

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HESAI TECHNOLOGY CO. LTD.,
Petitioner,

v.

OUSTER, INC.,
Patent Owner.

IPR2023-01456
Patent 11,178,381 B2

Before MEREDITH C. PETRAVICK, KEVIN W. CHERRY and
JON M. JURGOVAN, *Administrative Patent Judges*.

CHERRY, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Hesai Technology Co. Ltd. (“Petitioner”) filed a Petition to institute *inter partes* review of claims 1–3, 5–8, and 10–17 of U.S. Patent No. 11,178,381 B2 (Ex. 1001, “the ’381 patent”). Paper 2 (“Pet.”). Ouster, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”).

We have authority under 35 U.S.C. § 314 to determine whether to institute an *inter partes* review. The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” The Supreme Court has held that the Board, in a decision to institute under 35 U.S.C. § 314(b), may not institute review on less than all claims challenged in the petition. *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1355–56 (2018). Moreover, in accordance with our rules, “[w]hen instituting *inter partes* review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim.” 37 C.F.R. § 42.108(a) (2020); *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”).

Applying those standards, and upon considering the Petition, the Preliminary Response, and the evidence of record, we determine the information presented shows a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of at least one of the challenged claims of the ’381 patent. Accordingly, we institute an *inter partes* review of all challenged claims (i.e., 1–3, 5–8, and 10–17) of the ’381 patent, based on the grounds asserted in the Petition.

II. BACKGROUND

A. *Related Matters*

The parties identify the following proceedings as related matters involving the '381 patent: *Ouster, Inc. v. Hesai Group et al.*, Case No. 23-cv-00406 (D. Del.) and *Certain LIDAR*^[1] (*Light Detection and Ranging*) *Systems and Components Thereof*, Inv. No. 337-TA-1363 (ITC). Pet. 85; Paper 5, 1. Petitioner also states that it is also seeking institution of an “IPR against U.S. Patent No. 11,190,750.” Pet. 85.

B. *Real Parties-in-Interest*

Petitioner identifies itself, Hesai Group, and Hesai Inc. as the real parties-in-interest. Pet. 85. Patent Owner identifies itself as the real party-in-interest. Paper 5, 1.

C. *The '381 Patent*

The '381 patent is titled “Optical System for Collecting Distance Information within a Field.” Ex. 1001, code (54). The '381 patent is a continuation of Application No. 15/880,491, filed on Jan. 25, 2018 and issued as U.S. Patent No. 11,025,885, which is a continuation of Application No. 15/276,532, filed on Sept. 26, 2016 and issued as U.S. Patent No. 9,992,477. *Id.* at code (63). The '381 patent claims priority to Provisional Application No. 62/232,222 filed on Sept. 24, 2015. *Id.* at code (60).

The '381 patent relates to optical systems “for collecting distance information in the field of optical sensors.” *Id.* at 1:29–31. The optical systems of the '381 patent may include “lenses for collecting photons from a field,” “optical filters that reject normally incident light outside of the

¹ “LIDAR” or “LiDAR” stands for light (imaging,) detection and ranging. See Pet. 1; Prelim. Resp. 1.

operating wavelength, and pixels that detect incident photons.” *Id.* at code (57).

Figure 1 of the '381 patent is shown below.

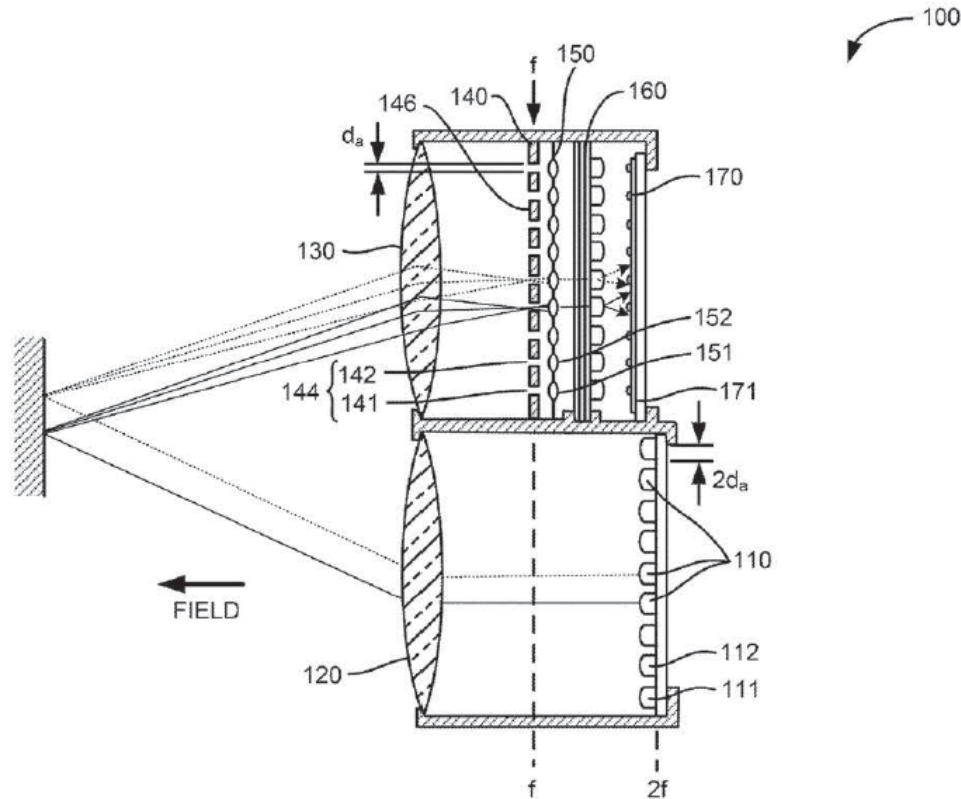


FIG. 1

Figure 1, above, is a schematic representation of a one-dimensional optical system for collecting distance information within a field. *Id.* at 2:5–7.

Figure 1 contains “a set of illumination sources 110,” each configured to output a beam “toward a discrete spot in the field.” *Id.* at 2:7–11. Figure 1 also contains a “bulk imaging optic 130” and “bulk transmitting optic.” *Id.* at 2:11–12, 5:34–36.

The optical system includes an “aperture layer 140,” which contains “a set of apertures 144” and a “stop region 146 around the set of apertures

144.” *Id.* at 2:12–17. Each aperture defines discrete fields of view ahead of the bulk imaging optic 130, which are described by the ’381 patent as “non-overlapping fields of view beyond a threshold distance from the system.”

Id. at 2:54–57. The illumination sources “project discrete illuminating beams at an operating wavelength into (and substantially only into) the fields of view defined by the apertures.” *Id.* at 2:57–60.

The ’381 patent further describes an “optical filter 160,” a “set of pixels 170” adjacent to the filter, and “a diffuser 180 interposed between the optical filter 160 and the set of pixels 170.” *Id.* at 2:27–35. The optical filter is “configured to pass light rays at the operating wavelength.” *Id.* at 2:27–29. The diffuser is “configured to spread collimated light” across a set of subpixels of a “pixel in the set of pixels 170.” *Id.* at 2:35–38. The ’381 patent explains that the pixels may include “an array of single-photon avalanche diode detectors” (“SPADs”). *Id.* at 9:7–9.

The ’381 patent’s optical system “collects three-dimensional distance data.” *Id.* at 2:40–44. The system reconstructs a virtual three-dimensional volume “based on recorded times between transmission of illuminating beams” and “detection of photons.” *Id.* at 2:44–49.

D. The Challenged Claims

Petitioner challenges claims 1–3, 5–8, and 10–17. Pet. 1. Of the challenged claims, claims 1 and 14 are independent. Claim 1, reproduced below with Petitioner’s identifiers for the claim limitations, is illustrative of the claimed subject matter.

[1(a)] An optical system for collecting distance information, the optical system comprising:

[1(b)] a bulk transmitting optic;

- [1(c)] a plurality of optical emitters arranged behind the bulk transmitting optic and configured to output electromagnetic radiation of an operating wavelength through the bulk transmitting optic into a field external to the optical system according to an illumination pattern that comprises a plurality of non-overlapping emission regions;
- [1(d)] a bulk imaging optic disposed adjacent to the bulk transmitting optic;
- [1(e)] a plurality of pixels arranged behind the bulk imaging optic, wherein each pixel in the plurality of pixels has a field of view coincident with an emission region of a corresponding optical emitter in the plurality of optical emitters and each pixel comprises a plurality of single photon avalanche diodes (SPADs) operable to detect photons emitted from its corresponding optical emitter and received through the bulk imaging optic after being reflected from surfaces within the field; and
- [1(f)] an optical filter disposed in an optical path of the plurality of pixels, the optical filter configured to allow a set of wavelengths of electromagnetic radiation, including the operating wavelength, to pass through the optical filter while blocking electromagnetic radiation outside the set of wavelengths from reaching the plurality of pixels.

Ex. 1001, 16:61–17:21.

E. Evidence

Petitioner submits the following evidence:

Evidence	Exhibit No.
Declaration of James F. Shanley, Ph.D.	1003
Retterath et al., US 10,203,399 B2 (issued Feb. 12, 2019, filed Nov. 12, 2013) (“Retterath”)	1005
Borowski, US 2013/0300838 A1 (published Nov. 14, 2013, filed Dec. 21, 2011) (“Borowski”)	1006
Hipp, US 7,787,105 B2 (issued Aug. 31, 2010, filed Sept.	1007

Evidence	Exhibit No.
13, 2007) (“Hipp”)	
Weimer et al., US 8,736,818 B2 (issued May 27, 2014, filed Aug. 16, 2010) (“Weimer”)	1008
Imai, US 2016/0274223 A1 (published Sept. 22, 2016, filed Mar. 14, 2016) (“Imai”)	1009
Azuma et al., JP 2015-78953 (published Apr. 23, 2015, filed Oct. 18, 2013) (certified translation of Ex. 1010) (“Higashi”)	1011
Grzesik, US 2017/0040368 A1 (published Feb. 9, 2017, filed Apr. 14, 2015) (“Grzesik”)	1012
Pacala et al., US 2014/0211194 A1 (published July 31, 2014, filed Jan. 27, 2014) (“Pacala”)	1013

F. Asserted Grounds

Petitioner asserts the following grounds of unpatentability:

Claim(s) Challenged	35 U.S.C. §²	Reference(s)/Basis
1–3, 6–8, 10, 11, 14–17	103	Retterath, Borowski
6–8, 17	103	Retterath, Borowski, Hipp
1–3, 5–8, 10–13	103	Retterath, Borowski, Pacala
1–3, 6–8, 10–17	103	Retterath, Borowski, Weimer
1–3, 5–8, 10–13	103	Retterath, Borowski, Weimer, Pacala
6–8, 17	103	Retterath, Borowski, Weimer, Hipp
6–8, 17	103	Retterath, Borowski, Weimer, Hipp, Pacala
1–3, 10–16	103	Imai, Higashi
6–8, 17	103	Imai, Higashi, Grzesik

² The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. §§ 102, 103. Because the ’381 patent has an effective filing date after the effective date of the applicable AIA amendment, we refer to the AIA version of § 103.

Claim(s) Challenged	35 U.S.C. §²	Reference(s)/Basis
5	103	Imai, Higashi, Pacala

III. PATENTABILITY ANALYSIS

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

“In an [*inter partes* review], the petitioner has the burden from the onset 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) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics*,

³ Neither party relies on any objective evidence of obviousness or nonobviousness at this stage of the proceeding.

Inc., 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

We organize our patentability analysis into four sections. First, we address the level of ordinary skill in the art. Second, we address claim construction. Third, we provide an overview of the asserted references. And fourth, taking account of the information presented, we consider whether the Petition satisfies the threshold requirement for instituting an *inter partes* review under 35 U.S.C. § 314(a).

A. Level of Ordinary Skill in the Art

We consider the asserted grounds of unpatentability in view of the understanding of a person of ordinary skill in the art. In assessing the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quoting *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986)). “[O]ne or more factors may predominate.” *Id.*

Petitioner contends that a person of ordinary skill in the art would have “had an undergraduate degree in mechanical or electrical engineering or physics, plus 2-3 years of experience in LiDAR design.” Pet. 3.

Patent Owner “adopts Petitioner’s definition of a [person of ordinary skill in the art (POSITA)] as having an undergraduate degree in mechanical or electrical engineering or physics and two to three years of experience in LiDAR design” for purposes of its Preliminary Response. Prelim. Resp. 4.

Accordingly, for purposes of this Decision, we apply Petitioner’s unopposed definition of a person of ordinary skill in the art.

B. Claim Construction

We consider the proper construction of the claims. In interpreting the claims of the ’381 patent, we “us[e] the same claim construction standard that would be used to construe the claim[s] in a civil action under 35 U.S.C. [§] 282(b).” *See* 37 C.F.R. § 42.100(b) (2020). The claim construction standard includes construing claims in accordance with the ordinary and customary meaning of such claims as would have been understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. *See id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (*en banc*).

Petitioner contends that the parties exchanged preliminary constructions in a co-pending ITC investigation involving the ’381 patent; however, “no formal claim constructions are necessary.” Pet. 4. Petitioner further argues that “the prior art renders the challenged claims obvious under the construction advanced by both parties” in the ITC investigation. *Id.*

Patent Owner argues that Petitioner “proposed the following construction for the term ‘field of view’” in the ITC investigation: “detection area defined by an aperture or lens tube.” Prelim. Resp. 19–20 (citing Ex. 2002, 2). Patent Owner notes that Petitioner relied, in the (now terminated) ITC proceeding, on various pieces of extrinsic evidence to support this construction. *See id.* at 20–22 (citing Ex. 2004, 282; Ex. 2005, 51, 54–56, 70; Ex. 2006, 28). However, Patent Owner does not appear to argue that this construction is correct or that we should adopt it. *See id.* at 19–22. We decline to adopt a construction at institution that neither party actually

advocates. At this stage of the proceeding, we note that some of the definitions that were cited by Petitioner in the ITC proceeding are broader than the proposed construction. *See* Ex. 2004, 282 (defining “field of view” as “[t]he maximum angle of view that can be seen through a lens or optical instrument”). Thus, it appears that Petitioner’s ITC construction incorporates additional limitations that, at this stage of the proceeding, we are not persuaded are correct. Thus, for purposes of institution, we simply apply the plain and ordinary meaning of the term. If either of the parties believe that a construction of this term is necessary, they should address the proper construction during trial.

C. Prior Art

Before turning to Petitioner’s asserted grounds of unpatentability, we provide brief summaries of the asserted references.

1. Retterath

Retterath is titled “Methods and Apparatus for Array Based LIDAR Systems with Reduced Interference.” Ex. 1005, code (54). Retterath relates to “non-scanning LiDAR systems using an array of emitter/detector sets to cover a given field of view.” *Id.* at 1:9–12. Retterath explains that “[s]canning LiDAR units typically utilize a single laser, or multiple lasers, all operating at the same wavelength,” and that care must be taken so reflected light is received by photoreceptors “from the desired emitted source.” *Id.* at 2:9–12.

Figure 4 of Retterath is shown below.

Figure 4

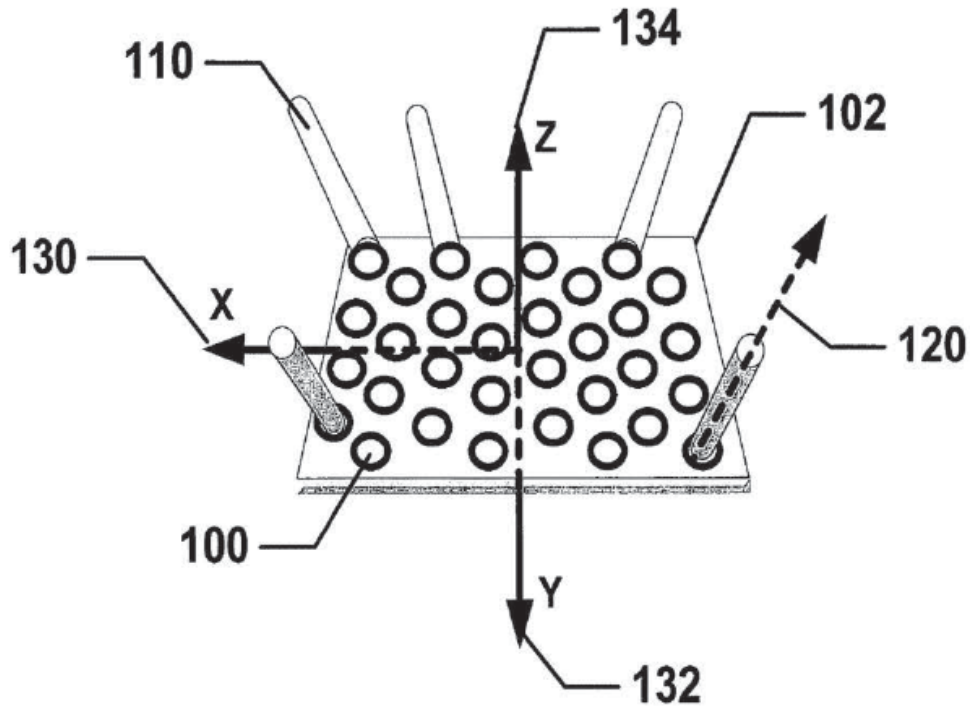


Figure 4, above, illustrates a perspective view of an emitter unit 102. *Id.* at 7:41–42. The emitter unit contains “emitter elements 100 arranged symmetrically about a top surface.” *Id.* at 7:42–45. Each emitter emits a beam of light 110 directed by a directional lens along a desired emitter vector 120. *Id.* at 7:45–46, 8:39–40.

Figure 8 of Retterath is shown below.

Figure 8

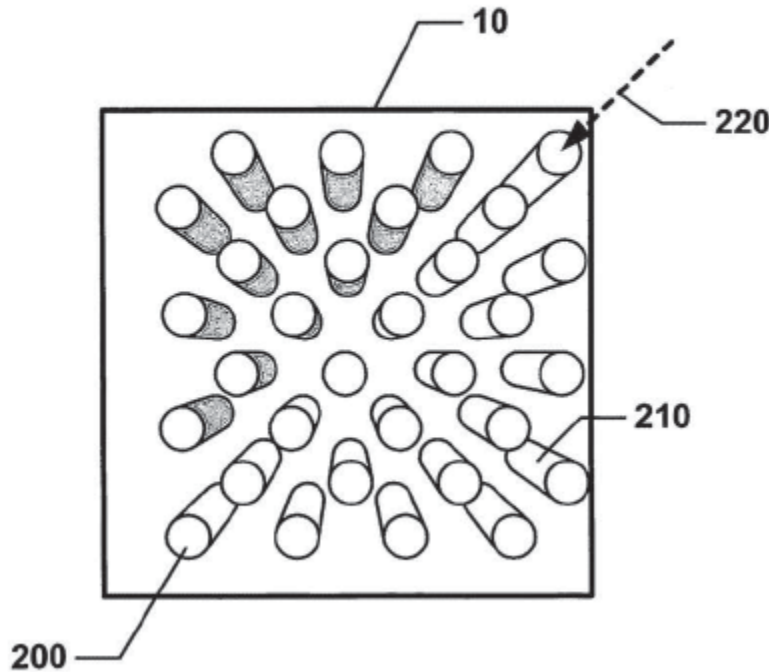


Figure 8 of Retterath illustrates a top view of detector elements 200 on the “emitter/detector array 10 surface.” *Id.* at 9:53–55. “Light 210 is received at each detector of detector elements 200.” *Id.* at 9:55–56. Each detector, according to Retterath, “has an optimal receiver detector vector (coincident axis) 220 along which the maximum optical energy will be transferred.” *Id.* at 9:56–59.

Retterath also describes the potential for “crosstalk among pulsed-laser LiDAR units.” *Id.* at 2:17–20. The crosstalk interference, according to Retterath, “can be reduced by utilizing time division synchronization between” LIDAR units “wherein the transmit times of one unit do not overlap with the transmit times of other units.” *Id.* at 2:21–24.

Figure 12 of Retterath is shown below.

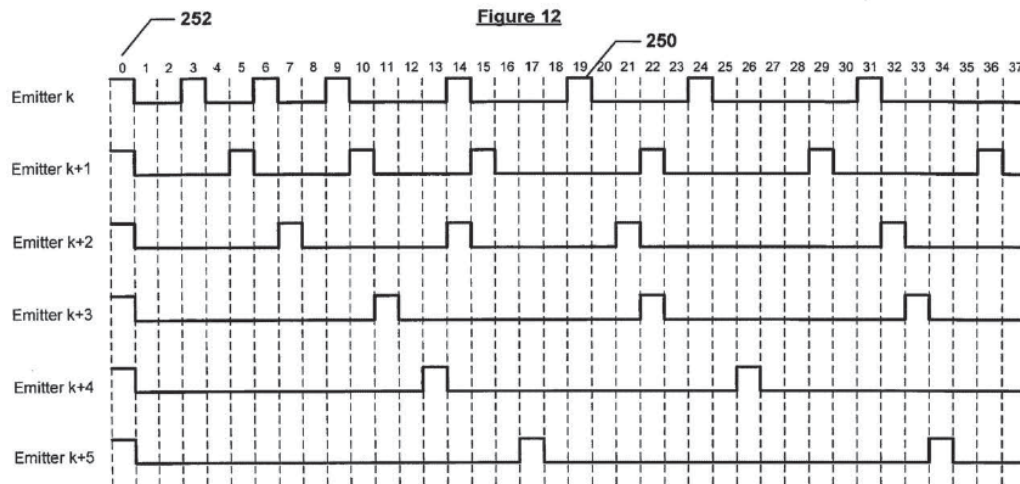


Figure 12, above, illustrates a pulse timing sequence for multiple emitters. *Id.* at 4:61–62. Figure 12 shows the energizing level “for six emitters that have coincident axes similar to one-another.” *Id.* at 11:26–30. The emitter levels “are shown for a time period 252 ranging from 0 through 37.” *Id.* at 11:31–33. “To accommodate detection of pulse sequences from a detector’s paired emitter the pulse sequences shown in FIG. 12 are sparsely populated.” *Id.* at 11:35–37.

2. *Borowski*

Borowski is titled “Methods and Devices for Generating a Representation of a 3D Scene at Very High Speed.” Ex. 1006, code (54). Borowski relates to “a 3D landscape real-time imager.” *Id.* at code (57). Borowski’s invention “is based on SPAD (Single Photon Avalanche Diodes) devices in which a single photon can generate an electrical signal when it impinges on a photosensitive layer.” *Id.* ¶ 2. A goal of Borowski’s invention is to “provide an imaging technique capable of generating a precise image of complex scenes in a faster way than with conventional techniques.” *Id.* ¶ 3.

3. *Imai*

Imai is titled “Object Detecting Device, Sensing Device, and Mobile Object Device.” Ex. 1009, code (54). Imai relates to an object detecting device “which detects whether there is an object and detects a distance and the like to the object.” *Id.* ¶ 3. According to Imai, “it is difficult to improve resolution in a detection range in a sub-scanning direction” while also “inhibiting the increase of detection data obtaining time” and decreasing “a detection distance.” *Id.* ¶ 6.

Figure 2A of Imai is shown below.

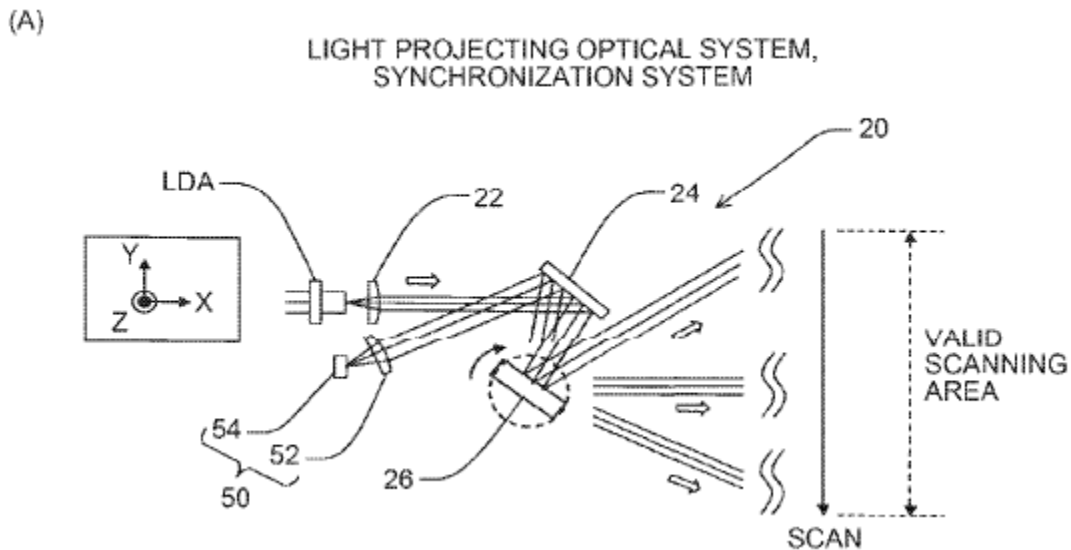


Figure 2A, above, illustrates a light projecting optical system and synchronization system. *Id.* ¶ 11. Imai’s optical system includes a laser diode array (LDA), “a coupling lens 22 arranged on an optical path of the light,” a reflecting mirror 24, and a rotary mirror 26. *Id.* ¶ 32. Light is emitted from the LDA, and is shaped into a predetermined profile by the coupling lens 26, “and then reflected by the reflecting mirror 24 to be deflected about a Z-axis by the rotary mirror 26.” *Id.* ¶ 33.

Figure 2B of Imai is shown below and depicts a light receiving optical system.

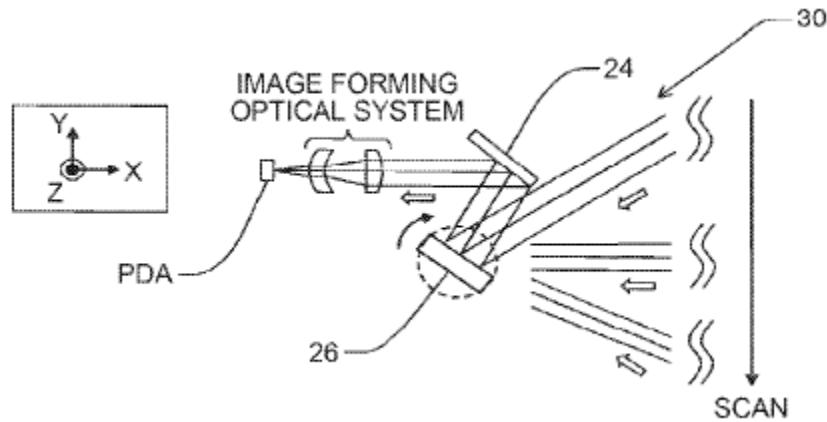


Figure 2B, above, illustrates a light receiving optical system. *Id.* ¶ 11. The light receiving optical system also includes the “rotary mirror 26” and “reflecting mirror 24.” *Id.* ¶ 37. The rotary mirror 26 “reflects the light projected from the light projecting optical system 20” and the reflecting mirror 24 “reflects the light from the rotary mirror 26” “to form an image of the light on a PDA (photo diode array) as an optical detector.” *Id.*

4. Higashi

Higashi is titled “Radar [D]evice.” Ex. 1011, code (54). Higashi relates to “a radar device that acquires information about an object that reflects light by irradiating light and receiving the reflected light.” *Id.* ¶ 1. According to Higashi, conventional radar devices employ a coaxial optical system. *Id.* ¶ 2. In coaxial optical systems, “it is difficult to measure the distance from the radar device to a nearby object due to the influence of internally scattered light.” *Id.* ¶ 3.

Higashi describes a radar device that includes “a light source 2, a one-dimensional scanner 3, a scanning control unit 4, a light detection unit 5, and a processing unit 6.” *Id.* ¶ 15.

D. Alleged Ground of Unpatentability Over Retterath and Borowski

Petitioner contends that claims 1–3, 6–8, 10, 11, and 14–17 of the '381 patent are unpatentable under 35 U.S.C. § 103 as obvious over Retterath and Borowski. Pet. 9–38. Patent Owner offers counterarguments. Prelim. Resp. 26–40.

1. Motivation to Combine Retterath and Borowski

Petitioner argues that a person of ordinary skill in the art would have been motivated to combine Retterath and Borowski with predictable results. Pet. 13–19. Petitioner asserts that a person of ordinary skill in the art would have recognized that following Borowski's suggestions of implementing each pixel in Retterath's detector array as a "macro-cell" having multiple SPADs would have "the predictable benefits . . . for smart averaging in time and space, enhancing image depth and acquisition speed." *Id.* at 14. Petitioner contends that the combined teachings of Retterath and Borowski would "enhance the signal to noise ratio of Retterath's detectors, and thereby improve system performance." *Id.* at 15 (citing Ex. 1003 ¶ 134). Petitioner argues that a person of ordinary skill in the art "would have been prompted to implement Retterath's LiDAR system using multiple SPADs per pixel (as suggested by Borowski) to achieve the performance advantages of SPADs known before September 2015, such as a high data-rate output in combination with low-power operation (and with the high signal-to-noise ratio described above)." *Id.* at 16 (citing Ex. 1003 ¶ 135). Petitioner further contends that a person of ordinary skill in the art would have been motivated "to combine Retterath and Borowski to utilize multiple SPADs for each pixel to improve detection capability and accuracy." *Id.* Petitioner also argues that a person of ordinary skill in the art "would have been prompted

to implement the Retterath-Borowski combination due to Borowski's express suggestion for 'an improved trade-off between image depth resolution and fast data acquisition for the detection of movements'. . . by 'local averaging between adjacent detectors to optimize the tradeoff between speed and sensitivity.'" *Id.* at 17 (citing Ex. 1006 ¶¶ 3, 26, 83, 136–138, 220, 221, 222, 233, 237, 249, 258, 267–271; Ex. 1003 ¶ 137). Finally, Petitioner argues that a person of ordinary skill in the art "would have found it obvious to combine Retterath and Borowski because doing so was the application of known techniques (Borowski's suggestion for multi-SPAD detectors) to a known system (Retterath's LiDAR system that utilized an array of detectors) ready for improvement to yield predictable results." *Id.* at 17–18 (citing Ex. 1003 ¶ 138).

At this time, Patent Owner does not dispute that there was a motivation to combine Retterrath and Borowski. Accordingly, we find that Petitioner has shown a reasonable likelihood of prevailing in showing that there is a motivation to combine these references.

2. *Claim 1*

a) *1(a): An optical system for collecting distance information, the optical system comprising*

Petitioner submits that the combination of Retterath and Borowski accounts for the preamble, to the extent that it is limiting. *See* Pet. 19 (citing Ex. 1003 ¶¶ 142–144). In particular, Petitioner notes that Retterath describes "LiDAR (light detection and ranging) systems" that "use an array of emitter/detector sets to cover a given field of view where each emitter/detector set is configured to receive reflected light energy that is on a given coincident axis unique for that emitter/detector set." *Id.* (citing Ex. 1005, 2:66–3:21, 3:58–61, 7:17–40). Petitioner identifies similar

disclosure in Borowski. *Id.* (citing Ex. 1006 ¶ 31, code (57)). At this time, Patent Owner does not dispute that the combination discloses the preamble. At this stage of the proceeding, based on Petitioner’s arguments and evidence, we find that, to the extent the preamble is limiting, Petitioner has shown sufficiently that the combination discloses the preamble.

b) 1(b): a bulk transmitting optic

Petitioner argues that the Retterath-Borowski combination provides a bulk transmitting optic, as claimed. Pet. 19 (citing Ex. 1003 ¶ 145). Petitioner asserts that “Retterath provides a macro lens, such as macro lens 80 (FIG. 6).” *Id.* (citing Ex. 1005, 9:12–28, 4:4–10). In particular, Petitioner asserts that Retterath indicates that “[t]he macro lens 80 is configured to diverge to produce a plurality of beams 82 along a multitude of emitter vectors (coincident axes) 120 throughout the device’s field of view.” *Id.* at 20 (citing Ex. 1005, 9:12–20). At this time, Patent Owner does not dispute that Retterath-Borowski discloses this limitation. At this stage of the proceeding, based on Petitioner’s arguments and evidence, we find that Petitioner has shown sufficiently that Retterath-Borowski discloses this limitation.

c) 1(c): a plurality of optical emitters arranged behind the bulk transmitting optic and configured to output electromagnetic radiation of an operating wavelength through the bulk transmitting optic into a field external to the optical system according to an illumination pattern that comprises a plurality of non-overlapping emission regions

Petitioner contends that the Retterrath-Borowski combination accounts for this limitation. *See* Pet. 20–24. Petitioner contends that Retterath “describes

an array of emitter elements 100” arranged “behind the macro lens 80” that “output converging light beams 84.” *Id.* at 20–22 (citing Ex. 1005, 6:8–15, 9:12–20, 19:3–54, Figs. 6, 11b; Ex. 1003 ¶¶ 147–148). Petitioner further contends that Retterath’s emitter elements “output laser beams according to an illumination pattern comprising a plurality of non-overlapping emission regions.” *Id.* at 22–24 (citing Ex. 1005, 3:1–4:34, 6:8–10:3, Figs. 4, 6, 7, 12–17, 18a; Ex. 1003 ¶¶ 148–152). Pointing to Figure 7, Petitioner notes that Retterath explains that each emitter has an emission region defined by round spot 94 of emitted laser beam.

Figure 7

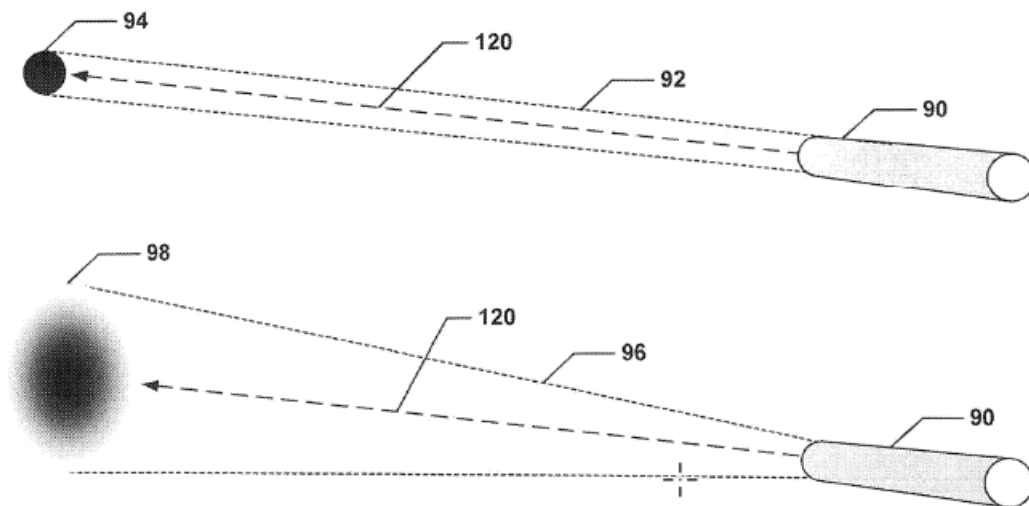


Figure 7 of Retterath is reproduced below. Figure 7 shows a beam profile for multiple emitters. Ex. 1005, 9:29–30. Retterath explains that “[t]he top diagram [of Fig. 7, reproduced above,] shows a perfectly collimated beam 92 that produced a round spot 94 on the surface of the reflecting object.” *Id.* at 9:29–36. Petitioner submits that Retterath explains that collimated beams 92 are preferred over diverging beams 96 because “a smaller round spot 94

size will result in fewer locations within the device field of view being illuminated” and “a smaller round spot 94 will generally reduce or remove crosstalk with detectors that are near the on-coincident axis matched detector for this emitter.” Pet. 22–23 (citing Ex. 1005, 9:35–44; Ex. 1003 ¶ 149). Petitioner identifies Figure 18a, reproduced below, as supporting its contentions.

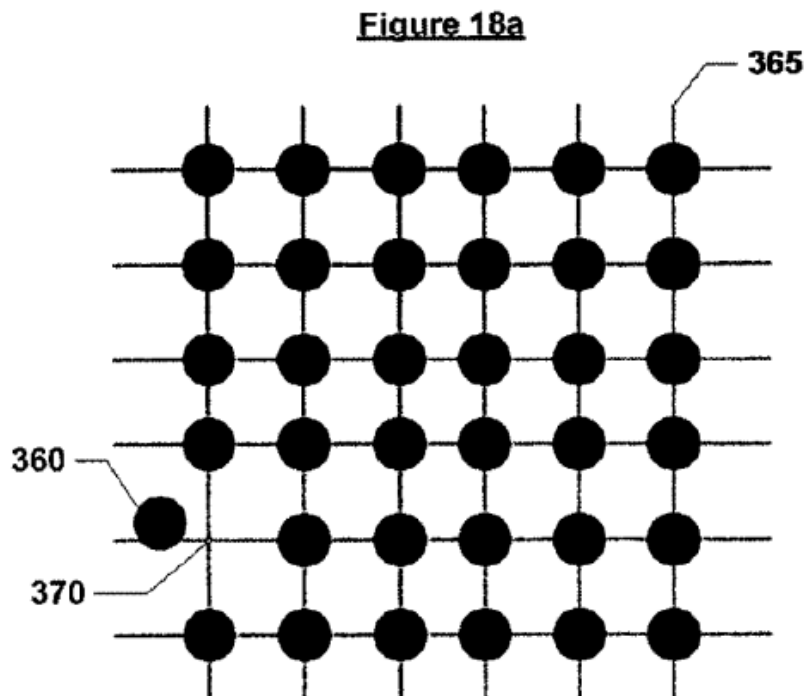


Figure 18a illustrates a pattern utilized for emitted ray angle adjustments. Ex. 1005, 5:8–9. Petitioner submits that “Retterath explains ‘an ideal location 370’ for each beam spot lies at the intersection of two grid lines, such that the overall illumination pattern has a plurality of non-overlapping emission regions.” Pet. 23 (citing Ex. 1005, 9:35–44; Ex. 1003 ¶ 150). Petitioner argues that Figures 4 and 6 of Retterath provide “examples of illumination patterns in which each beam from an individual emitter is output along a unique emission vector 120 and is non-overlapping with the

emission vectors of all other beams.” *Id.* at 23–24 (citing Ex. 1005, 7:63–8:16, 9:12–20, Figs. 4, 6; Ex. 1003 ¶ 151).

Patent Owner argues that Retterath “provides ample teachings indicating that emission regions of its disclosed emitters *can* and *do* overlap.” Prelim. Resp. 34–38 (citing Ex. 1005, 3:10–21, 9:29–52, 11:26–16:56, 17:11–13, Figs. 4, 6, 7, 12–16, 18a). Patent Owner contends that “Retterath teaches that an emission region like spot 94 in Figure 7 is only advantageous for ‘prevision LiDAR systems’—not for applications.” *Id.* at 35 (citing Ex. 1005, 9:35–36). Patent Owner argues that “Retterath’s ideal emitter regions assume the use of ‘precision’ emitter regions.” *Id.* at 35–36. Patent Owner contends that “Retterath’s disclosures teach away from the use of its system in a ‘precision LiDAR’ context that might use an ‘ideal’ set of emission regions like those shown in Figure 18a.” *Id.* at 36. Patent Owner argues that “[g]iven Retterath’s disclosures regarding pulse timing sequences, it is unclear why a [person of ordinary skill in the art] would have considered it important to use the ‘precision LiDAR system’ beam 94 shown in Figure 7 and not the ‘more typical’ beam 98.” *Id.* at 37. Patent Owner asserts that “it is unclear why a POSITA would have considered it necessary in Retterath’s system to ensure non-overlapping emission regions for each of the plurality of emitters.” *Id.* at 38. Patent Owner argues that “Retterath’s unique pulse timing sequences for different emitter/detector channels ensure that a detector detects light from its paired emitter even when there is interference from neighboring channels.” *Id.* Thus, Patent Owner submits that “instead of using ‘precision’ hardware that might be more costly or have more demanding power requirements, a [person of ordinary skill in the art] would have been motivated based on

Retterath's disclosures to use 'more typical' hardware that created overlap in the emission regions of neighboring emitters" *Id.*

On this record, we find that Petitioner has shown sufficiently that Retterath-Borowski accounts for this limitation. "A reference may be read for all that it teaches, including uses beyond its primary purpose." *In re Mouttet*, 686 F.3d 1322, 1331 (Fed. Cir. 2012). Although Retterath does not exclusively operate in "precision" mode, we find that Petitioner has shown sufficiently that Retterath discloses "non-overlapping emission regions," at least in that mode. "[C]ombinations of prior art that sometimes meet the claim elements are sufficient to show obviousness." *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1002 (Fed. Cir. 2016). Thus, Patent Owner's arguments that Retterath may have other modes that might not meet this limitation are not persuasive. Patent Owner is free to develop the record further on whether these additional modes may teach away from the combination during the trial.

d) 1(d): a bulk imaging optic disposed adjacent to the bulk transmitting optic

Petitioner argues that the Retterath-Borowski combination provides a bulk imaging optic disposed adjacent to the bulk transmitting optic. *See* Pet. 24 (citing Ex. 1003 ¶ 153). Petitioner submits that "Retterath describes a bulk imaging optic provided by a 'macro lens 230,' and the detector elements 200 are positioned behind macro lens 230." *Id.* (citing Ex. 1005, Fig. 11b, 6:8–15;10:23–30). Petitioner contends that "[t]he bulk imaging optic (i.e., macro lens 230) is disposed adjacent to the bulk transmitting optic (i.e., macro lens 80)." *Id.* (citing Ex. 1003 ¶ 155). Petitioner argues that "[f]or example, as shown in FIG. 11b [of Retterath], the detector array 200 and emitter array 100 are formed as diagonally neighboring sections 246,

248 (each with corresponding electronics 244).” *Id.* at 25. Petitioner further argues that “[t]he emitter array 100 is adjacent to the detector array 200, next to one another in quadrants shown in FIG. 11b, thereby providing the macro lens 230 (located in front of the detector array 200) at a location adjacent to the macro lens 80 (located in front of the emitter array 100).” *Id.* at 26. At this time, Patent Owner does not dispute that Retterath-Borowski discloses this limitation. At this stage of the proceeding, based on Petitioner’s arguments and evidence, we find that Petitioner has shown sufficiently that Retterath-Borowski discloses this limitation.

- e) *1(e): a plurality of pixels arranged behind the bulk imaging optic, wherein each pixel in the plurality of pixels has a field of view coincident with an emission region of a corresponding optical emitter in the plurality of optical emitters and each pixel comprises a plurality of single photon avalanche diodes (SPADs) operable to detect photons emitted from its corresponding optical emitter and received through the bulk imaging optic after being reflected from surfaces within the field; and*

Petitioner contends that Retterath’s detectors each include “photoreceptor 224 that comprises a ‘pixel’ because it detects incident light received through bulk optic 230 for a specific location in the array.” Pet. 26 (citing Ex. 1005, 9:52–10:22, Figs. 9–10). Petitioner argues that “[e]ach pixel in the plurality of pixels has a field of view coincident with an emission region of a corresponding optical emitter.” *Id.* at 26–27. Petitioner asserts that Figure 8 of Retterath “illustrates a [field of view] arrangement of Retterath’s detector in which each detector 200—and its photoreceptor 224—has a field-of-view over which it receives light beams 210, each of which is centered along a unique vector 220.” *Id.* at 27 (citing Ex. 1005,

9:56–59, 9:53–10:31, Figs. 8, 10). Petitioner argues that “each pixel in the Retterath-Borowski combination is operable to detect photons emitted from its corresponding optical emitted and received through the bulk imaging optic after being reflected from surfaces within the field.” *Id.* at 28 (citing Ex. 1005, 6:23–28, 8:47–49, Figs. 6, 10; Ex. 1003 ¶ 163). Petitioner further contends that Borowski suggests using a “multi-SPAD detector array,” which in the combination would be used to implement the array of detector 200 on Retterath’s LiDAR system, “such that each detector array is a pixel comprising a plurality of SPADs.” *Id.* at 29 (citing Ex. 1005, 3:5–9, 6:23–28, 7:41–8:14, 8:20–40, 9:54–10:31, Figs. 4, 5A, 6, 8, 10, code (57); Ex. 1006 ¶¶ 3, 14, 27, 44, 154–157, 233, 323, Figs. 1, 5, 12, 27, code (57); Ex. 1003 ¶¶ 164–165).

Patent Owner argues that Petitioner does not present any arguments, evidence, or explanation “of how Retterath satisfies the requirements of Petitioner’s proposed ITC construction for ‘field of view.’” Prelim. Resp. 26–32. However, as we explained above, neither Petitioner nor Patent Owner actually advocates for Petitioner’s proposed ITC construction in this proceeding. Moreover, based on the evidence and argument presented so far, we decline to adopt Petitioner’s proposed ITC construction at this time. Thus, on this record, we do not find Patent Owner’s arguments persuasive. At this stage of the proceeding, based on Petitioner’s arguments and evidence, we find that Petitioner has shown sufficiently that Retterath-Borowski accounts for this limitation.

- f) *(f): an optical filter disposed in an optical path of the plurality of pixels, the optical filter configured to allow a set of wavelengths of electromagnetic radiation, including the operating wavelength, to pass through the optical filter while blocking*

*electromagnetic radiation outside the set of
wavelengths from reaching the plurality of pixels*

Petitioner contends that the Retterath-Borowski combination discloses Element 1(f). Pet. 29. Petitioner argues that Retterath describes an optical filter provided by a bandpass filter 226 positioned in the optical path of each pixel 224. *Id.* (citing Ex. 1005, Figs. 9–10, 10:4–27). Petitioner asserts that “bandpass filter 226 is an optical filter that allows a set of wavelengths of electromagnetic radiation (e.g., encompassing the operating wavelength of the Retterath-Borowski combination) to pass through the macro lens 230 and onto the pixels 224, while blocking electromagnetic radiation outside the set of wavelengths from reaching the pixel 224s.” *Id.* (citing Ex. 1005, 5:26–28; Ex. 1003 ¶ 166). At this time, Patent Owner does not dispute that Retterath-Borowski discloses this limitation. At this stage of the proceeding, based on Petitioner’s arguments and evidence, we find that Petitioner has shown sufficiently that Retterath-Borowski discloses this limitation.

3. *Claims 2, 3, 6–8, 10, 11, and 14–17*

Patent Owner does not raise any other separate arguments regarding claims 2, 3, 6–8, 10, 11, and 14–17 other than those we have considered above with respect to claim 1.⁴ *See* Prelim. Resp. 22–26. We have reviewed Petitioner’s contentions regarding claims 2, 3, 6–8, 10, 11, and 14–17, and determine that they show a reasonable likelihood Petitioner will prevail with

⁴ Patent Owner does make arguments in the context of claim 1 that could apply to claim 6. *See* Prelim. Resp. 30–32. However, Patent Owner does not, at this time, appear to direct those arguments specifically at claim 6. Patent Owner is free to raise those arguments again and present additional evidence regarding them in its Patent Owner Response.

respect to obviousness of claims 2, 3, 6–8, 10, 11, and 14–17 over Retterath and Borowski.

E. Remaining Grounds

Petitioner contends that claims 6–8 and 17 of the '381 patent are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Retterath, Borowski, and Hipp and claims 1–3, 5–8, and 10–13 of the '381 patent are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Retterath, Borowski, and Pacala. *See* Pet. 38–48. Petitioner also raises similar grounds also adding Weimer. *See id.* at 1–2. In particular, Petitioner alleges that claims 1–3, 6–8, and 10–17 of the '381 patent are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Retterath, Borowski, and Weimer, claims 1–3, 5–8, and 10–13 of the '381 patent are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Retterath, Borowski, Weimer, and Pacala, claims 6–8 and 17 of the '381 patent are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Retterath, Borowski, Weimer, and Hipp, and claims 6–8 and 17 of the '381 patent are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Retterath, Borowski, Weimer, Hipp, and Pacala. *Id.* at 54–55. Petitioner also contends that claims 1–3 and 10–16 are unpatentable over the combination of Imai and Higashi, claims 6–8 and 17 are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Imai, Higashi, and Grzesik, and claim 5 is unpatentable under 35 U.S.C. § 103 as obvious over the combination of Imai, Higashi, and Pacala. *Id.* at 55–83. Patent Owner opposes. Prelim. Resp. 38–49. As we preliminarily conclude that Petitioner demonstrates a reasonable likelihood of prevailing on its challenge to claims 1–3, 6–8, 10, 11, and 14–

17 based on obviousness over Retterath and Borowski, we institute review on all challenged claims on all grounds set forth in the Petition, including Petitioner’s other obviousness challenges. *See SAS*, 138 S. Ct. at 1354; *PGS*, 891 F.3d at 1360. However, we offer some preliminary thoughts on Patent Owner’s arguments regarding these remaining grounds.

For the Retterath grounds that additionally include Weimer, Patent Owner argues that Retterath teaches away from a combination with Weimer. *See Prelim. Resp.* 38–40. In particular, Patent Owner argues that Retterath teaches away from “flash LIDAR systems” like Weimer. *Id.* On this record, we do not find this argument persuasive. Petitioner does not seek to incorporate “flash LIDAR” wholesale, but only relies on Weimer for its teachings regarding “VCSEL^[5] emitters and to utilize pixels (e.g., SPAD macro-cells), each with a non-overlapping field-of-view beyond a threshold distance and coincident alignment with a corresponding illumination beam from the VCSEL emitter.” *Pet.* 50. At this stage, even assuming Patent Owner is correct that Retterath criticizes “flash LIDAR,” it is not clear why a person of ordinary skill in the art would understand Retterath to criticize incorporating the particular teaching that Petitioner is relying upon.

As for the Imai-based grounds, Patent Owner offers two main arguments. *See Prelim. Resp.* 40–49. First, Patent Owner argues that Petitioner fails to show that Imai teaches the claimed “field of view” under Petitioner’s proposed construction from the (now terminated) ITC investigation. *See id.* 40–43. Second, Patent Owner argues that Imai fails to teach “a plurality of non-overlapping emission regions,” as claimed. *See id.*

⁵ “VCSEL” stands for “vertical-cavity surface-emitting lasers.” *See Ex. 1001*, 18:5–7.

at 43–49. With respect to Patent Owner’s “field of view” arguments, we decline to adopt Petitioner’s proposed ITC construction at this time, as explained above. Thus, because we do not adopt this construction, we do not find Patent Owner’s arguments based on that construction to be persuasive. As for Patent Owner’s “non-overlapping emission regions” arguments, we do not find them to be persuasive at this time. We note they appear to rely on a number of contentions about the prior art that are supported only by attorney argument, and lack sufficient evidentiary support to be entitled to much weight. Thus, on the current record, we do not find them to be persuasive. Patent Owner is free to further develop the record on this issue during the trial.

IV. CONCLUSION

For the foregoing reasons, we conclude that the information presented in the Petition establishes a reasonable likelihood that Petitioner would prevail in showing that at least one of claims 1–3, 5–8, and 10–17 of the ’381 patent would have been unpatentable. At this preliminary stage, we have not made a final determination as to the patentability of the challenged claims or any underlying factual and legal issues.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–3, 5–8, and 10–17 of the ’381 patent is hereby instituted on all grounds of unpatentability set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial commencing on the entry date of this decision.

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