IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

IN-DEPTH GEOPHYSICAL, INC. AND IN-DEPTH COMPRESSIVE SEISMIC, INC.,

Petitioners

v.

CONOCOPHILLIPS COMPANY,

Patent Owner.

Case No. IPR2019-00850
U.S. Patent 9,846,248

PETITIONERS' NOTICE OF APPEAL

Pursuant to 37 C.F.R. § 90.2(a) and 90.3(a), notice is hereby given that Petitioners In-Depth Geophysical, Inc. and In-Depth Compressive Seismic, Inc. hereby appeal to the United States Court of Appeals for the Federal Circuit under 35 U.S.C. §§ 141 and 142 from the Final Written Decision of the Patent Trial and Appeal Board ("PTAB") entered on September 3, 2020 in IPR2019-00850 (Paper 56) (attached hereto as Attachment A), and from all underlying orders, decisions, rulings and opinions.

In accordance with 37 C.F.R. § 90.2(a)(3)(ii), the expected issues on appeal include, but are not limited to, the following:

1. Whether the PTAB erred in finding that Petitioners have not shown by a preponderance of the evidence that claims 1-17 of U.S. Patent 9,846,248 (the '248 Patent) are unpatentable under 35 U.S.C. § 103 in view of Clay, Pavel and Zwartjes;
2. Whether the PTAB erred in finding that Petitioners have not shown by a preponderance of the evidence that claims 1-17 of the '248 Patent are unpatentable under 35 U.S.C. § 103 in view of Cordsen and Zwartjes;
3. Whether the PTAB erred by failing to properly analyze Petitioners' obviousness grounds;
4. Whether the PTAB erred by failing to consider Petitioners' evidence in the record, including Petitioners' Reply and supporting rebuttal

evidence;

5. Whether the PTAB made procedural errors that led to the erroneous conclusions in its Final Written Decision; and
6. Whether the PTAB erred in any finding or determination supporting or related to the foregoing issues, as well as other issues decided adversely to Petitioners in any orders, decisions, rulings and opinions and other issues Patent Owner may pursue on appeal.

Simultaneously with submission of Petitioners' Notice of Appeal to the Director of the United States Patent and Trademark Office, Petitioners' Notice of Appeal is being filed with the PTAB and, along with the required docketing fees, the Clerk's Office for the United States Court of Appeals for the Federal Circuit.

Dated: October 2, 2020

/ William P. Jensen/
William P. Jensen
USPTO Reg. No. 36,833
wjensen@craincaton.com

James E. Hudson III
USPTO Reg. No. 41,081
jhudson@craincaton.com

Crain, Caton & James
1401 McKinney St., Suite 1700
Houston, TX 77010
Telephone: 713-658-2323

Attorneys for Petitioners In-Depth Geophysical, Inc. and In-Depth Compressive Seismic, Inc.

CERTIFICATE OF SERVICE

I hereby certify that on October 2, 2020, a true and correct copy of Petitioners' Notice of Appeal and Attachment A was served by the PTAB E2E System on the PTAB and the original was served by U.S.P.S. Priority Mail Express (overnight) on the Director of the United States Patent and Trademark Office, at the following address:

Director of the United States Patent and Trademark Office
Office of the General Counsel
United States Patent and Trademark Office
Post Office Box 1450
Alexandria, Virginia 22313-1450

I hereby certify that on October 2, 2020, a true and correct copy of Petitioners' Notice of Appeal and Attachment A, together with the required docketing fees, was served electronically through the Court's CM/ECF System to the Clerk of the United States Court of Appeals for the Federal Circuit, at the following address:

Clerk of Court
United States Court of Appeals for the Federal Circuit
717 Madison Place, N.W.
Washington, DC 20439

I hereby certify that on October 2, 2020, a true and correct copy of Petitioners' Notice of Appeal and Attachment A was served by email (with consent) to counsel for the Patent Owner at the following addresses:

Dion M. Bregman
dion.bregman@morganlewis.com
Alexander B. Stein
alexander.stein@morganlewis.com
MORGAN, LEWIS &BOCKIUS LLP
1400 Page Mill Road
Palo Alto, CA 94304-1124
T. 650.843.4000
F. 650.843.4001

Rick L. Rambo
rick.rambo@morganlewis.com
Archis (Neil) V. Ozarkar
neil.ozarkar@morganlewis.com
MORGAN, LEWIS &BOCKIUS LLP
1000 Louisiana Street, Suite 4000
Houston, Texas 77002-5006
T. 713.890.5000
F. 713.890.5001

Dated: October 2, 2020

/William P. Jensen/
William P. Jensen
USPTO Reg. No. 36,833
Counsel for Petitioners

ATTACHMENT A

Trials@uspto.gov
571-272-7822

Paper 56
Date: September 3, 2020

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

IN-DEPTH GEOPHYSICAL, INC. AND
IN-DEPTH COMPRESSIVE SEISMIC, INC.,
Petitioner,

v.

CONOCOPHILLIPS COMPANY,
Patent Owner.

IPR2019-00850
Patent 9,846,248 B2

Before SCOTT A. DANIELS, JAMES A. TARTAL, and
SCOTT C. MOORE, *Administrative Patent Judges.*

MOORE, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)
Denying Petitioner's Motion to Exclude
Denying As Moot Patent Owner's Motion to Exclude
37 C.F.R. § 42.64

I. INTRODUCTION

Petitioner, In-Depth Geophysical, Inc. ("IDG") and In-Depth Compressive Seismic, Inc., ("IDC"), filed a Petition (Paper 1, "Pet.") requesting *inter partes* review of claims 1–17 of U.S. Patent No. 9,846,248 B2 (Ex. 1001, "'248 Patent"). We subsequently instituted an *inter partes* review as to all asserted grounds and all challenged claims. Paper 14 ("Decision on Institution" or "D.I.").

After institution, Patent Owner filed a Response to the Petition (Paper 30, "Response" or "Resp."), Petitioner filed a Reply (Paper 33, "Reply"), and Patent Owner filed a Sur-Reply (Paper 44, "Sur-Reply"). In addition, both parties filed Motions to Exclude (Papers 46, 47), as well as corresponding Oppositions (Papers 48, 50) and Replies (Papers 52, 53).

An oral hearing was held on June 9, 2020, and a transcript of the hearing is in the record. Paper 55 ("Hearing Tr.").

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that challenged claims 1–9 are unpatentable, but has not shown by a preponderance of the evidence that challenged claims 10–17 are unpatentable. We also deny both parties' Motions to Exclude.

A. *Related Proceedings*

The parties indicate that the '248 Patent was asserted in *ConocoPhillips Company v. In-Depth Compressive Seismic, Inc. and In-Depth Geophysical, Inc.*, Case No. 18-cv-00803 (S.D. Tex.). Pet. 8; Paper 7, 1.

Petitioner filed a concurrent petition seeking *inter partes* review of U.S. Patent 9,632,193 B2, which is related to the '248 Patent. Pet. 8–9; Paper 7, 1. In that proceeding, we declined to institute an *inter partes* review. *See* IPR2019-00849, Paper 14.

B. *The '248 Patent*

The '248 Patent is directed to a method of acquiring seismic data by deploying seismic receivers, directing a seismic energy wavefield into the ground, and recording reflected and/or refracted seismic data in the returning wavefield. Ex. 1001, 1:41–46, 1:66–2:12. The invention uses non-uniform or irregular spacing of the receivers in the lateral dimension to improve sensing of the wavefield. *Id.* at 3:52–62.

In general, the '248 Patent describes a survey area in which each receiver is laterally spaced from one another in a deliberately non-uniform manner. *Id.* at 1:66–2:4. The spacing between any two seismic receivers in the deliberately non-uniform direction varies by a distance of at least five percent between the largest spacing and the smallest spacing. *Id.* at 2:4–7.

The '248 Patent describes various arrangements of seismic data acquisition systems according to the claimed method. *See id.* at 2:56–3:22. For example, Figure 2, reproduced below, is a schematic top view of a portion of a seismic survey area showing an arrangement of lines of seismic receivers. Ex. 1001, 2:59–61.

Figure 2

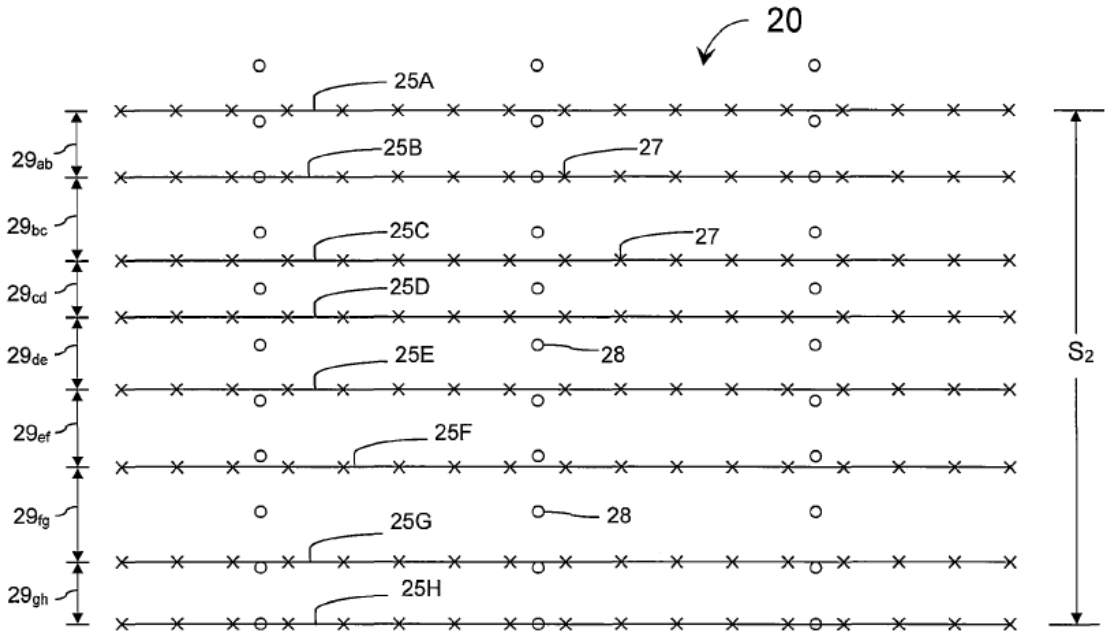


Figure 2 shows receiver lines 25A–H, arranged to be spaced from one another by an uncommon or irregular spacing $29_{ab–gh}$. *Id.* at 7:1–16, Fig. 2. "Along each receiver line are a number of generally evenly spaced seismic receivers **27**" indicated by "x's." *Id.* at 3:41–43, 7:3–5. Figure 2 also depicts seismic sources maintained in common regular spacing indicated as small circles or shot points 28, 58, 68. *Id.* at 3:43–45, 8:22–25.

Figure 5, reproduced below, is a schematic top view of a portion of a seismic survey area showing another arrangement of lines of seismic receivers. Ex. 1001, 3:1–3.

Figure 5

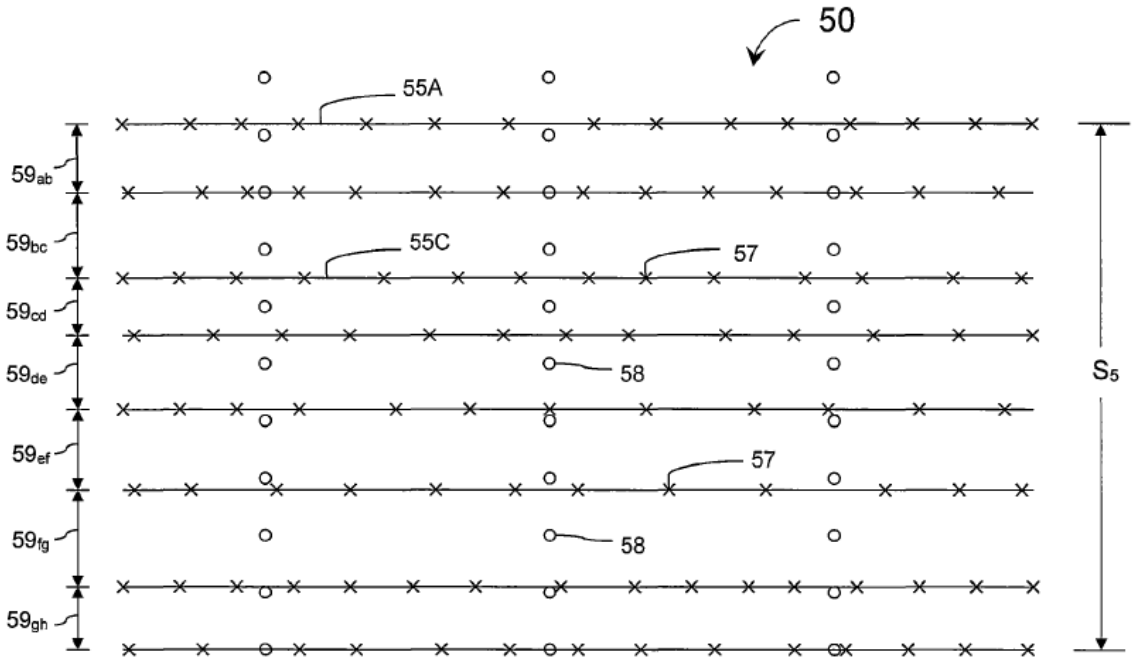
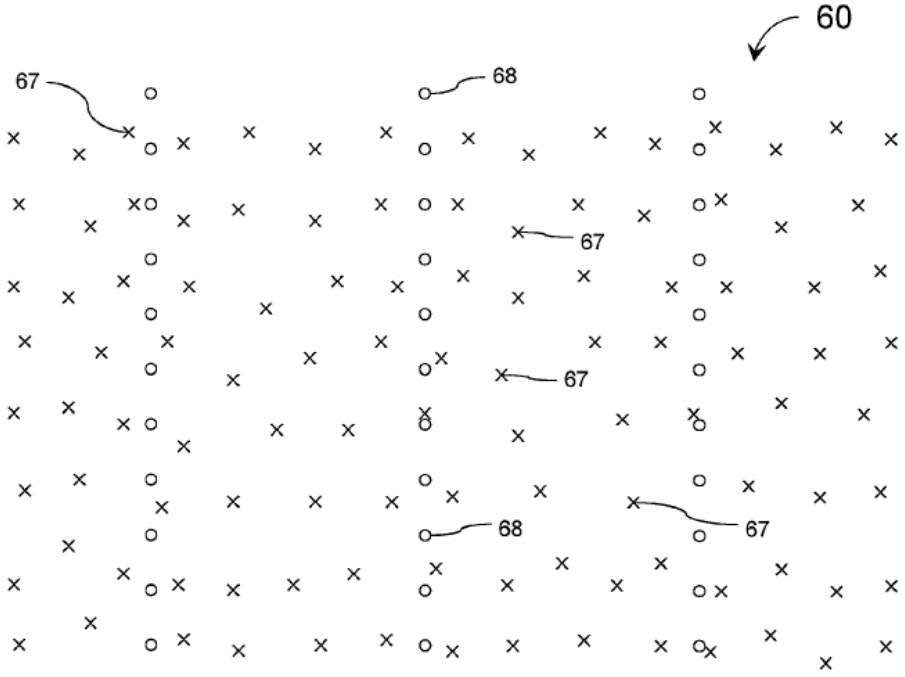


Figure 5 "has the same non-uniform receiver line spacing as system 20 in FIG. 2, but the spacing of the receivers along the receiver line is not only non-uniform, but not the same from receiver line to receiver line. In other words, the receivers do not line up in straight columns." *Id.* at 8:15–20.

Figure 6, reproduced below, is a schematic top view of a portion of a seismic survey area showing an alternative arrangement of lines of seismic receivers. Ex. 1001, 3:4–7.

Figure 6



In Figure 6, system 60 does not include alignment of receivers in any direction; rather, the arrangement of receivers is two dimensionally non-uniform. *Id.* at 8:21–22.

C. *Challenged Claims*

Of the challenged claims, claims 1, 10, and 14 are independent, and the remaining dependent claims all depend from one of claims 1, 10, or 14. Claim 1, reproduced below, is illustrative of the claimed subject matter.

> 1. A method of acquiring seismic data comprising the steps of:
>
> a. deploying receivers in a survey area wherein each receiver is laterally spaced from one another in two horizontal directions wherein the lateral spacing in at least one horizontal direction is deliberately non-uniform, wherein the receivers are not aligned in at least one of the two horizontal directions and wherein the spacing between any two

> seismic receivers in the deliberately non-uniform direction varies by a distance of at least five percent between the largest spacing and smallest spacing;
>
> b. identifying seismic source points within the survey area;
>
> c. directing seismic energy into the ground at the source points and recording reflected and/or refracted seismic data with the deployed seismic receivers;
>
> d. recovering the measured data from the deployed seismic receivers; and
>
> e. reconstructing the wavefield from the recovered data.

D. *Asserted Grounds of Unpatentability*

Petitioner asserts the following grounds of unpatentability based on 35 U.S.C. §§ 102 and 103.[1]

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1	1–9	102	Zwartjes[2]
2	1–17	103	Clay,[3] Pavel,[4] and Zwartjes

[1] Because the '248 Patent has an effective filing date prior to March 16, 2013, the effective date of applicable amendments to the Leahy-Smith America Invents Act ("AIA"), 125 Stat. 284 (2011), we refer to the pre-AIA versions of §§ 102 and 103.

[2] P. M. Zwartjes and M. D. Sacchi, *Fourier reconstruction of nonuniformly sampled, aliased seismic data*, 72 Geophysics V21-V32 (2007) (Ex. 1005).

[3] U.S. Patent No. 2,906,363 (issued Sept. 29, 1959) (Ex. 1006).

[4] U.S. Patent Application Publication No. 2009/0279384 A1 (published Nov. 12, 2009) (Ex. 1007).

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
3	1–17	103	Cordsen[5] and Zwartjes

Petitioner also relies on the Declaration of Dr. Ozgur Yilmaz (Ex. 1015, "Yilmaz Declaration"), the Supplemented Declaration of Dr. Yilmaz (Ex. 1023, "Yilmaz Supplemental Declaration"), and the Rebuttal Declaration of Dr. Yilmaz (Paper 1033, "Yilmaz Rebuttal Declaration").

Patent Owner relies on the Declaration of Dr. Fred Aminzadeh (Paper 2008, "Aminzadeh Declaration").

The Yilmaz Supplemental Declaration was the subject of a Motion to Submit Supplemental Information. Paper 21. We granted the Motion in part, but denied Petitioner's Motion as to paragraphs 65, 67, and 74 of the Yilmaz Supplemental Declaration for reasons explained below. *See* Paper 27; *infra* § II.E.3. Accordingly, paragraphs 65, 67, and 74 of the Yilmaz Supplemental Declaration are not of record in this proceeding, and Petitioner may not rely on these three paragraphs. *Id*. at 9.

II. ANALYSIS

A. *Level of Ordinary Skill in the Art*

Petitioner asserts that a person of ordinary skill in the art to which the '248 Patent pertains would have had "a degree in Earth Sciences, Geophysics, Applied Mathematics, Computer Science, or a similar

[5] Andreas Cordsen, Mike Galbraith, and John Peirce, *Planning Land 3-D Seismic Surveys*, Society of Exploration Geophysicists (1st ed. 2000) (Ex. 1008).

discipline, and accrued at least three years of experience with designing seismic data surveys." Pet. 18. Petitioner asserts that "[s]uch person would be familiar with basic principles of compressive sensing including those that can be leveraged to improve the design of seismic surveys." *Id.*

Patent Owner does not challenge Petitioner's definition of the level of ordinary skill in the art. Resp. 15.

On this record, we adopt Petitioner's formulation regarding the level of ordinary skill in the art. We also find on this record that Petitioner's formulation is consistent with the level of skill reflected by the cited prior art references. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

B. *Claim Construction*

In an *inter partes* review for a petition filed on or after November 13, 2018, a claim "shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b)." *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, 51,340, 51,358 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018) (now codified at 37 C.F.R. § 42.100(b) (2019)). In applying this claim construction standard, we are guided by the principle that the words of a claim "are generally given their ordinary and customary meaning," as understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (*en banc*) (citation omitted). "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence."

DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc., 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). There is a "heavy presumption," however, that a claim term carries its ordinary and customary meaning. *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002) (citation omitted).

In the Petition, Petitioner proposed that we construe the following terms (Pet. 19–27):

> "two horizontal directions,"
>
> "deliberately non-uniform," and
>
> "wherein the receivers are not aligned in at least one of the two horizontal directions."

We declined to construe any of these terms in our Institution Decision, having found that it was unnecessary to do so. *See* D.I. 16.

Patent Owner asserts in its Response that "no express constructions are necessary to resolve this IPR." Resp. 12. Petitioner's Reply does not request that we construe these terms or assert that any of the issues in dispute turns on the meaning of these terms. *See generally* Reply. On this record, we determine that it is unnecessary to adopt explicit constructions of any of these three claim terms in order to resolve the issues in dispute. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (applying *Vivid Techs.* in the context of an *inter partes* review).

Though the parties did not ask us to explicitly construe the claim term "a survey area," it appears that a dispute exists regarding the meaning of this

claim term. Petitioner contends that "a survey area" means "an area of the survey," which may be less than "the entire survey area." Reply 23. In support of this contention, Petitioner asserts that Patent Owner admitted in district court that "a survey area" can be a subset of the entire survey area. Reply 23–25 (citing Ex. 1032, 43, 48–58, 63–67).

Patent Owner, in contrast, contends that the claim term "a survey area" is the entire area where the source points and receivers are located. *See* PO Resp. 34–35 (arguing that Petitioner erred by not measuring distances between seismic receivers of Zwartjes located near the edge of Figure 7); Sur-Reply 5 (reiterating that the claim term "a survey area" refers to the entire seismic survey area, and not a portion thereof). In support, Patent Owner cites testimony in which Dr. Yilmaz admitted that Zwartjes Figure 1 depicts a portion of a seismic survey area. Sur-Reply 5 (citing Ex. 2017, 59:15–20).

We agree with Petitioner that the claim limitation "a survey area" can encompass less than the entire survey area. We are persuaded by Dr. Yilmaz's testimony that one of ordinary skill in the art would have understood this claim limitation to mean "*an area of the survey* that could be less than the *entire* survey area." Ex. 1033 ¶¶ 28–30. We have reviewed the Specification of the '248 Patent, and Dr. Yilmaz's opinion is consistent with the plain and ordinary meaning of the claim as used throughout the Specification. Patent Owner does not cite any testimony that disputes Dr. Yilmaz's opinions regarding how one of ordinary skill in the art would have understood this term. Patent Owner also does not identify any lexicographic definition or disclaimer that would justify limiting the construction of "a survey area" in the manner it proposes. In addition, the

testimony of Dr. Yilmaz that Patent Owner cites in its Sur-Reply does not undermine Petitioner's position. Dr. Yilmaz merely testified that Zwartjes Figure 1 depicts "a portion of a seismic survey area" that "is less than the entire seismic survey area." Ex. 2017, 59:15–20. Dr. Yilmaz did not state or imply that the claim term "a survey area," as used in the '248 Patent, can only mean "the entire seismic survey area," and cannot refer to a subset thereof. *See id*.

We decline to further construe any claim terms. *See Vivid Techs.*, 200 F.3d at 803; *Nidec*, 868 F.3d at 1017.

C. *Overview of the Asserted Prior Art*

1. *Zwartjes (Ex. 1005)*

Zwartjes discloses an algorithm for reconstruction of non-aliased, non-uniform seismic data. Ex. 1005, V21. Zwartjes states that, "[o]f the numerous methods for interpolating aliased seismic data, very few can handle nonuniform sampling." *Id.* at V22. Zwartjes describes combining "the principles of Fourier reconstruction of nonaliased, nonuniformly sampled data, which can handle nonuniform sampling, with the ideas of Gulunay's *f-k* interpolation of aliased uniformly sampled data in a new two-stage algorithm." *Id.*

Zwartjes indicates that, "[s]tarting from uniform sampling with or without missing positions, the sampling locations can be perturbed more and more to yield increasingly nonuniform sampling patterns. As sampling of seismic data becomes more nonuniform, the aliasing becomes more and more diffuse until it disappears altogether for random sampling." *Id.* at V23.

Zwartjes discloses applying the algorithm to "three 2D sampling geometries, one of which is completely uniform and two that are uniform

with a random deviation in the coordinates of maximum 25% and 50% of the sampling interval." *Id.* at V29. Zwartjes Figure 9(c), below, is a sampling geometry with two spatial directions measured in meters. Ex. 1005, V29.

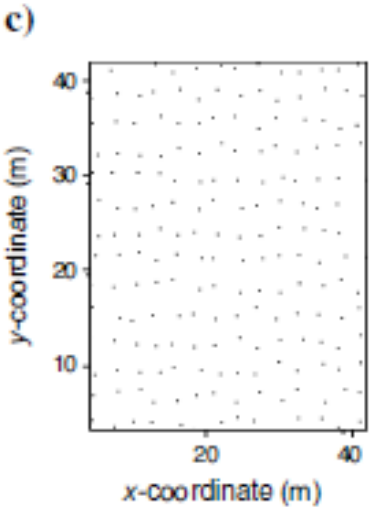


Figure 9(c) depicts a sampling geometry with 196 traces and a sampling interval of 3 meters in both the X and Y directions, in which the coordinates of the traces randomly deviate in the x and y directions a maximum of 50% of the sampling interval. *Id.*

2. *Clay (Ex. 1006)*

Clay discloses improvements in the area of seismic prospecting, "having application to the use of a pattern of geophones or of shot holes that will furnish a broad band of reduction or rejection of horizontally traveling seismic interferences." Ex. 1006, 1:15–22. Clay describes an "arrangement of geophones . . . so spaced that the response of the array to horizontally traveling transients will be substantially less than that obtained with a conventional array of evenly spaced geophones, thus still further improving the ratio of essentially vertically traveling reflection energy to essentially

horizontally traveling interfering energy." *Id.* at 1:63–69. Clay discloses "geophones 21 . . . placed upon or embedded in the surface of the ground 20 with the separate geophone groups 22, 23, and 24 each positioned at a desired detection station along the profile being prospected." *Id.* at 2:57–61.

Clay Figure 13, below, is a schematic plan view of a rectangular array of transducers. Ex. 1006, 2:44–45.

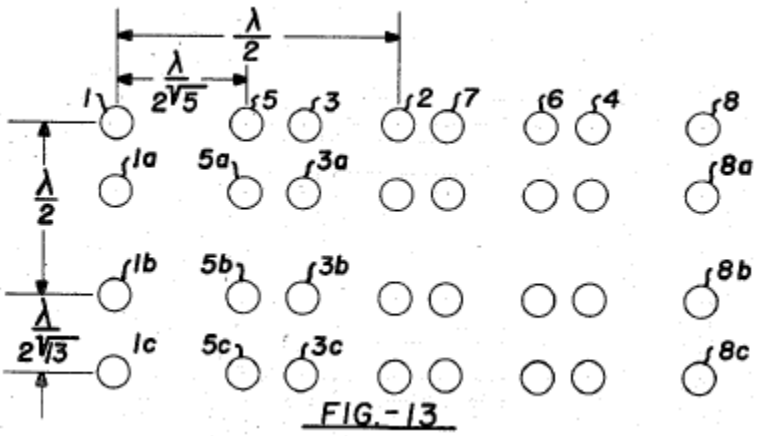


Figure 13 "shows a rectangular areal pattern of geophones in which geophones 1 through 8 . . . [,] 1a through 8a, 1b through 8b, and 1c through 8c," are arranged in four rows. *Id.* at 4:62–67; Fig. 13. The geophones within each row are spaced from each other in a non-uniform manner, and the spacing between the rows also is non-uniform. *See id.*

3. *Pavel (Ex. 1007)*

Pavel discloses a node-based seismic data acquisition system 100 including a plurality of station units 108 including receivers 62 coupled to the earth for sensing reflected seismic energy waves produced by a seismic signal generator 106. Ex. 1007 ¶ 25. Pavel's system includes "wireless sensor stations 108 that form an array (spread) 110 for seismic data

acquisition. The array may utilize asymmetric distribution or an asymmetric grid distribution." *Id.* at ¶ 26.

Pavel teaches "[a]symmetric distributions, which may in one sense be characterized as a non-uniform spacing between at least some of the nodes or stations 108, may be advantageous when the in-field environment has obstacles (e.g., rivers or dense foliage) and/or when it may be desirable to acquire a relatively large amount of information from a defined area." *Id.* Pavel Figure 4, below, is a schematic illustration of a node-based seismic data acquisition system. Ex. 1007 ¶ 13.

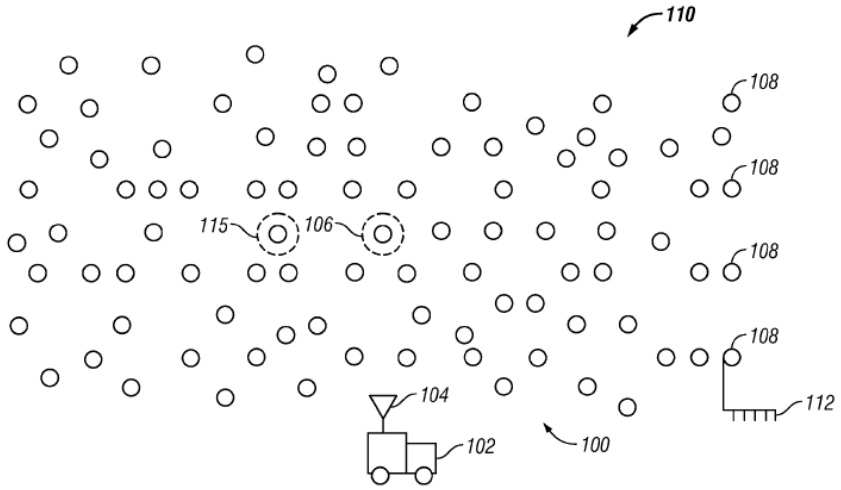


FIG. 4

Figure 4 depicts array 110, with seismic signal generator 106, and station units 108. *Id.* at ¶ 25. The depicted station units 108 are spaced in a non-uniform manner. *See* Fig. 8.

4. *Cordsen (Ex. 1008)*

Cordsen discloses that "[n]umerous layout strategies have been developed for 3-D [seismic] surveys. One has to establish which features are important in the area of the survey in order to select the best design

option." Ex. 1008, 77. Cordsen indicates that "[t]he trend in 3-D designs has been to irregularize the offset and azimuth distribution, but still keep field operations feasible (i.e., straight lines, short driving distances, etc.). Sometimes this irregularity has been accomplished with rather arbitrary offsets and skids." *Id.* at 96. Cordsen discloses "[t]he main advantages of a true randomization of sources and receivers are improvements in the offset and azimuth distribution." *Id.*

Cordsen Figure 5.18b, below, describes one possible layout of sources and receivers.

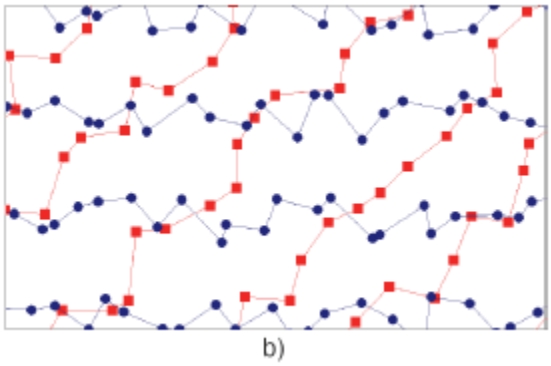


Figure 5.18b illustrates receivers that are indicated by blue dots and source stations by red squares. *See* Ex. 1008, 14. A randomization function was used to determine the location of the source and receiver stations. *Id*. at 99. According to Cordsen, "a quasi-random grid of sources shot into a quasi-random grid of receivers leads to a reduction of migration aliasing artifacts in the final image. Such field implementation could significantly reduce acquisition costs." *Id.*

D. *Ground 1: Alleged Anticipation of Claims 1–9 by Zwartjes*

1. *Principles of Law*

Petitioner contends in Ground 1 that challenged claims 1–9 are unpatentable as anticipated under 35 U.S.C. § 102. Pet. 10. To anticipate a patent claim under 35 U.S.C. § 102, a single prior art reference must "describe every element of the claimed invention, either expressly or inherently," to one of ordinary skill in the art. *Advanced Display Sys., Inc. v. Kent State Univ.*, 212 F.3d 1272, 1282 (Fed. Cir. 2000). "[A] reference can anticipate a claim even if it does not expressly spell out all the limitations arranged or combined as in the claim, if a person of skill in the art, reading the reference, would at once envisage the claimed arrangement or combination." *Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1381 (Fed. Cir. 2015) (internal quotations omitted).

2. *Analysis of Ground 1*

Petitioner asserts that Zwartjes expressly or inherently discloses all the limitations of claims 1–9. Pet. 28. In particular, Petitioner contends that the sampling of seismic data described in Zwartjes is "a method of acquiring seismic data" as recited in the preamble of claim 1. Pet. 28 (citing Ex. 1005, V23). Petitioner contends that the discussions and examples in Zwartjes of perturbing sampling locations to yield "increasingly nonuniform sampling patterns" discloses deploying receivers that are laterally spaced in the deliberately non-uniform manner recited by claim 1, step a. Pet. 29 (citing Ex. 1005, V23, V29, V31, Fig. 9c; Ex. 1015 ¶ 59). Regarding the remainder of this step, Petitioner contends that the same portions of Zwartjes disclose receivers that are not aligned in at least one horizontal direction, wherein the largest and smallest spacing in the deliberately non-uniform direction varies

by at least five percent. *See* Pet. 30–32 (citing Ex. 1005, V29, Fig. 9c; Ex. 1015 ¶ 59; Ex. 1016).

Petitioner contends that Zwartjes also inherently discloses "identifying seismic source points within the survey area" as recited in claim 1, step b. *See* Reply 6–7. In particular, Dr. Yilmaz testifies that the data reflected in Figures 9(d), (e), and (f), which corresponds to the sampling locations depicted in Figures 9(a), (b), and (c), could not have been generated by a single seismic source. Ex. 1023, 24–25.[6]

Regarding claim 1, steps c, d, and e, Petitioner contends that directing seismic energy into the ground at the source points, recording the reflected or refracted seismic energy with deployed receivers, recovering data measured by the deployed receivers, and reconstructing a wavefield from the reconstructed data, would have been necessary to conduct a seismic survey and generate results using the reconstruction methods discussed in Zwartjes. Pet. 32–36 (citing Ex. 1005, V23, V29; V31, Fig. 9c; Ex. 1015 ¶ 59).

Petitioner further contends that the receivers depicted in Figure 9(c) of Zwartjes are spaced in a manner that satisfies the additional limitations recited in dependent claims 2–9. Pet. 36–39 (citing Ex. 1005, Fig. 9c; Ex. 1015 ¶ 59; Ex. 1016).

Patent Owner argues in response that Zwartjes does not disclose either an actual seismic survey of the type allegedly required by claim 1, or multiple "source points" as recited in that claim. PO Resp. 33–48. Patent Owner also argues that Petitioner relies on two separate embodiments from Zwartjes in a manner that is impermissible in an anticipation argument. *Id*.

[6] In some instances (e.g., when the contents of a numbered paragraph span multiple pages), we have cited to *page numbers* of Dr. Yilmaz's declaration.

at 48–53. Patent Owner further argues that Petitioner has failed to show that Zwartjes discloses deployed receivers spaced in the manner required by dependent claims 3–9. *Id*. at 53–55.

We find on this record that Petitioner has demonstrated persuasively that Zwartjes discloses each undisputed limitation of claims 1–9, and we adopt Petitioner's contentions regarding these limitations as our own findings. *See* Pet. 27–39; Ex. 1015 ¶¶ 56–60. We now turn to the disputed limitations. *See* Paper 15 ("[A]ny arguments for patentability not raised in the response may be deemed waived.").

Patent Owner's first argument—that Zwartjes discloses a "synthetic survey," and not an "actual seismic survey" of the type required by claim 1– is not persuasive. *See* Resp. 33–36. In this regard, Patent Owner offers testimony from Dr. Aminzadeh that Figure 9 of Zwartjes depicts synthetic data, and not real-world data of the type Patent Owner contends is required by claim 1. *See* Ex. 2008 ¶¶ 28–33.

As discussed above, Zwartjes discloses an algorithm for reconstruction of non-aliased, non-uniform seismic data. Ex. 1005, V21. The mathematical models of Zwartjes are intended for use in reconstructing seismic survey results in real-world surveys. *See, e.g.*, Ex. 1015 ¶ 58 ("Zwartjes is directed to the field of seismic data acquisition and reconstruction.").

The particular seismic survey described on page V29 of Zwartjes and depicted in Figure 9(c) was modeled on a computer, rather than performed in the real world. *See* Ex. 1005, V29. But though Zwartjes uses a mathematical model to *simulate* the results of a particular geologic survey, the evidence persuasively demonstrates that one of ordinary skill in the art

would have understood Zwartjes to disclose parameters and mathematical reconstruction techniques for an actual seismic survey. *See, e.g.*, Ex. 1015 ¶ 56 ("Zwartjes is directed to the field of seismic data acquisition and reconstruction."); *see also Bristol-Myers Squibb Co. v. Ben Venue Labs., Inc.*, 246 F.3d 1368, 1379 (Fed. Cir. 2001) (explaining that "anticipation does not require actual performance of suggestions in a disclosure," instead "anticipation only requires that those suggestions be enabling to one of skill in the art"). Indeed, Zwartjes was published in a geophysics journal, not a mathematics journal. *See id*. at V21. Zwartjes also states that one set of synthetic survey data "simulat[es] the situation in some parts of the North Sea." *See id*. at V29. Further, Dr. Aminzadeh admitted during his deposition that synthetic data is intended to "simulate some sort of real life situation," and "is usually [a gross] approximation of the real life." Ex. 1034, 70:4–20; *see also* Ex. 1036, 3 (errata sheet correcting testimony at Ex. 1034, 70:13).

We find on this record that one of ordinary skill in the art would have understood page V29 and Figure 9(c) of Zwartjes to both expressly and inherently disclose survey parameters and reconstruction techniques that apply to real-world seismic surveys.

We also are not persuaded by Patent Owner's argument that Zwartjes fails to inherently disclose multiple seismic source points. Dr. Yilmaz explains in his Supplemental Declaration that the laws of mathematics dictate that multiple seismic source points were necessary to generate the data illustrated in Figures 9(d), 9(e), and 9(f) of Zwartjes. Ex. 1023, 24–25. Dr. Yilmaz's deposition testimony further explains that Figures 9(d), 9(e), and 9(f) of Zwartjes each depict planar events, and that it would be

impossible to create such planar events with a single seismic source point because a single seismic source point would create a spherical wave, not a planar wave. Ex. 2009, 68:12–69:12.

Patent Owner argues in its Response that Clay, Pavel, and Cordsen disclose that it is possible to perform a seismic survey using a single seismic source point. Resp. 37–42. Patent Owner also points out that certain portions of Zwartjes disclose that a seismic survey may be performed with a single seismic source point. *Id*. at 39–40 (citing Ex. 2009, 84:16–17, 86:9–10 (testimony from Dr. Yilmaz that Figures 4, 5, and 6(a) of Zwartjes could be produced with a single shot)). These arguments are not persuasive because they do not address the substance of Petitioner's contentions. Petitioner has never argued that it is not possible to conduct a seismic survey with a single seismic source point, or that all embodiments disclosed in Zwartjes use multiple source points. Petitioner and Dr. Yilmaz merely contend that the *specific* survey described and depicted on page V29 and in Figure 9(c) of Zwartjes—could not have been conducted with a single seismic source point, which Patent Owner has not persuasively refuted.

Patent Owner additionally argues that we should discount Dr. Yilmaz's testimony because Dr. Aminzadeh was able to create a single-source synthetic survey that produced results "remarkably similar to the synthetic results in the Figure 9 series of Zwartjes." Resp. 46–47 (citing Ex. 2008 ¶¶ 45–53). But unlike the synthetic results depicted in Figure 9 of Zwartjes, Dr. Aminzadeh's single-source survey generated curved waves. *See* Ex. 2008 ¶ 50. In other words, Dr. Aminzadeh's results appear consistent with Dr. Yilmaz's opinion that a single-source seismic survey would generate spherical (i.e., curved) waves, rather than the planar waves

in Figure 9. *See* Ex. 2009, 68:12–69:12. Dr. Aminzadeh's results do not appear "remarkably similar" to those depicted in Figure 9 of Zwartjes.

On this record, and having reviewed the arguments, declarations, and deposition transcripts of Dr. Yilmaz and Dr. Aminzadeh, we are persuaded that Figure 9(c) of Zwartjes depicts results of a seismic survey that necessarily employed two or more seismic source points. Accordingly, we find on this record that Zwartjes inherently would have disclosed two or more "seismic source points" to one of ordinary skill in the art.

Patent Owner additionally argues that Petitioner is relying on Figure 11 of Zwartjes as teaching multiple source points, even though Figure 11 depicts an embodiment different than the one described and depicted on page V29 and in Figure 9(c). Resp. 48–53. According to Patent Owner, this reliance on two separate embodiments is improper in an anticipation argument. *Id*. This argument is not persuasive because we have found that the embodiment described and depicted at page V29 and Figure 9(c) of Zwartjes inherently discloses multiple source points. Accordingly, we need not reach Petitioner's alternative argument that the embodiment depicted in Figure 11 also discloses multiple seismic source points.

Patent Owner also raises an additional argument in its Sur-Reply regarding claim 1—that Petitioner has not shown that the source points of Zwartjes are "within the survey area." Sur-Reply 2. Petitioner asserts in the Petition that a person of ordinary skill in the art "would have understood from the description of Zwartjes above and FIG. 9c that source points were necessarily present in the survey area in order to acquire the non-uniformly sampled seismic data." Pet. 33 (citing Ex. 1015 ¶ 59). Petitioner further argued at the oral hearing that it was improper for Patent Owner to raise this

new argument in its Sur-Reply. Hearing Tr. 11:7–21. We agree with Petitioner.

Our Scheduling Order and Practice Guide each make clear that Patent Owner must set forth all substantive arguments for patentability in the Response, and may not raise new arguments in the Sur-Reply. *See* Paper 15, 7 ("Patent Owner is cautioned that any arguments for patentability not raised in the response may be deemed waived."); Patent Trial and Appeal Board Consolidated Trial Practice Guide (Nov. 2019) ("Consolidated TPG"),[7] 74 ("[A] reply or sur-reply may only respond to arguments raised in the preceding brief. . . . 'Respond' . . . does not mean proceed in a new direction with a new approach as compared to positions taken in a prior filing. . . . [A] reply or sur-reply that raises a new issue or belatedly presents evidence may not be considered.")

Patent Owner argued at the oral hearing that this argument was not new because it was disclosed "at Patent Owner's Response at page number seven," where Patent Owner "highlight[ed] the words within the survey area." Hearing Tr. 42:13–18. But the portion of page 7 of the Response cited by Patent Owner is part of Patent Owner's argument that the synthetic survey of Zwartjes does not satisfy "the real-world, physical aspects of claim 1" that supposedly require an actual seismic survey. *See* Resp., 6–7. Specifically, Patent Owner argues that synthetic surveys, like the ones described in Zwartjes, do not include the claim limitations "identifying seismic source points **within the survey area**" or "**directing seismic energy *into the ground* at the source points**" because they are performed on a

[7] The Consolidated TPG is available at https://www.uspto.gov/TrialPracticeGuideConsolidated.

computer, and not by actually directing seismic energy into the ground within a survey area. *See id.*

Though Patent Owner highlighted the claim language "within the survey area" as part of its argument that this language required an actual, physical survey, Patent Owner did not argue in the Response that the synthetic source points of Zwartjes were not located within the corresponding survey area. Accordingly, Patent Owner waived this argument, and may not raise it in the Sur-Reply.

Moreover, on this record, and in view of Patent Owner's failure to argue otherwise in the Response, we find that Petitioner has demonstrated that Zwartjes inherently discloses identifying multiple seismic source points "within the survey area," as recited in claim 1. *See* Pet. 32–33; Ex. 1015, 23–24; Ex. 1023, 24–25; Paper 15, 7; Consolidated TPG, 74.

Turning now to the dependent claims, Patent Owner argues that the evidence cited by Petitioner fails to demonstrate that Zwartjes discloses receivers spaced in the manner recited in claims 3–9. Resp. 53–55. In particular, Patent Owner argues that claims 3–9 specify certain spacing distances "between *all of the* deployed receivers *in the survey area* . . ., not some undefined subset thereof." *Id.* at 54. Patent Owner contends that Petitioner's measurements do "not reflect measurements of spacing distances between all deployed receivers (or sources) in relevant survey areas for all of the references." *Id.*

This argument is not persuasive because it depends on Patent Owner's argument that the claim term "a survey area" can only refer to the entire seismic survey area. *See* Resp. 53–55. For the reasons discussed above, we reject this claim construction argument, and hold that the claim limitation "a

survey area" can refer to less than the entire survey area. *See supra* § II.B. Accordingly, the 12x12 grid of seismic receivers measured by Petitioner constitutes "a survey area," notwithstanding the fact that Zwartjes describes a 14x14 grid of seismic receivers. *See* Reply 26 (citing Ex. 1033 ¶ 32; Ex. 1016, 5–8).

We also find that Zwartjes discloses the receivers spaced in the manner required by claims 3–9 even if the recited "a survey area" is construed to encompass the entire 14x14 grid of seismic receivers described in Zwartjes. In his Rebuttal Declaration, Dr. Yilmaz measured all of the additional receivers depicted in Figure 9(c), and determined that over 80% of the total number of receivers that could be measured were spaced more than 30% further apart in the non-uniform direction than the smallest spacing between receivers in the non-uniform direction. Ex. 1033 ¶ 33. Dr. Yilmaz further calculated that at least 70% of all of the receivers (including those depicted and those not depicted in Figure 9(c)) necessarily would have been spaced more than 30% apart. *Id*. We credit Dr. Yilmaz's testimony because his calculations appear to be correct and consistent with the receiver spacing depicted in Figure 9(c) of Zwartjes.

Patent Owner further argues that Petitioner's measurements are inaccurate because Petitioner did not take into account the differing scales on the X and Y axes of Zwartjes. Resp. 55. However, the measured distances are nearly perpendicular to the axes of Figure 9(c), so any distortion would be minimal. Ex. 1033 ¶ 34. Petitioner also offers rebuttal testimony from Dr. Yilmaz that any measurement error would be insignificant and would not impact his opinion that the deployed receivers of Zwartjes are spaced in a manner that would necessarily satisfy claims 3–9.

See Reply 28–29 (citing Ex. 1033 ¶¶ 34–37). We have reviewed Dr. Yilmaz's calculations and find his methodology and results to be persuasive and consistent with Figure 9(c). Accordingly, we determine on this record that Petitioner has shown that Zwartjes discloses deployed receivers that are spaced in the manner required by dependent claims 3–9.

For the reasons discussed above, and having considered all of the evidence and arguments submitted by the parties, we find that Zwartjes expressly or inherently discloses all of the disputed and undisputed limitations of independent claim 1 and dependent claims 2–9. Accordingly, Petitioner has shown by a preponderance of the evidence that claims 1–9 of the '248 Patent are anticipated by Zwartjes.

E. *Grounds 2 and 3: Alleged Obviousness of Claims 1–17 over Clay, Pavel, and Zwartjes; Alleged Obviousness of Claims 1–17 over Cordsen and Zwartjes*

1. *Principles of Law*

Petitioner argues in Grounds 2 and 3 that challenged claims 1–17 are unpatentable as obvious under 35 U.S.C. § 103. Pet. 10. An invention is not patentable under 35 U.S.C. § 103 "if the differences between the subject matter sought to be patented 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." 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 skill in the art; and, (4) where in evidence, so-called secondary considerations, including commercial success, long-felt but unsolved needs,

and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17−18 (1966).

Our Rules specify that a petition for *inter partes* review must "specify where each element of the claim is found in the prior art patents or printed publications relied upon." 37 C.F.R. § 42.104(b)(4) (2018). When evaluating a combination of teachings, we also must "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (citing *In re Kahn*, 441, F.3d 977, 988 (Fed. Cir. 2006)). In order to pass muster, the reason to combine must demonstrate that one of ordinary skill would have had reason to combine the relevant teachings *in the specific manner claimed*. *See KSR*, 550 U.S. at 418 ("[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." . . . [I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.").

Thus, in order to set forth a ground of unpatentability based on obviousness in the manner required by our Rules and governing case law, the Petition must identify *both* the specific teaching in each prior art reference that it relies upon with respect to each claim limitation, *and* a rationale for why one of ordinary skill in the art would have combined those specific teachings in the specific manner claimed.

2. *Secondary Considerations*

The parties have not directed us to any evidence of secondary considerations.

3. *Analysis of Grounds 2 and 3*

In our Decision on Institution, we observed that the Petition did not appear to adequately specify the bases for Grounds 2 and 3:

> The claim charts in the Petition do not appear to identify the specific combination of teachings that Petitioner is relying upon to demonstrate obviousness. For example, in its claim chart for Ground 2, Petitioner cites portions of Clay, Pavel, and Zwartjes as allegedly teaching or suggesting each and every element of claim 1, and does not identify which specific reference is relied upon with respect to each element. *See* Pet. 45–54. Petitioner's claim chart for Ground 3 is similar: Petitioner repeatedly cites disclosures from both Cordsen and Zwartjes with respect to individual claim elements, and does not identify the specific reference that is relied upon for each claim element. *See id*. at 67–79.
>
> Petitioner's rationales for combining the cited references also appear to lack specificity. For example, in its discussion of Ground 2, Petitioner argues that a skilled artisan would have had reason to modify Clay to incorporate Pavel's receiver pattern. Pet. 42–43. Two paragraphs later, Petitioner argues that a skilled artisan would have had reason to modify Clay to incorporate the non-aligned receiver pattern of Zwartjes. *Id*. at 44. In the next paragraph, Petitioner argues that such a person also would have had reason to modify Zwartjes to incorporate the non-uniform sampling patterns of Clay and/or Pavel. *Id*. at 44–45.
>
> In its discussion of Ground 3, Petitioner indicates that a skilled artisan would have had reason to apply "the reconstruction techniques taught by Zwartjes to the irregular or non-uniform sampling pattern of Cordsen with a reasonable expectation of success." *Id*. at. 66. This rationale also appears, at least preliminarily, to lack specificity.

D.I. 28–29. After we issued our Decision on Institution, Petitioner moved to supplement Dr. Yilmaz's declaration to include additional testimony regarding why one of ordinary skill in the art allegedly would have had

reason to combine the cited references. *See* Paper 21, 2–4; Ex. 1023 ¶¶ 65, 67, 74. Though we permitted Petitioner to supplement the record in other ways, we denied Petitioner's request to supplement the evidence regarding reasons to combine. *See* Paper 27, 9; Ex. 1023 ¶¶ 65, 67, 74.

Petitioner subsequently filed a Reply that purports to identify the specific combinations of references upon which Petitioner is relying. *See* Reply 12–14. Petitioner's Reply identifies two specific combinations of references for Ground 2, and one specific combination for Ground 3. *See id*. at 14. Petitioner's Reply also cites to new evidence regarding why one of ordinary skill in the art allegedly would have combined these newly-identified combinations to arrive at the claims. *See id*. at 16–21 (citing Ex. 1033 ¶¶ 23–27; Ex. 2009, 182:14–17). Petitioner asserts that the substance of these new arguments was disclosed to Patent Owner during the October 31, 2019, deposition of Dr. Yilmaz—a deposition that took place nearly two months after our September 6, 2019, Decision on Institution. *See* Reply 12; D.I. 1. Petitioner further asserts that this post-institution disclosure of the bases for Grounds 2 and 3 was justified because Petitioner was unaware at the time it filed its Petition whether the Board would accept its claim construction positions. *See id*. at 12–13.

Patent Owner argues in response that the Petition fails to adequately specify the bases for Grounds 2 and 3 in the Petition, or to provide adequate motivation-to-combine theories. Resp. 16. Regarding Ground 2, Patent Owner argues: "Petitioners alternatively rely on all three references for most of the claim limitations," and thus "alternatively assert hundreds of different combinations of these references for each of the independent claims." *Id*. at 17–18. Patent Owner argues that Petitioner also failed to explain why one of

ordinary skill in the art would have been motivated to combine the references in any particular manner with a reasonable expectation of success. *Id*. at 22. Patent Owner makes similar arguments regarding Ground 3. *See id*. at 19–22. Patent Owner additionally argues that Petitioner should not be permitted to rely on the new arguments regarding Grounds 2 and 3 set forth in the Reply, and that Petitioner has not offered any adequate justification for not including these arguments in its Petition. *See* Sur-Rely 2–5.

The statutes and rules governing *inter parties* reviews make clear that Petitioner was required to specify the bases for Grounds 2 and 3, and the evidence supporting these grounds, *in the Petition itself*. *See* 35 U.S.C. § 312(a) (We may consider a petition for *inter partes* review "only if . . . the petition identifies, in writing and with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim."); 37 C.F.R. 42.104(b) (A petition for *inter partes* review must identify "how the construed claim is unpatentable under the statutory grounds," and "must identify . . . where each element of the claim is found in the prior art patents or printed publications relied upon").

Decisions from our reviewing court also make clear that a petitioner must make out its arguments for unpatentability in the petition, and cannot change course later. "Unlike district court litigation—where parties have greater freedom to revise and develop their arguments over time and in response to newly discovered material—the expedited nature of IPRs bring with it an obligation for petitioners to make their case in their petition to institute." *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016). In an *inter partes* review, the petitioner has the

burden from the outset to show with particularity why the patent it challenges is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016).

In addition, our Trial Practice Guide provides that Petitioner cannot use its Reply to introduce evidence or arguments that should have been set forth in its Petition. *See, e.g.,* Consolidated TPG 73 ("Petitioner may not submit new evidence or argument in reply that it could have presented earlier, e.g., to make out a prima facie case of unpatentability.").

On this record, and consistent with our Decision on Institution (*see* D.I. 27–29) and Decision on Petitioner's Motion to Submit Supplemental Information (*see* Paper 27, 5–7), we determine that Petitioner improperly waited until after institution to sufficiently identify the specific combination of teachings from the prior art references on which it was relying, or the reasons why one of ordinary skill in the art would have allegedly combined the teachings of those references in a manner that would have satisfied the challenged claims.

We reject Petitioner's argument that it was unable to specify the bases for Grounds 2 and 3 until after institution, when it knew whether the Board would accept its claim construction positions. *See* Reply 12–13. We declined to construe any claim terms in our Decision on Institution. *See* D.I. 15–16. Thus, even assuming *arguendo* that an unexpected claim construction ruling could in some circumstances justify supplementing an unpatentability ground, Petitioner's argument would still have no merit in this proceeding.

For the foregoing reasons, we do not consider the new arguments and evidence regarding Grounds 2 and 3 that are set forth in the Reply. We

instead evaluate Grounds 2 and 3 on the basis of the evidence and arguments set forth in the Petition, the Yilmaz Declaration, and the portions of the Yilmaz Supplemental Declaration that we admitted into the record.

We agree with Patent Owner that the claim charts in the Petition and supporting declarations do not identify sufficiently the specific combination of teachings that Petitioner is relying upon to demonstrate obviousness of each claim. The claim charts are vague and identify multiple prior art references that allegedly teach various claim limitations, without identifying which specific reference Petitioner intends to rely on for each limitation. *See* Pet. 45–63, 67–79.

Petitioner's charts for Grounds 2 and 3 also do not contain citations to specific portions of Zwartjes that allegedly teach or suggest the individual limitations of claims 1, 10, or 14. Instead, Petitioner repeatedly directs Patent Owner and the Board to "[s]ee Section VIII(B)(2) for Zwartjes disclosure." Pet. 67–71, 74–76, 78. It appears that Petitioner intended to reference Section VIII(A)(2) of the Petition, the "Overview of Zwartjes" section, rather than Section VIII(B)(2), which is an "Overview of Pavel." *See* Pet. 27–28, 40–41.[8] But Section VIII(A)(2) of the Petition is merely a generalized overview of Zwartjes. *See* Pet. 27–28. This section does not adequately specify where any element of independent claims 1, 10, or 14 "is found in the prior art" Zwartjes reference, or identify "the specific portions" of Zwartjes "that support the challenge." 37 C.F.R. § 42.104(b)(4).

[8] In the Yilmaz Supplemental Declaration, Dr. Yilmaz corrects the corresponding citations in his claim chart to refer to the "Overview of Zwartjes" section of his declaration, which corresponds to Section VIII(A)(2) of the Petition. *See* Ex. 1023, 60–65, 67–69, 71–72.

Petitioner's rationales for combining the cited references lack specificity and do not cure the defects and ambiguities in Petitioner's claim charts. *See* Pet. 45–63. In its discussion of Ground 2, Petitioner first argues that a skilled artisan would have had reason to modify Clay to incorporate Pavel's receiver pattern. Pet. 42–43. Two paragraphs later, Petitioner argues that a skilled artisan would have had reason to modify Clay to incorporate the non-aligned receiver pattern of Zwartjes. *Id*. at 44. In the following paragraph, Petitioner argues that such a person also would have had reason to modify Zwartjes to incorporate the non-uniform sampling patterns of Clay and/or Pavel. *Id*. at 44–45. These contradictory rationales do not adequately clarify Petitioner's unpatentability contentions.

We find on this record that the Petition did not provide Patent Owner with adequate notice of the specific combination of references that Petitioner was pursuing with respect to Ground 2. For the same reasons, Petitioner has not shown by a preponderance of the evidence that one of ordinary skill in the art would have had reason to combine specific teachings or suggestions from Clay, Pavel, and Zwartjes, in a manner that would have satisfied each limitation of independent claims 1, 10, or 14, or dependent claims 2–9, 11–13, or 15–17.

Petitioner's stated rationale for Ground 3 is slightly more specific, but nevertheless fails to remedy the defects and ambiguities in Petitioner's claim charts. *See* Pet. 62–79. Petitioner contends that a skilled artisan would have had reason to apply "the reconstruction techniques taught by Zwartjes to the irregular or non-uniform sampling pattern of Cordsen with a reasonable expectation of success[]." *Id*. at. 66. Even assuming *arguendo* that this conclusory and general rationale somehow would have given Patent Owner

notice of the specific reference that Petitioner was relying on for each limitation of claims 1–17, the Petition would still fail to identify "where each element of the claim is found in the prior art" Zwartjes reference, or "the specific portions of the evidence that support the challenge." 37 C.F.R. § 42.104(b)(4).

For the foregoing reasons, we find that the Petition did not provide Patent Owner with adequate notice of the specific combination of references that Petitioner was pursuing with respect to Ground 3. For the same reasons, Petitioner has not shown by a preponderance of the evidence that one of ordinary skill in the art would have had reason to combine specific teachings or suggestions from Cordsen and Zawartjes in a manner that would have satisfied each limitation of independent claims 1, 10, or 14, or dependent claims 2–9, 11–13, or 15–17.

F. *Assignor Estoppel*

Patent Owner argues in its Response that the doctrine of assignor estoppel should bar institution in this case "because Mr. Peter Eick, one of the listed inventors on the '248 Patent who assigned all rights to Patent Owner . . ., is now employed by Petitioner(s)." Resp. 58. Patent Owner concedes that its assignor estoppel "argument is foreclosed by current precedent," but makes this argument in an attempt to preserve its rights on appeal. *See id*. (citing *Arista Networks, Inc. v. Cisco Sys., Inc.*, 908 F.3d 792 (Fed. Cir. 2018)).

We note that Patent Owner did not argue assignor estoppel in its preliminary response to the Petition. Thus, the issue of assignor estoppel was not before us when we issued our Decision on Institution. Even assuming *arguendo* that Patent Owner could raise such an argument now

after institution, it would still fail because it is foreclosed by controlling precedent from our reviewing court. *See Arista*, 908 F.3d at 804 ("In sum, we conclude that [35 U.S.C.] § 311(a) . . . unambiguously dictates that assignor estoppel has no place in IPR proceedings."). For the foregoing reasons, we reject Patent Owner's argument that the Petition was barred by the doctrine of assignor estoppel.

G. *Petitioner's Motion to Exclude*

Petitioner moves to exclude Exhibit 2008 (the Aminzadeh Declaration), Exhibit 2011 (Dr. Aminzadeh's CV), and Exhibits 2012–2015. Paper 46, 1. For the reasons set forth below, Petitioner's Motion to Exclude is *denied*.

Before addressing the substance of Petitioner's arguments, we note that page 1 of the Motion to Exclude directs us to a separate document, Paper 31, which "further explains the nature of the objections." Paper 46, 1. Page 11 of the Motion to Exclude contains similar references to arguments set forth in Paper 31. *See* Paper 46, 11. Our Rules unambiguously foreclose such attempts to incorporate by reference arguments from other documents. 37 C.F.R. § 42.6(a)(3) (2018) ("Arguments must not be incorporated by reference from one document into another document."). Accordingly, we disregard these references to Paper 31 and consider only the arguments set forth in the Motion to Exclude.

Petitioner first contends that the Aminzadeh Declaration should be excluded pursuant to Federal Rules of Evidence 401, 402, 403, and 702. Paper 46, 1. In particular, Petitioner argues that Dr. Aminzadeh's testimony is not the product of reliable principles and methods because he lacks the experience in the field of compressive sensing necessary to qualify as a

person of ordinary skill in the art. *See* Paper 46, 1–4; Fed. R. Evid. 702(c); *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579, 592 n.10 (1993). We note, however, that there is no requirement of a perfect match between the expert's experience and the relevant field. *SEB S.A. v. Montgomery Ward & Co.*, 594 F.3d 1360, 1373 (Fed. Cir. 2010). A person may not need to be a person of ordinary skill in the art in order to testify as an expert under Rule 702, but rather must be "qualified in the pertinent art." *Sundance, Inc. v. DeMonte Fabricating Ltd.*, 550 F.3d 1356, 1363–64 (Fed. Cir. 2008). Petitioner does not address the relevant legal standard, much less demonstrate persuasively that Dr. Aminzadeh is not "qualified in the pertinent art." *Sundance*, 550 F.3d at 1363–64. Moreover, Dr. Aminzadeh testifies in his declaration that he has been involved in numerous projects related to compressive sensing over the course of 30+ years. Ex. 2008 ¶ 14. We determine on this basis that Dr. Aminzadeh is "familiar with basic principles of compressive sensing including those that can be leveraged to improve the design of seismic surveys." *See supra* § II.A. Accordingly, Petitioner does not persuade us that Dr. Aminzadeh is not sufficiently qualified to provide helpful testimony in this proceeding. *See* Paper 46, 2–3.

Petitioner next contends that Dr. Aminzadeh provides no basis for his opinion that claim 1 requires a real-world, physical, seismic survey. *See* Paper 46, 4–5. In our analysis of Ground 1, however, we found that Zwartjes expressly or inherently discloses survey parameters and reconstruction techniques for use in real-world seismic surveys. *See supra* § II.D.2. Thus, Zwartjes anticipates claim 1 even if Dr. Aminzadeh is correct about this issue. Accordingly, this portion of Petitioner's Motion to Exclude is moot.

Petitioner also contends that we should exclude several portions of Dr. Aminzadeh's testimony that support his opinion that the embodiment described and depicted on page V29 and Figure 9(c) of Zwartjes could have employed a single seismic source point, rather than multiple seismic source points. Paper 46, 5–10. As discussed above, however, we are persuaded on this record that the embodiment described and depicted on page V29 and Figure 9(c) of Zwartjes inherently discloses multiple seismic source points. *See supra* § II.D.2. Accordingly, these portions of Petitioner's Motion to Exclude also are moot.

Petitioner next contends that Exhibit 2011 (Dr. Aminzadeh's CV) should be excluded under Federal Rule of Evidence 702 because it "is replete with opinions that are unreliable and inadmissible." Paper 46, 11. This portion of Petitioner's Motion to Exclude is moot because this Decision does not rely on any opinions allegedly set forth in Exhibit 2011.

Petitioner further contends that we should exclude Exhibits 2012 through 2015 under Federal Rules of Evidence 401, 402, 403, and 802, because these exhibits relate to Patent Owner's assignor estoppel argument—an argument that Patent Owner admits is foreclosed by current precedent. Paper 46, 11–12. Petitioner also asserts that Exhibits 2012, 2014, and 2015 are hearsay. These arguments are moot because this Decision rejects Patent Owner's assignor estoppel argument.

Because each substantive argument in Petitioner's Motion to Exclude is either unpersuasive or moot, Petitioner's Motion to Exclude is *denied*.

H. *Patent Owner's Motion to Exclude*

Patent Owner moves to exclude testimony during the October 31, 2019, deposition of Dr. Yilmaz that was allegedly elicited by leading

questions, and testimony from Dr. Aminzadeh's Deposition that was allegedly transcribed incorrectly. Paper 47, 1–15. For the reasons set forth below, Patent Owner's Motion to Exclude is *denied*.

The testimony from Dr. Yilmaz's October 31, 2019, deposition that is the subject of Patent Owner's Motion to Exclude is the testimony in which Dr. Yilmaz allegedly disclosed the new arguments and evidence regarding Grounds 2 and 3 that were set forth in Petitioner's Reply. *See* Paper 47, 5–10. We have held, however, that Petitioner may not rely on the new evidence and arguments regarding Grounds 2 and 3 that were allegedly disclosed during Dr. Yilmaz's October 31, 2019, deposition, and set forth in Petitioner's Reply. *See supra* § II.E.3. Accordingly, this portion of Patent Owner's Motion to Exclude is moot.

Patent Owner's argument regarding incorrectly transcribed testimony relates to an instance in which Dr. Aminzadeh allegedly used the word "simulate," and the reporter incorrectly transcribed this word as "assimilate." *See* Paper 47, 14–15. Patent Owner subsequently withdrew this portion of its Motion to Exclude after Dr. Aminzadeh corrected this alleged error in an errata sheet. Paper 53, 5. Accordingly, this portion of Patent Owner's Motion to Exclude has been withdrawn.

Because each substantive objection in Patent Owner's Motion to Exclude is either moot or has been withdrawn, Patent Owner's Motion to Exclude is *denied as moot*.

III. CONCLUSION

For the foregoing reasons, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–9 of the '248 Patent are

unpatentable, but has not shown by a preponderance of the evidence that claims 10–17 are unpatentable.[9]

In summary,

Claims	35 U.S.C. §	Reference(s) / Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–9	§ 102	Zwartjes	1–9	
1–17	§ 103(a)	Clay, Pavel, Zwartjes		1–17
1–17	§ 103(a)	Cordsen, Zwartjes		1–17
Overall Outcome			1–9	10–17

[9] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*, 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

For the reasons set forth above, it is hereby:

ORDERED that claims 1–9 of U.S. Patent 9,846,248 B2 have been shown to be unpatentable;

FURTHER ORDERED that claims 10–17 of U.S. Patent 9,846,248 B2 have not been shown to be unpatentable; and

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

PETITIONER:

William P. Jensen
James E. Hudson III
CRAIN, CATON & JAMES
wjensen@craincaton.com
jhudson@craincaton.com

PATENT OWNER:

Dion M. Bregman
Rick L. Rambo
Neil V. Ozarkar
Alexander B. Stein
MORGAN, LEWIS & BOCKIUS LLP
dion.bregman@morganlewis.com
rick.rambo@morganlewis.com
neil.ozarkar@morganlewis.com
alexander.stein@morganlewis.com