

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HESAI TECHNOLOGY CO., LTD.
Petitioner

v.

OUSTER, INC.
Patent Owner

Case No. IPR2023-01421
U.S. Patent No. 11,175,405

PATENT OWNER SUR-REPLY

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<i>Yita LLC v. MacNeil IP LLC</i> , 69 F.4th 1356 (Fed. Cir. 2023)	19

EXHIBIT LIST

EXH. NO.	DESCRIPTION
2001	Respondent's Proposed Claim Construction dated June 28, 2023, filed in ITC Inv. No. 337-TA-1363
2002	Respondent's Proposed List of <i>Markman</i> Exhibits dated July 13, 2023, filed in ITC Inv. No. 337-TA-1363
2003	Excerpts from <i>Fluorescence Microscopy, Principles to Biological Apps</i> (2d ed. 2017)
2004	Excerpts from Merriam-Webster's Collegiate Dictionary (11th ed. 2014)
2005	Respondent's Proposed List of Terms to be Construed dated June 21, 2023, filed in ITC Inv. No. 337-TA-1363
2006	Excerpts from Rudolf F. Graf, <i>Modern Dictionary of Electronics</i> (7th ed. 1999)
2007	Excerpts from Frank Pedrotti, <i>Introduction to Optics</i> (3d ed. 2006)
2008	Biography of Patrick W. Lauppe
2009	Declaration of Patrick W. Lauppe ISO Motion for <i>Pro Hac Vice</i> Admission
2010	Declaration of Jason A. Janét, Ph.D.
2011	Transcript of James F. Shanley, Ph.D., deposition dated June 6, 2024
2012	U.S. Patent No. 7,969,558, to David S. Hall
2013	Warren J. Smith, <i>Practical Optical System Layout and Use of Stock Lenses</i> (1997)
2014	Sergey L. Vinogradov, "Evaluation of performance of silicon photomultipliers in LIDAR applications" (2017)

EXH. NO.	DESCRIPTION
2015	Edoardo Charbon et al, “SPAD-Based Sensors” (2013)
2016	Cristiano Niclass, et al, “A Single Photon Avalanche Diode Array Fabricated in Deep-Submicron CMOS Technology” (2006)
2017	Deposition Transcript of James F. Shanley, Ph.D. dated Nov. 6, 2024
2018	Excerpts from Deposition Transcript of James F. Shanley, Ph.D., dated Jun. 28, 2024, in IPR2023-01456 and IPR2023-01457

I. INTRODUCTION

Petitioner's reply fails to cure any of the deficiencies with the Petition identified in the Patent Owner Response.

For the Pacala-Droz combination, Petitioner pivots and identifies a new alleged "stop region" in Droz's waveguides. But Petitioner's new theory continues to fail, since Droz's reflective waveguides do not define a field of view using "stop region[s]" as the '405 patent claims require. Further, none of Petitioner's reply arguments change the clear import of its expert Dr. Shanley's testimony that a POSITA would not have been motivated to or capable of combining Pacala and Droz.

For the Hall-Borowski-Spector combination, Petitioner relies on an entirely new obviousness theory to untimely try to fill the gaps in the combination identified in the Patent Owner Response related to the combination of Hall and Spector. Petitioner's improper new reply theory, supported by nothing but attorney argument, must be disregarded. Moreover, Petitioner's reply arguments fail to remedy the fundamental incompatibility of (1) Hall and Borowski and (2) Borowski and Spector. Furthermore, the failure of all of Petitioner's obviousness combinations is underscored by clear evidence of skepticism and failure by others as to using SPADs in LIDAR systems—which Petitioner fails to rebut.

Accordingly, the Board should find claims 21 and 23-34 (the "challenged

claims”) of U.S. Patent No. 11,175,405 (the “’405 patent”) patentable over the instituted grounds.

II. THE BOARD SHOULD REJECT PETITIONER’S PROPOSED COMBINATIONS.

A. The Board Should Reject the Pacala-Droz Combination.

1. Patent Owner’s Construction of “Stop Region” is Supported by the Intrinsic and Extrinsic Evidence

As shown in the Patent Owner Response and the accompanying expert declaration of Dr. Janét, the plain and ordinary meaning of “stop region” in the ’405 patent claims, as supported by the intrinsic and extrinsic evidence, is an optically non-transparent region that defines a field of view for a photosensor. POR at 25-32. Petitioner fails to show otherwise—instead, mischaracterizing the intrinsic and extrinsic evidence in an effort to support its overbroad view that a stop region is simply any region that stops light for any purpose. The Board should reject Petitioner’s arguments and adopt Patent Owner’s construction.

Petitioner incorrectly asserts that Patent Owner “relies on a sentence from a single embodiment” for the “stop region” construction. Reply at 3. Not so. Patent Owner’s proposed construction for “stop region” is supported *throughout* the specification of the ’405 patent, including in many different figures and the accompanying descriptions. *See* EX1001, Figs. 17, 19A-B, 37:18-25, 39:26-59; *see also* Figs. 2, 10, 17, 18A-C, 19A-D, 20C-D, 20G, 21C-E, 22A-F, 22H, 23D-E, 38:36-39:5, 40:2-40:8, 40:56-63, 41:10-25, 42:3-10, 42:16-20, 43:64-67, 44:6-8,

44:17-21, 47:28-34, 47:38-41, 48:5-19, 48:25-29, 48:59-49:6, 49:59-50:11. In every case, the '405 patent describes or shows “stop region[s]” to be an optically non-transparent region that defines a field of view for a photosensor. Nothing in the '405 patent specification supports Patent Owner and its expert’s position that a “stop region” encompasses any region that stops light for any purpose.

Petitioner argues that the *aperture layer*—not “stop region[s]”—define the field of view in the '405 patent. Reply at 3. *First*, this interpretation is contradicted by the '405 patent specification. For example, the '405 patent specification discloses an **“optically non-transparent stop region 1746 configured to define a narrow field of view when placed at the focal plane of an imaging optic[.]”** EX1001, 37:18-23 (emphasis added). Further, figures of the '405 patent—including Figure 17 shown in the demonstrative diagram below—show that the *edges* of the stop regions are what defines the maximum cone of light rays entering the optical system. In other words, it is the *stop regions* defining the field of view—not some other structure:

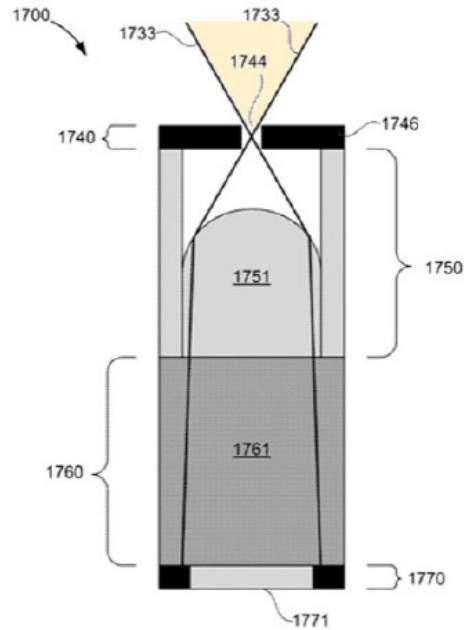


FIG. 17

EX2010, ¶ 107.

Second, even if the “aperture layer” defines a field of view, this still supports Patent Owner’s proposed construction of “stop region.” The stop region is *part* of the aperture layer. As such, if the “aperture layer” defines a field of view, then so too does the “stop region.” Indeed, Petitioner’s expert testified that the stop region impacts the field of view as part of the aperture layer. EX2017, 8:11-19 (“[T]he aperture layer defines the field of view and the stop regions are there to limit extraneous light.”).

Petitioner’s remaining points about the intrinsic evidence of the ’405 patent have no merit. In the Patent Owner Response, Patent Owner presented strong evidence that the ’405 patent specification does not consider *any* non-transparent

region a “stop region”—because it labels certain non-transparent structures “spacer structure[s].” POR at 28-29. Petitioner quibbles that the “spacer structure[s]” in the ’405 patent are not part of the “aperture layer”—and thus are not relevant to the “stop region” issue. Reply at 3-4. But Petitioner does not (and cannot) dispute that the ’405 patent *could have* referred to the “spacer structure[s]” in the ’405 patent as “stop region[s].” But instead, a different term—“spacer structure[s]”—was chosen, indicating that the term “stop region” was not contemplated to include *any* structure that stopped light. Accordingly, the intrinsic evidence regarding “spacer structure[s]” undermines Petitioner’s overbroad understanding of “stop region.” *See also* EX1001, Figs. 22A-B, 47:28-34 (similarly distinguishing “sidewalls” from “stop regions”); *see also id.*, Figs. 22D-F, 22H, 23D-E, 48:5-41, 48:50-49:6, 49:59-50:11.

Petitioner and its expert also mischaracterize discussion in the ’405 patent specification of an “optical filter layer **2060**” as showing stop regions that prevent light from travelling between channels. Reply at 4 (citing to EX1033, ¶ 18; EX1001, 41:7-29). But this discussion is irrelevant, since it relates to an optical filter layer—not any stop region that comprises part of an “aperture layer” as claimed. Moreover, it provides no indication that any stop regions prevent light from moving between channels. *See also* EX1001, 41:25-29 (indicating that “[c]ollectively, **these interleaved layers** prevent stray light...from traveling into an optical filter region

of an adjacent receiver channel”—not stop regions (emphasis added)).

The extrinsic evidence further supports Patent Owner’s “stop region” construction, notwithstanding Petitioner’s reply arguments. The reply declaration of Petitioner’s expert merely parrots the arguments in the reply, which Patent Owner addresses above. EX1033, ¶¶ 14-19. Petitioner quibbles that Patent Owner’s cited extrinsic publications refer to “aperture stops”—not “stop regions.” Reply at 4-5. But as Dr. Janét opined, a POSITA’s understanding of a “stop region” in the “aperture layer” of the ’405 patent claims would have been informed by the extrinsic, well-known optical concept of an “aperture stop.” EX2010, ¶¶ 107-108. Petitioner points to an example in the extrinsic publications of systems consisting only of a lens. Reply at 5 (citing EX2013 at 49). But this example is irrelevant, since there is no “aperture layer” separate from the lens in such a system. In contrast, Patent Owner’s examples from extrinsic publications are relevant because they include the structure called for by the claims, using similar language, and therefore, are indicative of the ordinary meaning to one of skill in the art of an aperture layer having stop regions. EX2010, ¶¶ 107-108.

Accordingly, the Court should construe “stop region” as an optically non-transparent region that defines a field of view for a photosensor.

2. The Pacala-Droz Combination Does Not Satisfy a “Stop Region” as Properly Construed

As discussed in the Patent Owner Response, instead of pointing to a properly construed “stop region” that defines a field of view for a photosensor for the Pacala-Droz combination, Petitioner pointed to the “absorbing layer” in Droz that merely prevents light from moving *between* optical channels without defining a field of view. POR at 32-38.

In an attempt to account for Patent Owner’s construction, Petitioner now provides a new theory on reply for what it asserts to be a “stop region” in Droz’s disclosures. Petitioner asserts that the rightmost ends of absorbing layers 368 and 378 in Figure 3B of Droz are “stop region[s]” per the ’405 patent claims, as shown in Petitioner’s demonstrative diagram reproduced below:

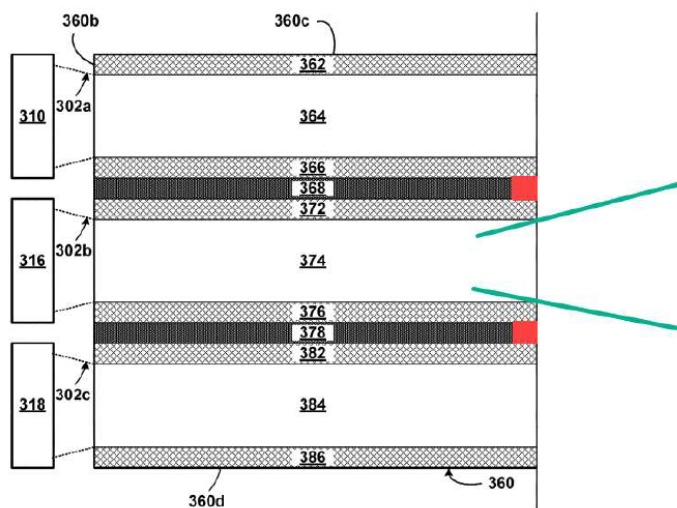


FIG. 3B

Reply at 8.

Petitioner’s new theory fails when the correct construction of “stop region” is

applied. The rightmost ends of absorbing layers 368 and 378 do *not* define a field of view. Light can enter the core layer 374 of the middle waveguide in Figure 3B from all sorts of different angles—and the rightmost ends of absorbing layers 368 and 378 do nothing to limit those angles of light. Accordingly, the rightmost ends of absorbing layers 368 and 378 do not define a field of view.

Petitioner and its expert have added green lines to the above demonstrative diagram, apparently to suggest that there is some limit to the angles of light that can enter core layer 374. But the green lines in the above demonstrative diagram are arbitrary and fail to represent a limit on light that can enter core layer 374. Light rays at more extreme angles than what is represented by the green lines in Petitioner’s demonstrative diagram can enter core layer 374 and will still be passed along to detector 316.¹ EX2010, ¶ 109. Cladding layers 372 and 376 are reflective and will guide light rays along to detector 316, as shown via blue lines in the below demonstrative diagram:

¹ Petitioner’s citation to Figure 3A of Droz (Reply at 6-7) is misplaced, since that system functions differently the Figure 3B embodiment the Petition relies upon. Pet. at 27-28. For example, the Figure 3A embodiment lacks the reflective cladding layers included in Figure 3B. EX1006, Fig. 3A, 12:61-13:26.

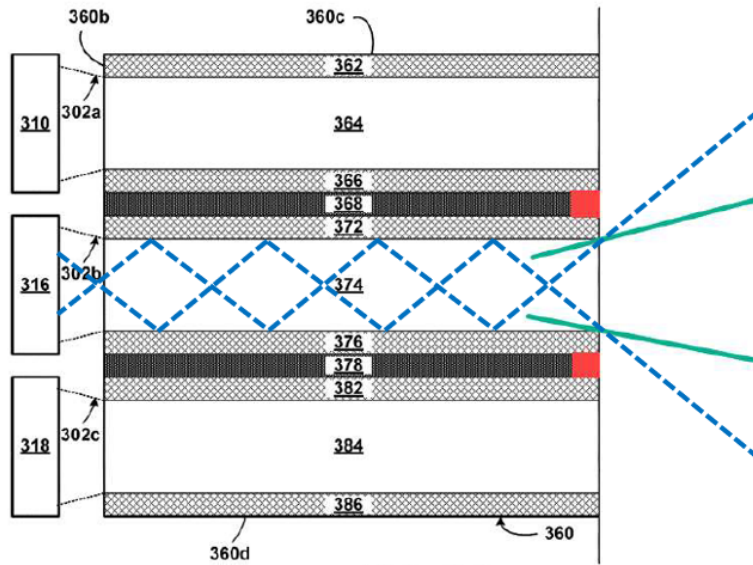


FIG. 3B

Reply at 8 (blue lines added); EX2010, ¶ 109.

Petitioner and its expert appear to agree that Droz's waveguides operate to guide light at different angles toward the detectors. For example, if the green lines in demonstrative diagram are continued, they contact the cladding layers and so can only reach detector 316 if reflected:

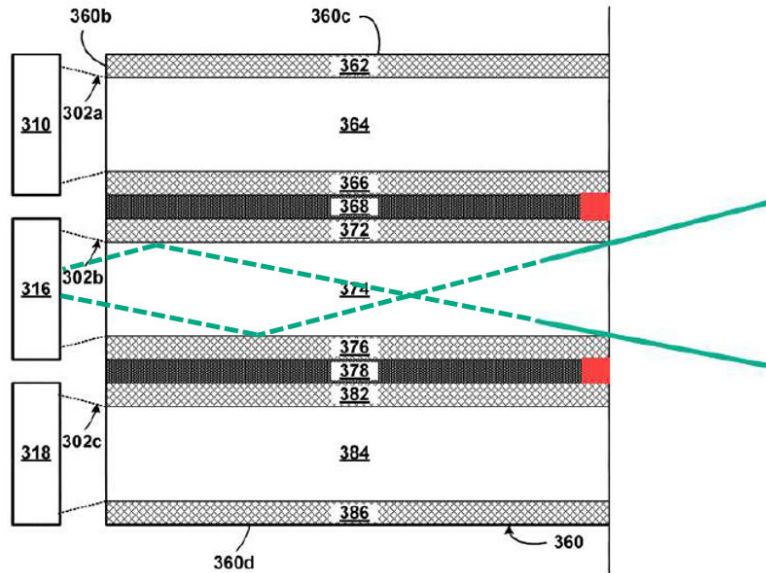


FIG. 3B

Reply at 8 (dashed lines added); EX2010, ¶ 109. Further, Petitioner’s expert opines that Droz’s waveguides “guide” light to the detector through reflection. EX1003, ¶ 150 (describing Droz as disclosing “cladding layers (362, 366, 372, 376, 382, and 286) that reflect light that reaches the edge of the core layer in order to guide it along the path defined by the waveguide”).

The operation of the newly asserted “stop region[s]” at the rightmost ends of absorbing layers 368 and 378—which play no role in limiting the angles of light that can enter the system—is fundamentally different from the “stop region[s]” disclosed by the ’405 patent. POR at 35-36. For example, Figure 17 of the ’405 patent shows “marginal ray lines” that represent the most extreme angles of light that can enter the system through stop region 1746. Stop region 1746 stops light entering the system at more extreme angles, as shown by the red lines in the annotated version

of Figure 17 below:

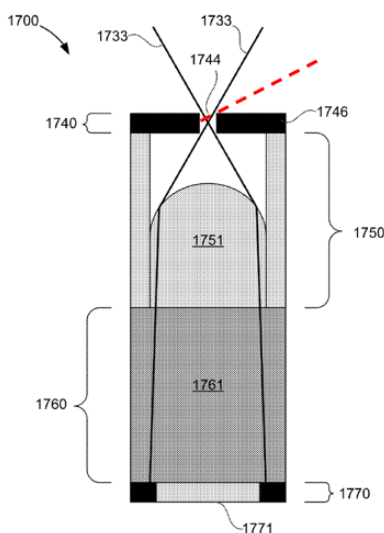


FIG. 17

EX1001, Fig. 17 (red line added). Petitioner's expert asserts that "the sizes of the input ends of the waveguides (and their corresponding fields of view) depend at least in part on the light-absorbing layers" in Droz. EX1033, ¶ 21. But this merely reiterates the fact that Droz relies on the fundamentally different technique of relying on the *size* of the input ends of the waveguides to define a field of view. POR at 35-36. Nothing in Droz indicates that the absorbing layers *themselves* define a field of view like the "stop regions" contemplated by the '405 patent. In fact, Droz indicates the opposite—that light from all sorts of different angles can enter its system regardless of the absorbing layers due to the design of Droz's waveguides.

As discussed in the Patent Owner Response, if the absorbing layers in Droz acted to define the fields of view of the photodetectors (as Petitioner contends they do), and not just to prevent leakage between waveguides, then a POSITA would

have expected to see them on the *top* and *bottom* edges of Figure 3B. POR at 36-37. But the absorbing layers *do not* appear on the top and bottom edges—indicating that they do *not* serve to define a field of view like Petitioner asserts. In response, Petitioner and its expert assert without support that there are “likely” or “typically” unidentified “other structures and components not illustrated” that would prevent light from entering the waveguides from the top and bottom edges. Reply at 9; EX1033, ¶ 26. Such conclusory and baseless assertions—which fail to cite any evidence—should be disregarded.

Since neither the Petition nor the Reply identify a properly construed “stop region” in Droz, the Pacala-Droz combination fails to render any claims unpatentable.

3. A POSITA Would Not Have Been Motivated to Combine Pacala with Droz

As discussed in the Patent Owner Response, Petitioner failed to meet its burden to show that a POSITA would have been motivated to combine Pacala and Droz. POR at 38-44. Rather, the evidence indicates that a POSITA would not have had a reasonable expectation of success in combining Pacala and Droz given the myriad issues with designing a system that combined Droz’s stationary system into the rotating system disclosed by Pacala. Furthermore, Petitioner and its expert failed to show *how* the combination would have taken place—failing even *attempt* any analysis related to crucial aspects of the rotating combined system including size,

weight, mass distribution, and rotational forces. *Id.* Accordingly, the Pacala-Droz combination must fail.

Testifying regarding the Pacala-Droz combination, Dr. Shanley stated that **“you have to have a team to put all these pieces together.”** EX2011, 58:20-21 (emphasis added). Since Petitioner and Patent Owner both assert that a POSITA would have been a single person, rather than a team, Dr. Shanley’s testimony is clear evidence that the Pacala-Droz combination would have been *outside* the capability of a POSITA. Petitioner and Dr. Shanley attempt to muddy the waters on Dr. Shanley’s testimony to suggest he never testified that a team of engineers would have been necessary to combine Pacala and Droz. Reply at 12-13 (“Dr. Shanley opined that a team would normally be involved[.]”); EX1033, ¶ 13. But Petitioner and Dr. Shanley’s attempts to explain away his testimony simply ignore his unambiguous testimony that “you **have** to have a team to put all these pieces together.” EX2011, 58:20-21 (emphasis added). Dr. Shanley’s testimony that a team would be required is fatal to the Pacala-Droz combination—and Petitioner and its expert’s misleading attempt to suggest otherwise should be given no weight.

Even if Dr. Shanley’s testimony were not fatal, Petitioner failed to provide critical evidence for showing *how* the Pacala and Droz systems would be combined, including size, weight, mass distribution, and rotational forces critical to combining Droz’s stationary system with Pacala’s rotating one. These gaps in the Petition’s

showing as to the Pacala-Droz combination represent another fatal failure—contrary to Petitioner’s argument that these are mere “bodily incorporation” considerations. Reply at 9-15. The Petition simply failed to show *how* the Pacala-Droz combination would work, omitting any analysis of the significant modifications necessary for the combined system. Such an unsupported combination, backed by nothing but conclusory assertions, must fail. *See Medtronic, Inc. v. Teleflex Innovations S.a.r.l.*, 70 F.4th 1331, 1346-47 (Fed. Cir. 2023) (affirming failure to prove obviousness where Board found that combination required “significant modifications ... not proposed in the Petition”) (citation omitted); *ActiveVideo Networks, Inc. v. Verizon Commc’ns, Inc.*, 694 F.3d 1312, 1327 (Fed. Cir. 2012) (affirming finding of no obviousness where patent challenger’s expert “failed to explain ... how any specific combination would operate”).

Petitioner’s remaining contentions regarding Dr. Shanley’s testimony as to what size, weight, or rotational force analysis a POSITA would have been capable of performing are baseless and conclusory, since Dr. Shanley testified that he *never* performed or had any basis for performing any of this analysis. EX2011, 54:6-55:13 (testifying he is unable to answer regarding the weight, size, or mass distribution of the combined Pacala-Droz system). For example, Dr. Shanley’s conclusory and unexplained assertion that rotational forces “could have no effect” on the Pacala-Droz system “once it’s designed” is nothing more than hindsight-driven circular

reasoning entitled to no weight. EX2011, 61:2-11.

Petitioner argues that Pacala and Droz do not “require[] any particular size, weight, or material” and that Pacala’s system is not “compact” or “tightly packed.” Reply at 13. But even *Petitioner’s expert* has opined that Pacala’s system is compact and low cost. In two of Hesai’s parallel IPR proceedings against Ouster’s patents (IPR2023-01456, IPR2023-01457), Dr. Shanley testified that Figure 2 in Pacala shows a compact and low-cost device, as indicated by “the way the arrangement of the swivel device is, the two optical elements, the transmit and receive areas, and his electrical layout on the side, just the drawing looks very, very compact, and the description that he provides in the text basically leads one to assume that it’s a nice compact device.” EX2018, 78:6-79:16. This is in line with Patent Owner’s expert Dr. Janét’s opinions on Pacala. EX2010, ¶¶ 111-21 (opining about issues that would have discouraged a POSITA from combining Pacala with Droz, including volume considerations).²

² An alleged “fractions of a millimeter” Droz embodiment was not discussed in the Petition or either of Shanley’s declarations in this proceeding. Reply at 13-14. Accordingly, Petitioner’s invocation of this embodiment is improper on reply. Further, it is unsupported attorney argument.

Dr. Janét’s testimony supports that a POSITA would not have been motivated to or capable of combining Pacala and Droz. EX2010, ¶¶ 110-21. In a two-sentence footnote, Petitioner argues that Patent Owner’s expert Dr. Janét should be “given little weight” regarding the Pacala-Droz combination based on Petitioner’s attorney argument mischaracterization of Dr. Janét’s record. Reply at 14 n.2. Petitioner’s attempt to discredit Dr. Janét should be rejected.

First, it is undisputed in this proceeding that Dr. Janét meets *either* party’s POSITA definition. *See, e.g.*, EX2010, ¶ 3 (Bachelor of Science in Mechanical Engineering from the University of Virginia); EX2010, Ex. A at 2 (listing LIDAR work between 2011-2013); EX1034, 23:11-24:22 (discussing at least a year of designing LIDAR systems); *id.*, 26:21-40:15 (discussing several additional years of designing LIDAR systems). Accordingly, Petitioner is arguing that Dr. Janét must have *more* than the undisputed knowledge of a POSITA—which is not required. *See, e.g., KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 420 (2007) (obviousness inquiry is as to “a person with ordinary skill in the art”).

Second, Petitioner’s contentions are based on nothing but attorney argument that mischaracterizes the record. Petitioner’s assertion that Dr. Janét’s experience designing LIDAR systems “typically failed to result in even a rudimentary functional LiDAR system” has no basis in fact. Reply at 14 n.2. For example, Dr. Janét discussed a “deployed system” using a “production grade or commercial grade

LiDAR system.” EX1034, 36:22-37:15; *see also id.*, 21:3-22 (discussing functional LIDAR Dr. Janét researched); *id.*, 31:15-34:5 (discussing additional LIDAR Dr. Janét designed for DARPA challenges). Petitioner’s remaining remarks about Dr. Janét’s LIDAR experience—that it involved “isolated projects,” “analyzing an existing LiDAR device,” or “integrating it into a larger system”—are also inaccurate—and even if true, fail to provide a basis for discrediting Dr. Janét’s testimony. *See* EX1034, 34:14-35:11 (discussing “hands-on” work with LIDAR systems); *id.*, 35:22-36:21 (discussing variety of Dr. Janét’s LIDAR projects, including some not otherwise described at length); *id.*, 32:16-33:13 (discussing design of LIDAR system when “we didn’t really have a commercial off-the-shelf LiDAR option”); *see also* Petition at 12 (providing POSITA definition generally requiring “two to three years of experience in LiDAR design”).

Accordingly, Petitioner fails to provide a legal or factual basis for discrediting Dr. Janét’s testimony.

B. The Board Should Reject the Hall-Borowski-Spector Combination.

1. Without Petitioner’s Improper New, Attorney Argument “Pixel Resolution” Theory, the Hall-Borowski-Spector Combination Must Fail

As discussed in the Patent Owner Response, a POSITA would not have been motivated to use Hall’s rotating system with Spector’s aperture array. POR at 45-56. Spector discloses that its aperture array must be used with a horizontal and vertical scanning system that fills in gaps in the field of view—which is incompatible

with Hall's rotating system. EX2010, ¶¶ 124-42. Patent Owner showed that a POSITA would have understood that without Spector's scanning system, the Hall-Borowski-Spector system would be inoperative, because the resulting system would have left major gaps in the field of view. POR at 45-56. Petitioner confirms in its reply that "Petitioner does not propose including Spector's scanning system into [sic] Hall." Reply at 16.

Unable to deny the inoperability of the Hall-Borowski-Spector combination as described in the Petition, Petitioner raises a new argument on reply. In this new theory, Petitioner argues, without any supporting expert testimony, that a POSITA would have been motivated to use "a finer resolution for the apertures" disclosed by Spector in the Hall-Borowski-Spector combination. Reply at 16. This unsupported attorney argument, presented for the first time reply, is improper and entitled to no weight.

First, in his two declarations and two depositions in this case, Dr. Shanley has not *once* opined that a POSITA would have been motivated to change or even capable of changing the pixel resolution disclosed by Spector. Tellingly, the only expert evidence Petitioner cites for its new "pixel resolution" theory of the Hall-Borowski-Spector combination is deposition testimony from Dr. Shanley about the combined **Pacala-Droz** system—not the Hall-Borowski-Spector combination. Reply at 17 (citing EX2011, 56:4-20); *see also* EX2011, 55:5-56:20 (discussing "the

mass distribution for the Pacala-Droz system”). Dr. Shanley was asked about the Hall-Borowski-Spector combination in deposition and had ample opportunity to explain Petitioner’s “pixel resolution” theory. Yet he failed even to mention spacing or resolution of apertures in the context of this combination. EX2011, 62:4-67:2. With no supporting expert opinion, Petitioner’s “pixel resolution” theory is nothing more than unsupported attorney argument—entitled to no weight in the Board’s analysis. *See Icon Health & Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1043 (Fed. Cir. 2017) (“Attorney argument is not evidence.”).

Second, even if Petitioner’s “pixel resolution” theory for the Hall-Borowski-Spector combination had any evidentiary support, it should be disregarded as an untimely new theory. Neither Petitioner nor its expert discussed increasing the resolution of apertures in the Hall-Borowski-Spector combination for the Petition. Petition at 58 (discussing the Hall-Borowski-Spector combination as involving “applying Spector’s aperture array within Hall’s system”); EX1003, ¶ 191 (discussing incorporating “an aperture array at Hall’s light detection module” based on Spector). Throughout its discussion of the “pixel resolution” theory in the Reply, Petitioner does not cite a *single* disclosure in the Petition or the Shanley Declaration regarding pixel resolution. Reply at 15-18.

New obviousness theories, presented for the first time on reply in an effort to fill gaps in the obviousness combinations asserted in the Petition, are improper and

routinely disregarded. *See Yita LLC v. MacNeil IP LLC*, 69 F.4th 1356, 1367 (Fed. Cir. 2023) (finding no abuse of discretion where Board did not consider new reply argument where petitioner “waited until its reply to present what in substance is an argument that it would have been obvious to a relevant artisan to modify” what a prior art reference discloses); *see Patent Trial and Appeal Board Consolidated Trial Practice Guide* (Nov. 2019)³, 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.”); *Acceleration Bay, LLC v. Activision Blizzard Inc.*, 908 F.3d 765, 775 (Fed. Cir. 2018) (Board did not abuse discretion in declining to consider reply declaration that “raises a new obviousness argument ... that could have been made in the petition.”); *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1331 (Fed. Cir. 2019) (Board did not abuse its discretion by disregarding new reply theory where “petition says nothing” about allegedly obvious modification—“[n]or did [petitioner] submit any expert testimony with its petition about how to do so”); *3M Co. v. Bay Materials, LLC*, IPR2022-01214, Paper 77 at 39 (P.T.A.B. Jan. 16, 2024) (finding as “untimely” petitioner’s new argument regarding knowledge of a POSITA disclosed “for the first time in the Reply”); *Dish Network LLC v. Sound View Innovations, LLC*, IPR2020-01041, Paper 41 at 27 (P.T.A.B. Jan. 18, 2022) (declining to consider “new reply argument [that] attempts

³ Available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

to fill in a gap in Petitioner’s unpatentability contentions”). Petitioner’s “pixel resolution” theory is just such an argument.

Accordingly, Petitioner’s untimely new reply theory, supported only by attorney argument, regarding “pixel resolution” in the Hall-Borowski-Spector combination should be disregarded. Since the Hall-Borowski-Spector combination depends on Petitioner’s improper new theory, the Hall-Borowski-Spector combination must fail.

2. A POSITA Would Not Have Been Motivated to Combine Borowski and Spector

In the Patent Owner Response, Patent Owner and its expert showed that the evidence directly undermined Petitioner’s asserted motivation to combine (1) SPADs based on Borowski’s teachings and (2) an aperture array based on Spector. POR at 56-57. Petitioner’s sole asserted motivation to combine Spector’s aperture array was to “reduc[e] crosstalk and multipath signals.” Pet. at 56 (citing EX1003, ¶ 192). But Spector discloses that its aperture “may be beneficial to establish the individual optical detection sites” *only* for “detectors with a large fill factor[.]” EX1005, 3:54-56. For detectors where “the detectors are much smaller than the spacing between the detectors (fill factors less than 10%),” Spector discloses that “individual light spots are defined by the array itself.” *Id.*, 3:49-54. Accordingly, Spector indicates that Petitioner’s asserted motivation to combine is only applicable for systems with certain detector fill factors—and inapposite for

systems with other detector fill factors. EX2010, ¶¶ 143-44. But Petitioner fails to account for these Spector disclosures at all—providing no analysis to indicate that the SPADs in the Hall-Borowski-Spector combination would have had an appropriate fill factor. For this reason alone, the Hall-Borowski-Spector combination must fail.

Moreover, the evidence indicates that the SPADs in the Hall-Borowski-Spector combination would *not* have had a large fill factor per Spector’s disclosures. POR at 56-57. The 2017 Vinogradov paper discloses that fill factor has been a consistent challenge for SPADs, with fill factors as low as 3.14%. EX2014 at 3.

On reply, Petitioner points to disclosures in the Vinogradov paper and the “Takai” paper (presented for the first time on reply) indicating other fill factors in particular research applications. Reply at 19-21. However, Vinogradov and Takai indicate that increases in fill factor would have required incorporating specific technologies or implementations that came with significant disadvantages. EX2014 at 3 (discussing “backside illuminated SPAD technology with SOI substrate” that “introduced prohibitively high dark count rate”); *id.* at 3 (discussing “digital SiPM” technology); *id.* at 3-4 (discussing “digital SiPM” implementation “where a direct access is provided to a sub-group of SPADs ... to reduce the number of electronic components and connections at the front-side area,” which is “rather expensive and inflexible in scaling of the dSiPM dimensions and especially in producing arrays of

dSiPMs due to large periphery occupied by electronics”); EX1032 at 1 (discussing SPAD implementation with “two custom layers that are designed to provide a full-depletion layer with a high electric field profile”).

Petitioner provides *no* evidence or argument that a POSITA would have been capable of or motivated to implement any of these technologies in the Hall-Borowski-Spector combination. Indeed, as of 2017, the Vinogradov paper indicates that “there are no attempts either to implement SPAD arrays or dSiPMs as a single photon number resolving LIDAR receiver or to combine an array of SPAD arrays or dSiPMs as a focal plane array of photon number resolving detectors in 3D imaging LIDARs.” EX2014 at 4. Further, there is no evidence that any of these technologies would have led to a “large fill factor” or otherwise led to a system for which a POSITA would have been motivated to combine with Spector’s aperture array. *See* EX1005, 3:49-56.

Accordingly, Petitioner has failed to meet its burden to show that a POSITA would have been motivated to combine Borowski and Spector.⁴

⁴ Petitioner and its expert also cast various aspersions against Vinogradov—but none of these support discrediting the Vinogradov paper’s disclosures. Petitioner characterizes Sergey Vinogradov as “a lone researcher in Russia,” with Dr. Shanley describing Russia as “not considered to be leading, or even active, in LiDAR design

3. A POSITA Would Not Have Been Motivated to Combine Hall and Borowski

As discussed in the Patent Owner Response, a POSITA would not have been motivated to combine Hall's system with Borowski's SPADs because of the incompatibility between the use of (1) SPADs that are undisputedly highly prone to noise and (2) Hall's system, in which Hall discloses "[t]he detection of return signals includes significant sources of measurement noise that are exacerbated as measurement ranges are extended." POR at 58-62 (citing EX1008, 2:29-31). On reply, Petitioner only reinforces this incompatibility by arguing that incorporation of SPADs into Hall's system would "increase range," which is exactly what Hall

and related research." Reply at 19; EX1033, ¶ 36. The nationality of Vinogradov is irrelevant—and Petitioner and its expert's characterizations of Russia are baseless. Dr. Shanley further argues that it is "not clear from his paper" whether Sergey Vinogradov is a POSITA, EX1033, ¶ 36—but Dr. Shanley has made no such showing for any of the alleged prior art he relies on and there is evidence supporting the reliability of the Vinogradov paper. EX1034, 47:18-49:19; EX2014 at 1 (SPIE-published paper). Petitioner's quibbles with Vinogradov's methodology should be disregarded, since they essentially boil down to Petitioner and its expert's hindsight-driven disagreement with Vinogradov's findings. Reply at 28-29; EX1033, ¶ 37.

discloses to “exacerbate[.]” the “significant sources of measurement noise” in a LIDAR system. Reply at 25; EX1008, 2:29-31.

None of Petitioner’s arguments on reply change the fact that Petitioner failed to account for the “significant sources of measurement noise” disclosed by Hall in the Hall-Borowski-Spector combination. Petitioner points to Dr. Shanley’s laundry list of “well-known techniques for reducing noise in LiDAR systems.” Reply at 24 (citing EX1003, ¶¶ 50-56). But generalized lists of techniques, without any indication of which of these techniques, if any, could be implemented in the Hall-Borowski-Spector combination, “fail to explain ... how any specific combination would operate[.]” *ActiveVideo*, 694 F.3d at 1327; *Medtronic*, 70 F.4th at 1346-47. Petitioner also points to various allegedly noise-limiting features in the Hall, Borowski, and Spector references. Reply at 24-25. But Petitioner has nothing but attorney argument to support its contention that these features would be sufficient to overcome—or would address in any way—the measurement noise in the Hall system if SPADs were used.

Accordingly, Petitioner failed to meet its burden to show that a POSITA would have been motivated to combine Hall and Borowski.

III. SECONDARY CONSIDERATIONS OF NONOBVIOUSNESS

A. Skepticism

Nothing in Petitioner’s reply disputes that Dr. Shanley was aware of SPADs since the 1990s; he worked on multiple LIDAR projects between the 1990s and the

2017 priority date at issue here; and he declined to use SPADs in *any* of those LIDAR projects. EX2011, 12:18-22, 14:10-15:4. Contrary to Petitioner’s attorney argument, this nearly *30-year* span during which Petitioner’s expert knew about SPADs and chose *not* to incorporate them into LIDAR systems constitutes strong evidence of industry skepticism and non-obviousness. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1335 (Fed. Cir. 2016) (“If industry participants or skilled artisans are skeptical about whether or how a problem could be solved or the workability of the claimed solution, it favors non-obviousness.”); *Env’t Designs, Ltd. v. Union Oil Co. of Cal.*, 713 F.2d 693, 697-98 (Fed. Cir. 1983) (“Expressions of disbelief by experts constitute strong evidence of nonobviousness.”)

Contrary to Petitioner’s mischaracterization of the record, Dr. Shanley also testified that he was unaware of any commercial or *noncommercial* LIDAR devices that used SPADs prior to the ’405 patent. EX2011, 79:2-5 (testifying that he was unaware of “any commercial LIDAR devices that use SPADs prior to the ’405 patent”); *id.*, 79:11-14 (testifying that he was only able to “assume” that there were noncommercial LIDAR devices using SPADs prior to the ’405 patent). Dr. Shanley’s testimony clearly speaks to industry skepticism of SPAD-based LIDAR systems.

Petitioner appears to suggest that the testimony of its own expert—an industry participant and purported POSITA—is insufficient to support industry skepticism.

Reply at 27-28. The caselaw says otherwise. The *Environmental Designs* case is instructive. 713 F.2d at 697-98. There, in affirming a nonobviousness finding, the Federal Circuit found that there was “highly probative evidence of nonobviousness” in that both parties’ experts had testified to skepticism about the patented technology prior to the patent at issue. *Id.* at 697. Similarly, both experts in this proceeding—Dr. Shanley and Dr. Janét—testified to knowing about SPADs prior to the ’405 patent but declining to use them in LIDAR systems due to various issues. EX2011, 12:18-22, 14:10-15:4; EX1034, 47:18-48:9 (discussing “devil of a time” in trying to integrate SPADs into LIDAR systems).

Petitioner also argues that the testimony of Dr. Shanley should be ignored because it relates in part to a system designed in 2008. Reply at 27-28. But Dr. Shanley indicated that factors like unavailability of off-the-shelf SPADs that motivated his decision not to use SPADs in LIDAR systems in 2008 persisted until well after the 2017 priority date at issue here. EX2011, 17:2-20 (testifying that he used a component that was “off-the-shelf” in a LIDAR system rather than SPADs, because an off-the-shelf component was cheaper and more reliable); *id.*, 79:15-80:13 (testifying that SPADs have only been “cheap and off-the-shelf” since around 2020); *see also id.*, 23:20-22 (testifying that the LIDAR field has not changed very much since 2008).

B. Failure by Others

Since Petitioner's arguments regarding failure by others relate to the Vinogradov paper, Patent Owner incorporates by reference its discussion of Vinogradov in Section II.B.2 above.

IV. CONCLUSION

The Board should find claims 21 and 23-34 of the '405 patent patentable over the instituted grounds.

Dated: November 15, 2024

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CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this sur-reply complies with the type-volume limits of 37 C.F.R. § 42.24(c)(4) because it contains 5,589 words, according to the word-processing system used to prepare this sur-reply, excluding the parts of this sur-reply that are exempted by 37 C.F.R. § 42.24(c) (including the table of contents; a table of authorities; a listing of facts that are admitted, denied, or cannot be admitted or denied; a certificate of service or this certificate word count; and appendix of exhibits).

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CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. Section 42.6, that a complete copy of the attached **PATENT OWNER SUR-REPLY**, including all exhibits (**Nos. EX2017 and EX2018**) and related documents, are being served via electronic mail on the 15th day of November 2024, upon Petitioner by serving Petitioner's counsel of record as follows:

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