

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SEABED GEOSOLUTIONS (US), INC.,
Petitioner,

v.

MAGSEIS FF LLC¹,
Patent Owner.

Case IPR2018-00961
Patent 8,228,761 B2

Before KRISTINA M. KALAN, KEVIN W. CHERRY, and
JON M. JURGOVAN, *Administrative Patent Judges*.

JURGOVAN, *Administrative Patent Judge*.

JUDGMENT
FINAL WRITTEN DECISION
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

¹ On December 17, 2018, each of the challenged patents were assigned from Fairfield Industries, Inc. to Fairfield Seismic Technologies, LLC. *See* Paper 15, 1. On January 9, 2019, Fairfield Seismic Technologies LLC changed its name to Magseis FF LLC d/b/a Magseis Fairfield. *See* Paper 17, 1. We update the caption accordingly.

I. INTRODUCTION

Petitioner, Seabed Geosolutions (US), Inc., filed a Petition requesting *inter partes* review of claims 1–24 of U.S. Patent No. 8,228,761 B2 (Ex. 1030, the “761 Patent”). Paper 2 (“Petition” or “Pet.”). Patent Owner, Fairfield Industries Inc.², filed a Preliminary Response to the Petition. Paper 5 (“Prelim. Resp.”). Petitioner filed a Reply (Paper 8) on September 7, 2018, and Patent Owner filed a Sur-Reply (Paper 10) on September 18, 2018. The Reply and Sur-Reply were directed to the limited issue of whether Schmalfeldt is a “printed publication” for which *inter partes* review is appropriate under 35 U.S.C. § 311(b). See Paper 7. We instituted trial of claims 1–24 of the 761 Patent (“the Challenged Claims”) on all grounds under 37 C.F.R. § 42.108. Paper 11 (“Dec. Inst.”).

During the trial, Patent Owner filed a Patent Owner Response (Paper 18, “PO Resp.”), and Petitioner filed a Reply thereto (Paper 27, “Reply”). Patent Owner filed a Sur-Reply (Paper 29). Petitioner and Patent Owner filed requests for Oral Argument (Papers 31 and 32). We held the hearing on August 9, 2019 in the Alexandria Office. Paper 37 (“Tr.”).

Petitioner filed Objections to Patent Owner’s Evidence (Paper 21). No motions to exclude, however, have been filed by either party.

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. Having reviewed the complete trial record, we determine that Petitioner has shown, by a preponderance of the evidence, that, except for claim 8, the Challenged Claims are unpatentable.

² As noted above, Patent Owner has changed its name to Magseis FF LLC d/b/a Magseis Fairfield.

II. BACKGROUND

A. Related Matters

Patent Owner asserted the 761 Patent against Petitioner in *Fairfield Industries Inc. v. Seabed Geosolutions (US) Inc.*, Case No. 4:17-cv-01458 (S.D. Tex.). Paper 4, 2.

The 761 Patent is also related to U.S. Patent No. RE45,268 E, which is the subject of the same litigation and IPR2018-00960. *Id.*

The 761 Patent is also related to U.S. Patent No. 8,879,362 B2, which is the subject of the same litigation and IPR2018-00962. *Id.*

B. The 761 Patent

The 761 Patent describes a marine seismic exploration method and system comprised of self-contained ocean bottom pods 400, which are tethered together with cable 402, as shown below in Figure 21. Ex. 1030, Abstract, 24:52–25:2.

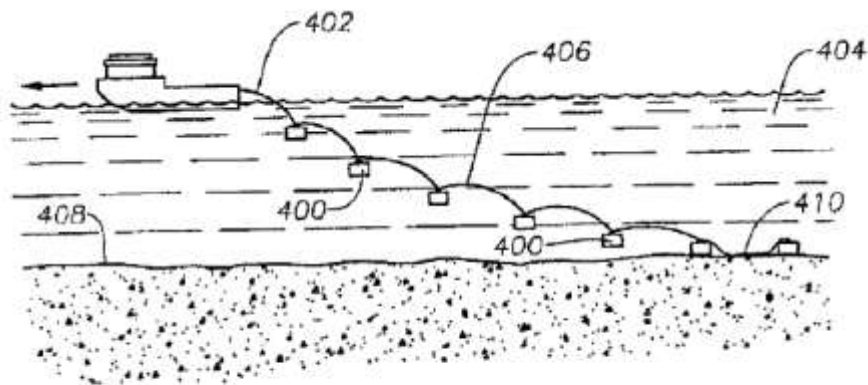
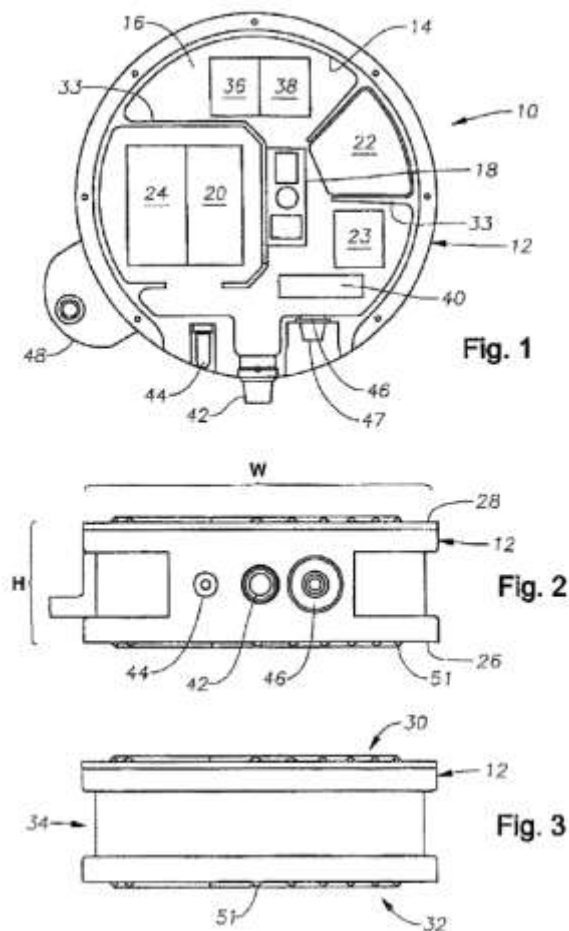


Fig. 21

In Figure 21, pods 400 are deployed from a boat and settle on the ocean floor along the marine vessel's direction of travel. "Acoustic energy sources, such as air guns, discharge energy pulses which travel downwardly

into subsurface geologic formations underlying the water.” *Id.* at 2:4–7. The pods record acoustic reflections from the geologic formations as seismic data. *Id.* at 1:12–23, 9:41–44. Upon retrieval of the pods from the ocean floor, seismic data recorded by the pods can be retrieved for use in analyzing the subsurface geologic formation. *Id.* at 9:49–51, 55–57.

Details of pod 10 are provided in Figures 1–3 of the 761 Patent. *Id.* at 14:33–16:61.

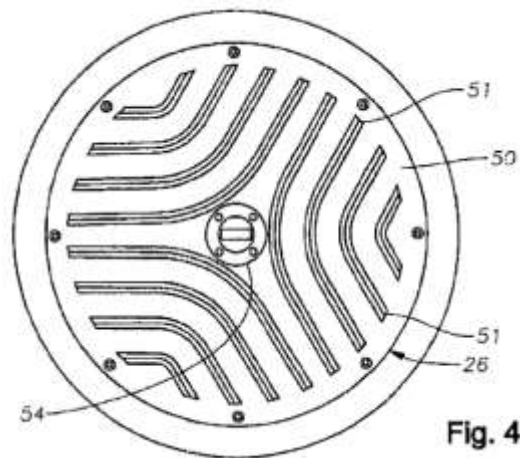


In Figure 1, pod 10 comprises water-tight case 12 containing at least one geophone 18, clock 20, power source 22, control mechanism 23, and seismic data recorder 24. *Id.* at 14:34–39. Pod 10 is self-contained such that power source 22 meets all of its power requirements, and control mechanism 23

provides all of its control functions, eliminating the need for external communications or control. *Id.* at 14:39–43; 46–51. “[G]eophone 18 is internally mounted within pod 10 and thus requires no external wiring or connection.” *Id.* at 14:49–51. “Pod 10 is weighted to have negative buoyancy so that it sinks towards the ocean floor when deployed.” *Id.* at 14:43–45.

Figures 2 and 3 show the low-profile configuration of pod 10. *Id.* at 15:35–37. Pod 10 has disk-shaped plates 26, 28 “jointed” to wall 14. *Id.* at 15:37–40. “[T]he width W of plates 26, 28 is greater than the height H of wall” 14. *Id.* at 15:40–44. Pod 10 is symmetrical about its x and y axes. *Id.* at 15:55–56.

Figure 4 shows an external surface 50 of one or both of plates 26, 28. *Id.* at 16:62–63.



In Figure 4, external “surface 50 [includes] projections 51, such as ridges or grooves, to enhance coupling between pod 10 and the ocean floor.”

Id. at 16:63–65.

C. Illustrative Claims

Of the challenged claims, claims 1 and 15 are independent. Claims 1 and 15 are set forth below:

1. An ocean bottom seismic data collection system comprising:
 - a. a disk-shaped case;
 - b. at least one geophone disposed within said case;
 - c. a clock disposed within said case;
 - d. a power source disposed within said case; and
 - e. a seismic data recorder disposed within said case.

Ex. 1030, 26:13–19.

15. An ocean bottom seismic data collection system comprising:
 - a. a low-profile, disk-shaped case comprising a first circular plate, a second circular plate and a circular wall joining said first and second plates, wherein said case is characterized by a height and a diameter, wherein the diameter is greater than said height;
 - b. at least one geophone disposed within said case;
 - c. a clock disposed within said case;
 - d. a power source disposed within said case; and
 - e. a seismic data recorder disposed within said case,
 - f. wherein said system has a negative buoyancy.

Id. at 26:59–27:3.

D. Prior Art Relied Upon

Petitioner relies upon the following prior art references:

Jones	US 6,951,138 B1	Oct. 4, 2005	Ex. 1011 ³
Mattaboni, Paul J., <i>MITOBS: A Seismometer System for Ocean-Bottom Earthquake Studies</i> , MARINE GEOPHYSICAL RESEARCHES 3 (1977) 87–102.			Ex. 1006

³ Petitioner contends Jones is prior art under 35 U.S.C. § 102(e) and that all other references are prior art under 35 U.S.C. § 102(b). Pet. 5–6.

- Sutton, George H., *Optimum Design of Ocean Bottom Seismometers*, MARINE GEOPHYSICAL RESEARCHES 9 (1987) 47–65. Ex. 1033
- Schmalfeldt, Bernd, *Explosion-Generated Seismic Interface Waves in Shallow Water*, SACLANTCEN Report SR-71, July 1, 1983. Ex. 1034
- Cranford, M.D., *A Direct-Recording Ocean-Bottom Seismograph*, BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA, Vol. 66, No. 2, pp. 607–615, April 1976. Ex. 1005
- Carrack Measurement Technology–Ocean Bottom Systems: miniDOBS Seismometer (1998) <http://www.carrack.co.uk/minidobs.htm#Geophones>. Ex. 1007
- Willoughby, David F., *A Microprocessor-Based Ocean-Bottom Seismometer*, BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA, Vol. 83, No. 1, pp. 190–217, February 1993. Ex. 1008

E. Instituted Grounds of Unpatentability

We instituted *inter partes* review on the following grounds of unpatentability:

Ground	Challenged Claim(s)	Basis	References
1	1, 3–6, 8, 9, 11–22	§ 103(a) ⁴	Mattaboni, Sutton, Schmalfeldt, Jones
2	1, 2, 10	§ 103(a)	Cranford, Sutton, Schmalfeldt, Jones

⁴ Because the claims at issue have an effective filing date prior to March 16, 2013, the effective date of the applicable provisions of the Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), we apply the pre-AIA versions of 35 U.S.C. §§ 102 and 103 in this Decision.

Ground	Challenged Claim(s)	Basis	References
3	7, 24	§ 103(a)	Mattaboni, Sutton, Schmalfeldt, Jones, Carrack
4	23	§ 103(a)	Mattaboni, Sutton, Schmalfeldt, Jones, Willoughby

F. Testimony

Petitioner supports its challenges with a declaration from Dr. Gerard Beaudoin (Ex. 1032). Dr. Beaudoin further testified at trial by deposition on January 21–22, 2019 and June 4, 2019, and transcripts of that testimony have been entered into evidence (Ex. 2024; Ex. 2102).

Patent Owner supports its contentions with the declaration of Dr. Rocco Detomo (Ex. 2051). Dr. Detomo further testified by deposition on April 11–12, 2019, and the transcript of that testimony has been entered into evidence (Ex. 1104).

III. ANALYSIS

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs. LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (holding that adopting the broadest reasonable interpretation standard is a reasonable exercise of the Office’s rulemaking authority).⁵ Under the broadest reasonable

⁵ The revised claim construction standard for interpreting claims in *inter partes* review proceedings as set forth in the final rule published October 11,

interpretation standard, claim terms generally are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *See In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

We construe the following terms only to the extent explicitly set forth below, and determine that no additional terms require express construction. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (explaining that only claim terms in controversy need to be construed, and only to the extent necessary to resolve the controversy).

1. *Construction of “seismic data” and “seismic data recorder”*

Patent Owner contends we should construe “seismic data” as “*data containing information about lithologic subsurface formations, obtained by applying an acoustic signal to the ground and receiving the reflected signal.*” PO Resp. 27. Patent Owner also contends we should construe “seismic data recorder” to mean “*a recorder that records data containing information about lithologic subsurface formations, obtained by applying an acoustic signal to the ground and receiving the reflected signal.*” *Id.*

We agree with Patent Owner’s constructions of the terms “seismic data” and “seismic data recorder.” PO Resp. 26–34. These constructions are consistent with the 761 Patent’s use of the terms. Ex. 1030, 1:12–23; 9:41–47. The 761 Patent makes clear that “seismic data” results from

2018 does not apply to this proceeding, because the new “rule is effective on November 13, 2018 and applies to all IPR, PGR, and CBM petitions filed on or after the effective date.” Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51340 (Oct. 11, 2018) (to be codified at 37 C.F.R. pt. 42).

applying a seismic signal and using the claimed node(s) to receive the seismic signal reflected from subsurface formations. Ex. 1030, 1:12–23, 9:41–47. In particular, the 761 Patent states:

Seismic exploration generally utilizes a seismic energy source to generate an acoustic signal that propagates into the earth and is partially reflected by subsurface seismic reflectors (i.e., interfaces between subsurface lithologic or fluid layers characterized by different elastic properties). The reflected signals (known as “seismic reflections”) are detected and recorded by seismic units having receivers or geophones located at or near the surface of the earth, thereby generating a seismic survey of the subsurface. The recorded signals, or seismic energy data, can then be processed to yield information relating to the lithologic subsurface formations, identifying such features, as, for example, lithologic subsurface formation boundaries.

Ex. 1030, 1:12–23.

Petitioner contends there is a “heavy presumption” that claims terms have their ordinary meaning (*CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002)), and that Patent Owner did not overcome this presumption with a clear and precise definition (*In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994)). Reply 8. Claim terms must be construed, however, in light of the specification. *See In re Translogic Tech., Inc.*, 504 F.3d at 1257. In the Specification, the 761 Patent describes “*seismic data*” as resulting from an acoustic signal from a seismic energy source that propagates into the earth and is partially reflected at subsurface lithologic or fluid boundaries and is detected and recorded as seismic energy data by seismic receivers. Ex. 1030, 1:12–23. Petitioner argues that this passage of the 761 Patent does not mention “*seismic data*.” We note, however, that this passage does mention “*seismic energy data*” which is shortened to “*seismic*

data” when mentioned later in the 761 Patent. *See, e.g.*, Ex. 1030, 2:48–51, 3:17–19, 3:26–30, 3:35–40, 3:61–63, 9:41–63.

Petitioner further contends that several publications establish that “*seismic data*” is not limited to the oil and gas industry, but may be used in other fields such as earthquake monitoring. Reply. 10 (citing Exs. 1112–1114, 1121). Patent Owner argues that its constructions are consistent with, and supported by, other publications from the oil and gas industry. PO Resp. 33 (citing Ex. 2003; Ex. 2004, 213–232). Collectively, these publications establish that the term “*seismic data*” is used differently in different fields, but the best source for determining the meaning of a claim term is the patent’s Specification. *See, e.g., In re Abbott Diabetes Care Inc.*, 696 F.3d 1142, 1149–50 (Fed. Cir. 2012); *In re Suitco Surface, Inc.*, 603 F.3d 1255, 1260–61 (Fed. Cir. 2010); *Vitronics Corp. v. Conceptronic Inc.*, 90 F.3d 1576, 1583 (Fed. Cir. 1996). As the 761 Patent uses the term “*seismic data*” consistent with the meaning proposed by Patent Owner, and not the more expansive definition proposed by Petitioner, we adopt Patent Owner’s proposed construction as the correct one to use for our analysis in this decision.

The plain meanings of claim terms are construed not in a vacuum, but in the context of the entire patent disclosure. *See In re Translogic Tech., Inc.*, 504 F.3d at 1257. Our construction of “*seismic data*” and “*seismic data recorder*” is consistent with the 761 Patent’s use of the terms.

The Board similarly construed these terms in IPR2014-01113 (Paper 10, 9–10); IPR 2014-01114 (Paper 10, 12); IPR2014-01115 (Paper 10, 10); and IPR2014-01205 (Paper 8, 16–17). Furthermore, as Patent Owner notes (PO Resp. 31), these terms have been similarly construed in Federal District

Court. Ex. 2002, *Fairfield Industries Inc. v. Wireless Seismic, Inc.*, Case No. 4:14-cv-2972, Dkt. 125, 9–10 and 36 (S.D. Tex. Mar. 10, 2015) (construing “seismic data” as “data containing information about lithologic subsurface formations, obtained by applying an acoustic signal to the ground and receiving the reflected signal.”). Patent Owner’s declarant agrees with these constructions. Ex. 2051 ¶¶ 62–69.

The Board thus has construed the terms on several previous occasions, and we see no good reason to expand the previous constructions of the same terms to include “*any and all seismic data, regardless of its origin or purpose*” as Petitioner proposes. Reply 6. Petitioner’s reasons for the proposed departure from the constructions in previous decisions include that those decisions involved different parties and were not appealed. *Id.* These circumstances, however, do not compel the conclusion that the previous constructions are not the right ones to apply in this Decision. That the previous decisions were not appealed does not undermine the previous decisions.

Petitioner further attempts to draw a distinction between the claims in the previous decisions involving multiple ocean-bottom seismometers (“OBSs”) used for seismic exploration surveys and the ’761 Patent’s claims, which recite in the preamble “an” OBS, by arguing that the 761 Patent claims only one OBS. Reply 7. For this proposition, Petitioner cites the case of *Baldwin Graphic Sys., Inc. v. Siebert, Inc.*, 512 F.3d 1338, 1342 (Fed. Cir. 2008), which holds the indefinite articles “‘a’ . . . carries the meaning of ‘one or more.’” *Id.* This case, however, actually supports the opposite conclusion as that propounded by Petitioner, because the indefinite article “a” or “an” in conjunction with the open-ended transition

“comprising” means the 761 Patent’s claims are not restricted to a single OBS, but could encompass multiple OBSs, as did the previous Board decisions. Thus, *Baldwin* undercuts Petitioner’s argument.

We thus decline to adopt Petitioner’s proposed construction that “*seismic data*” should be given the meaning of “*any and all seismic data, regardless of its origin or purpose.*” Reply 6.

2. Construction of “*wherein the system has a negative buoyancy*”

We decline to adopt Patent Owner’s proposed construction of “*wherein the system has a negative buoyancy*” to mean “*wherein the system has no flotation device.*” PO Resp. 9–11. Although the 761 Patent states in its background that “the device should be easily retrievable without the need for flotation devices” (Ex. 1030 9:22–23), we find no mention in the patent that negative buoyancy is achieved by forgoing use of a flotation device. An OBS data collection system could have a flotation device and yet, because of the relative densities of other components, have a buoyancy that is overall negative. “*Negative buoyancy*” appears to have a well-understood plain and ordinary meaning, i.e., “*a density that is greater than seawater such that the device sinks,*” which we apply in this decision. Ex. 1005, 614; Ex. 1011, 4:24–30; Ex. 1032 ¶ 24. This is consistent with how the 761 Patent uses the term. Ex. 1030, 14:43–45.

Patent Owner contends that construction of “*negative buoyancy*” to mean temporary negative buoyancy would render the element superfluous, which is presumptively unreasonable. PO Resp. 38. We do not agree. As noted, the 761 Patent’s Specification does not connect negative buoyancy to lack of a flotation device. The proposed construction thus has no support in the 761 Patent’s Specification. Dr. Detomo’s testimony concerning industry

use of “negatively buoyant,” “positively buoyant,” and “variably buoyant” systems (Ex. 2051 ¶¶ 71–74) does not disclose the underlying facts or data on which his opinion is based, and that testimony is therefore entitled to little or no weight. 37 C.F.R. § 42.65(a).

B. Principles of Law of Obviousness

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) where present, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

C. Level of Ordinary Skill in the Art

“The person of ordinary skill in the art is a hypothetical person who is presumed to know the relevant prior art.” *In re GPAC*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). Factors that may be considered in determining the level of ordinary skill in the art may include: (A) “type of problems encountered in the art;” (B) “prior art solutions to those problems;” (C) “rapidity with which innovations are made;” (D) “sophistication of the technology; and” (E) “educational level of active workers in the field.” “In a given case, every factor may not be present, and one or more factors may predominate.”

Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc., 807 F.2d 955, 962 (Fed. Cir. 1986); *Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696 (Fed. Cir. 1983). Prior art references may provide evidence of the level of ordinary skill in the art. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

Petitioner contends a person of ordinary skill in the art would have had a bachelor's degree in electrical or mechanical engineering, geophysics, or a related discipline, and about four (4) to five (5) years of experience with autonomous seismic nodes. Pet. 10; Reply 10; Ex. 1032 ¶¶ 16–19.

Patent Owner contends a person of ordinary skill in the art would have had: (a) a bachelor's degree in electrical or mechanical engineering, geophysics, mathematics, engineering, or the equivalent thereof; (b) greater than five (5) years of experience with the conduct of seismic surveys with geophones, or the equivalent thereof; and (c) at least two (2) years of experience working specifically with ocean bottom seismic data acquisition technologies, or the equivalent thereof. PO Resp. 25 (citing Ex. 2051 ¶¶ 50–51).

Considering the foregoing, we find that a person of ordinary skill in the art of OBS technology would have had: (i) a bachelor's degree in electrical or mechanical engineering, geophysics, mathematics, general engineering, or equivalent thereof, and five (5) years of experience with the conduct of surveys with geophones, or the equivalent thereof, including two (2) years of work specifically with OBS technologies, or the equivalent thereof; or (ii) a bachelor's degree and an advanced degree in electrical or mechanical engineering, geophysics, mathematics, general engineering, or equivalent thereof, and four (4) years of experience with the conduct of

surveys with geophones, two (2) years of which involve work specifically with OBS technologies, or the equivalent thereof.

We adopt these statements as describing the level of ordinary skill in the art pertinent to the 761 Patent in our obviousness analysis.

D. Determination that Schmalfeldt is a “Printed Publication”

All grounds of the Petition challenging the 761 Patent’s claims rely on Schmalfeldt (Ex. 1034). Pet. 5. In the Preliminary Response, Patent Owner contended that Petitioner failed to show Schmalfeldt is a “printed publication” under 35 U.S.C. § 311(b). Petitioner argues “[Patent Owner’s] Response did not re-allege this argument, thereby waiving it.” Reply 4.

We agree that Patent Owner’s failure to re-allege the argument in the Response waives the argument that Schmalfeldt is not a “printed publication.” *See In re Nuvasive*, 842 F.3d 1376, 1380 (Fed. Cir. 2016) (finding waiver where a patent owner “challenged the public accessibility of the prior art references during the preliminary proceedings of the inter partes review . . . but failed to challenge public accessibility during the trial phase”); *SAP Am., Inc. v. Versata Dev. Group, Inc.*, CBM2012-00001, Paper 81 (Sept. 13, 2013); Paper 12. In any case, Petitioner has demonstrated Schmalfeldt is a printed publication for reasons noted. Dec. Inst. 10–20; *see also* Reply 4 (citing Ex. 1105).

Accordingly, we determine Petitioner has shown Schmalfeldt is a “printed publication” under 35 U.S.C. § 102.

E. Ground 1: Asserted Obviousness of Claims 1, 3–6, 8, 9, and 11–22 based on Mattaboni, Sutton, Schmalfeldt, and Jones

Petitioner contends Mattaboni, Sutton, Schmalfeldt, and Jones render obvious claims 1, 3–6, 8, 9, and 11–22 under 35 U.S.C. § 103(a).

Pet. 11–56.

1. Mattaboni (Ex. 1006)

Mattaboni is titled “MITOBS: A SEISMOMETER SYSTEM FOR OCEAN-BOTTOM EARTHQUAKE STUDIES.” Ex. 1006, 1. “MITOBS” appears to be an acronym for “MIT ocean-bottom seismometer.” *Id.* Mattaboni describes the MITOBS as “a free-fall, pop-up instrument capable of recording seismic data on the ocean floor.” *Id.* at 2. Mattaboni states that sensors and recording electronics are housed in an aluminum cylinder attached to three glass spheres to provide positive buoyancy to return the device to the sea surface. *Id.* The cylinder sits vertically atop a steel base, which serves as ballast and as a platform to couple ground motion to seismometers. *Id.* After a pre-set time interval, a motor drives a mechanical latch release. *Id.* The capsule then floats to the surface, leaving the base on the sea-floor. *Id.* Mattaboni’s Figure 1, shown below, shows these features of MITOBS.



Fig. 1. MITOBS, external view. Visible are the pressure case, the flotation assembly and recovery aids, the lever arms and mechanical dogs of the release assembly, and the expendable base plate.

Mattaboni states MITOBS includes sensors, i.e., three geophones, and a recording system that uses both magnetic tape and semiconductor memories to record seismic activity when detected. *Id.* at 5. These are housed within a cylindrical pressure vessel, as shown above in Mattaboni's Figure 1. *Id.* at 8. Mattaboni uses a cylinder rather than a sphere for lower cost and ease of operation at sea. *Id.*

2. Sutton (Ex. 1033)

Sutton is titled "Optimum Design of Ocean Bottom Seismometers," and discusses research Sutton conducted to determine how OBS's could

more optimally be designed so that they “couple” to the seafloor, to better sense and more accurately record seismic data; and not “cross couple” to ocean currents, which cause unwanted signals to be sensed and recorded. Ex. 1033, Abstract, 48, 63–64. Sutton explains that “[OBSs] have been widely used . . . to collect seismic data for determination of the structure of the oceanic lithosphere, stress patterns in regions of earthquake activity, and geoacoustic parameters of the ocean floor.” *Id.* at Abstract. Sutton also found that OBS packages should be designed with (1) the minimum mass possible; (2) radius of area in contact with the sediment proportional to the cube root of the mass, and a maximum radius less than $\frac{1}{4}$ of the shear wavelength; (3) density of the OBS should be approximately that of the sediment; (4) a low profile and a small vertical cross section with water; and (5) low density gradients, and a maximum symmetry about the vertical axis.” *Id.* In particular, Sutton concludes, based on his research, that OBSs “should be designed with . . . a low profile and a small vertical cross section with water . . . and maximum symmetry about the vertical axis” (*id.* at Abstract); that “small cross section in the water and symmetry about the vertical axis . . . minimiz[es] cross coupling” (*id.* at 48); and that “low height-to-base area ratio . . . small (smooth) cross section with the water . . . and maximum symmetry about the vertical axis” “will minimize rocking modes, cross coupling, and noise coupled to the OBS by motion of the water” (*id.* at 63).

With respect to consideration (3), Sutton explains that

[i]f the density of the OBS is the same as that of the surrounding medium, then the OBS is neutrally buoyant and the OBS should move with its surroundings for seismic inputs regardless of coupling effects. An instrument with a low vertical profile and

density equal to that of the sediment should move with the sediment.

Id. at 17.

Sutton also states the following:

To obtain OBS masses that are as small as possible, the geophones must be separated from the necessarily massive package that contains power, electronics, recording, and recovery equipment. . . . Separation of the geophones and the recording package requires an electromechanical connection between the sensors and the recording package.

Id. at 18.

3. *Schmalfeldt (Ex. 1034)*

Schmalfeldt is titled “Explosion-Generated Seismic Interface Waves in Shallow Water: Experimental Results.” Ex. 1034, 1. Schmalfeldt describes an ocean-bottom seismometer comprising sensors, preamplifiers, and analogue/digital electronics. *Id.* at 11. Schmalfeldt’s OBS is powered via a thin coaxial cable by a battery in a surface buoy. *Id.* The geoacoustic and auxiliary sensors consist of three geophones, an omnidirectional hydrophone mounted outside the OBS or floating above, tilt-meters to monitor the inclination of the OBS to the sea floor, a compass to determine the OBS orientation, and a thermistor. *Id.* Figure 3 of Schmalfeldt, as annotated by Petitioner, is reproduced below.

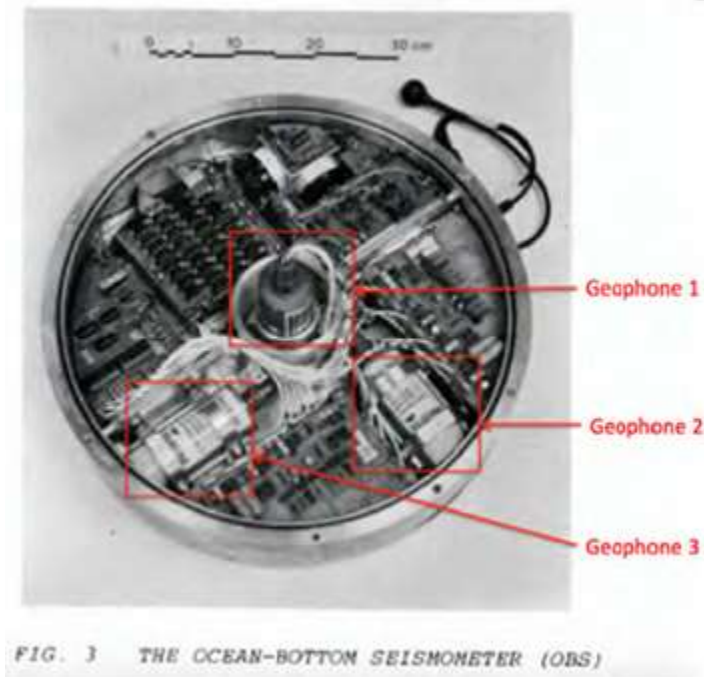


Figure 3 shows Schmalfeldt's OBS with the three geophones identified by Petitioner's annotations. Pet. 15. Schmalfeldt's OBS rests so that its bottom plate is directly coupled to the seafloor. Ex. 1034, 10 ("A crucial point in the deployment was the need to ensure that the OBS was well coupled to the bottom."). Schmalfeldt's OBS communicates by a wire with a radio-buoy, which in turn communicates with a computer onboard a ship. *Id.* at 7, Fig. 4. The deployment of Schmalfeldt's OBS system is shown below in Figure 5.

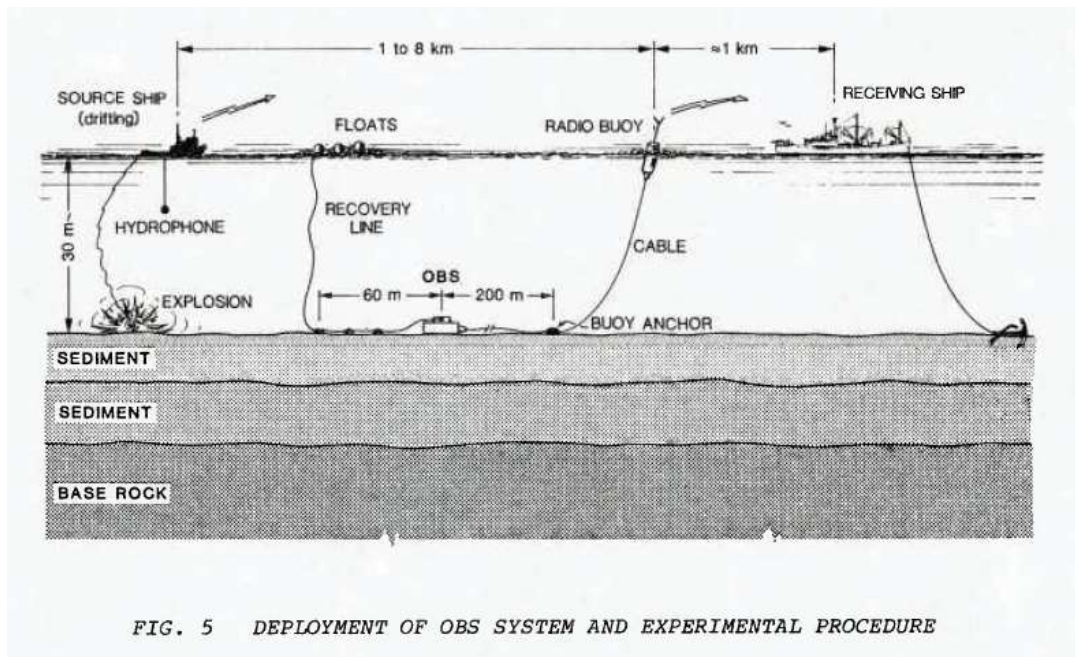


Figure 5 of Schmalfeldt shows the set up for seismic experiments involving acoustic waves traveling in loose sediment on the ocean floor.

4. Jones (Ex. 1011)

Jones is titled “Method and Apparatus for an Ocean Bottom Seismic Acquisition Technique.” Ex. 1011, code (54). Jones discloses a multi-component ocean bottom seismometer (“MOBS”) that is self-propelled and is capable of swimming, under its own power, to a designated location on the sea floor, and attaching itself to the sea floor to attain optimal coupling and enhanced multi-component seismic recordings. *Id.* at 1:41–47. “After completing a survey, the MOBS store[s] the seismic recordings internally and return[s] to a designated location near the sea surface for retrieval by a support vessel or swimming to another sea bottom location for another seismic survey.” *Id.* at 1:47–50. Figures 1 and 2 of Jones are reproduced below.

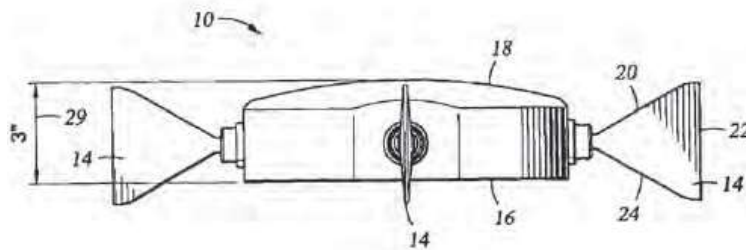
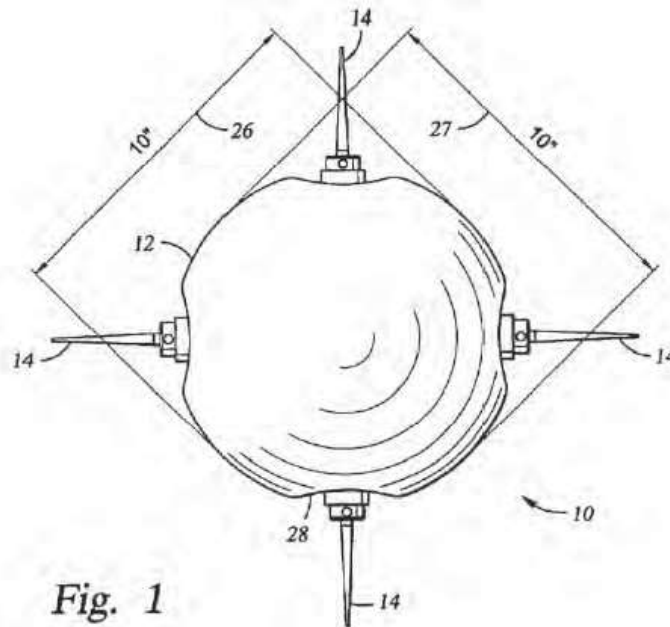


Fig. 2

As shown in Figures 1 and 2, the MOBS has a low-profile, symmetrical case that is described in Jones’s Specification as “discoid in shape.” *Id.* at 2:37–41, 2:48–51. The center of gravity of the device is along its vertical axis that passed through the center of the top and bottom plates, and the case is symmetrical about the center vertical axis. *Id.* at 2:26–28, 2:48–51. Also, the case rests directly on the seafloor so that its bottom plate is directly coupled to the seafloor. *Id.* at 3:40–60. Figure 3 of Jones is reproduced below.

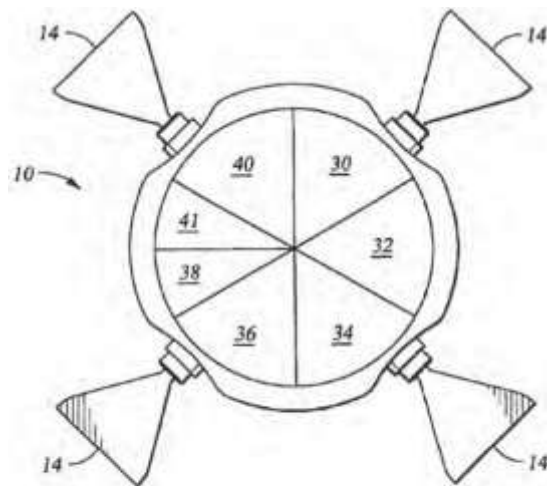


Fig. 3

Figure 3 is a schematic top cross sectional view of a Jones's MOBS instrument. *Id.* at 2:23–24. Figure 3 shows that “the MOBS is schematically compartmentalized into geophone housing 30, recording housing 32, navigation housing 34, power unit 36, control unit 38, propulsion control unit 40, [and] buoyancy control unit 41.” *Id.* at 2:41–45. “The buoyancy of each MOBS can be controlled by taking on or expelling water from buoyancy adjustment tank 41.” *Id.* at 4:25–26. “Buoyancy may be varied to adjust to condition of the water column.” *Id.* at 4:26–27.

5. *Petitioner's Analysis of Claim 1*

Petitioner reads claim 1 on the combined references as follows:

1. *An ocean bottom seismic data collection system comprising:*

Petitioner contends that Mattaboni discloses an OBS capable of recording three components of seismic data on the sea floor. Pet. 21; Ex. 1006, Abstract. Petitioner avers Jones discloses its MOBS attains multi-component seismic recordings. Pet. 22; Ex. 1011, 1:43–48. Petitioner further contends Schmalfeldt discloses an OBS that comprises sensors.

Pet. 22; Ex. 1034, 7. Petitioner's declarant testifies this feature is taught by the references. Ex. 1032 ¶¶ 76, 176.

a. a disk-shaped case;

Petitioner states that Jones teaches an OBS that is “discoid in shape with a flat bottom 16 and a curved upper surface 18.” Pet. 22–23; Ex. 1011, 2:38–39, Figures 1, 2. Petitioner also contends Schmalfeldt teaches an OBS with a disk-shaped case. Pet. 23; Ex. 1034, Fig. 1. Petitioner's declarant testifies the claimed feature is taught by the references. Ex. 1032 ¶¶ 77–81, 176.

b. at least one geophone disposed within said case;

Petitioner states Mattaboni discloses geophones disposed within a pressure case. Ex. 1006, 4, Fig. 2. Petitioner contends Jones discloses its MOBS has a geophone housing. Pet. 25; Ex. 1011, 2:41–42. Petitioner also avers Schmalfeldt discloses geophones in a case. Ex. 1034, 7, Fig. 3; Ex. 1032 ¶¶ 82–85, 176. Petitioner's declarant testifies this feature is taught by the references. Ex. 1032 ¶¶ 77–81, 176.

c. a clock disposed within said case;

Petitioner states Mattaboni teaches a real-time clock housed in its cylindrical pressure vessel. Pet. 25–26; Ex. 1006, 8. Petitioner's declarant testifies a POSITA would have understood Mattaboni to teach the claimed feature. Ex. 1032 ¶¶ 86–87, 176.

d. a power source disposed within said case; and

Petitioner contends Mattaboni teaches lithium batteries contained within the pressure capsule. Pet. 26–27; Ex. 1006, 10. Petitioner states Jones's MOBS has a power unit 36. Pet. 26; Ex. 1011, 2:41–44. Petitioner's declarant testifies a POSITA would have understood the

descriptions in these references to teach the claimed feature. Pet. 26–27; Ex. 1032 ¶¶ 88–90, 176.

e. a seismic data recorder disposed within said case.

Petitioner states Mattaboni teaches both a magnetic tape recorder and semiconductor memories housed within the pressure vessel. Pet. 27; Ex. 1006, Abstract, Figure 2. In addition, Petitioner avers Jones teaches its MOBS has a recording housing 32 and stores multi-component seismic recordings internally. Pet. 27; Ex. 1011, 2:41–43. Petitioner’s declarant contends a POSITA would have understood the descriptions in the references to teach the claimed feature. Pet. 27; Ex. 1032 ¶¶ 91–93, 176.

6. *Patent Owner’s Arguments Concerning Claim 1*

Patent Owner argues that the claimed “*seismic data recorder*” is not disclosed by the prior art references. PO Resp. 57–58. Specifically, Patent Owner contends “prior art systems like Mattaboni and Cranford were not capable of recording “seismic data” as that term has been construed because they lacked the bandwidth necessary to record data containing information about lithologic subsurface formations obtained by applying an acoustic signal to the ground and receiving the reflected signal.” *Id.* at 26–34, 57 (citing Ex. 2051 ¶¶ 76–81, 127, 137). Patent Owner’s declarant contends the frequency response for Mattaboni’s recorder is around 4–40 Hertz, as shown in the frequency response curve of Mattaboni’s Figure 4, reproduced below. Ex. 1032 ¶ 77.

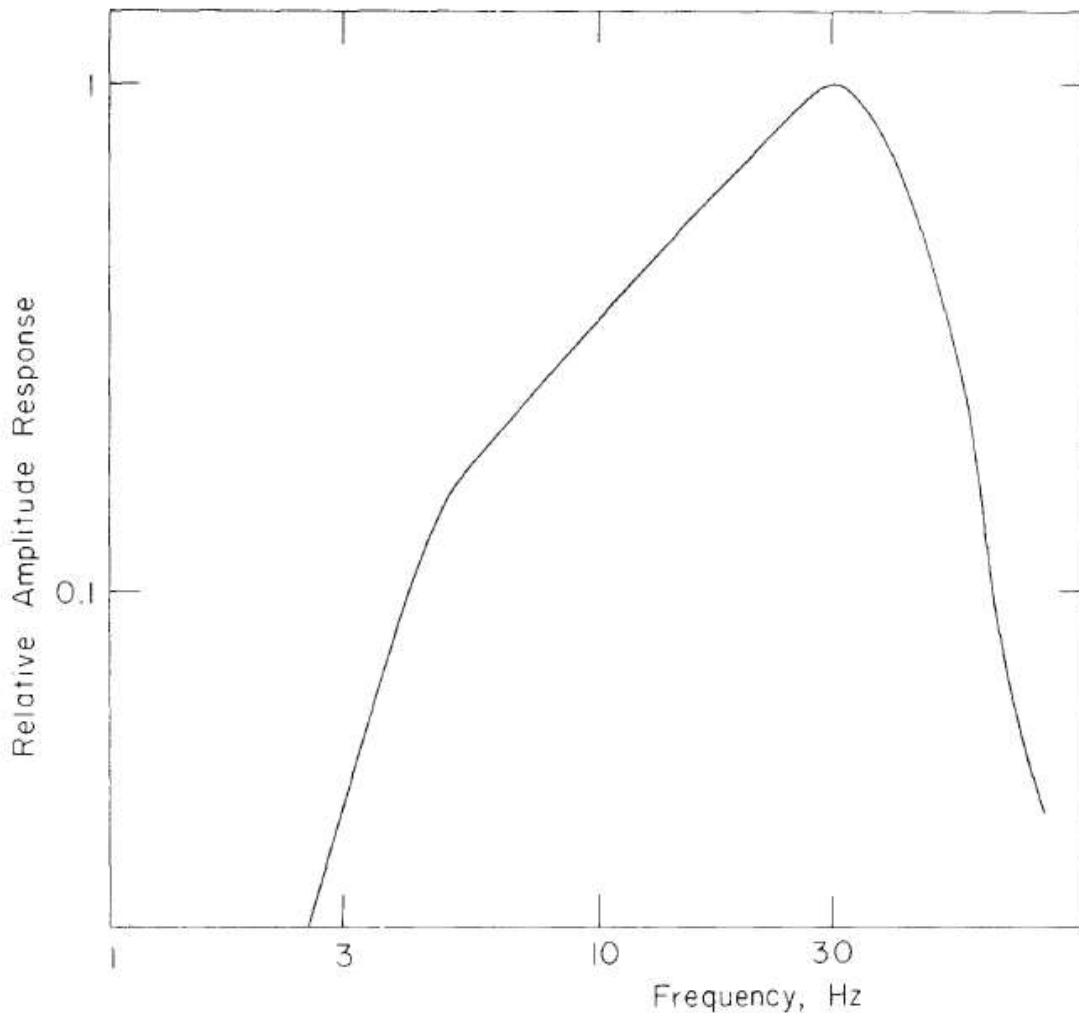


Fig. 4. Displacement response curve for MITOBS. The response curve (log-log scale), arbitrarily set to unity at the peak, is the product of the manufacturer's specified response curve for the geophone and the measured transfer function of the preamp and filter blocks of Figure 3.

The caption for Mattaboni's Figure 4 indicates that it is not the response curve for a seismic data recorder, but for "the manufacturer's specified response curve for the geophone and the measured transfer function of the preamp and filter blocks of Figure 3."

Patent Owner's declarant further contends (1) Mattaboni's data at frequencies above 40 Hertz would be contaminated by noise; (2) that a recorder would have to record signals at frequencies above 50 Hertz, and often as high as 120 Hertz, to be useful in a seismic exploration survey; and

(3) that Mattaboni is focused on recording signals between 25 and 35 Hertz. Ex. 2051 ¶ 78.

7. *Our Analysis of Claim 1*

As we analyze the evidence, Mattaboni's Figure 4 does not relate to any characteristic of its memories that limits the frequency range of recorded seismic data. Rather, Mattaboni's Figure 4 is "the product of the manufacturer's specified response curve for the geophone and the measured transfer function of the preamp and filter blocks of Figure 3." Ex. 1006, Fig. 4 (caption). Mattaboni discloses that its memories are capable of recording data at 120 times per second, or 60 Hertz, and thus above the 50 Hertz that Patent Owner contends is necessary to record "*seismic data*."

Regarding Patent Owner's statements (1) and (2) above, Patent Owner's declarant does not disclose the underlying facts or data on which these opinions are based, and they are thus entitled to little or no weight. 37 C.F.R. § 42.65(a). Regarding Patent Owner's statement (3), Mattaboni states that the displacement response peak of its instrument is between 25 and 35 Hertz, which is the most important range for microearthquakes. Ex. 1006, 5. Mattaboni, however, also states the effective frequency band of the disclosed instrument is "from about 2 Hz to somewhat over 50 Hz (Figure 4)." *Id.* at 5. Thus, Mattaboni's instrument records signals "somewhat over 50 Hz" which is "at least above 50 Hz" and in the frequency range which Patent Owner's declarant contends is needed to record "*seismic data*." Ex. 2051 ¶ 35; Ex. 1104, 301:5–302:1 (testifying that 8–50 Hz range is minimum for "*seismic data*" under Patent Owner's construction).

Reviewing the foregoing evidence, we find that Petitioner has shown that Mattaboni, Sutton, Schmalfeldt, and Jones suggest instruments that disclose each limitation of claim 1.

8. *Petitioner's Analysis of Claim 15*

Petitioner reads claim 15 on the combined references as follows:

15. *An ocean bottom seismic data collection system comprising:*

Petitioner refers to the reading of claim 1 on the combination to teach claim 15's preamble. Pet. 46–47. As the wording is identical, Petitioner has made a sufficient showing that the combined references teach the claim 15's preamble for the reasons stated for claim 1.

a. a low-profile, disk-shaped case comprising a first circular plate, a second circular plate and a circular wall joining said first and second plates, wherein said case is characterized by a height and a diameter, wherein the diameter is greater than said height;

Petitioner contends this limitation is taught in part by Mattaboni's OBS housed in a cylindrical pressure vessel with endcaps. Pet. 47; Ex. 1006, 8, Fig. 1. Petitioner's declarant states a POSITA would have understood the two endcaps to be a "first circular plate" and "a second circular plate" as claimed. Ex. 1032 ¶ 134. Petitioner notes Sutton teaches OBSs should be designed with a low profile and small vertical cross section with water and maximum symmetry about the vertical axis. Pet. 48; Ex. 1033, Abstract. Petitioner relies on Jones to teach a discoid shape with flat bottom and curved upper surface. Pet. 48; Ex. 1011, 2:38–39. Petitioner also relies on Jones's teaching that the preferred dimensions of its OBS are

10 x 10 x 3 inches, meaning its case's diameter is greater than its height. Pet. 48; Ex. 1011, 2:51–53, Figs. 1 & 2. Petitioner further relies on Schmalfeldt as teaching an OBS in a low-profile, disk-shaped case with a diameter greater than its height, with a height of the cylindrical container from 12.5 to 18 cm and a diameter of 50 cm. Pet. 48–49; Ex. 1034, Fig. 3, Table 1. Petitioner's declarant testifies that a POSITA would have understood the references to teach a circular bottom plate, a circular top plate, and a circular wall joining the top and bottom plates. Ex. 1032 ¶¶ 134–138, 176.

b. at least one geophone disposed within said case;

Petitioner relies on claim 1's reading to meet this claim limitation. Pet. 50.

c. a clock disposed within said case;

Petitioner relies on claim 1's reading to meet this claim limitation. Pet. 50.

d. a power source disposed within said case; and

Petitioner relies on claim 1's reading to meet this claim limitation. Pet. 50.

e. a seismic data recorder disposed within said case,

Petitioner relies on claim 1's reading to meet this claim limitation. Pet. 50.

f. wherein said system has a negative buoyancy.

Petitioner refers to the reading of claim 6 on the references to teach this limitation. Pet. 50. For claim 6, Petitioner contends Mattaboni's system has a negative buoyancy. Pet. 35; Ex. 1006, 11. Petitioner states Jones teaches buoyancy can be controlled. Pet. 35; Ex. 1011, 4:24–30. Petitioner

contends Schmalfeldt teaches a package density of 1.6 g/cm³ which a POSITA would have understood to mean negative buoyancy. Pet. 35; Ex. 1034, 12, Table 1; Ex. 1032 ¶ 109. Petitioner’s declarant testifies a POSITA would have understood the descriptions and Table 1 to teach the claimed element. Ex. 1032 ¶¶ 107–110, 176.

9. *Patent Owner’s Arguments Concerning Claim 15*

We already addressed Patent Owner’s arguments against the references with respect to claim 1. Also, we addressed Patent Owner’s contention that “*wherein the system has a negative buoyancy*” means that the system has no flotation device (PO Resp. 9–11), a proposed construction that we reject in this decision (*see supra* at 13–14).

Patent Owner further argues the claim limitation stating “*wherein the system has a negative buoyancy*” means that the seismic data recording system has a negative buoyancy, not merely some external weight mechanism that detaches and remains on the bottom after retrieval. PO Resp. 34–42. Patent Owner argues the limitation should not be interpreted to read on systems that include buoys, foam for flotation, glass spheres for flotation, or other flotation devices. *Id.*

10. *Our Analysis of Claim 15*

Although it is true the 761 Patent states “the device should be easily retrievable without the need for flotation devices or release mechanisms” (Ex. 1031, 9:22–24), the claims recite no such limitation, and it is improper to import limitations into the claims or to read a particular embodiment appearing in the written description into the claim if the claim language is broader than the embodiment. *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993) (*citing In re Zletz*, 893 F.2d 319, 321 (Fed. Cir. 1989)). The

claim does not preclude flotation devices or release mechanisms. Moreover, overall buoyancy of a system can be negative even with flotation devices. Indeed, the system must be negatively buoyant to reach the ocean floor without propulsion.

Accordingly, based on the foregoing evidence, we find that Petitioner has shown that Mattaboni, Sutton, Schmalfeldt, and Jones suggest instruments that disclose each limitation of claim 15.

11. Claim 3 Analysis

Petitioner reads claim 3 on the combined prior art references as follows:

- 3. The ocean bottom seismic data collection system of claim 1, wherein said case comprises a first plate and a second plate joined by a wall extending therebetween.*

Petitioner contends this limitation is taught in part by Mattaboni's OBS housed in a cylindrical pressure vessel with endcaps. Pet. 27; Ex. 1006, 8, Fig. 1. Petitioner's declarant states a POSITA would have understood the two endcaps to be a "first plate" and "a second plate" as claimed. Ex. 1032 ¶ 94. Petitioner also relies on Jones to teach a discoid shape with flat bottom and curved upper surface. Pet. 29; Ex. 1011, 2:38–39. Petitioner's declarant states a POSITA would have understood that the top plate and bottom plate of Jones's OBS are two plates joined by a wall extending therebetween. Pet. 29; Ex. 1032 ¶ 95. Petitioner further relies on Schmalfeldt as teaching an OBS in a low-profile, disk-shaped case with top and bottom plates joined by a cylindrical wall extending therebetween. Pet. 30–31; Ex. 1032 ¶ 98.

Patent Owner presents no argument or evidence specifically directed to claim 3. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 3 is taught by the combination of references.

12. Claim 4 Analysis

Petitioner reads claim 4 on the combined prior art references as follows:

4. *The ocean bottom seismic data collection system of claim 3, wherein said wall is characterized by a height and said plates are characterized by a width, wherein the wall height is less than the plate width.*

Petitioner contends this limitation is taught by Sutton, which states that OBSs should be designed with a low profile and small vertical cross section with water. Pet. 31; Ex. 1033, Abstract. Petitioner states that Jones discloses an OBS that has dimensions of 10 x 10 x 3 inches. Pet. 31; Ex. 1011, 2:51–52, Figs. 1–2. Petitioner’s declarant testifies that Jones’s OBS has a wall characterized by a height (3 inches) and plates characterized by widths (10 inches), wherein the wall height is less than the plate width. Pet. 31; Ex. 1032 ¶ 100. Petitioner further notes that Schmalfeldt’s OBS has a maximum height of 18 centimeters and a diameter of 50 centimeters. Pet. 32; Ex. 1034. Fig. 3, Table 1. Petitioner’s declarant contends that Schmalfeldt’s Figure 3 shows the OBS with its top removed, and when deployed, the device would have a top plate attached to enclose the device. Pet. 32; Ex. 1032 ¶ 101. Petitioner’s declarant states that a POSITA would have understood Schmalfeldt to disclose a wall characterized by a height (18

centimeters) and plates characterized by a width (50 centimeters), wherein the wall height is less than the plate width.

Patent Owner presents no argument or evidence specifically directed to claim 4. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 4 is taught by the combination of references.

13. Claim 5 Analysis

Petitioner reads claim 5 on the combined prior art references as follows:

5. *The ocean bottom seismic data collection system of claim 1, wherein said geophone is mounted against said plate.*

Petitioner contends this limitation is taught by Sutton, which discloses that its OBS should be designed with a low profile and small vertical cross section with water. Pet. 33; Ex. 1033, Abstract. Petitioner also contends Jones discloses that its OBS's dimensions are 10 x 10 x 3 inches. Pet. 33, Ex. 1011, 2:51–53, Figs. 1–2. Petitioner's declarant testifies that a POSITA would have understood from the disclosure and Figures that Jones's OBS has a low profile because it has a height of 3 inches and a width of 10 inches. Pet. 34; Ex. 1032 ¶ 104. Petitioner further states that Schmalfeldt has a maximum height of 18 centimeters and a diameter of 50 centimeters. Pet. 34; Ex. 1034, Fig. 3, Table 1. Petitioner's declarant testifies that a POSITA would have understood Schmalfeldt's OBS to disclose a low-profile case because its height is 18 centimeters and width is 50 centimeters. Pet. 34–35; Ex. 1032 ¶ 105.

Patent Owner presents no argument or evidence specifically directed to claim 5. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 5 is taught by the combination of references.

14. Claim 6 Analysis

Petitioner reads claim 6 on the combined prior art references as follows:

6. *The ocean bottom seismic data collection system of claim 1, wherein said system has a negative buoyancy.*

Petitioner contends Mattaboni's OBS has a negative buoyancy of 42 kg in water. Pet. 35; Ex. 1006, 97. Petitioner also contends Jones discloses controlling buoyancy by taking on or expelling water from a tank. Pet. 35; Ex. 1011, 4:24–30. Petitioner further contends Schmalfeldt discloses that its OBS has a package density of 1.6 g/cm³, which a POSITA would understand to have a negative buoyancy. Pet. 35; Ex. 1034, Table 1; Ex. 1032 ¶ 109. Petitioner's declarant contends a POSITA would have understood the descriptions and Table of Schmalfeldt to disclose an OBS with negative buoyancy. Pet. 35; Ex. 1032 ¶¶ 107–110, 176.

Patent Owner contends, as previously noted, that the broadest reasonable construction of "*wherein the system has a negative buoyancy*" can be no broader than "*wherein the system has no flotation device.*" PO Resp. 34. For reasons explained in our claim construction in Section III.A.2 of this decision, we do not agree with Patent Owner's contention. "*Negative buoyancy*" means "*a density that is greater than seawater such that the device sinks.*" Ex. 1005, 614; Ex. 1011, 4:24–30; Ex. 1032 ¶ 24.

Reviewing the evidence, we find Petitioner has shown that Mattaboni, Jones, and Schmalfeldt have a “*negative buoyancy*” under the proper construction of the term.

Reviewing the evidence, we determine that Petitioner has shown that claim 6 is taught by the combination of references.

15. Claim 8 Analysis

Petitioner reads claim 8 on the combined prior art references as follows:

8. *The ocean bottom seismic data collection system of claim 3, wherein said geophone is mounted against said plate.*

Petitioner contends Schmalfeldt’s Figure 3 shows that its geophones are mounted against the bottom plate. Pet. 36; Ex. 1034, Fig. 3. Petitioner’s declarant testifies that a POSITA would have understood that Schmalfeldt’s OBS is “mounted against” the bottom plate. Pet. 36; Ex. 1032 ¶¶ 111, 176.

Patent Owner contends the prior art does not disclose claim 8’s limitation. PO Resp. 58–60. Specifically, Patent Owner contends Mattaboni’s geophones are gimballed and “must be allowed to move freely so that they can orient themselves in accordance with gravity—a requirement that would be defeated if the geophones were mounted against the bottom plate as shown in Schmalfeldt.” PO Resp. 59. Patent Owner’s declarant contends a POSITA would not have been motivated to modify Mattaboni to use fixed geophones as taught by Schmalfeldt, and that the combination of Mattaboni and Schmalfeldt would not work. PO Resp. 60; Ex. 2051 ¶¶ 130–133, 140–143.

In the Reply, Petitioner contends that Patent Owner concedes that geophones are mounted against the bottom plate in Schmalfeldt. Reply 20. Petitioner contends that Patent Owner's declarant testified that gimballed and non-gimballed geophones had both been known for decades before 2003, and that a POSITA in May 2003 would have been aware of the two alternative ways of mounting geophones. Reply 20–21; Ex. 1104, 260:13–261:11.

Petitioner appears to assert that it would be “obvious to try” using non-gimballed geophones over gimballed geophones to arrive at the limitation of claim 8. A showing of “obvious to try,” however, requires more. Specifically, Petitioner needed to show a “design need or market pressure” existed in the art that would have led a POSITA to select the option of mounting a geophone against a plate of the OBS's case over the other option of not mounting the geophone against the plate. *See KSR*, 550 U.S. at 421. Petitioner has not made this showing, which is its burden to carry. 35 U.S.C. § 316(e).

Accordingly, we find Petitioner has not shown that claim 8 is taught by the combination of references.

16. *Claim 9 Analysis*

Petitioner reads claim 9 on the combined prior art references as follows:

9. *The ocean bottom seismic data collection system of claim 3, wherein said geophone is located substantially along an axis passing through said first and second plates.*

Petitioner contends Mattaboni discloses a vertically oriented geophone that is centrally located in the case, as shown in Mattaboni's Figure 2. Pet. 36–37; Ex. 1006, 91, Fig. 2. Petitioner's declarant states a POSITA would have understood that the vertically oriented geophones are located substantially along an axis, for example, the vertically oriented geophone, is located substantially along an axis passing through first and second plates (endcaps). Pet. 36; Ex. 1032 ¶ 112.

Petitioner further contends Schmalfeldt discloses a geophone centrally located in a case as shown in Schmalfeldt's Figure 3. Pet. 38; Ex. 1034, Fig. 3. Petitioner's declarant states that a POSITA would have understood Schmalfeldt's geophone to be located substantially along an axis passing through the first and second (top and bottom) plates. Pet. 38; Ex. 1032 ¶¶ 113–114.

Patent Owner presents no specific argument or evidence specifically directed to claim 9. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 9 is taught by the combination of references.

17. Claim 11 Analysis

Petitioner reads claim 11 on the combined prior art references as follows:

- 11. The ocean bottom seismic data collection system of claim 1 wherein the case is substantially symmetrical.*

Petitioner contends Sutton discloses that OBSs “should be designed with maximum symmetry about the vertical axis.” Pet. 38; Ex. 1033, Abstract. Petitioner also contends Jones discloses an OBS that is “discoid in

shape with a flat bottom 16 and a curved upper surface 18.” Pet. 38; Ex. 1011, 2:38–39. Petitioner further contends that Jones’s Figures 1 and 2 show that its case is substantially symmetrical about multiple axes. Pet. 38–39; Ex. 1011, Figs. 1, 2. In addition, Petitioner contends that Schmalfeldt’s circular case is symmetrical about the axis passing through the center of the case. Pet. 39–40; Ex. 1032 ¶¶ 117–118. Furthermore, Petitioner contends that Mattaboni’s OBS is housed in a circular pressure vessel which is symmetrical about an axis passing vertically through the center of the cylinder. Pet. 40; Ex. 1032 ¶ 118. Petitioner’s declarant testifies that a POSITA would have understood the above descriptions and Figures of Sutton, Jones, Schmalfeldt, and Mattaboni to disclose claim 11. Ex. 1032 ¶¶ 115–119, 176.

Patent Owner presents no specific argument or evidence for claim 11. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 11 is taught by the combination of references.

18. Claim 12 Analysis

Petitioner reads claim 12 on the combined prior art references as follows:

- 12. The ocean bottom seismic data collection system of claim 1, the case having a first axis and a second axis wherein the case is substantially symmetrical about each of the first and second axes.*

Petitioner contends Sutton discloses that OBSs “should be designed with maximum symmetry about the vertical axis.” Pet. 40–41; Ex. 1033, Abstract. Petitioner also contends Jones discloses an OBS that is “discoid in

shape with a flat bottom 16 and a curved upper surface 18.” Pet. 41;
Ex. 1011, 2:38–39. Petitioner also contends that Jones’s Figures 1 and 2 show that its case is substantially symmetrical about multiple axes. Pet. 38–39; Ex. 1011, 2:38–39, Figs. 1 and 2. Petitioner further contends Schmalfeldt’s Figure 3 discloses a circular case which is symmetrical about the vertical axis and any axis orthogonal to the vertical axis. Pet. 42; Ex. 1032 ¶ 122. In addition, Petitioner contends Mataboni’s OBS is housed in a cylindrical pressure vessel which is symmetrical about its vertical axis and any axis orthogonal to the vertical axis. Pet. 42; Ex. 1032 ¶ 123. Petitioner’s declarant concludes that a POSITA would have understood the above descriptions and Figures of Sutton, Jones, Schmalfeldt, and Mataboni to disclose claim 12. Ex. 1032 ¶¶ 120–124, 176.

Patent Owner presents no argument or evidence specifically directed to claim 12. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 12 is taught by the combination of references.

19. Claim 13 Analysis

Petitioner reads claim 13 on the combined prior art references as follows:

13. *The ocean bottom seismic data collection system of claim 1, wherein the case is characterized by a height and a diameter wherein the diameter is greater than said height.*

Petitioner contends Sutton discloses that OBS’s “should be designed with . . . a low profile and a small vertical cross section with water.” Pet. 43; Ex. 1033, Abstract. Petitioner also contends Jones discloses that the

preferred dimensions of its instrument are 10 x 10 x 3 inches. Pet. 43; Ex. 1011, 2:51–53, Figs. 1, 2. Petitioner contends a POSITA would have understood from Jones that a diameter of ten inches is greater than the height of three inches. Pet. 43; Ex. 1032 ¶ 126. Petitioner further contends Schmalfeldt’s OBS has a maximum height of 18 centimeters and a diameter of 50 centimeters. Pet. 43–44; Ex. 1034, Fig. 3, Table 1. Petitioner’s declarant testifies that a POSITA would have understood from the above description, Figure and Table that Schmalfeldt’s OBS is characterized by a height (18 centimeters) and a diameter (50 centimeters), wherein the diameter is greater than the height. Pet. 44; Ex. 1032 ¶ 127.

Patent Owner presents no argument or evidence specifically directed to claim 13. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 13 is taught by the combination of references.

20. Claim 14 Analysis

Petitioner reads claim 14 on the combined prior art references as follows:

14. *The ocean bottom seismic data collection system of claim 13, wherein the height is no more than 50% of the diameter.*

Petitioner contends Sutton discloses that OBS’s “should be designed with . . . a low profile and a small vertical cross section with water.” Pet. 44; Ex. 1033, Abstract. Petitioner also contends Jones discloses that the preferred dimensions of its instrument are 10 x 10 x 3 inches. Pet. 43; Ex. 1011, 2:51–53, Figs. 1 and 2. Petitioner contends a POSITA would have understood that Jones’s OBS is characterized by a height (3 inches) and a

diameter (10 inches), wherein the height is no more than 50% of the diameter. Pet. 45; Ex. 1032 ¶ 130. Petitioner further contends Schmalfeldt's OBS has a maximum height of 18 centimeters and a diameter of 50 centimeters. Pet. 45–46; Ex. 1034, Fig. 3, Table 1. Petitioner's declarant testifies that a POSITA would have understood the above description, Figure and Table that Schmalfeldt's OBS is characterized by a height (18 centimeters) and a diameter (50 centimeters), wherein the height is no more than 50% of the diameter. Pet. 46; Ex. 1032 ¶ 131.

Patent Owner presents no argument or evidence specifically directed to claim 14. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 14 is taught by the combination of references.

21. Claim 16 Analysis

Petitioner reads claim 16 on the combined prior art references as follows:

16. *The ocean bottom seismic data collection system of claim 15, wherein the height is no more than 50% of the diameter.*

Petitioner relies on the same mapping as provided for claim 14 to show that claim 16 is unpatentable over the cited prior art references. Pet. 50.

Patent Owner presents no argument or evidence specifically directed to claim 16. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 16 is taught by the combination of references.

22. *Claim 17 Analysis*

Petitioner reads claim 17 on the combined prior art references as follows:

17. *The ocean bottom seismic data collection system of claim 15, further comprising an internal, water-tight compartment in which said seismic recorder is disposed.*

Petitioner contends Mattaboni discloses that its sensor, electronics, and recorder are housed in a cylindrical pressure vessel (Figure 1) with aluminum endcaps that are 7.6 centimeters thick with double O-ring seals, and that pressure tests were run to 34.5 MPa (5000 psi) equivalent to 3.4 km water depth. Pet. 50; Ex. 1006, 94–95, Abstract. Petitioner’s declarant testifies that a POSITA would have understood the above descriptions and Mattaboni’s Figure 2 to disclose a seismic data recorder disposed in a pressure case that is an internal, water-tight compartment. Pet. 51; Ex. 1032 ¶¶ 159–160, 176, Fig. 2.

Patent Owner presents no specific argument or evidence specifically directed to claim 17. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 17 is taught by the combination of references.

23. *Claim 18 Analysis*

Petitioner reads claim 18 on the combined prior art references as follows:

18. *The ocean bottom seismic data collection system of claim 15, further comprising an internal, water-tight compartment in which said geophone is disposed.*

Petitioner contends Mattaboni discloses that its sensor, electronics, and recorder are housed in a cylindrical pressure vessel (Figure 1) with aluminum endcaps that are 7.6 centimeters thick with double O-ring seals and that pressure tests were run to 34.5 MPa (5000 psi) equivalent to 3.4 km water depth. Pet. 50; Ex. 1006, 94–95. Petitioner contends that the sensors are short period geophones. Pet. 50; Ex. 1006, 91. Petitioner’s declarant testifies that a POSITA would have understood the above descriptions and Mattaboni’s Figure 2 to disclose a geophone disposed in a pressure case that is an internal, water-tight compartment. Pet. 52; Ex. 1032 ¶¶ 161–162, 176, Fig. 2.

Patent Owner presents no argument or evidence specifically directed to claim 18. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 18 is taught by the combination of references.

24. *Claim 19 Analysis*

Petitioner reads claim 19 on the combined prior art references as follows:

19. *The ocean bottom seismic data collection system of claim 15, further comprising an internal, water-tight compartment in which said clock is disposed.*

Petitioner contends Mattaboni discloses that its sensor, electronics, and recorder are housed in a cylindrical pressure vessel (Figure 1) with aluminum endcaps that are 7.6 centimeters thick with double O-ring seals, and that pressure tests were run to 34.5 MPa (5000 psi) equivalent to 3.4 km water depth. Pet. 53; Ex. 1006, 94–95. Petitioner contends Mattaboni

discloses a “real-time clock is used to identifying the time of events on the data recorder.” Pet. 53; Ex. 1005, 94, Fig. 3. Petitioner’s declarant testifies that a POSITA would have understood the above descriptions and Mattaboni’s Figure 3 to disclose a clock disposed in a pressure case that is an internal, water-tight compartment. Pet. 54; Ex. 1032 ¶¶ 163–165, 176, Fig. 3.

Patent Owner presents no argument or evidence specifically directed to claim 19. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 19 is taught by the combination of references.

24. Claim 21 Analysis

Petitioner reads claim 21 on the combined prior art references as follows:

21. *The ocean bottom seismic data collection system of claim 15, wherein said geophone is located substantially along an axis passing through said first and second plates.*

Petitioner relies on the same mapping as provided for claim 9 to show that claim 21 is unpatentable over the cited prior art references. Pet. 55.

Patent Owner presents no argument or evidence specifically directed to claim 21. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 21 is taught by the combination of references.

25. Claim 22 Analysis

Petitioner reads claim 22 on the combined prior art references as follows:

22. *The ocean bottom seismic data collection system of claim 21, wherein said geophone is mounted adjacent said plate along said axis.*

Petitioner's declarant states that Schmalfeldt discloses geophones adjacent to the bottom plate of its OBS. Pet. 56; Ex. 1032 ¶ 173; Ex. 1034, Fig. 3. Petitioner's declarant also states Schmalfeldt's Figure 3 discloses a geophone centrally located substantially along an axis passing through the top and bottom plates of Schmalfeldt's OBS. Pet. 56; Ex. 1032 ¶ 174. Petitioner's declarant contends a POSITA would have understood that at least one of Schmalfeldt's geophones are located substantially along an axis passing through the plates of Schmalfeldt's OBS. Pet. 56; Ex. 1032 ¶ 175.

Patent Owner argues for patentability of claim 22 on the same basis as argued for claim 8. PO Resp. 58–60. The recitation of claim 22 differs significantly, however, from claim 8. Accordingly, we do not agree with Patent Owner that the same argument Patent Owner made with respect to claim 8 applies to claim 22.

Specifically, claim 22 recites that the geophone is “*adjacent*” which means “1 a : not distant: NEARBY” or “b : having a common endpoint or border.” Merriam-Webster (last viewed 10/8/19) https://www.merriam-webster.com/dictionary/adjacent?utm_campaign=sd&utm_medium=serp&utm_source=jsonld. Thus, “*adjacent*” in claim 22 encompasses the geophone merely being near but not in contact with the plate whereas “*mounted against*” in claim 8 means the geophone contacts the plate.

Reviewing the evidence, we determine that Petitioner has shown that claim 22 is taught by the combination of references.

25. *Motivation to Combine*

Petitioner contends a person of ordinary skill in the art (POSITA) would have been motivated to combine Mattaboni, Sutton, Schmalfeldt, and Jones because they discuss “the same technology area—seismic data collection devices—and specifically, OBS’s, which would have provided a POSITA with an initial impetus to combine the references.” Pet. 15–16; Ex. 1032 ¶ 63. Petitioner contends “Sutton concluded that OBS’s should have “a low profiled and a small vertical cross section with water” and “maximum symmetry about the vertical axis.” Pet. 17; Ex. 1033, Abstract, 48. Petitioner contends Sutton explained that this form factor minimizes cross coupling and coupling of water motion to the motion of the OBS, and torqueing caused by the upper part of an OBS moving with water and the lower part moving with sediment, which distorts detected motion. Pet. 17; Ex. 1033, 64. Petitioner contends “from Sutton’s observations a POSITA would have understood that Mattaboni’s relatively tall cylindrical form factor was undesirable, and should be modified so that the end plates are widened and the wall length shortened, so as to provide ‘a low profile [device with] . . . a small vertical cross section with water.’” Pet. 17; Ex. 1033, Abstract; Ex. 1032 ¶ 66. For this reason, Petitioner concludes that a POSITA would have been motivated to combine Mattaboni and Sutton.

Petitioner also contends a POSITA would have been motivated to combine Schmalfeldt with Mattaboni and Sutton because Schmalfeldt’s

OBS was symmetrical and cylindrical like Mattaboni's OBS, but had cylinder height decreased and end plates increased in size, as Sutton taught was optimal. Pet. 18; Ex. 1032 ¶ 68.

Petitioner further contends "by the time of the 761 Patent's priority date, it was technically feasible to create OBS's with the types of components included in Mattaboni's OBS, but in a low profile, symmetrical form factor." Pet. 18. By this time, Petitioner contends, relatively low-cost memory, energy-dense and smaller batteries, and smaller electronic components which required less power, were available. Pet. 18–19; Ex. 1032 ¶ 69. Thus, Petitioner contends the "POSITA would have had an expectation of success in designing OBS's with Mattaboni's components, but with [Sutton's] form factor," similar to Schmalfeldt's OBS. Pet. 19.

According to Petitioner, like Schmalfeldt's OBS, Jones's OBS (the "MOBS") was enclosed in a low-profile case with symmetry about the vertical axis. Pet. 20; Ex. 1033, Abstract; Ex. 1032 ¶ 71. Given the similar and overlapping teachings of these OBS references, Petitioner concludes a POSITA would have a reasonable expectation of success in combining the references. Pet. 21; Ex. 1032 ¶¶ 72–75.

We are persuaded that Petitioner has provided the necessary showing that a POSITA would have been motivated to combine the references for the reasons advanced by Petitioner. The various OBSs disclosed in these references set forth various options a POSITA could pursue in designing an OBS, and the featured similarities would have led a person of ordinary skill in the art to combine them.

Specifically, Mattaboni teaches the desirability of a self-contained OBS with geophones, data recorder, electronics, and battery in a cylindrical

housing. Ex. 1006, 2–9, Figs. 1, 2. Sutton teaches the desirability of low-profile and small vertical cross section with water, low density gradients, and maximum symmetry about the vertical axis, to avoid distortions in recorded seismic data. Ex. 1033, Abstract. Sutton, thus, teaches Mattaboni’s large vertical cross section should be reduced to a low-profile configuration. Ex. 1033, Abstract. Similarly, Schmalfeldt’s and Jones’s OBSs have a low-profile, symmetrical configuration as taught by Sutton, and show how geophones and other equipment can be accommodated inside of a disk-shaped case. Ex. 1034, 7, Fig. 3; Ex. 1011, Fig. 2. Petitioner has made a showing that similarities of Sutton’s, Schmalfeldt’s, and Jones’s OBS configurations suggest their combination. Ex. 1032 ¶¶ 73– 74; *see also KSR*, 550 U.S. at 420 (“in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle.”). In addition, Petitioner has shown for purposes of this decision that design trends existed (1) to reduce OBS configuration from high- to low-profile; (2) to reduce the size, cost, and power consumption of electronic components; and (3) to increase battery power capacity. Ex. 1032 ¶ 69. Petitioner has made a sufficient showing that these design trends, recognized as important in the obviousness analysis in *KSR*, 550 U.S. at 419, would have suggested modification of the references to obtain the claimed invention.

Patent Owner contends Petitioner relies on improper hindsight, and fails to meet its burden to show motivation to combine the references. PO Resp. 45–56. We do not agree. All of the challenge references belong to the narrow field of OBSs, and there are teachings in them suggesting their combination. In addition, configuration similarities and design trends

encourage the proposed combination of references. As explained, the OBSs of the references have similar components, and the references recognize the desirability of a self-contained, low-profile, symmetric configuration, with reduced size, cost and power consumption, and increased battery power capacity. These factors would have suggested a reasonable expectation of success in making the combination. Indeed, the law clearly provides that “[t]he motivation need not be found in the references sought to be combined, but may be found in any number of sources, including common knowledge, the prior art as a whole, or the nature of the problem itself.” *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1361 (Fed. Cir. 2006). Thus, we do not agree that Petitioner relied on improper hindsight, or fails to show motivation to combine the references.

Patent Owner contends Sutton “taught away” from the claimed invention by stating that the mass of a seismometer should be minimized, and that the sensor package should be separated from the other equipment. Ex. 1033, 18; PO Resp. 51–56. In particular, Patent Owner contends that Sutton states “geophones ***must be separated*** from the necessarily massive package that contains power, electronics, recording, and recovery equipment” which is “the exact ***opposite*** of what the claims require: that a geophone be included in the same case [as] all other components.” PO Resp. 51 (citing Ex. 1033, 18). Patent Owner adds “Sutton not only criticizes, discredits, and discourages the proposed combination—it forbids it.” PO Resp. 52.

We do not agree Sutton “teaches away” from the 761 Patent’s claims. The reason that Sutton separates geophones from other components is to reduce the mass of the geophones so that they can better sense seismic

signals pursuant to the mass criteria set forth in Sutton. Ex. 1033, 18. However, Sutton also identifies some disadvantages of not using a single package to incorporate the power, electronics, recording, and recovery equipment—added complexity and possibly lower reliability. *Id.* Thus, Sutton cannot be read as stating that under no circumstances should other components be combined with the geophones. Ex. 1110 ¶¶ 19–23. Instead, we agree with Petitioner that Sutton should be read as stating that the mass of the other components of the OBS available in 1987 precluded their combination with the geophone in meeting the design criteria set out in Sutton. *Id.*

Petitioner identifies prior art showing a design trend toward smaller components that would reduce mass and make it possible to fit all components, including the sensor package, within an OBS, as shown in Schmalfeldt and Jones, and still maintain the geophone mass compliant with the criteria specified by Sutton. Ex. 1032 ¶ 69; Ex. 1033, 18; Ex. 1034, Fig. 3; Ex. 1011, 2:37–46. It is well-established that scientific literature may drive design trends toward obvious techniques and combinations. *KSR*, 550 U.S. at 419. This is the case here. With the knowledge provided by this literature, a POSITA would have recognized that using components with reduced mass makes it possible to combine them all within one case as disclosed, for example, in Mattaboni, Schmalfeldt, and Jones. Thus, we do not find Patent Owner’s argument persuasive.

Patent Owner further argues “A POSITA would not have been motivated to simply widen a cylinder’s end plates and shorten its walls.” PO Resp. 55. Patent Owner contends that the curved surfaces of spheres and cylinders are beneficial for pressure vessels, and the advantages of these

structures would be lost by shortening the cylindrical wall of Mattaboni, as Petitioner suggests. *Id.* at 55; Ex. 1060, 6:39–43; Ex. 1006, 8; Ex. 2009, 3. We do not agree with Patent Owner’s argument, however, because the height of a cylindrical wall can be shortened without loss of curved surface area by widening its radius or diameter sufficiently. In addition, thickening or reinforcing the walls can overcome this issue. *See* Ex. 2024, 279:20–282:8. Moreover, as Petitioner notes, a number of other references show that it was known in the art to adopt a low-profile case with geophones and other components in one case, belying Patent Owner’s assertion that such a case design would not have been suggested in the art. *See* Ex. 1008, 2–3; Ex. 1011, 2:37–46, Figs. 1–3; Ex. 1034 § 2.1.1; Ex. 1110 ¶¶ 19–23.

Accordingly, based on the foregoing evidence, we conclude that a person of ordinary skill in the art would have had reason to combine Mattaboni, Sutton, Schmalfeldt, and Jones to obtain the claimed invention.

F. Ground 2: Asserted Obviousness of Claims 1, 2, and 10 based on Cranford, Sutton, Schmalfeldt, and Jones

1. Cranford (Ex. 1005)

Cranford is titled “A Direct-Recording Ocean-Bottom Seismograph,” and describes “[a] direct-recording ocean-bottom seismograph featuring small size and low cost [that] has been constructed and operated in the deep ocean.” Ex. 1005, 1, Abstract. The ocean-bottom seismograph of Cranford includes a geophone and hydrophone that are amplified and direct recorded on three channels of a magnetic tape. *Id.* at Abstract. BCD-coded time pulses, generated from a crystal oscillator signal, are recorded on a fourth channel of the magnetic tape. *Id.* The device is powered by nine D-cell

alkaline batteries enclosed in the package. *Id.* “For retrieval, an expendable base plate is released by a cable cutter on command from a clock comparator circuit.” *Id.* The data can be played back once the device is retrieved. *Id.* Figure 2 of Cranford is reproduced below.

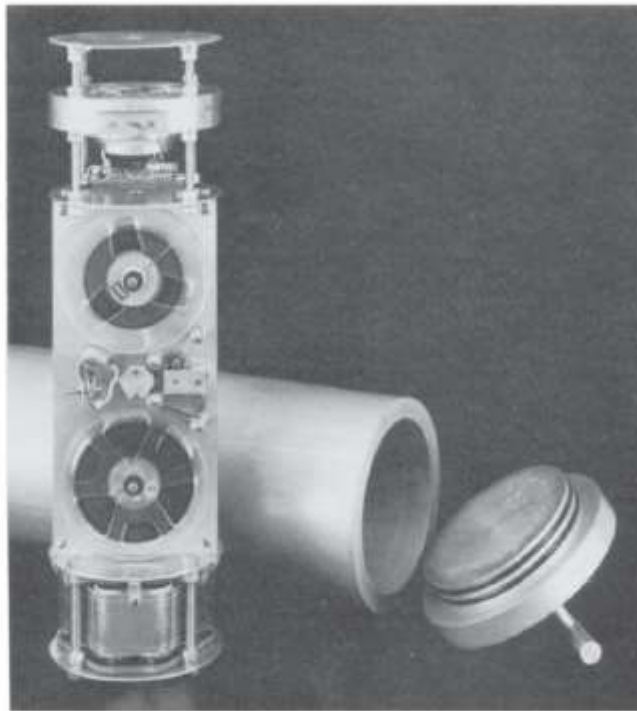


FIG. 2. Instrument and pressure case. Components from top to bottom: gimbal-mounted 2-Hz vertical geophones, tape deck, and battery pack. Electronic circuit boards are mounted behind the tape deck. Dimensions are 15-cm diameter by 53 cm.

Figure 2 of Cranford shows the instrument and water-tight pressure case. *Id.* at 609. From top to bottom the instrument includes a geophone, tape deck, and battery pack. *Id.* During deployment, Cranford's water-tight pressure case is enclosed in a housing that is attached to a “baseplate . . . made from a 0.64-cm iron plate weighing 25 kg and bent to form a V for stability during free-fall” which gives the “the total package” “12 kg of negative buoyancy.” *Id.* at 614. Figure 5 of Cranford is reproduced below.

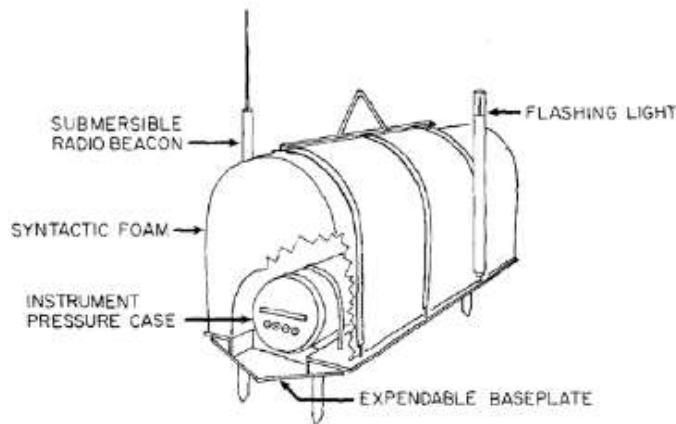


FIG. 5. External components of the seismograph. A single cable holds the baseplate to an aluminum frame while stainless steel straps secure the pressure vessel and syntactic foam flotation. The package measures 1.0 m in length by 0.7 m in height and weighs 114 kg. The float is painted with iridescent paint while a radio beacon and flashing light aid in locating the package on the surface.

Figure 5 of Cranford shows the external components of the seismograph with a single cable holding the baseplate to an aluminum frame.

2. *Petitioner's Analysis of Claim 1*

Petitioner reads claim 1 on the references as follows:

1. *An ocean bottom seismic data collection system comprising:*

Petitioner contends Cranford discloses a direct-recording ocean-bottom seismograph. Pet. 59; Ex. 1005, Abstract. Petitioner also contends Jones's MOBS records and stores multi-component seismic recordings. Pet. 59; Ex. 1011, 1:43–48. Petitioner argues Schmalfeldt's OBS comprises seismic sensors including geophones. Pet. 59; Ex. 1034, 11, Fig. 3.

a. a disk-shaped case;

Petitioner indicates Cranford teaches its instrument fits in a cylindrical pressure case with endcaps. Pet. 60; Ex. 1005, 611–613, Fig. 2. Petitioner states that a decade later, Sutton taught that OBSs should be designed with a low-profile, small vertical cross section, and maximum symmetry about the vertical axis. Pet. 60; Ex. 1033, Abstract. Petitioner contends Jones

discloses an OBS with flat bottom and curved upper surface, with height less than its diameter. Pet. 60–61; Ex. 1011, 2:38–39, 2:51–53, Figs. 1, 2. Petitioner further contends Schmalfeldt’s OBS has a disk-shaped case. Pet. 61–62; Ex. 1034, Fig. 3, Table 1. Petitioner’s declarant testifies a POSITA would have understood the descriptions, figures and table to disclose a disk-shaped case. Ex. 1032 ¶¶ 181–185, 213.

b. at least one geophone disposed within said case;

Petitioner states Cranford teaches its OBS has a geophone within a pressure case. Pet. 62; Ex. 1005, 608, Fig. 2. Petitioner also notes Jones’s MOBS has a geophone housing. Pet. 63; Ex. 1011, 2:41–42. Petitioner contends Schmalfeldt teaches its OBS has three geophones. Pet. 63; Ex. 1034, 7, Fig. 3. Petitioner’s declarant testifies a POSITA would have understood the description and Figures of the references to disclose at least one geophone disposed within a case. Pet. 63; Ex. 1032 ¶¶ 186–189, 213.

c. a clock disposed within said case;

Petitioner avers Cranford teaches a seismograph with crystal clock to set the time for commencement of recording, and that the clock fits within its cylindrical pressure case. Pet. 63–64; Ex. 1005, 610, 611, Fig. 1. Petitioner’s declarant testifies a POSITA would have understood these descriptions and Figure of the reference to teach the claimed feature. Pet. 64; Ex. 1032 ¶¶ 190–191, 213.

d. a power source disposed within said case; and

Petitioner states Cranford teaches its electronics and tape recorder motor are powered by batteries in the pressure case. Pet. 64–65; Ex. 1005, 611, Fig. 2. Petitioner further states Jones’s MOBS contains a power unit. Pet. 65; Ex. 1011, 2:41–44. Petitioner’s declarant testifies the POSITA

would have understood the references to teach the claimed feature. Pet. 65; Ex. 1032 ¶¶ 192–194, 213.

e. a seismic data recorder disposed within said case.

Petitioner states Cranford teaches its OBS records geophone and hydrophone outputs on magnetic tape, and that this tape recorder fits inside the cylindrical pressure case. Pet. 65–66; Ex. 1005, Abstract, 610, Fig. 2. Petitioner notes Jones’s MOBS attains multi-component seismic recordings stored internally. Pet. 66–67; Ex. 1011, 2:41–43, 1:43–48. Petitioner’s declarant testifies a POSITA would have understood the references to teach the claimed feature. Pet. 67; Ex. 1032 ¶¶ 195–198, 213.

3. *Patent Owner Arguments*

Patent Owner argues Cranford does not contain a “*seismic data recorder*” for use in seismic explorations surveys. PO Resp. 61. Specifically, Patent Owner elaborates that Cranford lacks the necessary bandwidth for a “*seismic data recorder*” as construed. *Id.*

4. *Our Analysis of Claim 1*

Patent Owner’s argument does not address that Petitioner also relies on Jones to teach the claimed “*seismic data recorder*” and that Jones’s MOBs attains multi-component seismic recordings that are stored internally in the performance of seismic surveys. Pet. 66–67; Ex. 1011, 2:41–43, 1:43–48; Ex. 1032 ¶¶ 195–198, 213. Accordingly, we are not persuaded by Patent Owner’s argument.

Reviewing the foregoing evidence, we find that Petitioner has shown that Cranford, Sutton, Schmalfeldt, and Jones suggest instruments that disclose each limitation of claim 1.

5. Claim 2 Analysis

Petitioner reads claim 2 on the references as follows:

2. *The ocean bottom seismic data collection system of claim 1, wherein said geophone is mounted adjacent said plate along said axis.*

Petitioner contends that Cranford discloses a cylindrical pressure case with endcaps. Pet. 67; Ex. 1005, 611–613, Fig. 2. Petitioner’s declarant testifies that a POSITA would have understood from the disclosure and Figure 2 that Cranford’s two endcaps are “*a first circular plate*” and “*a second circular plate*” and that Cranford’s cylinder is “a circular wall joining said first and second plates” as claimed. Pet. 67; Ex. 1032 ¶ 200.

Petitioner further contends Jones’s OBS is discoid in shape with a flat bottom and curved upper surface. Pet. 68; Ex. 1011, 2:38–39, Figs. 1 and 2. Petitioner contends the Cambridge Dictionary defines “circular” as “in the shape of a circle.” Pet. 68; Ex. 1014. Acknowledging the plates of Jones’s OBS are not a perfect circle, Petitioner’s declarant testifies that a POSITA would have understood that the plates are shaped like and therefore are “*circular*” as claimed, because Jones states any hydrodynamically efficient body shape will work. Pet. 68; Ex. 1011, 2:39–41; Ex. 1032, ¶ 202. Petitioner’s declarant states “[a] POSITA would have understood from the descriptions and Figures above that Jones discloses an OBS having a case with a first circular plate, a second circular plate, and a circular wall joining said first and second plates.” Pet. 68; Ex. 1032 ¶¶ 202–203.

Petitioner further contends Schmalfeldt discloses an OBS with a circular case. Pet. 69; Ex. 1034, Fig. 3, Table 1. Petitioner’s declarant testifies that a POSITA would have understood that Schmalfeldt’s Figure 3

shows the case opened with the top removed. Pet. 69; Ex. 1032 ¶ 205. Petitioner's declarant further testifies that a POSITA would have understood that when the top plate was attached, the case comprises a circular bottom plate, a circular top plate, and a circular wall joining the top and bottom plates. Pet. 69; Ex. 1032 ¶ 205. Petitioner's declarant concludes that a POSITA would have understood the descriptions, Figures and Table above to disclose the claimed limitation. Pet. 69–70; Ex. 1032 ¶¶ 199–206, 213.

Patent Owner presents no argument or evidence specific to claim 2. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 2 is taught by the combination of references.

6. *Claim 10 Analysis*

Petitioner reads claim 10 on the references as follows:

10. The ocean bottom seismic data collection system of claim 2, wherein the each plate is characterized by a width and the wall is characterized by a height, wherein the width of the plates is greater than the height of the wall.

Petitioner contends Sutton discloses that OBS's "should be designed with . . . a low profile and small vertical cross section with water." Pet. 70; Ex. 1033, Abstract.

Petitioner also contends Jones discloses an OBS that is discoid in shape with flat bottom and curved upper surface. Pet. 70; Ex. 1011, 2:38–39. Petitioner contends Jones further discloses that the dimensions of its OBS are 10 x 10 x 3 inches with a width greater than its height. Pet. 70; Ex. 1011, 2:51–53, Figs. 1 and 2.

Petitioner contends Schmalfeldt discloses an OBS with a low-profile case. Pet. 70–71; Ex. 1034, Fig. 3, Table 1. Petitioner’s declarant contends that Schmalfeldt’s Figure 3 shows the OBS case with its top plate removed, but that a POSITA would have understood that when the device was deployed, the top plate was attached to enclose the OBS, and from Figure 3 and Table 1, when the top plate was attached, the width of the plates is greater than the height of the wall. Pet. 71; Ex. 1032 ¶ 211, Fig. 3, Table 1. Petitioner’s declarant concludes that a POSITA would have understood from the descriptions and Figures above that Sutton, Jones, and Schmalfeldt disclose the limitations of claim 10. Pet. 71; Ex. 1032 ¶¶ 207–213.

Patent Owner presents no argument or evidence specific to claim 10. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 10 is taught by the combination of references.

7. *Motivation to Combine*

Petitioner contends the similarities of the OBSs of Cranford and Mattaboni would have suggested Cranford’s combination with Sutton, Schmalfeldt, and Jones. Pet. 57–59. Specifically, both OBSs were self-contained, free-fall instruments. Ex. 1005, 614, Fig. 2; Ex. 1006, Abstract, 88; Ex. 1032 ¶ 178. Both were used for earthquake detection. Ex. 1005, 614; Ex. 1006, 87, 88, 91; Ex. 1032 ¶ 178. Both were used as geophones, i.e., seismic wave sensors, and both had clocks, batteries, and tape recorders. Ex. 1005, Abstract, 610, 611, Figs. 1, 2; Ex. 1006, Abstract, 91, 94, 96, Figs. 2–3, Table 1; Ex. 1032 ¶ 178. Both OBSs had cylindrical pressure cases with endcaps, and double O-rings to seal the endcaps to the cylindrical

portion of the case. Ex. 1005, Abstract, 611, 613, Fig. 2; Ex. 1006, Figs. 1–2, Table 1, 94; Ex. 1032 ¶ 178. Petitioner contends because the Cranford and Mattaboni OBSs were so similar, a POSITA would have been motivated to combine Cranford, Sutton, Schmalfeldt, and Jones for the same reasons as Mattaboni, Sutton, Schmalfeldt, and Jones with a reasonable expectation of success in arriving at the claimed invention. Pet. 59; Ex. 1032 ¶ 179.

Patent Owner contends a POSITA would not have been motivated to combine Sutton, Schmalfeldt, and Jones with Cranford for the same reasons one allegedly would not have been motivated to combine Sutton, Schmalfeldt, and Jones with Mattaboni. PO Resp. 60–61. Patent Owner contends both Mattaboni and Cranford are earthquake monitoring devices and both have pressure vessels with endcaps. PO Resp. 60; Ex. 2051 ¶ 145. Patent Owner also argues Sutton evaluated the Cranford device and literally taught away from Cranford. PO Resp. 61; Ex. 2051 ¶ 149.

Referring back to Patent Owner’s arguments addressed in Section III.E.25, Patent Owner contends that Sutton teaches the geophones must be separated from the necessarily massive package that contains power, electronics, recording, and recovery equipment. PO Resp. 51–52; Ex. 1033, 18. As we explained in that Section, Petitioner has shown that the various OBSs disclosed in the references set forth various options a POSITA could pursue in designing an OBS, and the featured similarities and design trends would have led a person of ordinary skill in the art to combine them. For example, a POSITA would have understood the evolution from tape recorders to solid-state memories, reduction in component sizes, and increases in battery efficiency, all made it possible to incorporate the OBS components, including a geophone, in a single case. Accordingly, we

determine that Petitioner has shown there was sufficient reason for a POSITA to combine Cranford, Sutton, Schmalfeldt, and Jones.

Accordingly, based on the foregoing evidence, we conclude that a person of ordinary skill in the art would have had reason to combine Cranford, Sutton, Schmalfeldt, and Jones to obtain the claimed invention.

*G. Ground 3: Asserted Obviousness of Claims 7 and 24
Based on Mattaboni, Sutton, Schmalfeldt, Jones, and Carrack*

1. Carrack (Ex. 1007)

Carrack is titled “Ocean Bottom Systems: miniDOBS Seismometer.” Ex. 1007. Carrack’s miniDOBS is shown in the Figure below.



As the Figure shows, Carrack’s miniDOBS includes a geophone, pressure vessel, and recording system. Ex. 1007, 1–5. The miniDOBS also includes a clock and batteries. *Id.* Carrack’s miniDOBS includes a geophone “optimised for shear wave coupling,” as shown in the Figure below. Ex. 1007, 6.



As shown in the Figure above, the geophone's surface has ridges and grooves.

2. *Claim 7 Analysis*

Petitioner reads claim 7 on the combination of references as follows:

7. *The ocean bottom seismic data collection system of claim 3, at least one plate is provided with external ribs/grooves.*

Petitioner contends the above figure of Carrack discloses this feature. Pet. 78; Ex. 1007, 6. Petitioner's declarant testifies a POSITA would have understood Carrack to teach this feature. Pet. 78–79; Ex. 1032 ¶¶ 230–231, 234.

Patent Owner presents no argument or evidence specific to claim 7, or specific to claim 3, from which claim 7 depends. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 7 is taught by the combination of references.

3. *Claim 24 Analysis*

Petitioner reads claim 24 on the combination of references as follows:

24. *The ocean bottom seismic data collection system of claim 15, wherein at least one plate is provided with external coupling ridges.*

Petitioner contends the above figure of Carrack discloses this feature. Pet. 79; Ex. 1007, 6. Petitioner's declarant testifies a POSITA would have understood Carrack to teach this feature. Pet. 79; Ex. 1032 ¶¶ 232–234.

Patent Owner presents no argument or evidence specific to claim 24. *See generally* PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 24 is taught by the combination of references.

4. *Motivation to Combine*

Petitioner contends Carrack discusses the same specific technology area—seismic data collection devices—and discloses a similar OBS with similar components as Mattaboni, Sutton, Schmalfeldt, and Jones so that a POSITA would have had initial impetus to combine them. Pet. 74. Like these references, Petitioner contends Carrack teaches geophones, batteries, a clock, and a seismic data recorder. Pet. 74; Ex. 1007, 3–5. Petitioner contends these similarities would have led a POSITA to combine the references. Pet. 76. Furthermore, Petitioner's declarant testifies that a POSITA would have understood Carrack's teachings regarding optimizing the coupling of a seismometer to the seafloor to apply to self-contained seismometers. Pet. 76; Ex. 1032 ¶ 226.

Patent Owner argues for patentability of claim 7 and claim 24 on the same basis as for claim 1 and claim 15, respectively, from which claims 7 and claim 24 depend. PO Resp. 61.

For reasons explained in Sections III.C.7 to III.C.9, we find Patent Owner's contentions insufficient. We determine that Petitioner has made a sufficient showing of reasons why a POSITA would have combined Carrack with Mattaboni, Sutton, Schmalfeldt, and Jones with a reasonable expectation of success of arriving at the features recited in claim 7 and claim 24.

*H. Ground 4: Asserted Obviousness of Claim 23
based on Mattaboni, Sutton, Schmalfeldt, Jones, and Willoughby*

1. Willoughby (Ex. 1008)

Willoughby is titled "A Microprocessor-Based Ocean-Bottom Seismometer." Ex. 1008, 190. Willoughby teaches an OBS that includes geophones, batteries, a clock, control system, and seismic data recorder housed in a water-tight pressure case. Ex. 1008, Abstract, 191–192, 204–205, 208–209, Figs. 1, 2. Willoughby teaches that its sensor is a triaxial seismometer. Ex. 1008, 196.

2. Claim 23 Analysis

Petitioner reads claim 23 on the combination of references as follows:

*23. The ocean bottom seismic data collection system of claim 22,
wherein said geophone is a multi-component geophone.*

Petitioner contends Willoughby teaches a triaxial seismometer housed in an OBS. Pet. 82; Ex. 1008, 192. Petitioner contends a POSITA would have understood that the triaxial seismometer in Willoughby's OBS is a multi-component geophone. Pet. 82; Ex. 1032 ¶ 243. Furthermore, Petitioner's declarant testifies a POSITA would have understood Willoughby to teach the claimed limitation. Pet. 82; Ex. 1032 ¶¶ 243–245.

Patent Owner presents no argument or evidence specific to claim 23.
See generally PO Resp.

Reviewing the evidence, we determine that Petitioner has shown that claim 23 is taught by the combination of references.

3. *Motivation to Combine*

Petitioner states various reasons why a POSITA would have combined Willoughby with the other references. Pet. 80–82. Petitioner states “Willoughby cites to Mattaboni.” Pet. 80; Ex. 1008, 190, 217. Petitioner states Willoughby and Mattaboni are both “free-fall” devices dropped to the sea floor from a boat. Pet. 80; Ex. 1008, Abstract, 212; Ex. 1006, Abstract, 87–88; Ex. 1032 ¶ 237. Petitioner contends that, like Mattaboni, Schmalfeldt, and Jones, Willoughby’s seismometer includes geophones, a data recorder, clock, and batteries, as explained with respect to Ground 1. Pet. 80; Ex. 1008, Figs. 1, 2, 208–209. Petitioner contends because these references all pertain to the same narrow field of OBSs, and the similarity of the types of OBSs, a POSITA would have been motivated to combine Mattaboni, Sutton, Schmalfeldt, Jones, and Willoughby, as Petitioner’s declarant testifies. Pet. 80–81; Ex. 1032 ¶¶ 237–239. Petitioner further contends the POSITA would have been motivated to design an OBS with geophones to measure seismic waves in three orthogonal planes because the benefits of doing so were widely discussed in literature. Pet. 81; Ex. 1034, 3; Ex. 1006, 91; Ex. 1032 ¶ 240. In addition, Petitioner contends a POSITA would have had an expectation of success in using multicomponent geophones that can measure seismic waves in three orthogonal planes in an

OBS because such a multicomponent geophone was disclosed by Willoughby's OBS. Pet. 81–82; Ex. 1008, 196; Ex. 1032 ¶ 241.

Although Patent Owner argues claim 23 is not obvious for the same reasons stated for claim 15 from which claim 23 depends, we found those arguments to be insufficient. Patent Owner presents no additional argument or evidence specific to claim 23 regarding the reasons to combine Willoughby with Mattaboni, Sutton, Schmalfeldt, and Jones.

Reviewing the evidence, we are persuaded Petitioner has made a sufficient showing that a POSITA would have combined Willoughby with the other references for the stated reasons. Accordingly, we agree with Petitioner that claim 23 is obvious over the combination of references.

I. OBJECTIVE INDICIA OF NON-OBVIOUSNESS

1. Principles of Law

“[E]vidence rising out of the so-called ‘secondary considerations’ must always when present be considered en route to a determination of obviousness.” *Transocean Offshore Deepwater Drilling Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349 (Fed. Cir. 2012) (quoting *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983)). Objective evidence of nonobviousness includes such secondary considerations as commercial success, skepticism by experts in the field, unexpected results, industry praise for the invention, long-felt but unsolved needs, failure of others to obtain the claimed invention, copying, and passage of time between the prior art references and the claimed invention. *Graham v. John Deere Co.*, 383 U.S. 1, 18 (1966) (commercial success, long-felt but unsolved needs); *Kinetic Concepts, Inc. v. Smith & Nephew*,

Inc., 688 F.3d 1342, 1367 (commercial success, long-felt need, copying, unexpected results, acceptance by others, initial skepticism); *Apple Inc. v. Samsung Electronics Co., Ltd.*, 839 F.3d 1034, 1052–58 (Fed. Cir. 2016) (en banc), *cert. denied*, 138 S. Ct. 420 (industry praise, copying, commercial success, long-felt need); *Leo Pharm. Prods., Ltd. v. Rea*, 726 F.3d 1346, 1359 (Fed. Cir. 2013) (passage of time).

“For objective evidence to be accorded substantial weight, its proponent must establish a nexus between the evidence and the merits of the claimed invention.” *In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed. Cir. 1995). The weight attributed to the secondary evidence is proportional to its nexus to the merits of the invention. *Ashland Oil, Inc. v. Delta Resins & Refractories*, 776 F.2d 281, 306 (Fed. Cir. 1985). “[T]here is a presumption of nexus for objective considerations when the patentee shows that the asserted objective evidence is tied to a specific product and that product ‘is the invention disclosed and claimed in the patent.’” *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1329 (Fed. Cir. 2016) (citing *J.T. Eaton & Co. v. Atl. Paste & Glue Co.*, 106 F.3d 1563, 1571 (Fed. Cir. 1997)); *Crocs, Inc. v. Int’l Trade Comm’n*, 598 F.3d 1294, 1310–11 (Fed. Cir. 2010); *Brown & Williamson Tobacco Corp. v. Philip Morris, Inc.*, 229 F.3d 1120, 1130 (Fed. Cir. 2000); *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392–93 (Fed. Cir. 1988). “The presumption of nexus is rebuttable: a patent challenger may respond by presenting evidence that shows the proffered objective evidence was ‘due to extraneous factors other than the patented invention.’” *Demaco*, 851 F.2d at 1393. “Such factors include additional unclaimed features and external factors, such as improvements in marketing.” *See, e.g., Ecolchem, Inc. v. S. Cal. Edison Co.*, 227 F.3d 1361,

1378 (Fed. Cir. 2000); *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1312 (Fed. Cir. 2006); *Brown & Williamson Tobacco Corp. v. Philip Morris, Inc.*, 229 F.3d 1120, 1130 (Fed. Cir. 2000).

2. Nexus

To rely on the presented evidence of objective indicia of nonobviousness, Patent Owner is required to show a nexus to the 761 Patent's claims. Patent Owner contends that its Z3000, Z700, and ZXPLR systems practice claims 1–6, 10–20 and 23 of the 761 Patent. PO Resp. 62; Ex. 2051 ¶¶ 161–163. Specifically, Patent Owner submits several claim charts mapping the claims of the 761 Patent to its commercial systems. Ex. 2032; Ex. 2033; Ex. 2034. Patent Owner contends that because the 761 Patent's claims can be mapped to its commercial systems, there is a presumption that the evidence of objective indicia of nonobviousness presented in this case has a nexus to the claims. PO Resp. 63; Tr. 54.

Petitioner contends that “when, as here, a patent is plainly not inventive, that is, when the prima facie case of obviousness is strong, secondary considerations carry little weight.” Reply 21 (citing *Apple*, 839 F.3d at 1080). Petitioner further contends that “[m]erely establishing [Patent Owner's] OBSs meet the claims' requirements, by itself, is not probative, which is especially significant here given the breadth of the claims.” Reply 21 (citing *Institut Pasteur v. Focarino*, 738 F.3d 1337, 1347 (Fed. Cir. 2013) (“Objective indicia of non-obviousness must be tied to the novel elements of the claim at issue.”)).

The 761 Patent's claims are restricted to “ocean bottom seismic data collection systems” variously referenced as “pods” or “nodes.” See, e.g.,

Ex. 1030, 14:33–34, 26:13, 26:59; Ex. 2051 ¶¶ 72, 100, 165, 171, 181, 183. Patent Owner’s Z700, Z3000, and ZXPLR systems, however, comprise many more components than simply the nodes, as Petitioner recognizes. Reply 22–23. For example, in addition to the nodes, the Z700 system includes a specialized ship with a node handler system, a passive rope system for node attachment, acoustically-actuated release buoys for node recovery, and a data download system onboard the ship. Ex. 2035; Ex. 2036. The Z3000 system includes two remotely operated vehicles (ROVs). Ex. 2037. One ROV places autonomous nodes on the seafloor and the other ROV is a “seabed loader” which transfers nodes between a specialized ship and the placement ROV. *Id.* The specialized ship includes a data download system to obtain data from the nodes after retrieval. *Id.* The ZXPLR system is similar to the Z3000 system but uses ROVs with greater node capacity. Ex. 2038. The ZXPLR system’s nodes use blended-source acquisition, an indestructible outer shell, a high-efficiency lithium-ion battery, an atomic clock, new OBN geometries, increased data-collection rates, a hydrophone, and a three-component geophone. *Id.*

With the exception of the three-component geophone, none of these features of the Z700, Z3000, and ZXPLR systems are claimed in the 761 Patent, at least not to the level of specificity presented in the videos showing these features and their operation. *See* Exs. 2035–2038. Also, the 761 Patent describes several other features that are not claimed and that may be present in the commercial nodes, such as an acoustical location transducer 42 and a connector 46 permitting communication with the pod. Ex. 1030, 16:15–21. There is no indication in the record of how much if any

contribution these features have to the asserted objective indicia of nonobviousness.

A presumption of nexus does not apply “[w]hen the thing that is commercially successful is not coextensive with the patented invention—for example, if the patented invention is only a component of a commercially successful machine or process.” *Polaris Indus., Inc. v. Artic Cat, Inc.*, 882 F.3d 1056, 1072 (Fed. Cir. 2018). Here, the nodes claimed in the 761 Patent are merely one of many components of Patent Owner’s Z700, Z3000, and ZXPLR systems, and the submitted evidence does not indicate how to allocate the objective indicia of nonobviousness to the nodes claimed in the 761 Patent as opposed to the systems overall.

In sum, we have evaluated the presumption of nexus that the 761 Patent’s claims are linked to the objective indicia of nonobviousness, and we determine the presumption has been successfully rebutted by Petitioner’s arguments and evidence. We proceed to evaluate the objective indicia of obviousness to determine whether any apply to the 761 Patent’s claims.

3. *Commercial Success*

Patent Owner asserts it launched the market for autonomous ocean bottom seismic data acquisition units (“nodes”). PO Resp. 64. Specifically, Patent Owner contends it won the first contract to conduct the first deepwater autonomous ocean bottom seismic data acquisition survey for BP at Atlantis with the Z3000 system, and that it dominated the market for years thereafter, winning 100% of the projects it bid on from 2009 to 2011. PO Resp. 64; Ex. 2051 ¶¶ 164–172; Ex. 2029. Patent Owner relies on testimony of Ms. Stewart, an employee of Patent Owner, who submits a list of 56 bids won to perform seismic data acquisition surveys spanning from

2006 to 2019. Ex. 2029 ¶ 6. Patent Owner’s declarant contends that commercial success of Patent Owner’s products was based on disposing all components within a single case, which made the device simpler to handle, deploy, and retrieve, while competitors focused on developing systems with separate geophone packages. PO Resp. 64; Ex. 2051 ¶ 172.

Petitioner asserts Patent Owner has “cherry-picked” the data from two random years for tendered projects that it bid on, with no underlying data provided. Reply 23. Petitioner contends Patent Owner provided no evidence of market share, revenues, or profitability. *Id.* Petitioner contends the two primary reasons BP awarded Patent Owner the Atlantis project are unrelated to the 761 Patent’s claims and the Z3000 system nodes. *Id.* Specifically, Petitioner contends the project award was primarily because of the node handling system and because “the whole operation that they envisioned seemed to be more efficient, safer.” Reply 24; Ex. 2024, 167:19–168:8. Patent Owner’s declarant contends “superior handling and improved operability could only be accomplished by the simplicity and design of the claimed invention, which included all components within a single case—without external sensors, cabled connections (or “dangling bits”) that would complicate deployment and retrieval.” Ex. 2051 ¶ 170.

At the outset, we note that although Patent Owner submits a list of numerous bids won, we are aware of no evidence in the record that establishes market share, revenues, or profitability of these bids, as Petitioner asserts. Ex. 2029 ¶ 6; Reply 23. Consequently, while Patent Owner’s systems have had some success, we cannot assess whether and to what degree Patent Owner’s contracts were commercially successful due to the merits of Patent Owner’s systems as opposed to unrelated factors. *In re*

Huang, 100 F.3d 135, 140 (Fed. Cir. 1996) (“evidence related solely to the number of units sold provides a very weak showing of commercial success, if any”); *In re Applied Materials, Inc.*, 692 F.3d 1289, 1300 (Fed. Cir. 2012) (“probative evidence of commercial success relates to whether the sales represent ‘a substantial quantity in th[e] market’ . . . [j]ust as the number of units sold . . . is only weak evidence . . . so too is an assertion of market share lacking in sales data”). Moreover, without more information it is difficult to tell how significant the number of projects Patent Owner won is compared to the industry overall.

Even more difficult is to discern what proportion of any commercial success is owing to inclusion of the components in a single case as recited in the 761 Patent’s claims. Although including all OBS components in a single case may facilitate the handling of nodes, as Patent Owner contends, Petitioner’s declarant indicated that the node handling system, not the nodes, is the source of commercial success. Ex. 2024, 167:19–168:8. In addition, Petitioner’s declarant attributes commercial success to the “whole operation” of the Z3000 system seeming to be “more efficient, safer” compared with competitive systems. *Id.* In other words, Patent Owner’s declarant clearly expresses that, in addition to the node handling system, the commercial attraction of the Z3000 system is due to the overall system, not merely in the nodes or any other single component of the system apart from the node handling system. Consequently, from the evidence submitted in this case, we are aware of no way to determine how much if any commercial success stems from including all OBS components in one case as claimed, as opposed to the other features of Patent Owner’s systems, or unrelated factors.

Thus, we determine that the evidence of record fails to show that the commercial success is attributable to what is claimed in the 761 Patent.

4. *Skepticism and Unexpected Results*

Patent Owner argues that both parties' declarants have testified that they were skeptical that Fairfield's approach of including a geophone inside the same packages as all other recording equipment would work.

PO Resp. 64. Patent Owner's declarant testifies that Patent Owner's approach went against the industry's conventional thinking at the time of the invention. Ex. 2051 ¶¶ 173–179. Patent Owner also notes that Petitioner's declarant wrote, at the time, that he considered the claimed invention “inconceivable” when he first set out to find a vendor that could accomplish an ocean bottom seismic data acquisition survey using autonomous nodes. PO Resp. 3, 20, 64–67; Ex. 2022, 2. Specifically, he treated an OBS with an internal geophone with considerable skepticism because it used an internal geophone and not a separate geophone package. PO Resp. 2–3, 65; Ex. 2022, 4. He expressed “real surprise” upon learning Patent Owner's OBS had “satisfactory receiver bandwidth,” calling this result “counter intuitive.” PO Resp. 66, 20; Ex. 2022, 6.

Petitioner contends every prior art reference cited by Petitioner has geophones in the same package as other components, and there is nothing novel about OBSs with geophones in the same package as other components. Reply 24.

Petitioner is correct insofar as Mattaboni, Schmalfeldt, Jones, and Cranford disclose geophones in the same package as other components. Ex. 1005, 3, Fig. 2; Ex. 1006, 4, Fig. 2; Ex. 1011, 2:41–46, Fig. 3; Ex. 1034, 7, Fig. 3. Sutton and Carrack disclose geophones separate from other

components. Ex. 1007, 1; Ex. 1033, 18. Jones explicitly discloses use of its MOBS in a “seismic data acquisition and survey.” Ex. 1011, 4:33–54. Moreover, as we found above, Mattaboni expressly teaches a geophone in the same package with a bandwidth sufficient for seismic data acquisition. *See supra* at 37–41. Thus, although both declarants may have expressed “real surprise” and opined that it was “counter intuitive” that the geophones could achieve “satisfactory receiver bandwidth” when disposed in the OBS case, there is evidence that disposing a geophone within an OBS case was known in the field of seismology, including for a “seismic data acquisition and survey” as taught by Jones. Thus, the evidence does not show that Petitioner’s and Patent Owner’s declarants’ skepticism and surprise would have been shared by other experts in the field.

Accordingly, Patent Owner has not shown skepticism or unexpected results attributable to what is claimed in the 761 Patent.

5. *Industry Praise*

Patent Owner contends the Z3000 system received “a high level of notoriety throughout the industry” and “was the subject of numerous publications” and “the recipient of multiple awards.” PO Resp. 67–68. Patent Owner states its declarant was involved in two awards and described the Z3000 system as “a breakthrough technology that solves a critical problem for the petroleum industry and will enable the industry to more effectively develop oil and gas reserves in the future in these difficult areas.” PO Resp. 68 (emphasis omitted); Ex. 2022, 3. Patent Owner further notes its declarant’s proposal for the E&P Innovation award at the Offshore Technology conference in 2006 praises Patent Owner’s technology as having “exceeded expectations.” *Id.* Patent Owner also contends trade

publications praised the Z3000 system, “describing it as the first system utilized in a deepwater autonomous seismic data acquisition survey.” PO Resp. 68; Ex. 2051 ¶¶ 184–186.

Petitioner contends that the publications Patent Owner relies on as establishing industry praise are actually directed to the industry’s need and praise of “wide-azimuth” seismic data to image “subsalt reservoirs.” Reply 25; Ex. 2020, 2; Ex. 2021, 1; Ex. 2022, 1; Ex. 2025, 1; Ex. 2030. Petitioner contends the 761 Patent’s claims and Specification do not mention “wide azimuth” or “subsalt.” Reply 25. Petitioner further contends “there is little if anything tying the claim limitations, let alone any novel aspects of them, to the evidence [Patent Owner] cites and the particular problems addressed therein.” *Id.*

We agree with Petitioner that Patent Owner’s evidence points to wide-azimuth seismic data to image subsalt reservoirs as the reason for industry praise of the Z3000 system. Ex. 2020, 2; Ex. 2021, 1; Ex. 2022, 1; Ex. 2025, 1; Ex. 2030. Because the 761 Patent’s claims do not mention these features, Patent Owner has not established a nexus between the reason for industry praise of the Z3000 system and the claims of the 761 Patent.

6. *Long-Felt but Unresolved Need, Failure of Others, Copying, and the Passage of Time between Publication of the Prior Art and the Invention*

Patent Owner contends the Z3000 system met a long felt but unresolved need for an autonomous deep water ocean bottom seismic data acquisition system. PO Resp. 68; Ex. 2051 ¶¶ 187–189. Specifically, Patent Owner contends “antiquated academic system[s] (like those of Cranford and Mattaboni) were incompatible with the needs of seismic data acquisitions surveys, and the industry required technology capable of wide-azimuth imaging on the ocean bottom.” PO Resp. 68–69; Ex. 2024, 79:9–86:5,

95:17–98:15. Patent Owner further contends “[t]here was also a growing need for technology that allowed for repeatability so that reservoirs could be monitored over time.” PO Resp. 69; Ex. 2051 ¶ 23. Patent Owner’s declarant testifies that “efforts were made at using ocean bottom cabled systems to meet the need for wide-azimuth surveys in deep water” and that those efforts failed. PO Resp. 69; Ex. 2024, 102:12–25. Specifically, Patent Owner’s declarant testifies that the Sercel/Thales device “provided extremely poor data quality due to interference from the ‘tail’ connecting the sensor package to the recording unit.” PO Resp. 69; Ex. 2024, 143:21–144:13. Patent Owner’s declarant testifies that although Petitioner “developed a competing product years after [Patent Owner] had one on the market, its initial efforts did not lead to success.” PO Resp. 69; Ex. 2051 ¶¶ 187–188. Patent Owner further contends “after first following the conventional wisdom of separating the sensor package, Petitioner [] itself adopted this same solution of combining the sensor package in the same case with all the other components after the successful demonstration of [Patent Owner’s] node solution.” PO Resp. 69–70; Ex. 2051 ¶ 177. Patent Owner further contends “[m]ore than 25 years passed between the priority date of the 761 Patent and the publication of Mattaboni and Cranford, while the intervening period for Sutton was more than 15 years.” PO Resp. 70; Ex. 2051 ¶ 189. Patent Owner contends this “ancient and widely known prior art further suggests that the long felt need in the market was not being met by an allegedly obvious combination of the references relied on by [Petitioner].” PO Resp. 70.

Petitioner contends the long felt need in the industry was for “wide-azimuth” seismic data to image “subsalt reservoirs” and that Patent Owner

has not shown any nexus of this long felt need to the claims of the 761 Patent. Reply 25; Ex. 1030. Petitioner further contends Patent Owner's allegations of copying fail because copying "requires evidence of efforts to replicate a specific product." Reply 25; *Weyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010). Petitioner asserts that Patent Owner offers no such evidence. *Id.* In addition, Petitioner contends that Patent Owner's argument that the age of the prior art shows nonobviousness is backwards. *Id.* Specifically, Petitioner contends "[t]he wealth of prior art and its evolution over decades (Cranford and Mattabo[n]i in the 1970's, Sutton in the 1980's, Willoughby in the 1990's and Jones in the early-2000's) demonstrates how, by the 2003 priority date, there were 'a finite number of identified, predictable solutions' in OBS design, and the 761 Patent's claims simply recite 'combination[s] which only unite[] old elements with no change in their respective functions.' Reply 25–26; *KSR*, 550 U.S. at 421, 415–416.

Establishing long-felt need requires objective evidence that an art-recognized problem existed in the art for a long period of time without solution. *Newell Cos. v. Kenney Mfg. Co.*, 864 F.2d 757, 768 (Fed. Cir. 1988); *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1379 (Fed. Cir. 1983). Establishing long-felt need also requires objective evidence that the invention satisfies the long-felt need. *In re Cavanagh*, 436 F.2d 491, 496 (CCPA 1971). We agree with Petitioner that Patent Owner's evidence does not show that a long felt need for wide azimuth seismic data to image subsalt reservoirs (and the related failure to achieve those goals) has any nexus to the claims of the 761 Patent. As Petitioner notes, the 761 Patent does not mention "wide azimuth" or imaging

“subsalt reservoirs.” Reply 25. With respect to copying, Petitioner is further correct that case law requires a showing of efforts to replicate a specific product, such as Patent Owner’s Z3000 system, and Patent Owner does not provide evidence to support such replication. *Id.*; see also *Iron Grip Barbell Co. v. USA Sports, Inc.*, 392 F.3d 1317, 1325 (Fed. Cir. 2004) (“Not every competing product that arguably falls within the scope of a patent is evidence of copying. Otherwise every infringement suit would automatically confirm the nonobviousness of the patent. Rather, copying requires the replication of a specific product.”). In addition, we agree with Petitioner that the prior art publications show an evolution in OBS technology and establish “a finite number of identified, predictable solutions” in OBS design. Reply 26. Moreover, Patent Owner’s reliance on *Leo Pharmaceutical Products Ltd. v. Rea*, 726 F.3d 1346, 1356–57 (Fed. Cir. 2013), to argue that the age of the passage of time between the references indicates non-obviousness, is not persuasive. PO Resp. 70. The *Leo* decision “hinged on the fact that nothing in the cited prior art appreciated the problem the invention recognized and then solved.” *Nike, Inc. v. Adidas AG*, 812 F.3d 1326, 1338 (Fed. Cir. 2016), *overruled on other grounds*; *Aqua Prods., Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir. 2017). Here, Mattaboni and Cranford recognized the advantages of placing the geophone in the same case with other components. Thus, we agree with Petitioner that the situation here falls under the established precedent that “[t]he mere age of the references is not persuasive of the unobviousness of the combination of their teachings, absent evidence that, notwithstanding knowledge of the references, the art tried and failed to solve the problem.” *In re Wright*, 569 F.2d 1124, 1127 (CCPA 1977); see also *Iron Grip Barbell*, 392 F.3d at 1325

(“Absent [a] showing of long-felt need or [the] failure of others, [the] mere passage of time without the claimed invention is not evidence of [a patent’s] nonobviousness.”).

Accordingly, the evidence does not show a long-felt but unresolved need existed in the industry for what is claimed in the 761 Patent, or that Petitioner copied Patent Owner’s system. We further agree with Petitioner that the passage of time between publication of the prior art and the 761 Patent shows an evolution toward “a finite number of identified, predictable solutions” and that a POSITA would have arrived at the solution of including a geophone along with other OBS components within a case.

7. *Conclusion Concerning Objective Indicia of Nonobviousness*

In conclusion, we find that, although Patent Owner shows a presumption of nexus applies to some of the claims of the 761 Patent, Petitioner successfully rebuts the presumption through arguments and evidence of record. We further find that Patent Owner fails to show a nexus between the evidence of objective indicia of nonobviousness and the claims of the 761 Patent. Accordingly, we conclude that Patent Owner’s evidence of objective indicia of nonobviousness fails to show that any claims of the 761 Patent are nonobvious.

J. *Final Conclusion as to Obviousness*

Weighing the evidence of the disclosure of the references, the reasoning to combine the references, and the objective indicia of non-obviousness together, we determine that Petitioner has shown by a preponderance of the evidence that (1) claims 1, 3–6, 9, and 11–22, but not claim 8, are obvious under 35 U.S.C. § 103(a) based on Mattaboni, Sutton, Schmalfeldt, and Jones; (2) claims 1, 2, and 10 are obvious under 35 U.S.C.

§ 103(a) based on Cranford, Sutton, Schmalfeldt, and Jones; (3) claims 7 and 24 are obvious under 35 U.S.C. § 103(a) based on Mattaboni, Sutton, Schmalfeldt, Jones, and Carrack; and (4) claim 23 is obvious under 35 U.S.C. § 103(a) based on Mattaboni, Sutton, Schmalfeldt, Jones, and Willoughby.

IV. CONCLUSION

In light of the foregoing, Petitioner demonstrates by a preponderance of the evidence that claims 1–7 and 9–24 of the 761 Patent are unpatentable. Petitioner does not carry its burden to show that claim 8 is unpatentable.

V. ORDER

For the foregoing reasons, it is

ORDERED pursuant to 35 U.S.C. § 318(a) that claims 1–7 and 9–24 of the 761 Patent are determined to be unpatentable;

FURTHER ORDERED that claim 8 of the 761 Patent is not determined to be unpatentable;

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

Claim(s)	35 U.S.C. §	Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 3–6, 8, 9, and 11–22	§ 103(a)	Mattaboni, Sutton, Schmalfeldt, and Jones	1, 3–6, 9, and 11–22	8

Claim(s)	35 U.S.C. §	Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2, and 10	§ 103(a)	Cranford, Sutton, Schmalfeldt, and Jones	1, 2, and 10	
7 and 24	§ 103(a)	Mattaboni, Sutton, Schmalfeldt, Jones, and Carrack	7 and 24	
23	§ 103(a)	Mattaboni, Sutton, Schmalfeldt, Jones, and Willoughby	23	

IPR2018-00961
Patent 8,228,761 B2

For PETITIONER:

John C. Phillips
William Hunter
John Lane
FISH & RICHARDSON P.C.
phillips@fr.com
hunter@fr.com
jlane@fr.com
IPR45141-0001IP5@fr.com

For PATENT OWNER:

Jeff Costakos
Ruben J. Rodrigues
James De Vellis
FOLEY & LARDNER LLP
jcostakos@foley.com
rrodrigues@foley.com
jdevellis@foley.com
BOST-F-Fairfield761IPR@foley.com