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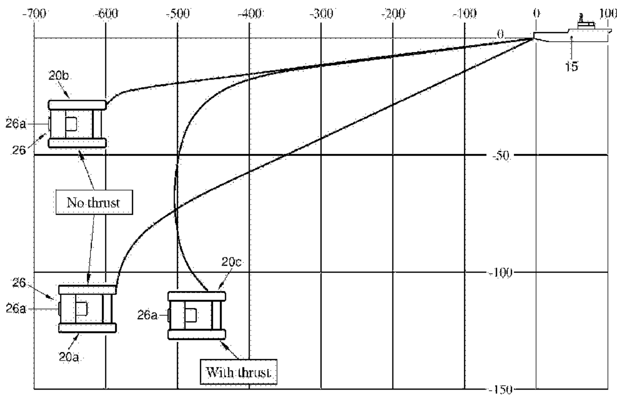
(54) **Surveying the seabed.**

(57) A method for surveying the seabed comprising a towing vessel, a towed vehicle comprising a near-seabed measurement device, and a thruster system, and a tow cable that connects the towing vessel to the towed vehicle, the method comprising: the towing vessel towing the towed vehicle at a required survey depth in the vicinity of the seabed; operating the near-seabed measurement device so as to survey the seabed; calculating an amount of thrust to achieve the required survey depth for a selected length of tow cable and for a selected tow speed; and activating the thruster system to the calculated amount.



P105999NL00

Surveying the seabed

The present invention relates to surveying the seabed using a towed vehicle.

In a known system, a towed vehicle is towed by a towing vessel to be at 10-15 metres above the seabed. The towed vehicle carries one or more near-seabed measurement devices for surveying the seabed. Typically, one of the near-seabed measurement devices is a side-scan sonar system comprising a sonar source which transmits wide angle conical or fan-shaped pulses towards the seabed and sensors which receive the reflections from the seabed that allow an image of the seabed to be built up.

For a fixed length of cable the depth at which the towed vehicle can be towed is a function of speed with the towing depth becoming shallower as the speed increases. Thus, if it is desired to survey the seabed at greater speed, the towed vehicle can only be maintained at the required depth by lengthening the tow cable. In one exemplary system, in order to maintain the towed vehicle at a depth of 250m while the towing vessel is travelling at 2m/s, a 900m cable is required. When the towing vessel is travelling at 4m/s (approximately 8 knots), a cable of 3500m is required to maintain the towing depth. From a cable handling point of view, an excessively long cable is undesirable. Moreover, when the towing vessel is required to turn during the survey, its turning circle must be sufficiently gentle to prevent the towed vehicle from crashing into the seabed. This problem is exacerbated the longer the cable is. Thus, an excessively long cable is also detrimental to the efficiency of the performance of the survey.

It is known to provide the towed vehicle with a depressor in order to increase the tow depth (for a given length of cable). The depressor is designed to provide a hydrodynamic depressive force to the towed vehicle and help it to maintain depth even at higher towing speeds. However, the use of the depressor by increasing the load creates a vicious cycle, because the increased load means the cable diameter must be increased, which leads to increased cable drag, which decreases the tow depth.

With this in mind, according to a first aspect, the present invention may provide a method for surveying the seabed comprising:

providing a towing vessel, a towed vehicle comprising a near-seabed measurement device and a thruster system, and a tow cable that connects the towing vessel to the towed vehicle;

the towing vessel towing the towed vehicle at a required survey depth in the vicinity of the seabed;

operating the near-seabed measurement device so as to survey the seabed;

calculating an amount of thrust to achieve the required survey depth for a selected length of tow cable and for a selected tow speed; and

activating the thruster system to the calculated amount.

By providing a towed vehicle with a thruster system, the present invention through appropriate activation of the thruster system is able to reduce the load on the tow cable and thereby extend the operating envelope of the system, whereby greater survey/tow depths with shorter tow cables at higher tow speeds may be achieved.

The towed vehicle may comprise one or more of the near-seabed measurement devices. The measurement devices may be active, for example, a side-scan sonar system and/or passive, for example, a magnetometer and/or a gradiometer.

The thrust calculation may take place once at the beginning of a survey. In such a case, the selected length of tow cable and selected tow speed are selected *a priori* and are kept constant throughout the survey. Alternatively, in the case where the length of tow cable and/or the tow speed may vary during the survey, the thrust calculation may take place one or more times during the survey. This may be done periodically or in response to a change in the length of tow cable and/or the tow speed.

For example, in one embodiment, the selected tow speed may be the current speed of the towing vessel, for example, derived from a navigation or control system of the towing vessel. The thrust calculation may be performed as a result of a change in the speed of the towing vessel or carried out periodically.

Preferably, the thruster system is arranged to provide a rearward thrust, i.e. to propel the towed vehicle in the tow direction. The thruster system may comprise a single thruster or a plurality of thrusters. In one embodiment, the thruster-system may provide a rearward thrust only. In other embodiments, the towed vehicle may further comprise a further thruster arranged to provide an upward thrust (which serves to propel the towed vehicle downwardly).

Preferably, the towed vehicle comprises moveable flaps for adjusting the position of the towed vehicle in the water when it is being towed.

Optionally, during the turning phase of a survey, the amount of activation of the thruster system can be adjusted to assist in preventing the towed vehicle from crashing into the seabed during the turn. If the thruster system is not activated as the turn commences, this will mean activating the thruster system to a predetermined amount. If the thruster system is activated as the turn commences, this will mean adjusting the thrust of the thruster system by a predetermined amount.

According to a second aspect, the present invention may provide a towed vehicle for use in the method according to the first aspect comprising a near-seabed measurement device, preferably a side-scan sonar system comprising a sonar source and an array of sensors, and a thruster system that is arranged to provide rearward thrust only.

In the context of the present invention, the term "seabed" is to be construed broadly so as to cover the floor of other expanses of water, such as that of an ocean, regardless of whether the other expanses of water are technically seas or not.

Exemplary embodiments of the invention are hereinafter described with reference to the accompanying drawings, in which:

Figure 1 shows a side view of an embodiment of the invention;

Figure 2 shows a schematic view of the controllers in an embodiment of the invention;

Figure 3 illustrates how the position of the towed vehicle varies according to the speed of the towed vehicle and the activation of the thruster system;

Figure 4 illustrates how the flaps allow for fine-tuning of the vertical position of the towed vehicle; and

Figure 5 illustrates how the flaps allow the horizontal position of the towed vehicle to be adjusted.

A side-scan sonar (SSS) system generally designated 10 for surveying the seabed 5 is shown in Figure 1. The system 10 comprises a towing vessel 15, a towed vehicle 20, and a tow cable 40 that connects the towing vessel 15 to the towed vehicle 20. In Figure 1, the towed vehicle 20 is shown in the vicinity of the seabed 5 at the required survey / tow depth D. Typically, the required survey depth is 10-15 meters above the seabed 5. The towed vehicle 20 comprises a near-seabed measurement device in the form of a side-scan sonar system. The side-scan sonar system comprises a sonar source 22 that emits conical or fan-shaped acoustic pulses towards the seabed 5 across a wide angle perpendicular to the direction of travel of the towed vehicle 20, thereby providing scan coverage of a wide swath of the seabed 5 along a track defined by the direction of travel of the towed vehicle 20. The side-scan sonar system comprises an array of sensors 24 that detects the acoustic reflections from the seabed 5 in a series of cross-track slices. In other embodiments, the towed vehicle 20, in addition to or as an alternative to the side-scan sonar system, may comprise other near-seabed measurement devices, such as magnetometers or gradiometers as examples. The towed vehicle 20 has a chassis which is rectangular in cross-section and is elongate having a longitudinal axis A. The towed vehicle 20 comprises a thruster system 26. In this embodiment, the thruster system 26 comprises a single thruster 26a that is mounted at the rear of the chassis and oriented so as to provide a rearward thrust in a direction along the longitudinal axis A, which serves to propel the towed vehicle 20 forward. The towed vehicle 20 comprises a plurality of moveable flaps (not shown). The flaps may be controlled by separate motors. The flaps serve as hydrodynamic control surfaces by which the up or down force that the towed vehicle 20 is subjected to can be made to vary, whereby the depth of the towed vehicle 20 can be adjusted, and/or by which the starboard or port force that the towed vehicle is subjected to can be made to vary, whereby the horizontal position of the towed vehicle 20 relative to the towing vessel 15 can be adjusted. The flaps may also be continually adjusted to keep the towed vehicle 20 levelled in the roll direction.

Referring to Figure 2, the operation of the SSS system 10 is controlled by a first, main controller 16 located on the towing vessel 15 and a second, subsea controller 28 located on the towed vehicle 20. The main controller 16 and the subsea controller 28 communicate via a communication link 30.

When the tow cable 40 comprises a more complicated umbilical cord, the communication link 30 may comprise electrical cables or optical fibres housed within the umbilical cord via which data signals may be transmitted between the controllers. In the latter case, electrical cables may also be used to deliver power to the towed vehicle 20, whereby it need not have its own on-board power supply.

The subsea controller 28 controls the operation of the sonar source 22 and collects the data from the array of sensors 24. The subsea controller 28 transmits the sensor data via the communication link 30 to the main controller 16. The subsea controller 28 controls the activation of the thruster system 26. The subsea controller 28 can activate the thruster system 26 to a selected amount, whereby a controllable thrust in the direction of travel of the towed vehicle 20 may be generated. The subsea controller 28 controls the flaps to keep the towed vehicle levelled in the roll direction. The subsea controller 28 also controls the flaps for adjusting the position of the towed vehicle 20 in the water.

The main controller 16 directs the overall operation of the SSS system 10 and the subsea controller 28 in particular. Based on parameters related to the towing speed (S), the towing cable length (L), and the required survey/tow depth (D), the main controller 16 can calculate the amount of activation of the thruster system 26 and transmit that to the subsea controller 28 via the communication link 30.

The calculation can be performed using one of the well-known formulae which define the drag and lift for tow bodies and cables in water. Preferably, the calculation further comprises a correction calculation which is empirically derived for a given system. The correction calculation corrects for, for example, strumming of the cable. Alternatively, the calculation can be based on data derived empirically derived for a given system.

The parameters can be input to the main controller 16 by the user via a keyboard (not shown) or automatically by other systems on the towing vessel 15. For example, the towing speed may be provided automatically by the navigation system (not shown) of the towing vessel 15. The main controller 16 receives the sensor data via the communication link 30 and processes it, using algorithms known in the art, to build up an image of the seabed 5 along the track being scanned.

Figure 3 illustrates how the position of the towed vehicle 20, in terms of its tow depth and its trailback from the towing vessel 15, varies according to the activation of the thruster system 26 and the tow speed for a constant length of tow cable 40.

Towed vehicle 20a represents a first dead tow situation in which the thruster system 26 is not activated and the tow speed is relatively low at 4 knots (2 m/s).

Towed vehicle 20b represents a second dead tow situation in which the thruster system 26 is again not activated and the tow speed has been doubled to a relatively high 8 knots (4 m/s). As a result of the increased tow speed, the load on the tow cable 40 is increased, whereby the towed vehicle 20b is forced to a shallower tow depth. It will be appreciated that both of these dead tow situations show the maximum possible tow depth for the indicated tow speed and a given cable length. With the thruster system 26 not activated, the system corresponds to the known SSS system in which the towed vehicle is not equipped with a thruster.

Towed vehicle 20c represents the situation in which the thruster system 26 is activated to a predetermined amount. This has the effect of reducing the load on the tow cable 40, whereby the towed vehicle 20c assumes a deeper tow depth than is possible for an equivalent known SSS system in which the towed vehicle is not equipped with a thruster.

In this way, the operating envelope of the SSS system 10 is extended in comparison with an equivalent known SSS in which the towed vehicle is not equipped with a thruster.

Although the nominal tow depth is determined by performing the above-mentioned calculation and activating the thruster system 26 to the calculated amount, further fine-tuning of the vertical position of the towed vehicle 20 is possible through control of the flaps as illustrated in Figure 4.

Figure 5 illustrates that through the control of the flaps the horizontal position of the towed vehicle 20 relative to the towing vessel 15 may be adjusted.

Depending on the flap design, either first and second separate groups of flaps may control the vertical and horizontal position of the towed vehicle 20, respectively, or a single group of flaps may control the vertical and horizontal position of the towed vehicle 20.

The extended operating envelope afforded by the thruster-equipped towed vehicle 20 creates more operational options when performing a survey of the seabed as will be hereinafter explained.

Higher survey speed

For economic reasons, it is always desirable to be able to carry out a survey at a higher speed. But, as discussed above, at a constant survey/tow depth, as the towing speed increases, the length requirements for the towing cable increase disproportionally and rapidly become impractically long. The SSS 10 deals with this problem by allowing the user to deploy a manageable length of towing cable L for a required survey tow depth D. With these parameters input into the main controller 16, the main controller 16 is able to calculate the amount the thruster system 26 should be activated to achieve the survey/tow speed. This calculation can be done *a priori*, or responsive to a signal from the navigation system of the towing vessel 25 that indicates its current speed. The required amount of thrust can then be transmitted to the subsea controller 28 on the towed vehicle 20 and the thruster system 26 appropriately activated. In this way, the required survey/tow depth can be achieved without an excessive length of towing cable and at higher speeds.

Limited cable length

In some instances, it may be desirable to survey a relatively deep seabed and a relatively high speed with a towing vessel equipped with only a limited length of cable. The SSS 10 may then be configured to operate using, as an example, the maximum length of towing cable L_{max} and a required survey/tow depth D.

With these parameters input into the main controller 16, the main controller 16 is able to calculate the amount the thruster system 26 should be activated to achieve the current survey/tow speed. This calculated can be done responsive to a signal from the navigation system of the towing vessel

25 that indicates its current speed. The required amount of thrust can then be transmitted to the subsea controller 28 on the towed vehicle 20 and the thruster system 26 appropriately activated. In this way, for a given survey/tow speed and for a given length of cable, a required survey/tow depth, which is deeper than could be achieved without a thruster 26, can be achieved.

Turning during a survey

Surveys are performed in a grid by scanning along a first track and then at the designated end-point of the track, turning the towing vessel 180 degrees and scanning a second track parallel to the first track and so on until the required grid is scanned. If the turn at the end of a track is too abrupt, the towed vehicle, since it is in the vicinity of the seabed may sink and crash into the seabed. The SSS 10, when operating in a mode when the thruster system 26 is activated can prevent the towed vehicle 20 from too rapidly decelerating in its forward direction during a turn, whereby its tendency to sink towards the seabed 5 is reduced. Moreover, optionally, when starting the turn, the main controller 16 can pre-emptively instruct the subsea controller 28, to activate the thruster system 26, or increase the amount of thrust generated by the thruster system 26, as the case may be, in order to reduce the tendency of the towed vehicle 20 to sink to the seabed during the turn.

In this way, the survey can be conducted more efficiently as the turning circle of the towing vessel 15 can be made quite abrupt without danger of the towed vehicle 20 crashing into the seabed 5.

The towed vehicle 20 of the SSS 10 is preferably provided with a fixed foil or depressor.

In other embodiments (not shown), the towed vehicle 20 can be a classic tow fish, for example, torpedo shaped, without any moveable flaps for adjusting the position of the tow fish in the water when it is being towed.

List of parts

Seabed	5
Side-scan sonar system	10
Towing vessel	15
Main controller	16
Towed vehicle	20
Sonar source	22
Array of sensors	24
Thruster system	26
Thruster	26a
Subsea controller	28
Communication link	30
Tow cable	40

Conclusies

1. Een methode om de zeebedding te onderzoeken omvattende:

het voorzien van een sleepvaartuig, een gesleept vehikel dat een dichtbij-zeebedding meetinstrument en een stuwkrachtsysteem omvat, en een sleepkabel die het sleepvaartuig met het gesleepte vehikel verbindt;

het slepen door het sleepvaartuig van het gesleepte vehikel op een gewenste diepte in de buurt van de zeebedding;

het zo bedienen van het dichtbij-zeebedding meetinstrument om de zeebedding te onderzoeken;

het berekenen van een hoeveelheid stuwkracht om de gewenste onderzoeksdiepte te bereiken voor een gekozen lengte van sleepkabel en voor een gekozen sleepsnelheid; en

het activeren van het stuwkrachtsysteem volgens de berekende hoeveelheid.

2. De methode volgens conclusie 1, waarbij het dichtbij-zeebedding meetinstrument een zij-scan sonar omvat met een sonar bron en een reeks sensoren.

3. De methode volgens conclusie 1 of 2, waarbij het dichtbij-zeebedding meetinstrument een magnetometer en/of een hellingmeter omvat.

4. De methode volgens één der voorgaande conclusies, waarbij de gekozen sleepsnelheid de huidige snelheid van het sleepvaartuig is.

5. De methode volgens conclusie 4, waarbij de stuwkrachtberekening wordt uitgevoerd als een gevolg van een verandering in de snelheid van het sleepvaartuig of periodiek wordt uitgevoerd tijdens het onderzoek.

6. De methode volgens één der voorgaande conclusies, waarbij het stuwkrachtsysteem is ingericht om enkel een achterwaartse stuwkracht te verschaffen.

7. De methode volgens conclusie 6, waarbij het stuwkrachtsysteem een enkele stuwer omvat.

8. De methode volgens conclusie 6, waarbij het stuwkrachtsysteem een veelvoud van parallelle stuwers omvat.

9. De methode volgens één der voorgaande conclusies, waarbij het gesleepte vehikel beweegbare flappen omvat om de positie van het gesleepte vehikel in het water aan te passen.

10. De methode volgens één der voorgaande conclusies, waarbij bij een draai de hoeveelheid stuwkracht voortgebracht door het stuwkrachtsysteem wordt verhoogd.

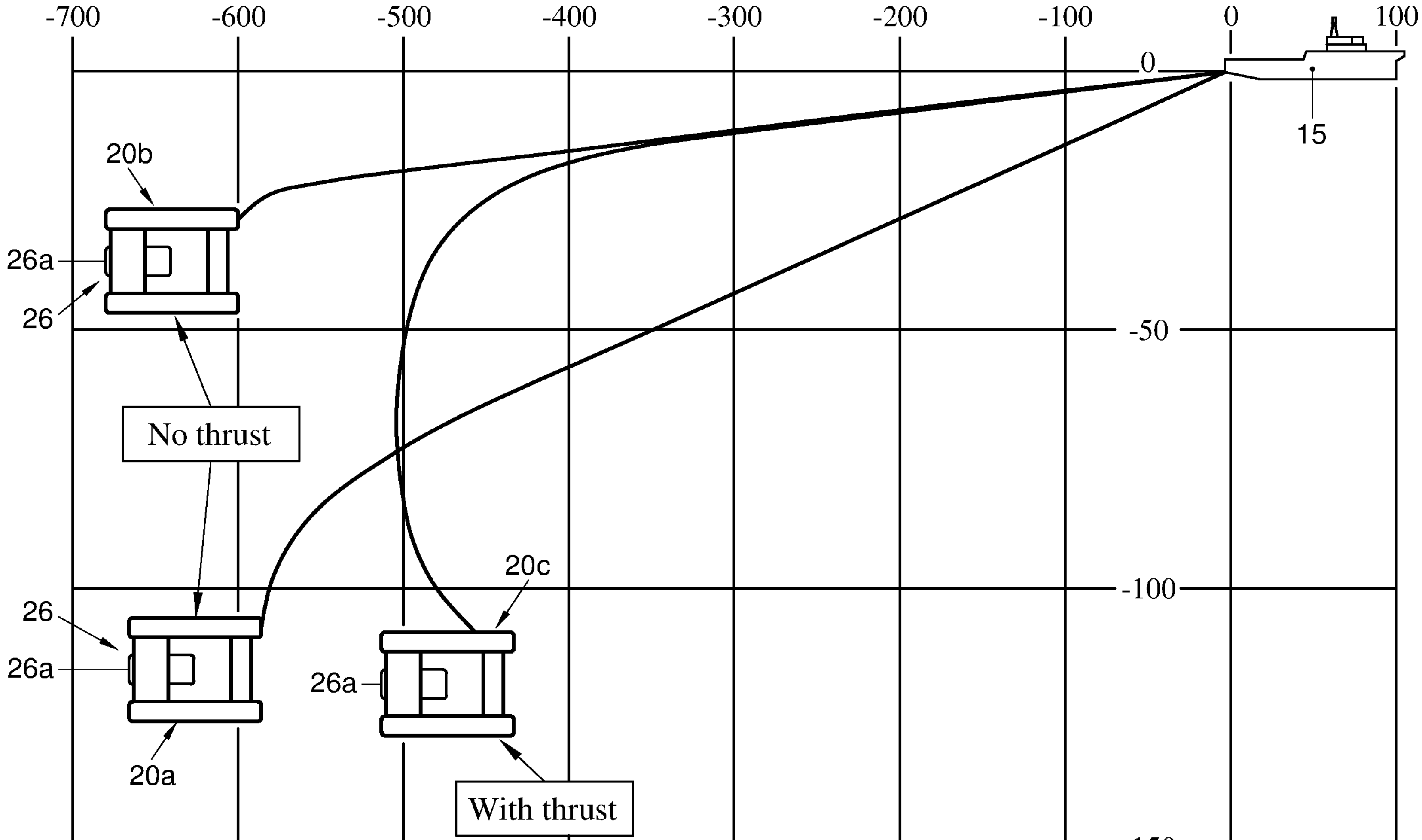
11. De methode volgens één der voorgaande conclusies, waarbij het gesleepte vehikel een vaste folie of depressor omvat.

12. Een gesleept vehikel voor gebruik in de methode volgens één der voorgaande conclusies, met een dichtbij-zeebedding meetinstrument, en een stuwkrachtsysteem dat is ingericht om enkel achterwaartse stuwkracht te verschaffen.

13. Een gesleept vehikel volgens conclusie 12, waarbij het dichtbij-zeebedding meetinstrument een zij-scan sonar omvat met een sonar bron en een reeks sensoren.

14. Een gesleept vehikel volgens conclusies 12 of 13, verder beweegbare flappen omvattend om de positie van het gesleepte vehikel in het water aan te passen.

15. Een gesleept vehikel volgens één der conclusies 12-14, verder een vaste folie of een depressor omvattend.



-700
-600
-500
-400
-300
-200
-100
0
100
0
-50
-100
-150
15
20b
26a
26
No thrust
26
26a
20a
20c
26a
With thrust

ABSTRACT

A method for surveying the seabed comprising a towing vessel, a towed vehicle comprising a near-seabed measurement device, and a thruster system, and a tow cable that connects the towing vessel to the towed vehicle, the method comprising: the towing vessel towing the towed vehicle at a required survey depth in the vicinity of the seabed; operating the near-seabed measurement device so as to survey the seabed; calculating an amount of thrust to achieve the required survey depth for a selected length of tow cable and for a selected tow speed; and activating the thruster system to the calculated amount.

FIG. 3

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE **P105999NL00**
Nederlands aanvraag nr. **2013970**	Indieningsdatum **12-12-2014**
	Ingeroepen voorrangsdatum
Aanvrager (Naam) **Fugro N.V.**	
Datum van het verzoek voor een onderzoek van internationaal type **14-02-2015**	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. **SN 63482**

I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

B63C11/42 **B63G8/00** **B63G8/42** **G01S15/89**

II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimumdocumentatie

Classificatiesysteem	Classificatiesymbolen
IPC	**B63C** **B63G** **G01V** **G01S**

Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

III.	☐	**GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES**	(opmerkingen op aanvullingsblad)
IV.	☐	**GEBREK AAN EENHEID VAN UITVINDING**	(opmerkingen op aanvullingsblad)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2013970

A. CLASSIFICATIE VAN HET ONDERWERP
INV. B63C11/42 B63G8/00 B63G8/42 G01S15/89
ADD.

Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)
B63C B63G G01V G01S

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden)

EPO-Internal, WPI Data

C. VAN BELANG GEACHTE DOCUMENTEN

Categorie *	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	US 7 775 174 B1 (HUMPHREYS DOUGLAS E [US] ET AL) 17 augustus 2010 (2010-08-17) * het gehele document * -----	1-15
X	WO 2008/105667 A1 (ARGUS REMOTE SYSTEM AS [NO]; BRYN JAN [NO]; KORNELIUSSEN FRODE [NO]; D) 4 september 2008 (2008-09-04) * het gehele document * -----	1-15
X	GB 2 163 114 A (OFFSHORE SYST ENG OSEL) 19 februari 1986 (1986-02-19) * het gehele document * -----	1-15
	-/--	

[X] Verdere documenten worden vermeld in het vervolg van vak C.

[X] Leden van dezelfde octrooifamilie zijn vermeld in een bijlage

* Speciale categorieën van aangehaalde documenten

"A" niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft

"D" in de octrooiaanvrage vermeld

"E" eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven

"L" om andere redenen vermelde literatuur

"O" niet-schriftelijke stand van de techniek

"P" tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur

"T" na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding

"X" de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur

"Y" de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht

"&" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid

27 augustus 2015

Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type

Naam en adres van de instantie
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De bevoegde ambtenaar

Scappazzoni, E

1

Formulier PCT/ISA/201 (tweede blad) (Januari 2004)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2013970

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN

Categorie *	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	GB 1 596 275 A (NAT RES DEV) 26 augustus 1981 (1981-08-26) * bladzijde 1, regel 10 - regel 45 * * bladzijde 2, regel 22 - regel 71 * * bladzijde 3, regel 64 - bladzijde 4, regel 59 * * bladzijde 5, regel 18 - regel 32 * -----	1-15

1

Formulier PCT/ISA/201 (vervolg tweede blad) (Januari 2004)

ONDERZOEKSRAPPORT BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE

Informatie over leden van dezelfde octrooifamilie

Nummer van het verzoek om een onderzoek naar de stand van de techniek
NL 2013970

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
US 7775174 B1	17-08-2010	GEEN	
WO 2008105667 A1	04-09-2008	BR PI0807333 A2	20-05-2014
		EP 2137059 A1	30-12-2009
		NO 326789 B1	16-02-2009
		US 2010260553 A1	14-10-2010
		WO 2008105667 A1	04-09-2008
GB 2163114 A	19-02-1986	GEEN	
GB 1596275 A	26-08-1981	GEEN	

WRITTEN OPINION

File No.	Filing date (day/month/year)	Priority date (day/month/year)	Application No.
SN63482	12.12.2014		NL2013970

International Patent Classification (IPC)
INV. B63C11/42 B63G8/00 B63G8/42 G01S15/89

Applicant
Fugro N.V.

This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the application
- ☐ Box No. VIII Certain observations on the application

Examiner
Scappazzoni, E

WRITTEN OPINION	Application number NL2013970

Box No. I Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the application as filed.

   ☐ filed together with the application in electronic form.

   ☐ furnished subsequently for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes:	Claims	2-11, 13-15
	No:	Claims	1, 12
Inventive step	Yes:	Claims	
	No:	Claims	1-15
Industrial applicability	Yes:	Claims	1-15
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1	US 7 775 174 B1
D2	WO 2008/105667 A1
D3	GB 2 163 114 A
D4	GB 1 596 275 A

a. Document D1 discloses *(the references in parentheses correspond to citations of this document)*:
Een methode om de zeebedding te onderzoeken *(figure 1, abstract, column 1, lines 39-46)* omvattende:
het voorzien van een sleepvaartuig *(towing vehicle 16)*, een gesleept vehikel *(towable vehicle 12)* dat een dichtbij-zeebedding meetinstrument *(figure 3, sensor 48a; column 5, line 62 - column 6, line 30)* en een stuwkrachtsysteem *(figure 3, propeller 40; column 5, line 62 - column 6, line 30)* omvat, en een sleepkabel *(towline 18)* die het sleepvaartuig met het gesleepte vehikel verbindt *(figures 1, 2)*;
het slepen door het sleepvaartuig van het gesleepte vehikel op een gewenste diepte in de buurt van de zeebedding *(figures 1, 2)*;
het zo bedienen van het dichtbij-zeebedding meetinstrument om de zeebedding te onderzoeken *(column 5, line 62 - column 6, line 30)*;
het berekenen van een hoeveelheid stuwkracht om de gewenste onderzoeksdiepte te bereiken voor een gekozen lengte van sleepkabel en voor een gekozen sleepsnelheid *(tables 1-5; columns 14-18)*; en
het activeren van het stuwkrachtsysteem volgens de berekende hoeveelheid *(tables 1-5; columns 14-18)*.**The subject-matter of independent claim 1 is thus not new.**

The features of dependent claims 2 to 11 are either disclosed in D1 or are straightforward options for the skilled person. **The subject-matter of dependent claims 2 to 11 does not therefore involve an inventive step.**

By using the same reasoning as above, mutatis mutandis, **the subject-matter of independent claim 12 is not new and the subject-matter of dependent claims 13 to 15 does not involve an inventive step.**

b. It should be further mentioned that the same reasoning as above can be done by using D2, D3 or D4 *(see cited passages in the search report)* instead of D1.