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5 METHOD FOR MESSAGE TRANSMISSION

The invention relates to a method for message transmission between a submerged partner, in particular a submarine, and a land-based or airborne partner, in particular an aircraft.

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In modern submarines, propulsion systems which are independent of external air allow an extremely long submersion time, which may be more than one week. In the submerged state, physical characteristics mean that communication with the outside world, for example for the reception and the transmission of information and tactical instructions, is possible only to an extremely restricted extent.

the invention relates to a method for message transmission between a submerged partner, in particular a submarine, and a land-based or airborne partner, in particular an aircraft. In order to overcome this problem, one known communication system (DE 101 15 194 A1) provides a buoy, which is connected to the submarine via a high-tensile-strength cable, in which data transmission lines are integrated. The cable is wound up on a cable drum by a winch which is installed in the submarine. When the cable is unwound, the buoy rises to the water surface, where it assumes a stable floating position. The buoy is retrieved into the submarine by winding up the cable onto the cable drum.

restricted extent. In addition to sensors such as a pressure sensor and optical sensor, the buoy is equipped with a transmitter and a receiver, which communicate with the submarine via the data transmission lines. Messages can be transmitted by means of the transmitter from the submarine to airborne or land-based stations, and drum by a winch which is installed in the submarine. When the cable is unwound, the buoy rises to the water surface, where it assumes a stable floating position.

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messages can be received from them by means of the receiver, without the submarine having to surface for communication purposes and in the process subjecting itself to danger from enemy forces.

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A buoy such as this in which the communication devices of the submarine are mounted admittedly helps to avoid the submarine having to surface for communication purposes, but it is not possible to overcome a not insignificant remaining risk of endangering the submarine, since the surfacing of a buoy, or a buoy which is floating on the sea surface, indicates to enemy forces the presence of a submerged submarine in the immediate vicinity of the buoy. The submarine can thus quickly be located and attacked.

In the case of one known system for voice transmission between a submerged submarine and a land station (US 3 230 500 A), a buoy floating in the vicinity of the submarine is provided, and represents a converter between the land-based radio transmitter and receiver and the submarine. For this purpose, the buoy is fitted with an antenna which projects above the water surface, and with an electroacoustic transducer which is immersed in the water and is attached to the buoy via a cable. Messages are transmitted from the land station to the submarine, and in the opposite direction from the submarine to the land station, by means of a radio link between the land station and the buoy on the one hand, and by acoustic underwater communication between the submarine and the buoy on the other hand. The underwater communication between the submarine and the buoy requires there to be a short distance between the submarine and the buoy for relatively undisturbed transmission, so that detection of radio traffic between the buoy and the land station by enemy forces makes it possible to deduce the presence of a submarine

in the vicinity of the buoy, thus increasing the probability of the submarine being detected.

5 In one method for gathering and transmission of digital information (DE 40 41 915 A1), a land-based first ground station can call up digital information by satellite from a second ground station which is arranged, for example, on a buoy, with this information being supplied to the second ground station by cable
10 from a measurement device which is installed on the buoy. For this purpose, the satellite transmits an identification of the second ground station at a fixed time, in response to which this second ground station transmits all of the information that it has gathered
15 to the satellite. The satellite sends an identification for the first ground station at a fixed time, and passes on to the first ground station the information in the satellite which has been sent from the second ground station.

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The invention is based on the object of specifying a method for message transmission between a submerged partner, in particular a submarine, and a land-based or airborne partner, in particular an aircraft, which
25 safely precludes any residual risk to the submerged partner of being located during the message transmission.

According to the invention, the object is achieved by
30 the features of claim 1.

The method according to the invention has the advantage that the process for message output and the process for message reception can be sufficiently separated from
35 one another in time that the one partner is no longer physically located in the region of the buoy when the other partner stores his message in the buoy or

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retrieves from the buoy the message stored in it. It is thus possible, for example, for the submerged partner to operate clandestinely and, when in the submerged state, to send a message which can be read from the buoy only by the authorized partner. A message such as this may have different types of contents, for example data relating to the sea region which has been reconnoitered, data about enemy forces, mine position data, technical data and requirements or tactical instructions for or by one partner. For its part, the partner retrieving the stored information can once again store a message in the buoy, which is then collected at a later time by the other partner, and is passed on board. The message is then read from the buoy on board.

Expedient embodiments of the method according to the invention with advantageous developments and refinements of the invention are specified in the further claims 2 to 8. One advantageous embodiment of the buoy for use in the method according to the invention is specified in claim 9.

The invention will be described in more detail in the following text with reference to one exemplary embodiment, which is illustrated in the drawing, of one possible scenario for message transmission in a sea region. In the figures:

Figures 1 each show a scenario in a sea region in which message transmission is taking place between a submerged submarine and a helicopter, at two different times,

Figure 3 shows a block diagram of the components of a buoy which is used in the scenario shown in Figures 1 and 2.

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In the method illustrated in Figures 1 and 2 for message transmission between a submerged partner and a land-based or airborne partner, the submerged partner is a submarine 11 and the partner which in this case is airborne is a helicopter 12. Alternatively, the partner may be a mobile control center on land. Although this is not illustrated in any more detail here, the helicopter 12 is equipped with a radio transmitter, for example a VHF radio transmitter, and a radio receiver, for example a UHF receiver. The communication means between these two partners 11, 12 is a buoy 13, whose major component is a recording and replay appliance for data from messages, referred to in the following text as a recorder 14. The recorder 14 has two interfaces 141, 142 for reading in messages which are stored on the recorder 14, and for reading out messages which are read from the recorder 14. A battery 15 is provided as the power supply for the recorder 14. Additional components in the buoy 13 are a radio transmitter, for example a VHF radio transmitter 16, and a radio receiver 17, for example a UHF receiving section, both of which are connected to an antenna 18. The radio transmitter 16 and the radio receiver 17 are connected to the recorder 14 via an electronics section 19 for signal preprocessing and A/D conversion. A control logic device 20 controls the electronics section 19, the radio transmitter 16, the radio receiver 17 and the recorder 14 in such a manner that, depending on the respective operating mode, data is transmitted from the recorder 14 via the radio transmitter 16, or data received by the radio receiver 17 is recorded in the recorder 14. All the described components of the buoy 13 are accommodated in a watertight floating body 21, which assumes a stable floating attitude in the water such that the antenna 18 projects vertically from the floating body 21, and projects above the sea surface

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22. The floating body 21 is symbolized in Figure 3 by the outline around the components.

The procedure for message transmission between the submarine 11 and the helicopter 12 by means of the buoy 13 is in principle for a message to be transmitted by the one partner, for example the submarine 11 or the helicopter 12, to be stored in the buoy 13 in the absence of the other partner, and for the stored message then to be retrieved from the buoy 13 by the other partner, for example the helicopter 12 or the submarine 11, in the absence of the other partner.

In a first scenario, which is illustrated in Figure 1, the submarine 11 carries a number of buoys 13 with it, which are designed as described. In order to transmit a message to the helicopter 12, the relevant message is stored in the buoy 13 by feeding the message via the interface 141 into the recorder 14, which records the message. The buoy 13 is ejected from the submarine 11 and rises to the sea surface 22, with the antenna 18 projecting above the sea surface 22 by virtue of the stable floating attitude of the buoy 13. While the buoy 13 is rising, the submarine 11 continues its journey and moves away from that sea region, with the buoy 13 being left behind it, even before the helicopter 12 flies into that sea region in order to make radio contact with the buoy 13. In order to guarantee that the submarine 11 has a sufficiently long time to move away from the buoy 13, possible extraction of the message from the buoy 13 or output of the message by the buoy 13 is inhibited for a certain time. The surfaced buoy 13 does not send the message via the transmitter into the surrounding area until this time has elapsed. The message is encrypted and coded, so that only the helicopter 12 with access authorization

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can receive and decrypt the message. The message is transmitted repeatedly for a certain time.

Alternatively, the transmission activity of the buoy 13 is not initiated automatically after a time has elapsed, but only when it is called up for transmission by the authorized helicopter 12. For this purpose, the helicopter 12 transmits a signal which is coded with an access authorization and is received by the buoy 13 via the radio receiver 17. After verification of the access authorization, the control electronics device 20 activates the recorder 14, and the message which has been recorded on the recorder 14 is supplied as transmission signals to the radio transmitter 16 via the electronics section 19, and is transmitted via the antenna 18. This message is now received in the helicopter 12.

The helicopter 12 may itself also store a message by radio for the submarine 11 in the buoy 13, and can leave the sea region. The message received via the radio receiver 17 is stored in the recorder 14.

The helicopter 12 can also itself carry a plurality of buoys 13' with it. A message for the submarine 11 is recorded by means of the recorder 14 in a buoy 13', and the buoy 13' containing the message is ejected. A buoy 13 such as this is a simplified version of the buoy 13 illustrated in the form of a block diagram in Figure 3, since the radio transmitter 16, the radio receiver 17, the electronics section 19 for signal processing and the control electronics device 20 are not needed. The helicopter 12 leaves that sea region once the buoy 13' with the stored message has been ejected.

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Figure 2 illustrates a scenario in which messages which have been left in the buoys 13 and 13' by the

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5 helicopter 12 are called up by the submarine 11. The submarine 11 which is returning to that sea region deploys an unmanned underwater vehicle 23, which collects the buoy 13 and the buoy 13' and returns them to the submarine 11, where the messages recorded in the recorder 14 in the buoys 13, 13' are read via the interface 142.

PATENT CLAIMS

1. A method for message transmission between a
5 submerged partner, in particular a submarine, and a
land-based or airborne partner, in particular an
aircraft, using at least one buoy (13; 13') which can
be deployed in a sea region and floats in the sea
region and has interfaces (141, 142) for feeding in and
10 reading messages, in which the message to be
transmitted is stored by the one partner in the buoy
(13; 13') and is taken by the other partner from the
buoy (13; 13'), characterized in that, in order to
transmit a message from the land-based or airborne
15 partner to the submerged partner, the message is stored
by the land-based or airborne partner in the buoy (13)
and is retrieved by the submerged partner from the buoy
(13) by means of an unmanned underwater vehicle (23),
and the stored message is read via the interfaces
20 (141, 142).

2. The method as claimed in claim 1, characterized in
that the land-based or airborne partner stores the
message by radio in the buoy (13) which is floating in
25 the sea region.

3. The method as claimed in claim 1, characterized in
that the message is stored by the land-based or
airborne partner by feeding it in via the interfaces
30 (141, 142) of the buoy (13') and then by ejecting the
buoy (13') into the water.

4. The method as claimed in one of claims 1 to 3,
characterized in that, in order to transmit a message
35 from the submerged partner to the airborne or
land-based partner, the message is fed into the buoy 13

from the submerged partner via the interfaces (141, 142), and the buoy (13) is deployed in the water, and the message is called up from the surfaced buoy (13) without the use of wires by the airborne or
5 land-based partner.

5. The method as claimed in claim 4, characterized in that the calling of the message from the buoy (13) is inhibited for a predeterminable time after surfacing of
10 the buoy (13).

6. The method as claimed in claim 4 or 5, characterized in that the message is transmitted by radio from the surfaced buoy (13).
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7. The method as claimed in claim 6, characterized in that the transmission of the message is initiated by a programmed time switch.

20 8. The method as claimed in claim 6, characterized in that the transmission of the message is initiated by reception of a signal, which is coded with an access authorization, and after verification of the access authorization.

25 9. The method as claimed in one of claims 1 to 8, characterized in that the message to be transmitted is encrypted.