

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SEABED GEOSOLUTIONS (US), INC.,
Petitioner,

v.

MAGSEIS FF LLC¹,
Patent Owner.

IPR2018-00962
Patent 8,879,362 B2

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

CHERRY, *Administrative Patent Judge*.

JUDGMENT
FINAL WRITTEN DECISION
35 U.S.C. § 318(a)

Determining All of the Challenged Claims Unpatentable

¹ On December 17, 2018, each of the challenged patents were assigned from Fairfield Industries, Inc. to Fairfield Seismic Technologies, LLC. See Paper 16, 1. On January 9, 2019, Fairfield Seismic Technologies LLC changed its name to Magseis FF LLC d/b/a Magseis Fairfield. See Paper 18, 1. We update the caption accordingly.

I. INTRODUCTION

A. Background

Seabed Geosolutions (US) Inc. (“Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting institution of *inter partes* review of claims 1–17 of U.S. Patent No. 8,879,362 B2 (Ex. 1060, “the ’362 patent”). Pet. 5. Magseis Fairfield f/k/a Fairfield Industries Inc. (“Patent Owner”) filed a Preliminary Response (Paper 5). 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.

The Petition challenges the patentability of claims 1–17 of the ’362 patent under 35 U.S.C. § 103² as unpatentable as obvious over Cranford³, Sutton⁴, Schmalfeldt⁵, and Jones⁶. Pet. 5.

² 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.

³ M.D. Cranford et al., *A Direct-Recording Ocean-Bottom Seismograph*, BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA, Vol. 66, No. 2, 607–615 (1976) (Ex. 1005, “Cranford”).

⁴ George H. Sutton et al., *Optimal Design of Ocean Bottom Seismometers*, MARINE GEOPHYSICAL RESEARCHES, Vol. 9, 47–65 (1987) (Ex. 1033, “Sutton”).

⁵ Bernd Schmalfeldt et al., *Explosion-Generated Seismic Interface Waves in Shallow Water: Experimental Results*, SACLANTCEN ASW Research Center, Report SR-71 (1983) (Ex. 1034, “Schmalfeldt”).

⁶ Jones, U.S. Patent No. 6,951,138 B1, filed Nov. 1, 2000, issued Oct. 4, 2005 (Ex. 1011, “Jones”).

On November 8, 2018, we instituted an *inter partes* review of all claims challenged in the Petition. See Paper 11, 38 (“Dec. on Inst.”).

After institution of trial, Patent Owner filed a Patent Owner Response (Paper 19, “PO Resp.”), and Petitioner filed a Reply (Paper 28, “Pet. Reply”). We also permitted Patent Owner to file a Sur-Reply (Paper 30, “PO Sur-Reply”) in lieu of Observations on Cross Examination.

Petitioner supports its arguments with a declaration by Gerald Beaudoin, dated April 26, 2018 (Ex. 1062), and a supplemental declaration by Gerald Beaudoin, dated May 9, 2019 (Ex. 1117). Patent Owner supports its Response with a declaration by Dr. Rocco Detomo, Ph.D., dated February 6, 2019 (Ex. 2052). Oral argument was held on August 9, 2019, a transcript of which is included in the record. Paper 38 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must prove unpatentability by a preponderance of the evidence. See 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–17 of the ’362 patent are unpatentable. See 35 U.S.C. § 316(e).

B. Related Proceedings

Patent Owner asserted the ’362 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 '362 patent is related to U.S. Patent No. RE45,268 E, which is also the subject of the same litigation and IPR2018-00960. *Id.*

The '362 patent is also related to U.S. Patent No. 8,228,761 B2, which is also the subject of the same litigation and IPR2018-00961. *Id.*

C. The '362 Patent

The '362 patent is titled “Ocean Bottom Seismometer Package.” Ex. 1060, code (54). The '362 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. 1060, code (57), 25:18–27.

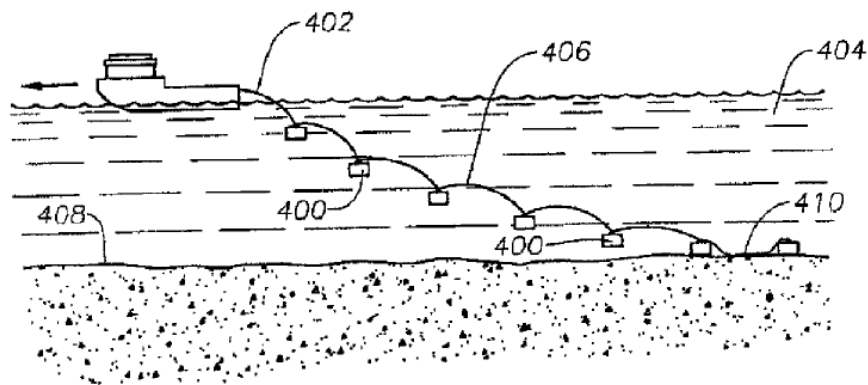
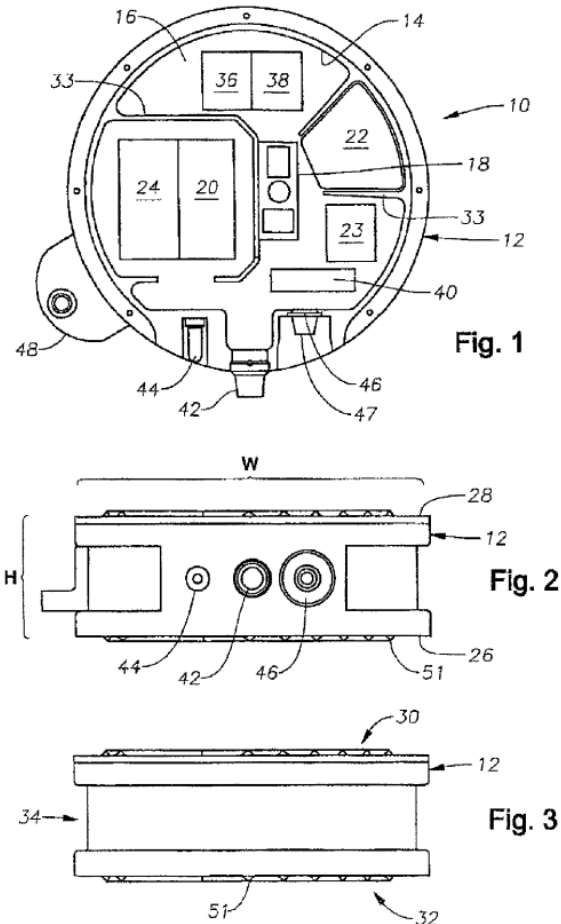


Fig. 21

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 2:30–33. The pods record acoustic reflections from the geologic formations as seismic data. *Id.* at 1:37–48. Upon retrieval from the ocean floor, seismic data recorded by the pods can be used in analyzing the subsurface geologic formation. *Id.* at 10:25–29, 12:63–65.

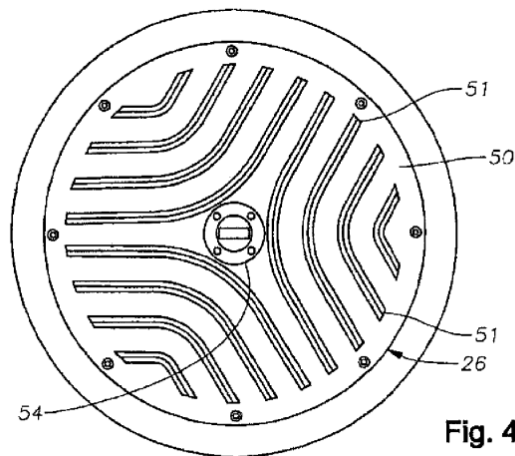
Details of the pod 10 are provided in Figures 1–3 of the '362 patent, reproduced below. *Id.* at 14:23–26.



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 14:67–15:2. 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 15:5–7. Geophone 18 is internally mounted within pod 10 and thus requires no external wiring or connection. *Id.* at 15:16–18. Pod 10 is weighted to have negative buoyancy so that it sinks towards the ocean floor when deployed. *Id.* at 15:9–11.

Figures 2 and 3 show the low-profile configuration of pod 10. Pod 10 has disk-shaped plates 26, 28 “jointed” to wall 14. *Id.* at 16:3–5. Width W of plates 26, 28 is greater than height H of wall 14. *Id.* at 16:7–11. Pod 10 is symmetrical about x and y axes. *Id.* at 16:22–23.

Figure 4, reproduced below, shows external surface 50 of one or both of plates 26, 28. *Id.* at 17:30–31.



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 17:31–33.

D. Illustrative Claim

Claims 1 and 12 are the only independent claims challenged in this proceeding. Claims 2–11 depend, directly or indirectly, from claim 1. Claims 13–17 depend, directly or indirectly, from claim 12. Claim 1 is illustrative and is reproduced below:

1. An ocean bottom seismic data collection system comprising:
a low-profile, disk-shaped case comprising a plate and a wall
coupled to the plate;
at least one geophone disposed within the case;
a clock disposed within the case;
a power source disposed within the case; and

a seismic data recorder disposed within the case,
wherein the system is configured to have a negative buoyancy.

Ex. 1060, 26:46–55.

II. LEVEL OF ORDINARY SKILL IN THE ART

“The person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art.” *In re GPAC*, 57 F.3d 1573, 1579 (Fed. Cir. 1995).

Petitioner and its Declarant contend that a person of ordinary skill in the relevant art would have

a bachelor’s degree in electrical or mechanical engineering, geophysics, or a related discipline, and about 4-5 years of experience with autonomous seismic nodes. However, a person with a more advanced degree and/or prior experience with other types of seismic data collection devices, could qualify as a POSITA with fewer years of experience.

Pet. 10–11 (citing Ex. 1062 ¶¶ 17–19).

Patent Owner contends that a person of ordinary skill in the art would have had: a.) at least a bachelor’s degree in physics, 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. 2052 ¶¶ 50–51).

Patent Owner also submits that “Dr. Detomo is an individual of at least ordinary skill in the art under either standard, and the analysis throughout this Response and [Dr.] Detomo’s report would not change

whether Petitioner or Patent Owner's level of ordinary skill in the art was adopted." *Id.*

Considering the foregoing, we find that a person of ordinary skill in the art would have had: (i) a bachelor's degree in electrical or mechanical engineering, geophysics, mathematics, general engineering, or equivalent thereof, and five years of experience with the conduct of surveys with geophones, or the equivalent thereof, including two (2) years of work specifically with ocean bottom seismic data acquisition 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 years of experience with the conduct of surveys with geophones, including two years of work specifically with ocean bottom seismic data acquisition technologies, or the equivalent thereof.

We adopt these statements as describing the level of ordinary skill in the art pertinent to the '362 patent in our obviousness analysis. We note that the level of skill in the art is reflected by the prior art of record, and that under either definition, our analysis would be the same. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d at 1579; *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978).

III. CLAIM CONSTRUCTION

In an *inter partes* review based on a petition filed prior to November 13, 2018, claim terms in an unexpired patent are construed according to their broadest reasonable interpretation in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b)

(2017);⁷ *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016).

There is a presumption that claim terms are given their ordinary and customary meaning, as would be understood by a person of ordinary skill in the art in the context of the specification. *See In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Nonetheless, if the specification “reveal[s] a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess[,] . . . the inventor’s lexicography governs.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316 (Fed. Cir. 2005) (en banc) (citing *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002)). Another exception to the general rule that claims are given their ordinary and customary meaning is “when the patentee disavows the full scope of a claim term either in the specification or during prosecution.” *Uship Intellectual Props., LLC v. United States*, 714 F.3d 1311, 1313 (Fed. Cir. 2013) (quoting *Thorner v. Sony Comp. Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012)). Additionally, only terms that are in controversy need to be expressly construed, and these need be construed only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

⁷ A recent amendment to this rule does not apply here because the Petition was filed before November 13, 2018. *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective Nov. 13, 2018) (codified at 37 C.F.R. § 42.100(b) (2019)).

A. “seismic data”

Patent Owner proposes construing the term “seismic data” in independent claims 1 and 12 (in the context of the recited “seismic data recorder”) as “data containing information about lithologic subsurface formations, obtained by applying an acoustic signal to the ground and receiving the reflected signal.” PO Resp. 26–34 (emphasis omitted). Patent Owner argues that the ’362 patent defines seismic data, stating:

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 receivers 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. 1060, 1:37–48.

Petitioner contends there is a “heavy presumption” that claims terms have their ordinary meaning (*CCS Fitness*, 288 F.3d at 1366), 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)). Pet. Reply 7–8. 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 ’362 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. 1060, 1:37–48. We note, however, that this passage does use the term “*seismic energy data*” which is shortened to “*seismic data*” when mentioned later in the ’362 patent. *See, e.g.*, Ex. 1060, 3:7–10, 3:43–45, 3:52–54, 3:64–66, 4:21–23, 10:22–28.

Petitioner 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. Pet. 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. The best source for determining the meaning of a claim term, however, 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). Because the ’362 patent uses the term “*seismic data*” with the meaning proposed by Patent Owner, and not the more expansive reading urged by Petitioner, we adopt Patent Owner’s proposed construction as the correct one to use for our analysis in this decision.

In addition, we note that the Board similarly construed these terms (albeit in unrelated patents) in IPR2014-01113 (Paper 10, 9–10); IPR2014-01114 (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 Indus. Inc. v. Wireless Seismic, Inc.*, Case No. 4:14-cv-2972, Dkt.

125, 9–10 and 36 (S.D. Tex. Mar. 10, 2015). Although these constructions do not bind us, these constructions further inform our understanding of the similar language in the '362 patent Specification.

Petitioner further attempts to draw a distinction between the patents in the previous decisions, involving multiple OBSs used for seismic exploration surveys, and the '362 patent, in which the claims allegedly recite only one OBS. Pet. Reply 7. For this proposition, Petitioner cites the case of *Baldwin Graphic Systems, Inc. v. Siebert, Inc.*, 512 F.3d 1338, 1342 (Fed. Cir. 2008), which held that the indefinite article “‘a’ . . . carries the meaning of ‘one or more.’” *Id.* This case, however, actually supports the opposite conclusion to the one propounded by Petitioner, because the indefinite article “a” or “an” in conjunction with the open-ended transition “comprising” means the '362 patent’s claims are not restricted to a single OBS, but could encompass multiple OBSs, as was the case in the previous Board decisions. Thus, *Baldwin* undercuts Petitioner’s argument.

Accordingly, in light of this Specification, we 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.” See Ex. 1060, 1:37–48. Thus, we do not adopt Petitioner’s proposed constructions of “*seismic data*” and “*seismic data recorder*.”

B. “negative buoyancy”

Independent claims 1 and 12 recite “wherein the system is configured to have a negative buoyancy.” Patent Owner contends that this term “can be no broader than ‘wherein the system has no flotation device.’” PO Resp. 34 (emphasis omitted). Patent Owner refers us to two passages of the

Specification to support this construction. First, Patent Owner points to the “Background of the Invention,” where, after discussing various prior art ocean-bottom seismometers (“OBS”), the ’362 patent explains

Those OBS units that utilize flotation devices for retrieval are undesirable because the typical decoupler device adds additional expense and complexity to the units, and generally must be activated in order to release the systems to the surface. In addition, such systems typically discard part of the unit, namely the weighted anchor or skid, leaving it as debris on the ocean floor. During deployment, since they are free floating, such systems are difficult to position in a desired location on the ocean floor. Notwithstanding the above-mentioned possibility of malfunction due to misorientation, during retrieval, the free-floating systems are often difficult to locate and have been known to be lost-at-sea, despite the presence of radio signals and beacons. Likewise, in rough seas, the units prove unw[ie]ldy to snare and lift on board, often colliding with the boom or vessel hull and potentially damaging the system.

Ex. 1060, 8:34–49. Second, near the conclusion of the “Background of the Invention,” the Specification states

The device should be easily deployable, yet able to be placed at a certain location with a high degree of confidence. Likewise, the device should be easily retrievable without the need for flotation devices or release mechanisms, nor should parts of the unit be left in the ocean during retrieval.

Ex. 1060, 9:51–55.

Patent Owner further argues the Specification uses the term “positively buoyant” to refer to flotation devices. PO Resp. 36 (citing Ex. 1060, 5:57–59, 6:30–32). Patent Owner contends that “[i]n contrast, the overall system of the claimed invention is described as having ‘negative buoyancy.’” *Id.* (citing Ex. 1060, 15:9–11 (“Pod 10 [with reference to Fig. 1] is weighted to have a negative buoyancy so that it will sink towards the ocean floor when deployed in a water column.”))).

Relying on the two long passages, the Specification's description of positive buoyancy, and the lack of any flotation devices in any of the disclosed embodiments, Patent Owner argues that the "[w]hile prior art systems may have had components that were negatively buoyant, the element 'wherein the system has a negative buoyancy' requires that the seismic data recording system have a negative buoyancy—not merely a component or external weight mechanism (such as a weighted base plate that would remain on the bottom of the ocean after retrieval or ballast water)." PO Resp. 36–37 (emphasis omitted). Thus, Patent Owner submits that the term should not be interpreted "such that it reads on systems that include buoys, foam for flotation, glass spheres for flotation, or other flotation devices." *Id.* at 37.

We are not persuaded by Patent Owner's argument. The term "negative buoyancy" appears to have a well-understood plain and ordinary meaning, i.e., a density that is greater than seawater so the device sinks, which we apply in this decision. *See, e.g.*, Ex. 1005, 614; Ex. 1011, 4:24–30. Indeed, this is precisely how the Specification uses the term. For example, the Specification refers to a non-rigid cable as having a "negative buoyancy," Ex. 1060, 12:32–33, which suggests the Specification did not mean to define it as referring to a specific configuration of the OBS. Moreover, when the Specification uses negative buoyancy in the context of the actual OBS units, it is clear it is referring to the relative density of the OBS units, not some particular configuration, e.g., without a flotation device. *See id.* at 12:33–39 ("When attached between two pods each having a negative buoyancy much greater than the cable, as the two jointed pods sink down through a water column, the drag on the non-rigid cable is much

greater than the drag on the units and thus acts as a parachute or brake, slowing the descent of the pods and maintaining the pods in an upright position.”); *see also id.* at 15:9–11 (“Pod 10 is weighted to have a negative buoyancy so that it will sink towards the ocean floor when deployed in a water column.”), 18:21–27 (“In one embodiment, glass beads may, be molded or otherwise incorporated into bumper portion 68 to increase the buoyancy of bumper portion 68. By increasing the buoyancy at the top of pod 10, this insures that pod 10 will be properly oriented, i.e., so that wedge shaped bumper 52b faces down, as pod 10 passes through a water column and settles on the ocean floor.”).

We do not believe that Patent Owner’s statements in the Specification amount to a definition or disavowal of this term. *See Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014) (“While we read claims in view of the specification, of which they are a part, we do not read limitations from the embodiments in the specification into the claims. We depart from the plain and ordinary meaning of claim terms based on the specification in only two instances: lexicography and disavowal.”). Given the Specification’s clear and consistent use of the term “negative buoyancy” to merely refer to the relative density of the pod with respect to seawater—its plain and ordinary meaning, we decline Patent Owner’s invitation to read its “no flotation devices” limitation into this term.

In addition to the “no flotation devices” limitation, Patent Owner also argues that this term cannot be construed to mean “**temporary** negative buoyancy caused by an external weight mechanism,” because such a reading would render the claim element superfluous. PO Resp. 38. Patent Owner bases this argument on Dr. Detomo’s contention that “any system for use on

the ocean bottom would have to, at some point, be negatively buoyant.” *Id.* (citing Ex. 2052 ¶ 71). Patent Owner asserts that “[t]he key distinction in the claimed invention is that the **system** has a negative buoyancy throughout deployment and retrieval, i.e. it **has no flotation device**.” *Id.* Relying extensively on the testimony of Dr. Detomo, Patent Owner draws distinctions between negatively buoyant systems, positively buoyant systems, and variably buoyant systems. *Id.* at 39–41 (citing Ex. 2052 ¶¶ 71–74). Patent Owner argues that based on Dr. Detomo’s testimony “Fairfield’s proposed construction is the correct one under the broadest reasonable interpretation ‘as it focuses on the key differentiating factor between negatively buoyant systems and positively or variably buoyant ones: that a negatively buoyant system requires an external force or mechanism for retrieval (e.g. an ROV or a cable/rope that is reeled in).’” *Id.* (quoting Ex. 2052 ¶ 75).

To begin with, we disagree that this limitation is superfluous. Patent Owner’s argument is premised on implicitly reading a limitation of requiring negative buoyancy into “ocean-bottom,” but, even if such a construction were correct, a patentee is free to make explicit what may be only implicit in other terms. Moreover, whatever the merit of Patent Owner’s argument that the Specification forbids flotation devices, we disagree that the passages forbid the system from ever having a non-negative buoyancy, however that is achieved. At best, the passages criticize flotation devices, “release mechanism[s],” and leaving parts on the ocean floor during retrieval. See Ex. 1060, 8:34–49, 9:51–55. The Specification is otherwise silent about how the negative buoyancy is achieved or whether it is permanent or

something that can be modified. Thus, we do not see any support for Patent Owner's prohibition on "temporary" negative buoyancy.

Patent Owner relies heavily on the testimony of Dr. Detomo to allege, in effect, that "negatively buoyant system" is used as a term of art in this field to refer to OBS systems without flotation devices. *See* Ex. 2052 ¶¶ 71–74. There are several reasons we do not find this extrinsic evidence entitled much weight in our analysis of the term "negative buoyancy." First, the claims and Specification do not use the term "negatively buoyant" (*see* Ex. 2052 ¶¶ 71–74), so whether "negatively buoyant system" may be a term of art does not necessarily indicate that we should limit the term "negative buoyancy." Second, Dr. Detomo's testimony on this point (Ex. 2052 ¶¶ 71–74) has very few citations, and the few citations it does have do not appear to use the terms (i.e., "negatively buoyant," "positively buoyant," and "variably buoyant"). Thus, we decline to give this unsupported testimony much weight. Finally, extrinsic evidence cannot overcome the clear use in Specification. Here, the Specification repeatedly uses "negative buoyancy" in its plain and ordinary sense, and we decline to use extrinsic evidence to redefine this term.

Accordingly, we construe "negative buoyancy" as "a density that is greater than seawater so the device sinks."

C. Remaining Terms

At this time, we determine that no further express construction of other terms is necessary for purposes of this Decision. *See Nidec Motor*, 868 F.3d at 1017.

IV. ANALYSIS

Petitioner contends that claims 1–17 would have been obvious over Cranford, Sutton, Schmalfeldt, and Jones. Pet. 11–69. Petitioner supports its contentions with the testimony of Mr. Beaudoin.

A. Obviousness

The U.S. Supreme Court set forth the framework for applying the statutory language of 35 U.S.C. § 103 in *Graham v. John Deere Co.*, 383 U.S. 1 (1966):

Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

Id. at 17–18.

As explained by the Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398 (2007):

Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit.

Id. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006))

(“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning

with some rational underpinning to support the legal conclusion of obviousness.”)).

“Whether an ordinarily skilled artisan would have been motivated to modify the teachings of a reference is a question of fact.” *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1327 (Fed. Cir. 2016). “[W]here a party argues a skilled artisan would have been motivated to combine references, it must show the artisan ‘would have had a reasonable expectation of success from doing so.’” *Arctic Cat Inc. v. Bombardier Recreational Prods. Inc.*, 876 F.3d 1350, 1360–61 (Fed. Cir. 2017) (quoting *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1068–69 (Fed. Cir. 2012)).

B. Scope and Content of the Prior Art

1. Cranford

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, 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 9 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.

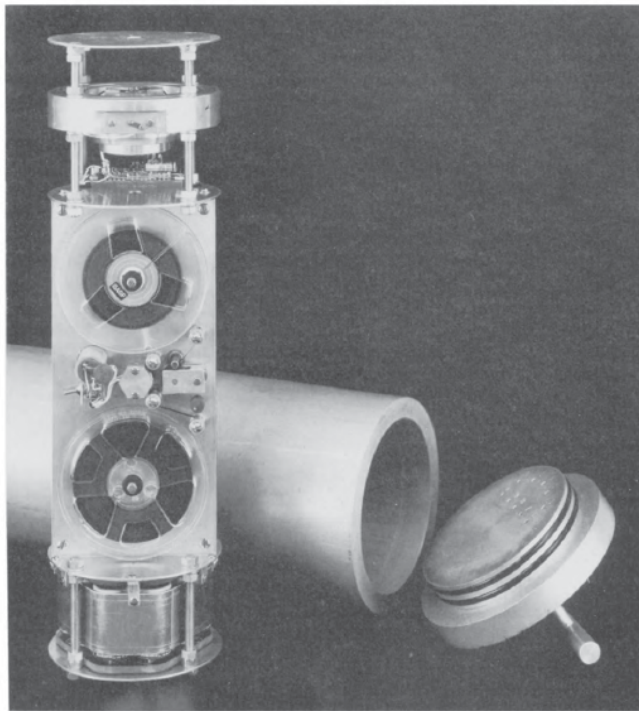


FIG. 2. Instrument and pressure case. Components from *top to bottom*: gimbal-mounted 2-Hz vertical geophone, tape deck, and battery pack. Electronic circuit boards are mounted behind the tape deck. Dimensions are 15-cm diameter by 53 cm.

Figure 2 of Cranford shows the instrument and water-tight pressure case. Ex. 1005, 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 “total package” “12 kg of negative buoyancy.” *Id.* at 614. Figure 5 of Cranford is reproduced below.

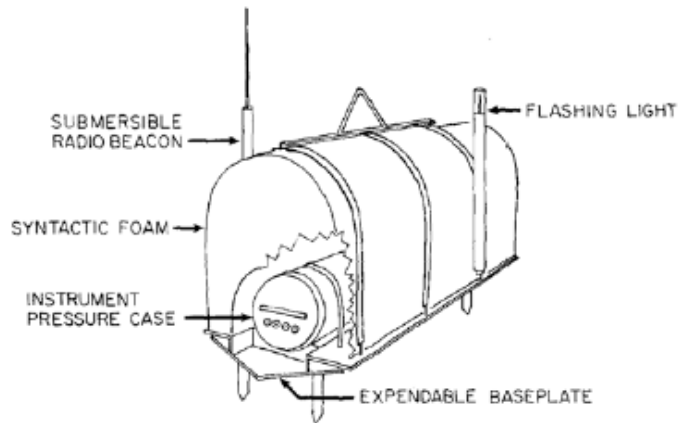


FIG. 5. External components of the seismograph. A single cable holds the baseplate to an aluminum frame while stainless steel straps secure the pressure vessel and syntactic foam flotation. The package measures 1.0 m in length by 0.7 m in height and weighs 114 kg. The float is painted with iridescent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

Ex. 1005, 6.

2. Sutton

Sutton is titled “Optimum Design of Ocean Bottom Seismometers,” and discusses research Sutton conducted to determine how OBSs 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) a 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) a

density of the OBS 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” (Ex. 1033, 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).

Sutton also states

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 64.

3. *Schmalfeldt*

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.

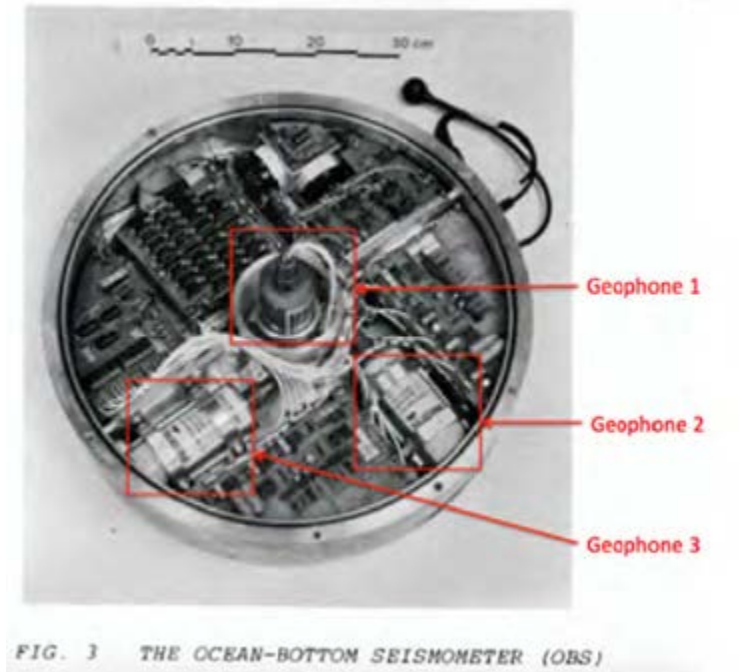


Figure 3, as annotated by Petitioner, shows a picture of Schmalfeldt's OBS with the three geophones labeled. Pet. 15. Schmalfeldt's OBS rests on the seafloor so that its bottom plate is directly coupled to the seafloor. Ex. 1034, 14 ("A crucial point in the deployment was the need to ensure that the 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 11, Fig. 4. The deployment of

Schmalfeldt's OBS system is shown below in Figure 5.

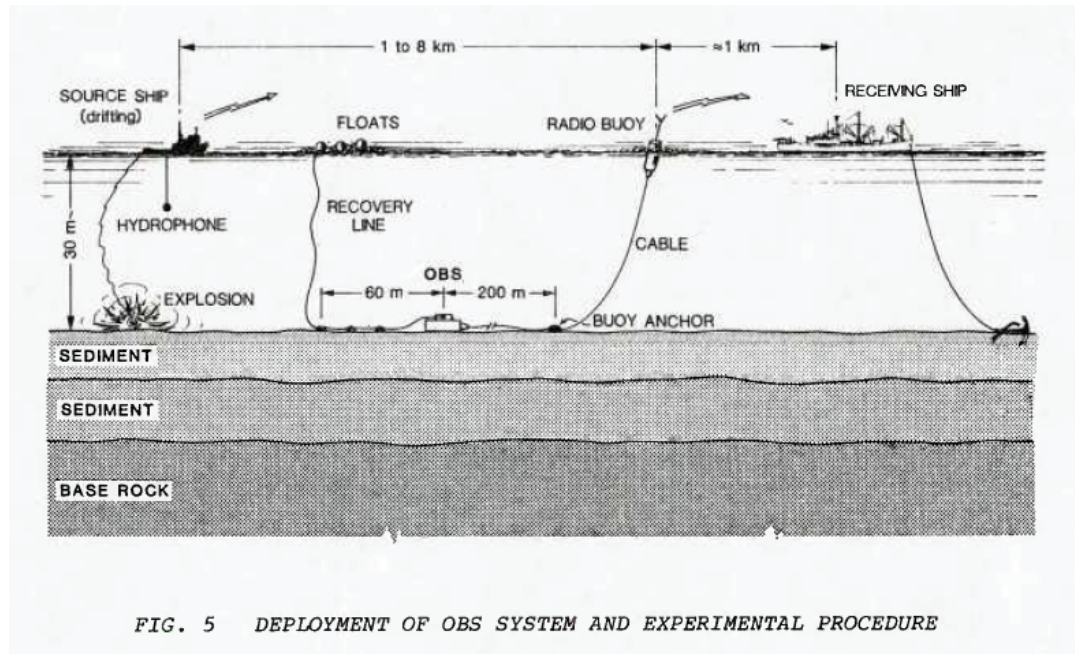
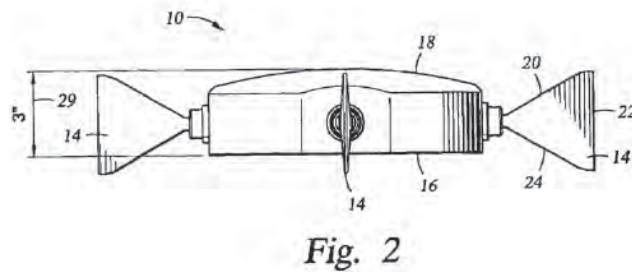
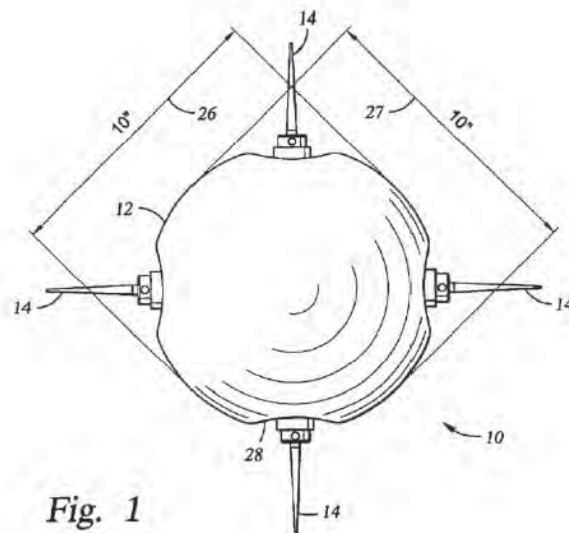


Figure 5 of Schmalfeldt shows the set up for seismic experiments concerning acoustic waves traveling in loose sediment on the ocean floor.

4. Jones

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 stores the seismic recordings internally and returns 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.



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 passes 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.

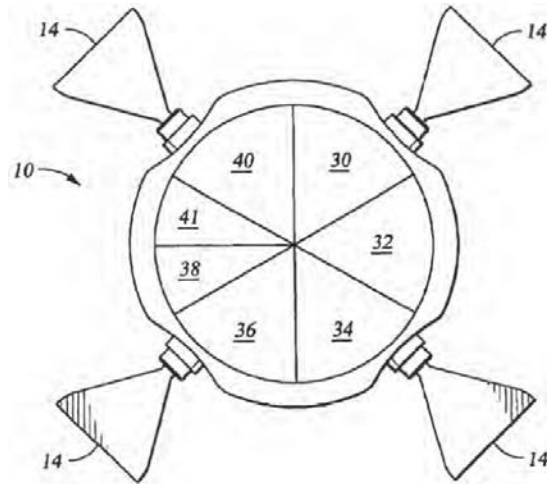


Fig. 3

Figure 3 is a schematic top cross sectional view of 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.

C. Discussion: Differences Between the Prior Art and the Claims; Motivation to Modify

1. Independent Claim 1

a. Undisputed Limitations

Petitioner maps elements from Cranford, Sutton, Schmalfeldt, and Jones to each limitation of claim 1, with support from the testimony of Mr. Beaudoin. Pet. 11–35. In particular, Petitioner relies on Cranford and Jones to teach or suggest most of the elements of claim 1, but concedes that Cranford does not teach or suggest “a low-profile, disk-shaped case

comprising a plate and a wall coupled to the plate,” and that Jones fails to disclose a clock disposed in the case. *See* Pet. 17, 25–26, 30–31. Petitioner relies on Sutton, Jones, and Schmalfeldt to teach “a low-profile, disk-shaped case comprising a plate and a wall coupled to the plate” and submits that a person of ordinary skill would have been motivated to combine Cranford with Jones, Sutton, and Schmalfeldt to obtain an OBS with a low-profile, disk-shaped case, and that a person of ordinary skill would have had a reasonable expectation of success in doing so. *See* Pet. 17–24.

With the exception of “seismic data recorder” and “negative buoyancy,” Patent Owner does not, at this time, dispute Petitioner’s proposed mapping to the limitations of claim 1. PO Resp. 54–55. We have reviewed Petitioner’s evidence and determine that Petitioner has shown sufficiently that the combination of Cranford, Jones, Sutton, and Schmalfeldt accounts for these currently undisputed limitations of claim 1. *See* Pet. 25–34; Ex. 1062 ¶¶ 83–102, 233.

b. “Seismic Data Recorder”

Patent Owner also contends that none of the prior art teaches or suggests the claimed “seismic data recorder.” PO Resp. 54–55. In particular, Patent Owner argues that Cranford is not capable of recording “seismic data” under our construction, because Cranford lacks adequate bandwidth to record data containing information about lithologic subsurface formations obtained by applying an acoustic signal to the ground and receiving the reflected signal. *Id.* (citing Ex. 2052 ¶¶ 76–84). Patent Owner contends that “[b]oth experts testified and opined that to record seismic data, a device must be capable of recording frequencies of at least 50 Hz, and generally up to 100–120 Hz.” PO Sur-Reply 23 (citing Ex. 2052 ¶ 35;

Ex. 2024, 159:10–22). Patent Owner asserts that “[b]oth experts also agreed that systems that were only capable of recording frequencies ‘into the 30’s’ would be ‘disqualifying.’” *Id.* at 23–24 (Ex. 2024, 335:1–336:11; Ex. 2052 ¶ 35).

We agree with Petitioner that Cranford teaches or suggests the claimed “seismic data recorder.” To begin with, we disagree with Patent Owner’s characterization of Mr. Beaudoin’s testimony. Although Patent Owner denies that it seeks to limit its construction to oil and gas exploration (PO Sur-Reply 17), the testimony of Mr. Beaudoin that Patent Owner cites relates to whether the devices would be satisfactory for the oil and gas exploration project he oversaw, not “seismic data” generally. Ex. 2024, 159:10–20, 335:1–336:11. Thus, Patent Owner’s reliance on Mr. Beaudoin’s testimony—which focuses on the requirements of oil and gas exploration, not obtaining information about lithologic subsurface formations—is not persuasive. Our construction only requires “seismic data” be “data containing information about lithologic subsurface formations, obtained by applying an acoustic signal to the ground and receiving the reflected signal.” Notably, our construction does not require a particular application (such as oil and gas exploration) or involve a particular type of lithologic subsurface formation. Dr. Detomo testified, in his view, “seismic data” in the claims means data between 8–50 Hz. Ex. 1104, 301:5–302:1. However, he further explained “seismic data” in the low end of the range, 8–15 Hz, is “important for resolving thicker lithologies.” *Id.* at 300:7–301:4, 302:6–304:9. The fact that this range may be less useful than a wider frequency band does not prevent it from meeting our construction. *See In re Mouttet*, 686 F.3d 1322, 1326 (Fed. Cir. 2012) (“[J]ust because

better alternatives exist in the prior art does not mean that an inferior combination is inapt for obviousness purposes.”). As such, even if Cranford’s frequency bandwidth “was 2–20Hz,” as Fairfield alleges, Cranford’s OBS is capable of recording “seismic data”—i.e., in the 8–15 Hz range. *See* Ex. 2052 ¶¶ 77–79 (Dr. Detomo testifying that the frequency range for Cranford was between 2–20 Hz).

Accordingly, we determine that the evidence of record sufficiently establishes that Cranford teaches or suggests this limitation.

c. “Negative Buoyancy”

Patent Owner argues that none of the references teach or suggest the limitation of “wherein the system has a negative buoyancy.” PO Resp. 55–56. However, that argument is premised on Patent Owner’s construction for “negative buoyancy,” which we did not adopt. We have reviewed Petitioner’s cited evidence and determine that Petitioner has shown sufficiently that the combination accounts for the limitation “wherein the system is configured to have a negative buoyancy.” *See* Pet. 34–35; Ex. 1062 ¶¶ 103–106, 233.

d. Motivation to Combine

With respect to the motivation to combine, Petitioner points to Sutton as providing the motivation to combine the references. Pet. 18–19. In particular, Petitioner argues that, based on Sutton, a person of ordinary skill would have understood that an OBS with a high profile (low base-to-height ratio) cylindrical instrument case (like Cranford’s) was undesirable when placed vertically on the seafloor. *Id.* at 19. Petitioner submits that Cranford recognizes this short-coming, but Sutton provides an alternative, better solution. *Id.* at 20 (citing Ex. 1062 ¶ 72). Petitioner asserts that, in view of

Sutton, a person of ordinary skill would have been motivated to significantly widen the length of the end plates and shorten the height of the cylinder. *Id.* Petitioner argues that this solution, as opposed to Cranford placing the cylinder horizontally on the seafloor, had the benefit of allowing the OBS to be in direct contact with the seafloor, allowing for improved coupling between the OBS and the seafloor. *Id.* Petitioner contends that a person would have looked to Schmalfeldt as an example of such a disk-shaped OBS, and that a person of ordinary skill would have been motivated to combine Schmalfeldt with Cranford and Sutton because Schmalfeldt's OBS was an example of the improvements that Sutton taught over Cranford's design. *Id.* at 20–21 (citing Ex. 1062 ¶ 74). Petitioner also notes that, as of the '362 patent's priority date, it was "technically feasible to create OBS's with the types of components included in Cranford's OBS, but in a low profile, symmetrical form factor." *Id.* at 21. Petitioner asserts that "[a]t the time of the '362 patent's priority date, in contrast to when Cranford was published decades earlier, relatively low cost solid-state memory was available, battery technology had improved significantly (allowing for the use of smaller, more energy dense batteries), and smaller versions of the types of electronic components contained in OBS's, which required less power, were available." *Id.* (citing Ex. 1062 ¶ 75).

Finally, Petitioner notes that Jones teaches a low-profile symmetrical OBS with its mass equally distributed about the vertical axis. *Id.* at 22. Petitioner asserts that this similarity to Sutton would have provided a person of ordinary skill another reason to expect success in designing OBS's with the form factor suggested by Sutton, because Jones disclosed an OBS with that type of form factor. *Id.* Petitioner contends that the "similar and

overlapping teachings of these references, all of which pertain to OBS's, would have provided a POSITA with a motivation to combine the references.” *Id.* at 24 (citing Ex. 1062 ¶¶ 79–80).

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, Cranford teaches the desirability of a self-contained OBS with geophones, data recorder, clock, electronics, and battery in a cylindrical housing. Ex. 1005, 2, 3, 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 Cranford'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. 1062 ¶¶ 68–69; *see also KSR*, 550 U.S. at 420 (“[I]n 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. 1062 ¶ 75. 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 attain 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. 46–54. We do not agree. All of the relied-upon 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. 49–54. 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. 49 (citing Ex. 1033, 18). Patent Owner adds “Sutton not only criticizes, discredits, and discourages the proposed combination—it forbids it.” *Id.*

We do not agree Sutton teaches away from the ’362 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. 1117 ¶¶ 19–23. Instead, we agree with Petitioner that Sutton should be read as stating that the mass of the other components of the kind of 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. 1062 ¶ 79; 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 Cranford, Schmalfeldt, and Jones.

Patent Owner further argues Petitioner fails to explain why anyone would be motivated to change the cylinder in Cranford into any other shape that would not be as inexpensive and which would not have similar beneficial properties at pressure under water—particularly in view of the '362 patent's discussion of prior art cylinders. PO Resp. 52–54. 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 Cranford, as Petitioner suggests. *Id.* at 52–53. 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. *See* Ex. 1011, Figs. 1–3, 2:37–46; Ex. 1034 § 2.1.1; Ex. 1117 ¶¶ 19–23. 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. 1011, Figs. 1–3, 2:37–46; Ex. 1034 § 2.1.1; Ex. 1117 ¶¶ 19–23. Accordingly, we determine that Petitioner has shown sufficiently that there is a motivation to combine the references in the manner asserted.

e. Summary

As discussed above, Petitioner has shown by a preponderance of the evidence that the combination of Cranford, Sutton, Schmalfeldt, and Jones teaches or suggests the claimed subject matter of claim 1, and has articulated a sufficient rationale for combining the teachings of the references to arrive at the claimed subject matter. Additionally, we considered Patent Owner's arguments and explained why each did not satisfactorily identify a deficiency in Petitioner's positions.

2. Claims 2–17

We have also reviewed Petitioner's evidence and arguments regarding claims 2–17. Pet. 35–69. Patent Owner does not offer any arguments, aside from those considered above with respect to claim 1, regarding claims 2–17. We determine that Petitioner has shown sufficiently that the combination of Cranford, Sutton, Schmalfeldt, and Jones accounts for the limitations of claims 2–17 and that a person of ordinary skill would have been motivated to combine the references in the manner proposed with a reasonable expectation of success.

D. Objective Indicia of Non-Obviousness

Notwithstanding what the teachings of the prior art would have suggested to one skilled in the art, objective evidence of non-obviousness (“secondary considerations”) may lead to a conclusion that the challenged claims would not have been obvious. *In re Piasecki*, 745 F.2d 1468, 1471–72 (Fed. Cir. 1984). Objective evidence of non-obviousness “may often be the most probative and cogent evidence in the record” and “may often establish that an invention appearing to have been obvious in light of the

prior art was not.” *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349 (Fed. Cir. 2012) (citation omitted).

Patent Owner puts forth evidence of commercial success, industry praise, skepticism, long-felt need, copying, and failure by others. PO Resp. 56–65.

To be relevant, evidence of secondary considerations of non-obviousness must be reasonably commensurate in scope with the claimed invention. *In re Kao*, 639 F.3d 1057, 1068 (Fed. Cir. 2011). Thus, to be accorded substantial weight, there must be a *nexus* between the merits of the claimed invention and the evidence of secondary considerations. *In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed. Cir. 1995). Nexus is a legally and factually sufficient connection between the objective evidence and the claimed invention, such that the objective evidence should be considered in determining non-obviousness. *Demaco Corp. v. F. Von Langsdorff Lic. Ltd.*, 851 F.2d 1387, 1392 (Fed. Cir. 1988). There is a “presumption of a nexus” when a product is “coextensive” with a patent claim. *Teva Pharms. USA, Inc. v. Sandoz, Inc.*, 723 F.3d 1363, 1372 (Fed. Cir. 2013). The Federal Circuit has held that “if the marketed product embodies the claimed features, and is coextensive with them, then a nexus is presumed and the burden shifts to the party asserting obviousness to present evidence to rebut the presumed nexus.” *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1130 (Fed. Cir. 2000).

Patent Owner is entitled to a presumption of a nexus if it 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) (citation omitted). The

Federal Circuit has explained that “[t]his is true even when the product has additional, unclaimed features.” *PPC Broadband, Inc. v. Corning Optical Commc’ns RF, LLC*, 815 F.3d 734, 747 (Fed. Cir. 2016). Even if unclaimed features do not prevent the presumption of a nexus, however, they may be the basis for rebutting the presumption. *Id.* To do so, a person challenging patent validity must show that the commercial success, or other objective evidence of non-obviousness, was due to “extraneous factors” including “additional unclaimed features.” *Polaris Indus.*, 882 F.3d at 1072.

1. Nexus

To rely on the presented evidence of objective indicia of nonobviousness, Patent Owner is required to show a nexus to the ’362 patent’s claims. Patent Owner contends that its Z3000, Z700, and ZXPLR systems practice claims 1–17 of the ’362 patent. PO Resp. 56; Ex. 2051 ¶¶ 132–134. Specifically, Patent Owner submits several claim charts mapping the claims of the ’362 patent to its commercial systems. Ex. 2048; Ex. 2049; Ex. 2050. Patent Owner contends that because the ’362 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. 57; Tr. 54.

Petitioner contends that “[w]hen, as here, a patent is plainly not inventive, that is, when the prima facie case of obviousness is strong, secondary considerations carry little weight.” Pet. Reply 20 (quoting *Apple*, 839 F.3d at 1080). Petitioner further contends that “[m]erely establishing [Patent Owner’s] commercial OBS nodes meet the claims’ requirements, by itself, is not probative, which is especially significant here given the breadth of the claims.” *Id.* (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 ’362 patent’s claims are restricted to “ocean bottom seismic data collection systems” variously referenced as “pods” or “nodes.” *See, e.g.*, Ex. 1060, 26:46–55; Ex. 2052 ¶¶ 72, 136, 142, 151, 154. Patent Owner’s Z700, Z3000, and ZXPLR systems, however, comprise many more components than simply the nodes, as Petitioner recognizes. Pet. Reply 23–24. 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 ’362 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 ’362 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. 1060, 16:46–52. 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 ’362 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 ’362 patent as opposed to the systems overall.

Accordingly, we do not apply a presumption of nexus that the ’362 patent’s claims are linked to the objective indicia of nonobviousness because Petitioner has successfully shown that these systems are not coextensive with the claims. Even if we did apply the presumption, however, our result would not be different because the presumption is rebuttable, and Petitioner has presented sufficient evidence to show that objective indicia of nonobviousness does not outweigh the showing of obviousness, for reasons explained further in the following sections.

2. *Commercial Success*

Patent Owner asserts it launched the market for autonomous ocean bottom seismic data acquisition units (“nodes”). PO Resp. 58. 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. 58; Ex. 2051 ¶¶ 135–143; 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. 58; Ex. 2052 ¶ 143.

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. Pet. Reply 22. Petitioner contends Patent Owner provided no evidence of market share, revenues, or profitability. *Id.* at 22–23. Petitioner contends the two primary reasons BP awarded Patent Owner the Atlantis project are unrelated to the ’362 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.” Pet. Reply 23–24; 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. 2052 ¶ 141.

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; Pet. 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) ("However, the more probative evidence of commercial success relates to whether the sales represent 'a substantial quantity in th[e] market.' . . . Just as the number of units sold . . . is only weak evidence . . . so too is an assertion of market share lacking in sales data." (quoting *Huang*, 100 F.3d at 140)). Moreover, without more information, it is difficult to tell how significant the number of projects Patent Owner won is compared to the industry overall.

It is even more difficult to discern what proportion of any commercial success is attributable to inclusion of the components in a single case as recited in the '362 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, Petitioner's

declarant clearly expresses, and we find persuasive, that in addition to the node handling system, the commercial attraction of the Z3000 system is due to the overall system; the commercial attraction is not merely due to the nodes or any other single component of the system apart from the node handling system, which is identified as one of the commercial attractors. We find this evidence persuasive and give it substantial weight.

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 '362 patent.

3. 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. 58–59. Patent Owner's declarant testifies that Patent Owner's approach went against the industry's conventional thinking at the time of the invention. Ex. 2052 ¶¶ 144–146. 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. 59; 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. 59; Ex. 2022, 4. He expressed "real surprise" upon learning Patent Owner's OBS had

“satisfactory receiver bandwidth,” calling this result “counter intuitive.”
PO Resp. 60–61; 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. Pet. Reply 24. Petitioner is correct that Schmalfeldt, Jones, and Cranford disclose geophones in the same package as other components. Ex. 1006, 4, Fig. 2; Ex. 1011, 2:41–46, Fig. 3; Ex. 1034, 7, Fig. 3. Sutton, however, discloses geophones separate from other components. Ex. 1033, 18. In any case, Jones explicitly discloses use of its MOBS in a “seismic data acquisition and survey.” Ex. 1011, 4:33–54. Moreover, as we found above, Cranford expressly teaches a geophone in the same package with a bandwidth sufficient for seismic data acquisition. *See supra* at 13–15. Thus, although both declarants expressed “real surprise” and opine 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 “seismic data acquisition and survey.” To the extent the skepticism was directed at the quality or other particular attributes of the data obtained by the geophones disposed within the case, those aspects are not claimed. *See Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1313 (Fed. Cir. 2006) (“But . . . to the extent that such a time savings was the result of the use of multiple appliances (rather than a single device requiring individual adjustment), that feature was not new; Truax had already accomplished this. And to the extent that the time savings resulted from the

patient's substitution of a new device without visiting the dentist, that feature was not claimed.”).

Accordingly, Patent Owner has not shown skepticism attributable to what is claimed in the '362 patent.

4. 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,” including the E&P Innovation award at the Offshore Technology conference in 2006 and the BP Helios Award for Innovation and Partnership. PO Resp. 62. Patent Owner states Petitioner's declarant, Mr. Beaudoin, nominated Patent Owner's Z3000 for 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. 62; Ex. 2020, 3. Patent Owner further notes Mr. Beaudoin's award proposal for the E&P Innovation award praises Patent Owner's technology as having “exceeded expectations.” PO Resp. 62. 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. 62; Ex. 2052 ¶¶ 151–157.

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.” Pet. Reply 24–25; Ex. 2020, 2; Ex. 2021, 1; Ex. 2022, 1; Ex. 2025, 1; Ex. 2030. Petitioner contends the '362 patent's claims and Specification do not mention “wide azimuth” or “subsalt.” Pet. Reply 24. 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. Accordingly, Patent Owner has not established a nexus between the reason for industry praise of the Z3000 system and the claims of the ’362 patent.

*5. 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. 62; Ex. 2052 ¶¶ 158–160. Specifically, Patent Owner contends “antiquated academic system[s] (like those of Cranford) 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. 63; 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. 63; Ex. 2052 ¶ 23. Petitioner’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. 63; Ex. 2024, 102:12–25. Specifically, Petitioner’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. 63; 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. 63–64; Ex. 2052 ¶¶ 158–159. 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. 64 (citing Ex. 2052 ¶ 148). Patent Owner further contends “[m]ore than 25 years passed between the priority date of the ’362 patent and the publication of Cranford, while the intervening period for Sutton was more than 15 years.” PO Resp. 64; Ex. 2052 ¶ 160. 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. 64.

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 ’362 patent. Pet. Reply 24; Ex. 1060. Petitioner further contends Patent Owner’s allegations of copying fail because copying “requires evidence of efforts to replicate a specific product.” Pet. Reply 25 (citing *Weyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir. 2010)). Petitioner asserts that Patent Owner offers no such evidence. *Id.* Petitioner further 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 in the 1970’s, Sutton and

Schmalfeldt in the 1980'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 '362 [patent] claims simply recite 'combination[s] which only unite[] old elements with no change in their respective functions.'" Pet. Reply 25; *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 '362 patent. As Petitioner notes, the '362 patent does not mention "wide azimuth" or imaging "subsalt reservoirs." Pet. 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."). Finally, 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. Pet. Reply 25. 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. 64. That 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 by Aqua Prods., Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir. 2017) (en banc). Here, Cranford recognized the advantages of placing the geophone in the same case with other components. Thus, we agree with Petitioner that this falls into 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 nonobviousness.”).

Accordingly, the evidence does not show a long-felt but unresolved need existed in the industry for what is claimed in the ’362 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 ’362 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.

E. 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 claims 1–17 of the '362 patent are unpatentable as obvious over the combination of Cranford, Schmalfeldt, Sutton, and Jones.

V. CONCLUSION

For the foregoing reasons, on this record, Petitioner has established by a preponderance of the evidence that claims 1–17 of the '362 patent are unpatentable.

VI. ORDER

Accordingly, it is:

ORDERED that claims 1–17 of U.S. Patent No. 8,879,362 B2 have been shown to be unpatentable; and

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

Claim(s)	35 U.S.C. §	References	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–17	§ 103(a)	Cranford, Sutton, Schmalfeldt, Jones	1–17	

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