The foregoing and other objects are achieved by the features of the independent claims. Further implementation forms are apparent from the dependent claims, the description and the figures.

According to a first aspect, there is provided a system for controlling at least one tugboat, the system comprising:

a land-based control center comprising a transmitter-receiver configured for wirelessly transmitting pilot-control thrust instructions for assisting a marine vessel to maneuver,

at least one tugboat configured for assisting a marine vessel to maneuver,

the tugboat comprising a control unit configured to control said tugboat; said control unit having a transmitter-receiver and configured to receive pilot control thrust commands from the land-based control center and the land based control center being configured to issue thrust commands to said tugboat and said tugboat being configured to carry out said thrust commands to assist said marine vessel upon receipt of said thrust commands form said land-based control center.

By providing a control center for controlling a at least one remote controlled tugboat the tugboat can be operated from a control center and the number of crew members needed on the tugboat can be reduced.

In a first possible implementation form of the first aspect the at least one tugboat is provided with an optical sensor arrangement or camera arrangement, preferably with a 360° field of vision in the horizontal plane of the area around at least one tugboat, a transmitter for wirelessly transmitting the signal of the optical sensor arrangement or

camera arrangement to the control center and the control center being provided with a receiver for receiving the signal from the optical sensor and the control center being provided with display screens for displaying, preferably real-time, and even more preferably real-time and on a 360° circular array of display screens, the signal of the optical sensor arrangement or camera arrangement to a human operator.

In a second possible implementation form of the first aspect the at least one tugboat is provided with an acoustic sensor arrangement, preferably a directional acoustic sensor arrangement with a 360° field of hearing in the horizontal plane, a transmitter for wirelessly

In an eighth possible implementation form of the first aspect the system further comprises a,
portable, control unit for a pilot, the pilot preferably being located in the vicinity of at least one tugboat, the control unit being configured to allow the pilot to wirelessly send thrust instructions to the at least one tugboats.

In a ninth possible implementation form of the first aspect the at least one tugboat is configured to follow an assisted marine vessel at a substantially constant distance, preferably with a fixed relative position to the assisted marine vessel, upon receipt of instructions accordingly, received from the control unit or from the control center.

In a tenth possible implementation form of the first aspect the augmented reality is overlaid on the display screens, both for sound and preferably also for obstacles in the course of the tugboat.

In an eleventh possible implementation form of the first aspect the tugboat is unmanned, and preferably at least partially autonomously operating.

According to a second aspect, there is provided a system for controlling at least one tugboat, said system comprising:
a control center for wirelessly remote-controlling said at least one tugboat to sail to a particular position for assisting a marine vessel to maneuver,
at least one tugboat configured for assisting a marine vessel to maneuver,
the tugboat comprising a control unit configured to control said tugboat; said control unit having a transmitter-receiver and configured to receive pilot control thrust instructions from said control center for navigating to said particular position and said control unit being configured to receive pilot control thrust commands from a mobile remote control unit configured to wirelessly control said tugboat once it has arrived at said particular

position, said mobile remote control unit being configured to issue thrust commands to said tugboat and said control unit being configured to carry out said thrust commands with said tugboat in order to assist said marine vessel upon receipt of said thrust commands from said remote control unit.

According to a third aspect, there is provided a method for controlling at least one tugboat that is suitable for assisting a marine vessel to maneuver, from a remotely located control center, said method comprising:
providing at least one tugboat,
providing a remotely located land-based control center,
sending instructions wirelessly from said remotely located land-based control center to at least one of said at least one tugboat for said tugboat to sail to a particular position for assisting a marine vessel to maneuver,
receiving said instructions wirelessly on said at least one tugboat,
said at least one tugboat sailing to said particular position upon receipt of said instructions to sail to a particular position,
wirelessly sending thrust commands from said remotely located land-based control center to said tug boat after said tug boat has arrived at said particular position,
said tug boat wirelessly receiving said thrust commands, and
said tug boat carrying out said thrust commands for assisting said marine vessel upon receipt of said thrust commands from said land-based remote control center.

According to a fourth aspect, there is provided a method for controlling at least one tugboat that is suitable for assisting a marine vessel to maneuver, from a remotely located control center, the method comprising:
providing at least one tugboat,
providing a remotely located land-based control center,
sending instructions wirelessly from the remotely located control center to at least one of the at least one tugboat for said tugboat to sail to a particular position for assisting a marine vessel to maneuver,
receiving the instructions wirelessly on the at least one tugboat,
said at least one tugboat sailing to said particular position,
providing a mobile remote control unit in the vicinity of said particular position,
wirelessly sending thrust commands from said mobile control unit to said tugboat after said tug boat has arrived at said particular position, and
said tugboat carrying out said thrust commands to said assisted marine vessel upon receipt of said thrust commands from said mobile remote control unit.

In a first possible implementation form of the fourth aspect the method comprises a human pilot operating said mobile remote control unit, preferably whilst being located on said assisted vessel.

In a second possible implementation form of the fourth aspect control of said tugboat passes from said control center to said mobile remote control unit when said tugboat assists said marine vessel to maneuver.

In a third possible implementation form of the fourth aspect the method further comprises the at least one tugboat autonomously sailing from its present position to the particular position, preferably including the at least one tugboat navigating autonomously from its present position to the particular position.

In a fourth possible implementation form of the fourth aspect sending instructions wirelessly comprises sending instructions to the at least one tugboat to follow an assisted marine vessel at a constant distance, preferably an assisted marine vessel that is connected to the at least one tugboat by a towing line with no tension on the towing line.

In a fifth possible implementation form of the fourth aspect the method further comprises detecting optical and/or acoustical signals with sensors on the at least one tugboat, and sending the signal from the detected the goals and/or acoustical sensors wirelessly to the remotely located control unit.

In a sixth possible implementation form of the fourth aspect the method further comprises sending instructions from a remote control unit, for example a portable remote control unit on an assisted vessel operated by a pilot, to the at least one tugboat to deliver the free end of a towing line connected to the at least one tugboat to a recipient on a marine vessel to be assisted, particularly to a recipient on a particular position on a marine vessel to be

assisted, and the at least one tugboat delivering the free end of the towing line to the recipient.

In a seventh possible implementation form of the fourth aspect the method further comprises sending instructions from a remote control unit, for example a portable remote control unit on an assisted vessel operated by a pilot, to the at least one tugboat to reel in a towing line, and the at least one tugboat reeling in the towing line.

In an eighth possible implementation form of the fourth aspect the method further comprises sending instructions from a remote control unit, for example a portable remote control unit on an assisted vessel operated by a pilot, for a thrust command with a given size and direction to the at least one tugboat for the at least one tugboat applying thrust of a size and direction to the assisted marine vessel in accordance with the instructions received from a remote position and the at least one tugboat applying thrust with a size and direction as instructed to the assisted marine vessel.

According to a fifth aspect, there is provided a land-based control center for controlling at least one tugboat, said land-based control center comprising:

a transmitter-receiver configured for wirelessly transmitting pilot-control thrust instructions to said at least one tugboat for assisting a marine vessel to maneuver, the pilot control instructions being received in a control unit of the at least one tugboat, the pilot control thrust commands being configured to wirelessly control said tugboat, and said pilot control thrust commands comprising a vector in relation to the hull of the assisted marine vessel.

According to a sixth aspect, there is provided a remote controlled tugboat for assisting a marine vessel to maneuver, the tugboat comprising:

a control unit having a transmitter-receiver configured to wirelessly receive pilot-control thrust commands transmitted from a land-based control center, said pilot-control thrust commands being for assisting a marine vessel to maneuver,

wherein the control unit is configured to command the tugboat based on the pilot control thrust commands and said tugboat is configured to execute said thrust commands to assist said marine vessel.

These and other aspects of the invention will be apparent from and the embodiment(s) described below.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following detailed portion of the present disclosure, the invention will be explained in more detail with reference to the example embodiments shown in the drawings, in which:

Fig. 1 is a side view of an assisted vessel and a plurality of tugboats during an assist operation,

Fig. 2 is a top view of the assisted vessel and plurality of tugboats of Fig. 1 during an assist operation with one additional tugboat on the side of the assisted vessel,

Fig. 3 is a top view of the assisted vessel and a plurality of tugboats of Fig. 1 during an assist operation with two additional tugboats on the side of the assisted vessel,

12. A method according to claim 11, comprising at least one human pilot operating said land-based remote control center.

13. A method for controlling at least one tugboat that is suitable for assisting a marine vessel to maneuver, from a remotely located control center, said method comprising:
providing at least one tugboat,
providing a remotely located land-based control center,
sending instructions wirelessly from said remotely located control center to at least one of said at least one tugboat for said tugboat to sail to a particular position for assisting a marine vessel to maneuver,
receiving said instructions wirelessly on said at least one tugboat,
said at least one tugboat sailing to said particular position,
providing a mobile remote control unit in the vicinity of said particular position,
wirelessly sending thrust commands from said mobile control unit to said tugboat after said tug boat has arrived at said particular position, and
said tugboat carrying out said thrust commands to said assisted marine vessel upon receipt of said thrust commands from said mobile remote control unit.

14. A method according to claim 13, comprising a human pilot operating said mobile remote control unit, preferably whilst being located on said assisted vessel.

15. A method according to claim 13, wherein control of said tugboat passes from said land based-control center to said mobile remote control unit when said tugboat assists said marine vessel to maneuver.

16. A land-based control center for controlling at least one tugboat, said land-based control center comprising:

a transmitter-receiver configured for wirelessly transmitting pilot-control thrust instructions to said at least one tugboat for assisting a marine vessel to maneuver, the pilot control instructions being received in a control unit of the at least one tugboat, the pilot control thrust commands being configured to wirelessly control said tugboat, and said pilot