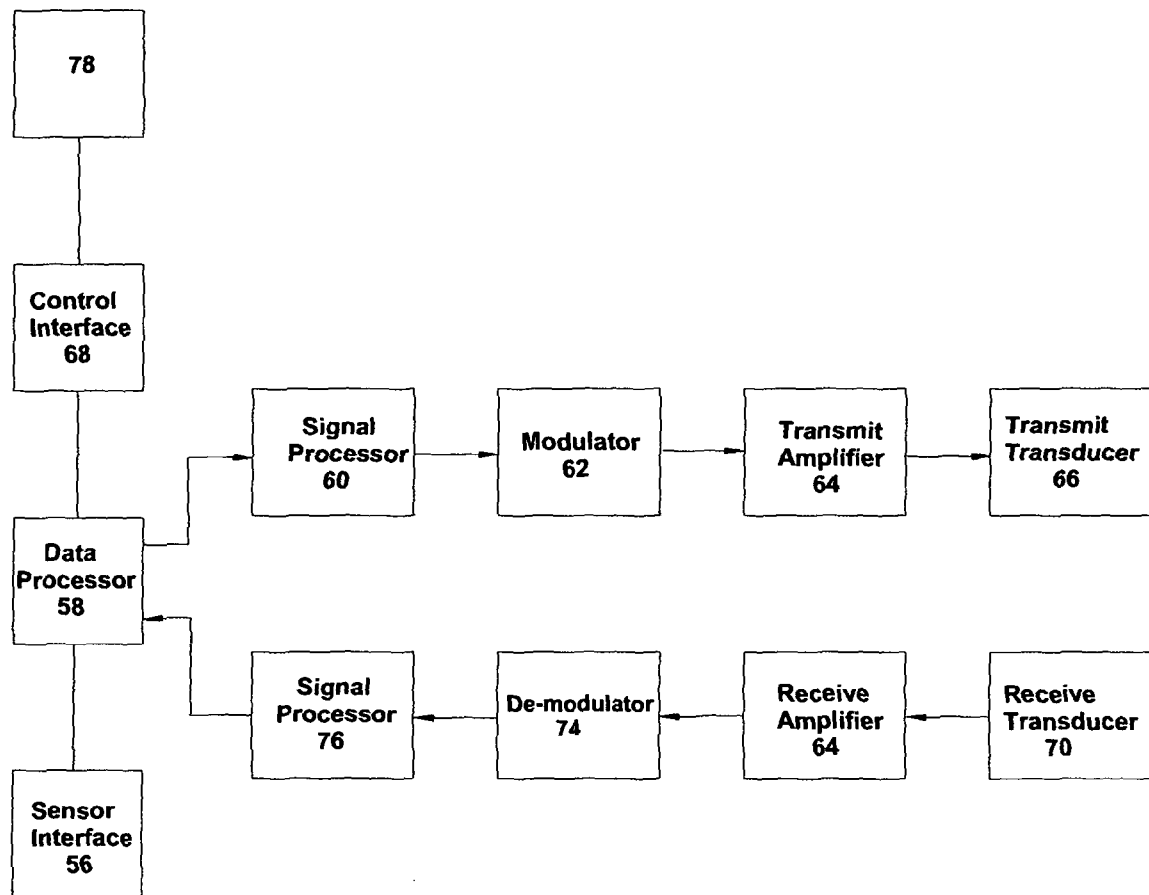


Figure 1.

**Figure 2.**

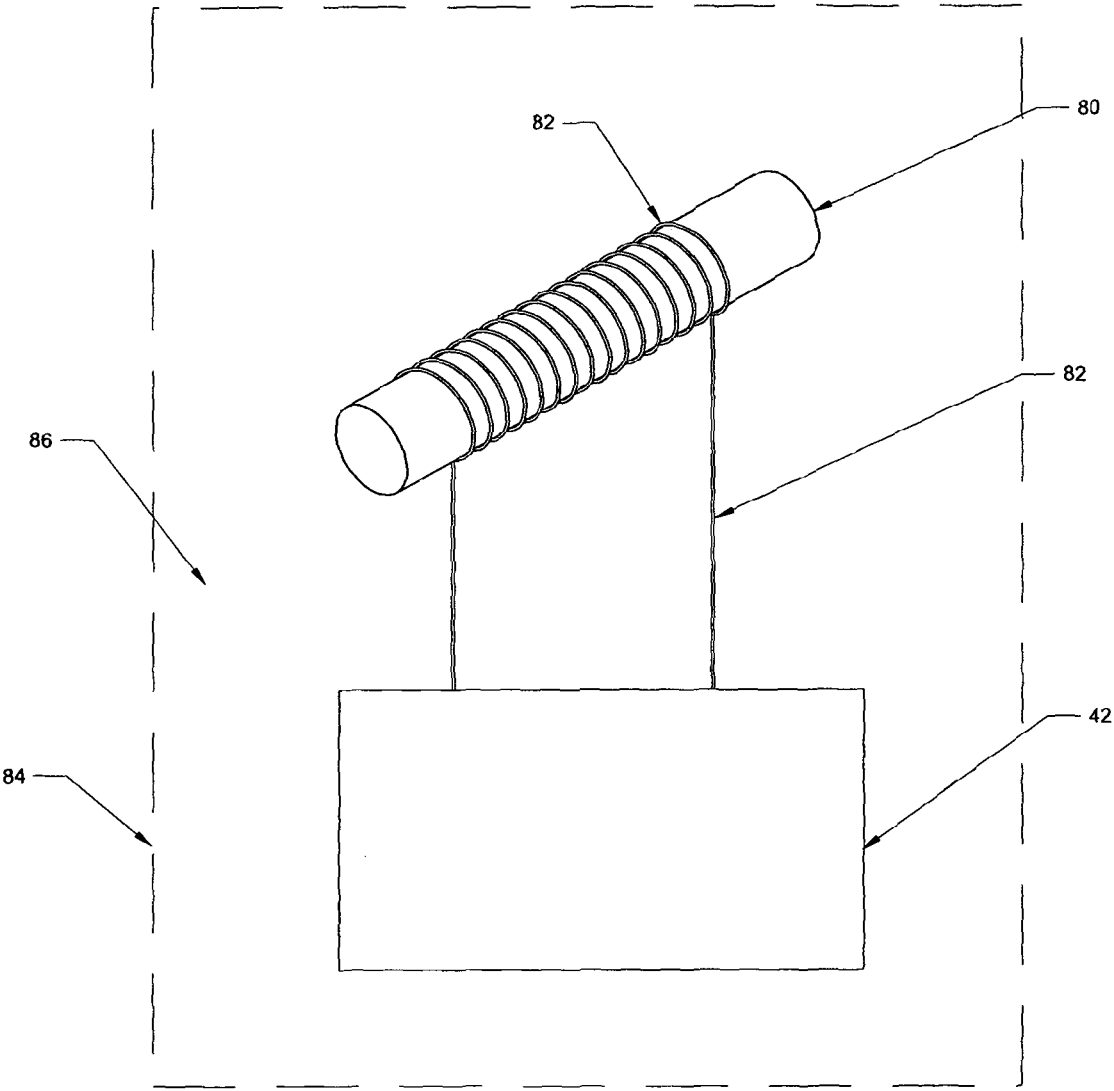


Figure 3.