

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent of: Angus Pacala et al.  
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Title: OPTICAL IMAGING SYSTEM WITH A PLURALITY OF  
SENSE CHANNELS

**SECOND DECLARATION OF DR. JAMES SHANLEY**

Exhibit 1040  
Hesai v. Ouster  
IPR2023-01457

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I, Dr. James Shanley, declare that:

## **I. INTRODUCTION AND SCOPE OF WORK**

1. On September 25, 2023, I provided an initial Declaration in the IPR2023-01457 proceeding. I have been asked to review and respond to the Patent Owner Response and the Declaration of Dr. Janét (EX2009). I have focused on portions of the Patent Owner's Response and Dr. Janét's Declaration that raise new issues or rationales. In this Second Declaration, I provide additional analysis regarding whether the references cited in Grounds 1-2 of the Petition render obvious the claims of the '750 Patent, responsive to assertions in the Patent Owner Response. Where the Patent Owner Response and the Dr. Janét's Declaration reach conclusions without contrary evidence or analysis, I adhere to the analysis in my prior testimony.

2. My analysis is directed by my education, training, and experience as a person of ordinary skill in the art as of the priority date of the '750 Patent, which for purposes of my analysis here is assumed to be the effective filing date of the '750 Patent—September 24, 2015.

3. I am being compensated at my standard consulting rate for my time providing my independent analysis, plus reasonable out-of-pocket expenses. I have received no additional compensation for my work in this matter, and my compensation does not depend upon the content of my opinions, any testimony that

I may provide, or the ultimate outcome of the matter. All of the opinions set forth in this declaration are my own.

## **II. SUMMARY OF OPINIONS**

4. Based on my experience and expertise, which is discussed in my initial declaration (¶¶1-13), and my review of Retterath, Borowski, Hipp, Weimer, Imai, Higashi, and Grzesik, it is my opinion that claims 44-48 and 50 of the '750 Patent are rendered obvious based on Grounds 1 and 2.

## **III. BASIS FOR OPINIONS**

5. In writing this Declaration, I have considered the following: my own knowledge and experience, including my work experience in the field of optical systems, electrical systems, and LiDAR systems and my experience working with others involved in those fields. In addition, I have analyzed the following publications and materials, in addition to other materials I cite in my declaration:

|        |                                                                                      |
|--------|--------------------------------------------------------------------------------------|
| EX1001 | U.S. Patent No. 11,190,750 to Pacala et al. ("the '750 Patent")                      |
| EX1002 | Excerpts from the Prosecution History of the '750 Patent ("the Prosecution History") |
| EX1005 | U.S. Patent No. 10,203,399 to Retterath et al ("Retterath")                          |
| EX1006 | U.S. Patent App. Pub. No. US 2013/0300838 to Borowski ("Borowski")                   |
| EX1007 | U.S. Patent No. 7,787,105 to Hipp et al ("Hipp")                                     |
| EX1008 | U.S. Patent No. 8,736,818 to Weimer et al ("Weimer")                                 |

|        |                                                                                                                                                                           |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EX1009 | U.S. Patent App. Pub. No. 2016/0274223 (“Imai”)                                                                                                                           |
| EX1010 | JP Publication No. JP 2015-078953 (“Higashi”)                                                                                                                             |
| EX1011 | Certified English Translation of JP Publication No. JP 2015-078953 (“Higashi”)                                                                                            |
| EX1012 | U.S. Patent App. Pub. No. US 2017/0040368 (“Grzesik”)                                                                                                                     |
| EX1013 | U.S. Patent App. Pub. No. 2014/0211194 (“Pacala”)                                                                                                                         |
| EX1014 | Lee <i>et al.</i> , “Accuracy-Power Controllable LiDAR Sensor System with 3D Object Recognition for Autonomous Vehicle,” in <i>Sensors</i> , Vol. 20, Iss. 19 (Oct. 2020) |
| EX1015 | ITC Inv. No. 337-TA-1363, Certain Lidar (Light Detection and Ranging) Systems And Components Thereof, EDIS Document Details re: Granting Motion for Termination           |
| EX1016 | U.S. Patent No. 9,651,658 (“Pennecot”)                                                                                                                                    |
| EX1017 | U.S. Patent No. 7,544,945 (“Tan”)                                                                                                                                         |
| EX1018 | U.S. Patent No. 6,747,747 (“Hipp-747”)                                                                                                                                    |
| EX1019 | Marino <i>et al.</i> , <i>A compact 3D imaging laser radar system using Geiger-mode APD arrays: system and measurements</i> , MIT Lincoln Lab (2003)                      |
| EX1020 | Complaint in ITC Inv. No. 337-TA-1363                                                                                                                                     |
| EX1021 | Complaint in <i>Ouster, Inc. v. Hesai Group et al</i> , No. 23-cv-00406 (D. Del.)                                                                                         |
| EX1022 | Order Granting Stay in <i>Ouster, Inc. v. Hesai Group et al.</i> , No. 23-cv-00406 (D. Del.)                                                                              |
| EX1023 | Matsubara et al., <i>Development of Next Generation LiDAR</i> , R&D                                                                                                       |

|        |                                                                                                                                                                                     |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | Review of Toyota CRDL (2012)                                                                                                                                                        |
| EX1024 | U.S. Patent No. 7,969,558 (“Hall”)                                                                                                                                                  |
| EX1025 | U.S. Patent No. 10,199,801 (“Li”)                                                                                                                                                   |
| EX1026 | Joint Claim Construction Chart from ITC Inv. No. 337-TA-1363                                                                                                                        |
| EX1027 | Certified English Translation of JP 2015-055314 (“Imai Priority”)                                                                                                                   |
| EX1028 | U.S. Patent Pub. No. 2016/0327639 (“Albert”)                                                                                                                                        |
| EX1029 | PCT Pub. No. WO2017/004663 (“Delic”)                                                                                                                                                |
| EX1030 | German Pat No. DE 10 2004 014 041 B4 (“Spies-041”)                                                                                                                                  |
| EX1031 | Certified English Translation of DE 10 2004 014 041 B4 (“Spies-041”)                                                                                                                |
| EX1032 | German Pat. No. DE 101 53 977 B4 (“Spies-977”)                                                                                                                                      |
| EX1033 | Certified English Translation of DE 101 53 977 B4 (“Spies-977”)                                                                                                                     |
| EX1034 | Donati, Silvano, Photodetectors: Devices, Circuits and Applications, Chapter 6, 2d Ed., The Institute of Electrical and Electronics Engineers, Inc. (2021, John Wiley & Sons, Inc.) |
| EX1035 | <i>Performance Analysis of Next-Generation LADAR for Manufacturing, Construction, and Mobility</i> , National Institute of Standards and Technology (2004)                          |
| EX1036 | U.S. Patent No. 8,742,325 (“Droz”)                                                                                                                                                  |
| EX1037 | <i>Report to Congress: DARPA Prize Authority</i> (2006)                                                                                                                             |
| EX1038 | Hall et al., <i>Team DAD Technical Paper</i> , DARPA Grand                                                                                                                          |

Challenge (2005)

|        |                                                                                                                           |
|--------|---------------------------------------------------------------------------------------------------------------------------|
| EX1039 | McManamon, <i>Field Guide to LiDAR</i> , SPIE Field Guides, Vol. FG36 (2015)                                              |
| EX1041 | Transcript of October 9, 2024 Deposition of Dr. Janet                                                                     |
| EX1042 | U.S. Patent No. 11,422,236                                                                                                |
| EX1043 | U.S. Patent No. 9,841,495                                                                                                 |
| EX1044 | U.S. Patent No. 9,804,264                                                                                                 |
| EX1045 | Bronzi, D., et al, <i>Figures of Merit for CMOS SPADs and Arrays</i> , May 2013                                           |
| EX1046 | Matsubara, H., et al, <i>Development of Next Generation LIDAR</i> , Feb. 2012                                             |
| EX1047 | Villa, F., et al, <i>CMOS Imager With 1024 SPADs and TDCs for Single-Photon Timing and 3-D Time-of-Flight</i> , July 2014 |

Patent Owner Response, IPR2023-01456

|        |                                                                                                      |
|--------|------------------------------------------------------------------------------------------------------|
| EX2001 | Respondent's Proposed List of Terms to be Construed dated June 21, 2023, in ITC Inv. No. 337-TA-1363 |
| EX2002 | Respondent's Proposed Claim Constructions dated June 28, 2023, in ITC Inv. No. 337-TA-1363           |
| EX2003 | Respondent's Proposed List of Markman Exhibits dated July 13, 2023, in ITC Inv. No. 337-TA-1363      |
| EX2004 | Excerpts from Rudolf F. Graf, <i>Modern Dictionary of Electronics</i> (7th ed. 1999)                 |
| EX2005 | Excerpts from Frank Pedrotti, <i>Introduction to Optics</i> (3d ed. 2006)                            |

|        |                                                                                                                       |
|--------|-----------------------------------------------------------------------------------------------------------------------|
| EX2006 | Excerpts from Ulrich Kubitscheck, Fluorescence Microscopy, From Principles to Biological Applications (2d ed. 2017)   |
| EX2009 | Declaration of Jason Janét, Ph.D.                                                                                     |
| EX2010 | Transcript of James F. Shanley, Ph.D., deposition dated June 28, 2024                                                 |
| EX2011 | The Oxford English Dictionary (2d Ed., Vol. III), Cham-Creeky (1989) (excerpts)                                       |
| EX2012 | Sergey L. Vinogradov, “Evaluation of performance of silicon photomultipliers in LIDAR applications” (2017)            |
| EX2013 | Edoardo Charbon et al, “SPAD-Based Sensors” (2013)                                                                    |
| EX2014 | Cristiano Niclass, et al, “A Single Photon Avalanche Diode Array Fabricated in Deep-Submicron CMOS Technology” (2006) |
| EX2015 | Transcript of James F. Shanley, Ph.D., deposition dated June 6, 2024                                                  |
| EX2016 | Transcript of Michael Lebby, Ph.D., deposition dated May 23, 2024 (excerpts)                                          |
| EX2017 | Hesai Technology Co., Ltd.’s Petition in IPR2023-01422, dated September 14, 2023                                      |
| EX2018 | Declaration of James F. Shanley, Ph.D., in IPR2023-01456, dated September 25, 2023 (excerpts)                         |

6. Although this Declaration refers to portions of the cited references, these are examples. A POSITA would have viewed the references in their entirety, and I have done so in my analysis.

#### IV. INTERPRETATIONS OF THE '750 PATENT CLAIMS AT ISSUE

7. I understand that, as a general rule, the claim terms of a patent are understood to have their ordinary and customary meaning to a POSITA at the time of the invention when read in the context of the patent and its prosecution history. I understand that there are certain exceptions to the general rule, including lexicography and disavowal, but based upon my review of the '750 Patent, I am not aware of any instances those exceptions in connection with this proceeding.

8. As I indicated in my first declaration (¶¶78-79), I do not believe that the claim language includes specialized terms that require further explanations or elaborative definitions. I believe that no constructions that substitute language for the original claim terms are necessary to resolve invalidity given the overlap between the embodiments of the '750 Patent and the prior art combinations of Grounds 1A-3. As I describe in more detail below, Patent Owner's proposed constructions contradict the '750 Patent itself and improperly inject ambiguity into otherwise ordinary claim terminology.

**A. “electromagnetic radiation output from each emitter in the illumination pattern []coincident with a field of view of a corresponding pixel” (claim 44)**

9. For example, I believe that a field of view “coincident with” an emission region as recited by claim 44 is a phrase that a POSITA would have understood without needing any substituted terminology. This is confirmed by

the '750 Patent's description and the plain usage by others at the time. I note that Patent Owner mischaracterizes my analysis of the "coincident with" element. For example, Patent Owner states that the analysis in my declaration "only take[s] into account the *direction* of an emitter radiation outputs and fields of view—not the *area* of these regions." POR, 2. This is not correct.

10. As I describe in more detail below, the analysis in my first declaration indicates that the prior art and the '750 Patent's preferred embodiments are remarkably similar. I believe that Patent Owner's proposal that "coincident with" be substituted by "cover substantially the same area in the field" (POR, 25-30)—is improper. Patent Owner's proposal narrowly requires that the field of view "*matches*" the "discrete spot" of an illumination source. *Id.* Based on my review of the '750 Patent, Patent Owner's language would have the effect of improperly excluding excludes example embodiments in the '750 Patent that fall outside of this narrow construction. Moreover, Patent Owner's proposal defies normal usage by others and injects ambiguity into the claim terms, as I discuss in more detail below.

11. *As a first matter*, I believe that Patent Owner's proposal improperly conflates the term "coincident" with "size" or "area." In doing so, Patent Owner never acknowledges the '750 Patent's express bifurcation of "coincident" and "size.":

Because the first illumination source **111** projects an illuminating beam that is substantially coincident (and substantially the same size as or minimally larger than) the field of view defined by the first aperture **141** (as shown in FIG. 4), a signal passed into the first lens **151** by the first aperture **141** in the aperture layer **140** can exhibit a relatively high ratio of light rays originating from the first illumination source **111** to light rays originating from other illumination sources in the system. Generally, because various illumination

EX1001, 6:3-11.

12. Consequently, the '750 Patent itself uses these terms differently from one another. The term “coincident” does not itself require “substantially the same size as.” If it did so, the parenthetical in column 6 would be rendered superfluous. Rather, this language isolates “size” as an additional characteristic (“and”) or optional species of “coincident.” The Patent Owner did not acknowledge this critical part of column 6 when proposing its substitute terminology, and its substitute terminology would conflict with the usage of the '750 Patent. *See* POR, 25-30.

13. I note that the grammatical structure at 6:3-6 of the '750 Patent is used elsewhere in the '750 Patent, likewise reciting an **additional** characteristic or optional species and confirming that the preceding term is not so limited. *See, e.g.*, EX1001, 5:25-35 (“substantially similar to (and slightly larger than)”); 13:50-51 (“Each lens tube (and each lens described above)”). This contrasts with the '750 Patent’s use of “i.e.” when the parenthetical serves a clarifying purpose. *See, e.g.*,

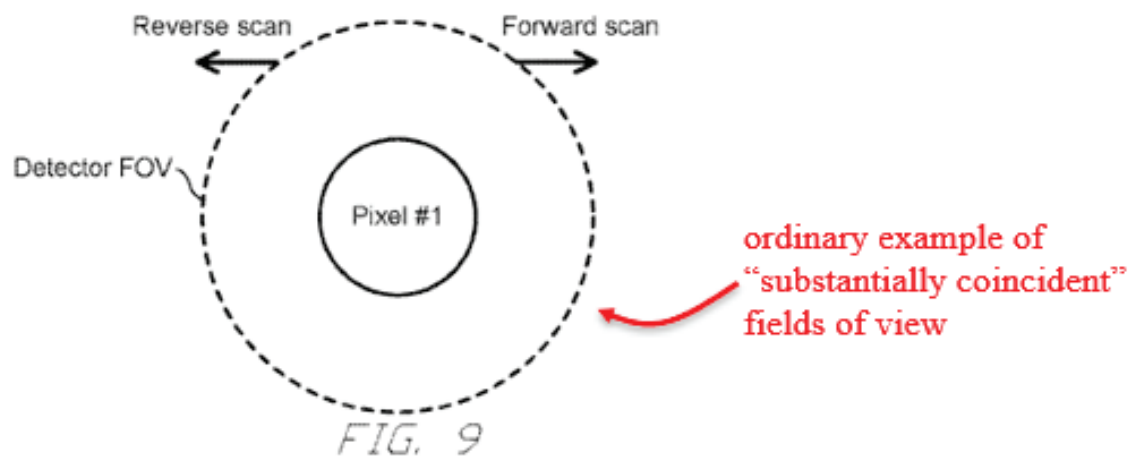
14:41-43 (“a two-dimensional grid array of channels (i.e., aperture, lens, and pixel sets or lens tube and pixel sets)”); 16:26-27 (“aligned with a single channel (i.e., with a single lens in the set of lenses).”).

14. The Patent Owner includes citation to FIG. 1 of the '750 Patent. Figure 1 does not support the Patent Owner's proposal. Figure 1 does not depict the scope of the “field of view” of any of the pixels. For example, even if the beam Patent Owner annotates red, for example, is detected by a corresponding pixel, FIG. 1 does not indicate a particular area of the field of view of the corresponding pixel, much less that it has substantially the same area as the emission region. And it certainly does not indicate “the same” area, as the emission region. EX1001, 3:52-63 (“each aperture in the set of apertures 144 defines a field of view in the field coincident a discrete spot output by a corresponding illumination source in the set of illumination sources 110.”). Although FIG. 1 indicates there is an overlapping relationship sufficient for the beam to be detected, FIG. 1 does not indicate a size of the field of view relative to a size of the corresponding emission region. *Id.* Dr. Janét relies on FIG. 1, despite its lack of indication of the extent of the fields of view. EX1041, 29 (“My opinion about the field of view of 111 would be any reference I have to Figure 1.”).

15. I note that FIG. 2 provides more information concerning the “field of view” corresponding to a pixel as compared with the information provided by FIG.

1. Importantly, FIG. 2 confirms that Patent Owner’s substitute terminology that requires the field of view to have the “same area” as the corresponding emission region and must be neither slightly smaller nor slightly larger than the emission region—is inconsistent with the ’750 Patent.

16. Based on my review and knowledge in the field, Dr. Janét’s citation to extrinsic dictionary definitions does not support Patent Owner’s substitute language. EX2009, ¶119. Nothing in Patent Owner’s dictionary definition of “coincident” requires the field of view to occupy “only” or “identically” the same place as the emission region. For example, two concentric circles can occupy the “*same* place or portion of space” with one another even though a first one of the circles is larger than the second one of the circles, such that the first circle does not occupy only or identically the same place as the second circle. Others in the LiDAR industry used “coincident” in its ordinary manner to describe overlapping areas (even if one area is larger than the other area), as demonstrated by other patent documents at the time.



EX1043, FIG. 9, 10:13-16 (“a lidar system 100 may be configured so that the detector FOV is *larger than* the light-source FOV, *and* the detector and light-source FOVs are *substantially coincident* or overlapped” and “may be substantially *coincident with* the left edge of the detector FOV.”); EX1044, FIG. 36, 57:65-58:2 (“the FOV<sub>R</sub> is *larger than* the FOV<sub>L</sub>, *and* the receiver and light-source FOVs may be substantially *coincident*, overlapped, or centered with respect to one another”)). To the extent that Patent Owner’s dictionary definition is recognized as being consistent with this ordinary usage by others in the LiDAR industry, it supports the plain meaning applied in the petition.

17. I note that Patent Owner itself has used the “coincident with” phrase in other extrinsic sources in manner inconsistent with Patent Owner’s narrow “same area” construction here. For example, claim 20 of the ’236 patent recites that “the first pixel has a field of view that is coincident with the first emitter”—but it certainly does not contend the “field of view” is somehow the same size area as the actual “first emitter” hardware. EX1042, cl. 20.

18. ***As a second matter***, I have been informed that a fundamental canon of claim construction is that a claim interpretation that excludes a preferred embodiment from the scope of the claim is rarely, if ever, correct. Patent Owner’s substitute language violates this principal because it excludes express examples recited by the ’750 Patent. For example, Patent Owner applies its proposed

construction in a way that excludes embodiments described in the '750 Patent in which the field of view is not the same size as the emission region. POR, 43 (excludes “slightly larger than”), 53 (excludes “slightly smaller than”). Such examples are expressly described in the specification, such as an option where a beam is “substantially the same size as *or minimally larger than*” a corresponding field of view. EX1001, 6:3-11; *see also* 11:11-19 (“substantially identical to *or slightly greater than*”). These examples would be excluded by Patent Owner’s proposal.

19. Figure 2 of the '750 Patent plainly indicates that one embodiment of the '750 Patent involves an emission region that is significantly *different* from the field of view of the corresponding pixel:

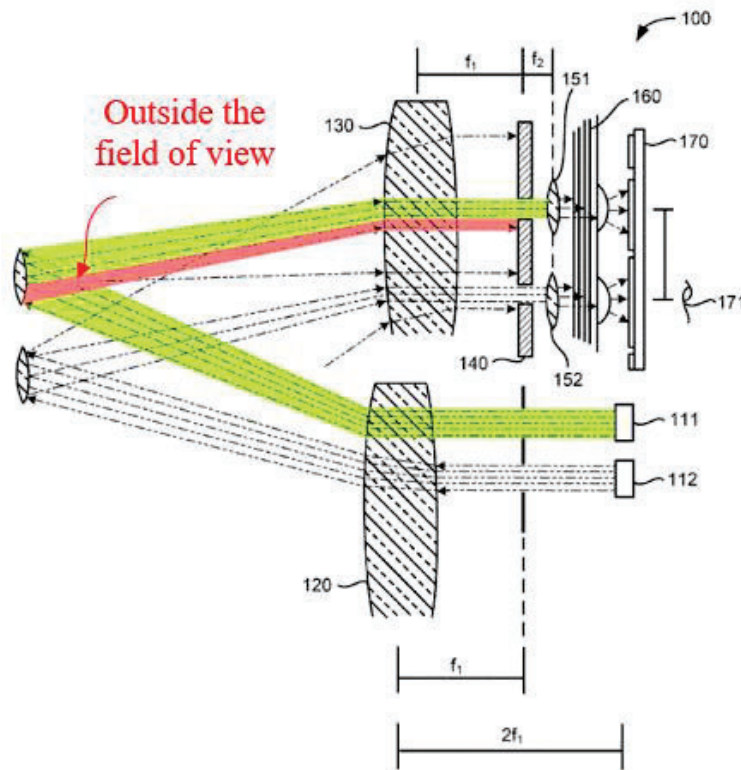


FIG. 2

EX1001, FIG. 2. As depicted above in FIG. 2, a meaningful portion of the area of the emission region from emitter 111 is *outside the field of view* of the corresponding pixel such that it is blocked by the aperture layer 140. EX1001, FIG. 2. I note that Patent Owner and Dr. Janét did not address this aspect of FIG. 2 in their proposal to limit the scope of the term “coincident.” POR, 24-30.

20. I note that the '750 Patent additionally indicates that the pixels have a field of view that can allow a pixel to receive light from a non-paired emitter. This is especially true in embodiments where the emission region is relatively large. The '750 Patent describes “light rays passed from the bulk imaging optic 130 into a

first pixel 171 in the set of pixels 170 **but originating from an illumination source other than the first illumination source** 111 paired with the first pixel 171” (EX1001, 6:14-18) and describes techniques intended to maintain effective signal-to-noise nonetheless.

21. Ultimately, the '750 Patent expressly includes and illustrates emission regions having an area differently sized from that of the field of view of a corresponding pixel. Patent Owner applies its narrow construction in a manner that improperly excludes such embodiments.

22. *As a third matter*, Patent Owner’s use of the word “substantially” makes the claim language more ambiguous, not less ambiguous. For example, the claim language recites “coincident” without reciting the word “substantially.” As I describe in more detail below, the Patent Owner Response repeatedly alleges that “*substantially* the same area” excludes prior art examples in which one of the field of view and the emission region is “slightly smaller than” or “slightly larger than” the other. POR, 43 (excludes “slightly larger than”), 53 (excludes “slightly smaller than”). I note that Dr. Janét indicated that the substitute language requires consideration of further factors of “minimizing wasted power and maximizing signal integrity discrimination or signal to noise ratio.” EX1041, 50 (“if it delivers on those, then - - on both of those, then a person with ordinary skill would understand that the illumination pattern substantially matches the field of view”). This is far afield from

the ordinary usage of “coincident with.” As I discuss in more detail below, the prior art combinations align with the same type of “coincident with” examples used in the ’750 Patent and likewise used by others in the LiDAR industry at the time.

**B. “stop region” (claim 44)**

23. I note again that that there is no need to formally construe the language of claim 44 in view of the similarity of the prior art to the ’750 Patent’s examples. Patent Owner asserts the term “stop region” as excluding structures blocking the detectable portion of the light spectrum, regardless of whether other types of optical energy may pass. Patent Owner’s interpretation is inconsistent with the ordinary meaning of this term because Patent Owner’s interpretation requires an absolute, optically perfect form of opacity for the stop region. POR, 21. For example, Patent Owner states that (“partial or substantial absorption of some light does not indicate a ‘stop region.’” *Id.*, *see also*, EX1041, 67 (“The term substantially is not the same as opaque. Substantially blocking, partially blocking where that might be used, it’s not the same as opaque.”)). Patent Owner does not identify support in the ’750 Patent for its narrowed interpretation. Based on my review of the ’750 Patent, there is no support for Patent Owner’s interpretation. Moreover, examples of “opaque” structures in the ’750 Patent would not block all kinds of light radiation and would fall outside of Patent Owner’s proposal.

24. I understand that Patent Owner cites the “opaque polymer” or the “stop region 146 (i.e., an opaque or reflecting region)” recited by the ’750 Patent. POR, 21; EX1001, 4:9-17. None of these passages indicate that the structures perfectly block all light. These passages instead merely use the terms that Patent Owner tries to narrow. Patent Owner has not identified any structure in the ’750 Patent that includes the absolute, optically perfect form of opacity.

25. Patent Owner’s citation to my testimony is out-of-context. I have acknowledged the possibility of light passing through even a structure made of an “opaque” material (*see, e.g.*, EX2010, 75:9-76:18), and never indicated a material must perfectly block all wavelengths to be effectively “opaque” for a LiDAR system.

## **V. GROUND 1 – RETTERATH AND BOROWSKI**

### **A. The Retterath Grounds disclose the claimed aperture layer including a “stop region”**

26. Patent Owner makes two arguments in support of its assertion that the Retterath Grounds do not provide a “stop region” as claimed. Both of these arguments fail to rebut the analysis set forth in the Petition and in my first declaration.

27. *As a first matter*, Patent Owner implicitly construes the term “stop region” as excluding structures blocking the detectable portion of the light spectrum, regardless of whether other types of optical energy may pass. As described above, this construction is erroneous. *Supra*, § IV.B.

28. *As a second matter*, Patent Owner's theory is incorrect because it is apparent that Retterath provides a "stop region" as described in claim 7. For example, Retterath expressly discloses that "inbound optical energy" is "*substantially blocked* by the detector waveguide." EX1005, 8:59-65. This inbound optical energy comprises energy that includes light from any number of sources and a full spectrum of wavelengths. Patent Owner's declarant appears to agree. EX1041, 78-79 (acknowledging Retterath's "inbound optical energy" includes "plethora of other types of optical energy whether the type is differentiated by the source or the type is differentiated by the wavelength. . ."). Based on my review of Retterath, it is clear that light reaching the waveguide material includes wavelengths across the spectrum. It is also clear that Retterath indicates light is blocked without limitation or exclusion as to particular wavelengths. Consequently, Retterath's straightforward description confirms Retterath's preference that the waveguide material absorbs/blocks as much light across as much of the spectrum as possible.

29. Even if Patent Owner's interpretation of the claimed "stop region" that excludes "substantially blocking" light were adopted, Retterath does not disclose any embodiments where a meaningful amount of light can pass through the waveguide material itself. Based on my review of Retterath, substantial blocking by the waveguide across a spectrum of wavelengths discloses the claimed "stop region."

30. The analysis in the Patent Owner Response mistakes examples where light passes without encountering the waveguide material, such that the light is only “partially” or “substantially” blocked when passing through an aperture at a relative angle, with examples where the waveguide material itself blocks incoming light. I note that, even if some light passes through apertures in the waveguide material or otherwise is able to pass around the waveguide structure, this does not have a bearing on whether the material itself is “opaque.” *Id.*

**B. A POSITA was motivated to combine Hipp’s “Shadow Mask” with the Retterath-Borowski Combination**

31. Even if Retterath in view of Borowski does not render obvious claim 44 (which it does), claim 44 is additionally rendered obvious based on further combination with Hipp. The Petition and my first declaration set forth many straightforward motivations for combining Hipp with the Retterath-Borowski combination. Pet., 40-44. These motivations are expressly supported by Hipp’s stated benefits. Pet., 40-44.

32. I understand that Patent Owner asserts that the combination presents “risk of interference from light scattered by the underside of Hipp’s shadow mask.” POR, 22-23. A POSITA would not have been dissuaded by this risk, whether or not SPADs were used. Hipp not only acknowledges this potential scenario, but offers the traditional solution in which “the rear side of the carrier glass is provided with a layer of material absorbing signal light.” EX1007, 22:7-10; *see also* EX1003, ¶107,

214. This solution would have been recognized as applicable regardless of detector type. Simply put, based on my knowledge and experience in the field and my review of Retterath, Borowski, and Hipp, I believe that a POSITA would have been motivated to implement Hipp's solution, especially in view of its express teaching that application of an absorbing material on the rear side of the carrier glass would effectively reduce unwanted noise. *Id.*

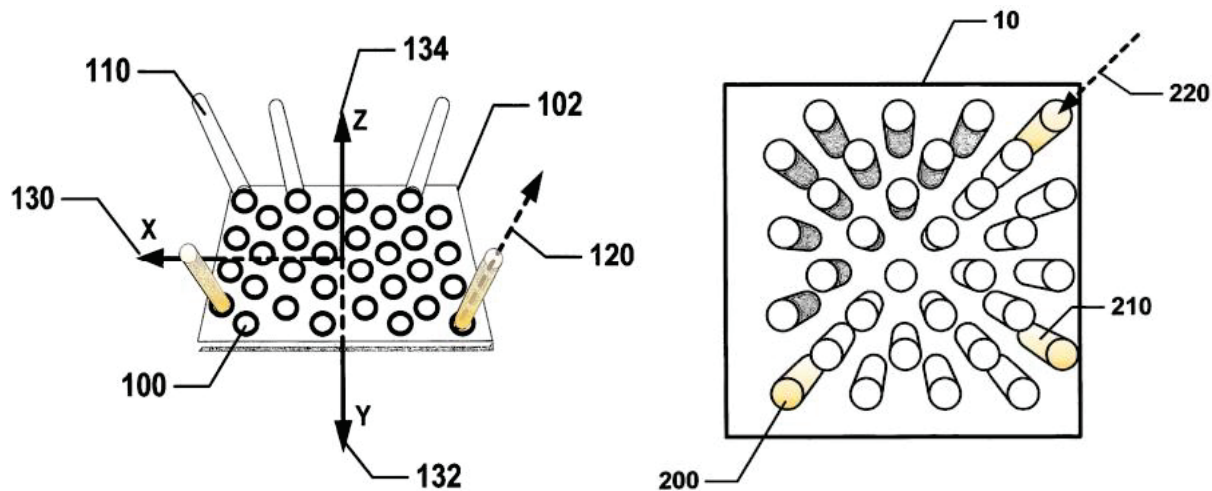
**C. The Retterath Grounds Disclose the “Fields of View Coincident with” Element**

33. I understand Patent Owner's claim construction and element-by-element mapping allege that my analysis relies only on Retterath's teachings that its “emitter and detector pairs has a unique shared directional axis.” POR, 31. This is not the case. As I discuss in more detail below, the Petition and the analysis of my first declaration highlighted Retterath's disclosure that is remarkably similar to the '750 Patent. Under the plain and ordinary meaning, or Patent Owner's improperly narrowed substitute language, the “coincident with” element is provided by the Retterath Grounds.

**1. Retterath Discloses the “fields of view coincident with” Element**

34. Patent Owner's analysis overlooks Reterrath's express teachings. For example, Retterath describes each emission region is output along a unique emission vector 120. Pet., 11-12, 22-27, 28-31 (citing EX1005, FIGS. 4, 6, 8). Moreover,

Retterath describes that each emission region is sized to be non-overlapping with other beams, such that the circular emission region is similarly oriented and sized with the circular field of view of its corresponding detector. Pet., 11-12, 22-27, 28-31 (citing EX1005, FIGS. 4, 6, 8). FIGS. 4 and 8 are reproduced below and depict the non-overlapping orientation nature of the beams, each beam being sized to the circular field of view of its corresponding detector.



Pet., 10, 31 (citing EX1005, FIGS. 4, 8).

35. I understand the Patent Owner cites Retterath's alternative scenarios in which "emitted energy from one emitter will possibly be received at a detector that is not its pair" to dispute that Retterath discloses "a field of view coincident with an emission region." POR, 32-33. Retterath's contemplation of such alternative scenarios is just like the similar contemplation in the '750 Patent, which likewise expressly acknowledges energy emitted from one emitter being received by a detector that is not its pair. See EX1001, 6:3-11. For example, the '750 Patent

discloses that rays from an emitter are sometimes detected by a non-paired pixel and are “noise.” *See* EX1001, 6:11-18. Retterath describes a similar situation where emitters are paired with pixels and the extent that energy from one emitter is “possibly” detected by a non-paired pixel.

36. Even if Patent Owner’s substitute language (“cover substantially the same area in the field”) is imported into the claim, Retterath’s detector fields of view and the emission region of a corresponding emitter are just like the ’750 Patent itself. The ’750 Patent discloses at least one embodiment where an emission region and detector field of view have different sizes. Based on my review of Retterath, this reference does not disclose any embodiments or examples where a size of an emission region is more than slightly different than a size of the corresponding field of view. As I described above, Retterath depicts the emission regions and corresponding fields of view as being virtually the same size (*see* FIGS. 4 and 8). Retterath’s teachings on this aspect are just like the ’750 Patent. Pet., 11-12, 22-27, 28-31 (citing EX1005, FIGS. 4, 8 (received light beams 210), 7 (collimated beam 92), 18a, 4:13-23, 20:41-44).

**2. The combination discloses the “fields of view coincident with” elements based on further combination with Weimer**

37. Retterath discloses that each pixel “has a field of view coincident with an emission region of a corresponding optical emitter,” as recited by claims 1 and 14. But even if Retterath alone did not teach this element, the “coincident with”

limitations are further provided based on Weimer's teaching. Pet., 34-36 ("match the field-of-view" of each pixel to the emission region of an emitter" and "controlling the emission pattern of individual lasers to match the field of view of a corresponding pixel."), 37-39.

38. For example, Weimer teaches that "[i]ndividual beams 208 can be directed to cover *an area corresponding to a single pixel* of the detector." EX1008, 4:56-58. Weimer also describes other similar examples, including a "laser spot size *only slightly smaller* than the receiver's instantaneous field of view". *Id.*, 1:56-60. Based on my review of Retterath, Borowski, Weimer, and the '750 Patent, these teachings are indistinguishable from the '750 Patent's examples. As I noted above, the '750 Patent likewise describes an emission region having a size that is the same or slightly different than a size of the corresponding pixel's field of view. EX1001, 6:3-11 ("an illuminating beam that is substantially coincident (and substantially the same size as or minimally larger than) the field of view"). Consequently, through Weimer's teachings, the combination set forth in the Petition provides example configurations described by the '750 Patent.

39. I understand that Patent Owner cites to FIG. 3A of Weimer at pages 33-34 of its Patent Owner Response. Patent Owner shades some of the squares pink in the Patent Owner Response. POR, 33; *see also, id.* 53 (annotating FIG. 2A). Patent

Owner's pink shading represents a misunderstanding of Weimer's configuration shown in FIGS. 2A/3A.

40. For example, based on my review of Weimer, Patent Owner's characterization of the field of view of Weimer's pixels is incorrect and contrary to Weimer's configuration. Patent Owner provides an annotated figure including pink squares and green circles, where pink squares correspond to areas that the Patent Owner construes as a "field of view" of a detector and green circles correspond to areas that the Patent Owner construes as "emission regions." POR, 52-53. Patent Owner did not provide any support in Weimer for its assertion that the green circles and pink squares accurately represent emission regions and fields of view of detectors. Moreover, regardless of the actual shape of the detector fields of view, because the pink squares of array 324 are stacked next to one another without spaces between squares, Patent Owner is asserting that there is no physical boundary or space between the field of view of one of Weimer's pixels and the field of view of an adjacent pixel. In fact, there would be non-sensitive areas between pixels (e.g., that provide physical separation and reduce crosstalk). The pink shading added by Patent Owner does not accurately portray the fields of view of each of the pixels depicted in Weimer's FIG. 2A. Accordingly, the purported relationship between Patent Owner's pink shading and the emission beam is based on an incorrect premise

regarding the shape of the field of view that is simply not supported by Weimer's actual teachings.

41. And, as I described above, the text of Weimer confirms that Patent Owner's analysis is incorrect. For example, Weimer expressly discloses each emission beam should "cover an area corresponding to a single pixel" (EX1008, 4:56-58) in the part of the description corresponding to FIG. 2A. Weimer teaches a traditional emission region-detector relationship, which is just like the '750 Patent claims. EX1008, 4:56-58. I note that Patent Owner did not address this disclosure in the analysis of FIG. 2A. Furthermore, I note that Weimer's suggestion that emission beams cover the area corresponding a single pixel is straightforward and was readily applicable to Retterath's circular-shaped emission regions and fields of view. Pet., 34-39.

42. Patent Owner's assertions demonstrate that Patent Owner's proposed substitute language ("cover substantially the same area in the field") is unworkable. For example, Patent Owner attempts to import into claim 44 a limitation that the area of an emission region and the field of view of a corresponding pixel be "substantially the same." However, Patent Owner provides no explanation as to how much similarity is required to reach the claim limitation. This is especially problematic in light of Patent Owner's contention that Weimer, which teaches "an area corresponding to a single pixel" or a "laser spot size only slightly smaller than the

receiver's instantaneous field of view," does not provide an emission region that is "substantially the same size" as the field of view of a corresponding pixel. As I discussed above, Patent Owner has not identified any distinction between Weimer's teachings and the disclosure of the '750 Patent.

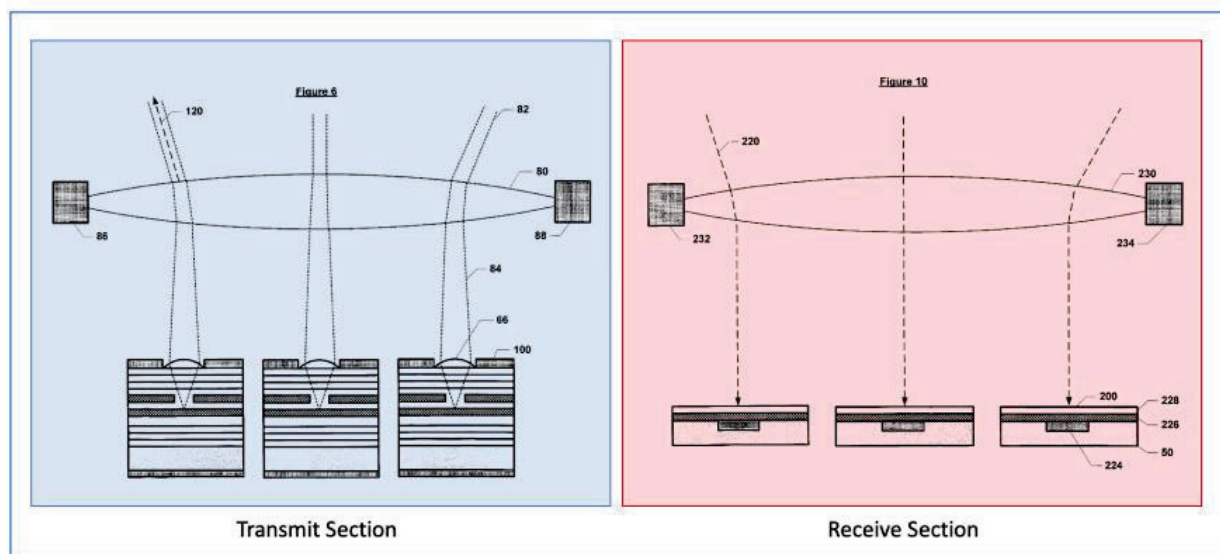
**D. The Retterath Grounds Disclose the Claimed Bulk Transmitting Optic "adjacent" to the Bulk Imaging Optic**

43. As an initial matter, I note that Patent Owner did not dispute that the "emitter array 100" and "detector array 200" are *adjacent* to one another, or that respective lenses over the "emitter array 100" and "detector array 200" would be *adjacent* to one another. POR, 34-40. I understand Patent Owner asserts that the combination would not include respective imaging and transmitting optics. *Id.* This assertion is clearly erroneous because it ignores the teachings of Retterath which expressly include respective lenses.

44. For example, the structure of the Retterath-Borowski combination includes bulk transmitting and imaging optics, and these optics are arranged "adjacent" to one another. Retterath and numerous corroborating references provide straightforward teachings of adjacent bulk and imaging optics, which was conventional at the time. I note that, in describing the combined system, the Petition highlighted Retterath's teachings of a "macro lens 230" positioned over the "emitter array 100" and a "macro lens 80" positioned over "detector array 200." These configurations involve the arrays and lenses being positioned adjacent (e.g.,

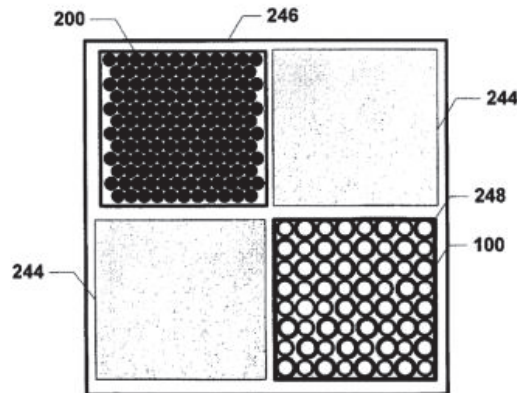
diagonally) to one another. *See, e.g.,* Pet., 10-12, 19-20, 27-28 (citing EX1005, FIGS. 6, 10, 11b, 4:4-10, 6:8-15, 9:12-28 (“macro lens 80”), 10:23-30).

45. Based on my knowledge and experience and review of Retterath, Retterath depicts that a macro lens 80 should be used when several emitter elements 100 are grouped together, and it is clear that Retterath also depicts that a macro detector lens 230 should be used when several detector elements 200 are grouped together. FIGS. 6 and 10 of Retterath, which illustrate the macro lenses placed near the emitter elements 100 and the detector elements 200, are reproduced below:



EX1005, FIGS. 6 and 10. These close groupings of emitters and detectors are exactly what is shown in FIG. 11b, where the emitter elements 100 are grouped loosely next to one another and detector elements 200 are grouped closely next to one another:

Figure 11b



EX1005, FIG. 11b. Retterath plainly teaches macro lenses placed over the detector and emitter arrays depicted in FIG. 11b adjacent to each other.

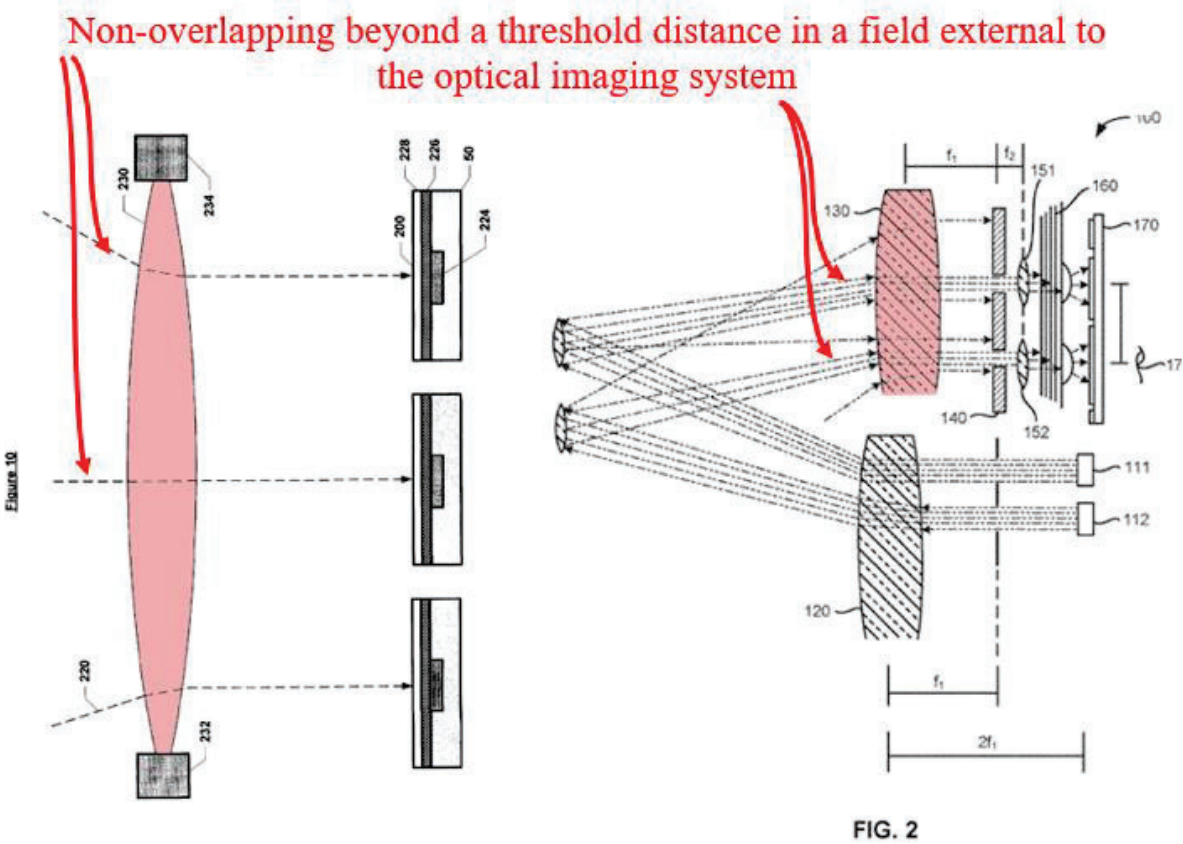
46. Patent Owner conflates Retterath's FIG. 11a configuration in which each emitter element 100 is positioned next to a detector element 200 with the FIG. 11b configuration where a large group emitter elements is placed adjacent to a large group of detector elements. Retterath indicates that Figure 11a includes a "single global lens" for "both emitter elements 100 and detector elements 200" because each emitter element 100 is positioned directly next to a detector element 200. EX1005, 10:40-55. And Retterath is clear that use of a single global lens is limited to such configurations: "**When single global lens are used** for emitter elements 100 and detector elements 200 optics, the distance between the emitter/detector pair **must be minimal.**" Retterath is clear that this is not the case in FIG. 11b. In FIG. 11b, all emitter elements 100 are grouped next to one another as depicted in FIG. 6 and all detector elements 200 are grouped next to one another as depicted in FIG. 10. This

results in the emitter elements 100 being spaced apart from the detector elements 100 in separate quadrants of FIG. 11b. EX1005, 10:62-11:1. Figure 11b illustrates an example of a dense arrangement emitters 100 (like FIG. 6) and a dense arrangement of detectors 200 (like FIG. 10), and Retterath expressly teaches macro lenses 80 and 230 are used in such arrangements. *See, e.g.*, EX1005, 4:4-10, 6:8-15, 9:1-28, 10:23-30, 17:43-52, 20:4-12. There is no need for further “modification” of Retterath.

**E. The Retterath Grounds disclose the claimed “threshold distance”**

47. The Petition provides extensive analysis that describes Retterath’s teachings regarding the “threshold distance.” *See, e.g.*, Pet., 21-23 (citing EX1005, 6:23-39, 7:61-8:14, 8:36-40, 9:56-10:31, 10:32-11:25, 15:14-16:56, FIGS. 8-10. Patent Owner never addressed this analysis.

48. Based on my review of Retterath and the ’750 Patent, it is apparent that Retterath provides at least as much detail concerning the “threshold distance” as the ’750 patent itself. In both cases, the field of view for a given detector does not overlap with the field of view for all other detector elements at a threshold distance beyond the macro lens (e.g., macro lens 230):



## Retterath

## '750 Patent

EX1005, FIG. 10, *see also* FIG. 8; EX1001, FIG. 2 (partial, annotated).

49. The fact that I mentioned a “number” or quantification of the “threshold distance” does not undermine the analysis in the Petition and in my first declaration. POR, 40-41. Patent Owner takes these quotes out of context without ever mentioning that the '750 Patent never requires, or even mentions, a numeric quantification of the “threshold distance.” Moreover, I note that the '750 Patent provides even fewer details than Retterath provides concerning the “threshold distance.” The Retterath grounds align with the same type of “threshold distance” examples of the '750 Patent.

## VI. GROUND 2 – IMAI AND HIGASHI

### A. The Imai Ground Discloses the “Fields of View Coincident with” Element

50. As discussed in the petition and in my first declaration, Imai describes configurations that are almost identical to example embodiments of the ’750 Patent with respect to the “fields of view coincident with” limitation. The Imai combinations thus provide the claimed “coincident” relationship between the fields of view and the emission regions. This is true both when applying the plain and ordinary meaning to the term “coincident” and when applying Patent Owner’s narrowed substitute language (“cover substantially the same area in the field”) for the term “coincident with.” I note that Patent Owner incorrectly alleges that Imai only discloses emission regions that are “*significantly* larger or smaller” than the detection regions of the corresponding detectors. POR, 41-43. Patent Owner also incorrectly states that the Petition “depends on the view that *any* overlap between emission and detection regions is sufficient.” *Id.*

51. In reality, Imai’s description is just like the description of the ’750 Patent concerning the size of a field of view relative to the corresponding emission region. For example, Imai and the ’750 Patent describe examples in which the emission region is “slightly larger”/“minimally larger” than the pixel field of view:

**Imai**

**’750 Patent**

[0101] The irradiation range of each LD is set to be slightly larger than corresponding light receiving ranges of the four PDs. According to this, it is possible to efficiently irradiate the

Because the first illumination source 111 projects an illuminating beam that is substantially coincident (and substantially the same size as or minimally larger than) the field of view defined by the first aperture 141 (as shown in FIG. 4),

EX1009, [0101]; EX1001, 6:3-18.

52. Based on my knowledge and experience in the field and my review of Imai and the '750 Patent, a POSITA would have recognized that there is no meaningful distinction between the area relationship described by Imai and the area relationship described by the '750 Patent. *See*, Pet., 54-58, 61-64; EX1009, [0099] (“irradiation range of the LD1 corresponds to light receivable ranges of the PD1 to PD4”), [0100]-[0101]. Patent Owner argues that the “minimally larger” area of the '750 Patent falls under the “coincident with” claim elements but the “slightly larger” area of Imai does not fall under these same claim elements, but there is no meaningful difference between “slightly” and “minimally” in the context of Imai and the '750 Patent

53. I understand that Patent Owner does not dispute the further analysis set forth in the Petition explaining why “a POSITA would have been motivated to implement the 16 LDs such that electromagnetic radiation output from each LD is coincident with a field of view of a corresponding PD.” Pet., 63-64 (describing a motivation to provide a balanced tradeoff of detection time and detection distance). This analysis provides an independent reason that the Imai grounds render obvious Element 44(f).

**B. The Imai Ground Discloses the Claimed Bulk Transmitting Optic Adjacent to the Bulk Imaging Optic**

54. I understand Patent Owner asserts that “Figure 2C does not indicate that any element is adjacent to any other element, because elements have been omitted.” POR, 45. This assertion ignores Imai’s teachings. For example, Imai expressly addresses the spatial relationship of the depicted aspects of the system, including a spatial (xyz) coordinate system. As plainly evident from FIGS. 2A-2C, and Imai’s description, FIGS. 2A-2B illustrate transmitting and receiving paths of the top view (along the z-axis) and FIG. 2C illustrates the side view (along the y-axis). EX1009, FIGS. 2A-2C. Figure 2C thus shows a perspective that is rotated relative to FIGS. 2A-2B. Both when FIG. 2C is viewed independently, and certainly when viewed collectively with FIGS. 2A and 2B, the respective lenses are plainly “adjacent” to one another. *Id.*

55. Imai explains exactly what is “partially omitted” from FIG. 2C, and thus there is no question as to what exactly is shown and what is omitted from FIG. 2C. The omitted aspects include portions of the optical path to reflecting mirror 24 which extends out of the page in the perspective shown in FIG. 2C (as compared to FIG. 2A and 2B which are shown in a perspective rotated relative to FIG. 2C). EX1009, [0038]. In particular, Imai states “At (C) in FIG. 2, the optical path from the LDA to the reflecting mirror 24 and the optical path from the reflecting mirror 24 to the PDA are illustrated in a partially omitted manner.” *Id.*

56. Thus, there are no additional components between the LDA and coupling lens 22 or between the PDA and imaging forming optical system. In the x-direction, the objects illustrated as adjacent are in fact adjacent. In other words, for those objects depicted in the X-Z plane of FIG. 2C, the relative positions of the structures are accurately depicted—the LDA is adjacent to the coupling lens 22 in the X-Z plane, and the PDA is adjacent to the imaging forming optical system in the X-Z plane.

57. The selective citations to my testimony do not support Patent Owner's assertion that Imai does not disclose bulk optics adjacent to each other. Patent Owner first makes an incorrect statement that "Dr. Shanley confirmed in his testimony that Figure 2C is not an accurate representation of spatial relationships in the depicted system." POR, 47. I disagree with this characterization of my testimony. Even a schematic drawing would have been useful to a POSITA to convey the physical layout of the system. This is especially the case in FIG. 2C, which illustrates the respective lens components with reference to the cited X-axis and Z-axis. *Id.* The respective lenses are aligned on the x-direction, and spaced adjacently along the z-direction. The depicted arrangement is just like the '750 Patent's example in which "the bulk transmitting optic is adjacent and offset laterally and/or vertically from the bulk imaging optic." EX1001, 11:2-7.

58. To be clear, based on my knowledge and experience in the field and my review of Imai, a POSITA would have recognized Imai at least suggests an adjacent relationship between the transmitting and imaging optics. Imai plainly illustrates the respective lenses adjacent to one another in the z-direction of an X-Z plane, without any teaching or indication that the lenses should not be adjacent to one another.

### **C. The Imai Grounds Disclose the Claimed “Threshold Distance”**

59. The Patent Owner Response appears to ignore analysis of Imai’s teachings that address the claimed “threshold distance” in the Petition and in my first declaration. *See, e.g.*, Pet., 51-52, 55-59, (citing EX1009, [0099]-[0101], [0125], FIGS. 7A-7B, 10-11; EX1001, 5:17-28, 11:16-19), fn. 3. The Patent Owner Response never addressed this analysis.

60. Here again, based on my review of Imai and the ’750 patent, Imai provides at least as much detail regarding the “threshold distance” as the ’750 patent itself. Patent Owner made an unsupported assertion regarding my testimony as to whether the threshold distance is a “quantifiable number.” POR, 50. Patent Owner’s assertion ignores that the ’750 Patent itself also does not require, and does not ever mention, a numeric quantification of the “threshold distance,” and Patent Owner takes my testimony out of context in attempting to suggest otherwise.

## **VII. GROUND 3 – WEIMER, BOROWSKI, AND HIPP**

**A. The Weimer Ground discloses the claimed bulk transmitting optic adjacent to the bulk imaging optic**

61. Based on my review of Weimer, it is clear that the Petition expressly identified Weimer's teachings (and numerous corroborating references) of a bulk transmitting optic (e.g., transmit optics 318) and bulk imaging optic (e.g., receive optics 322), and their adjacent arrangement. Pet., 73 ("receive optic 322"), 76 (citing EX1009, 10:3-16, FIG. 3A).

62. Patent Owner's argument that the Weimer ground does not disclose adjacent optics relies on an assertion that FIG. 3A is not drawn to scale. POR, 51. A drawing that conveys the physical layout of a system is useful whether or not the entirety of the drawing is "to scale." This is especially the case in FIG. 3A, which provides horizontal ("Cross-track") and vertical ("Direction of Flight") axes, and illustrates the respective lenses 318 and 322 are aligned on the vertical-axis, and spaced adjacently along the horizontal-axis. This arrangement of lenses is indistinguishable from the '750 Patent's description that "the bulk transmitting optic is adjacent and offset laterally and/or vertically from the bulk imaging optic." EX1001, 11:11-13.

63. Even if a relationship between transmitting and imaging optics is not expressly disclosed (which it is), a POSITA would have recognized that Weimer suggests an adjacent relationship between the transmitting and imaging optics. Weimer illustrates the respective lenses adjacent to one another. This is consistent

with conventional adjacent arrangements. Furthermore, Weimer does not include any teaching or indication that the lenses should not be adjacent to one another.

**B. The Weimer Ground Discloses The “Coincident With” Element**

64. The Patent Owner’s assertions regarding Weimer in Ground 3 fail for the same reasons as discussed above regarding the Retterath-Borowski-Weimer system. *Supra*, VII.A. For example, Weimer’s teachings are indistinguishable from the ’750 Patent’s preferred embodiments. EX1008, 4:56-58 (“Individual beams 208 can be directed to cover an area corresponding to a single pixel of the detector.”); *see also, id.* 1:56-60 (“only slightly smaller”); EX1001, 6:3-11; Pet. 74-75, 77-78.

**C. The Weimer Ground Discloses The Claimed “Threshold Distance”**

65. I note that here again Patent Owner’s assertions rely exclusively on my testimony taken out of context, and do not respond to the analysis set forth in the Petition and my first declaration highlighting Weimer’s teachings of the claimed “threshold distance.” *See, e.g.,* Pet., 72-73, 74-76 (citing EX1008, 1:56-59, 4:56-58, 10:17-45, FIGS. 2A, 3A); EX1001, 5:17-28, 11:16-19.

66. As I discussed above, Patent Owner ignores that the ’750 Patent itself never requires and does not even mention a numeric quantification of the “threshold distance.” Patent Owner’s on testimony regarding quantification of the “threshold distance,” taken out of context, is not relevant. POR, 53. Weimer’s description is just like the ’750 Patent with respect to the “threshold distance” limitation.

**D. A POSITA Would Not Have Been Motivated to Combine Weimer, Borowski, and Hipp**

67. Patent Owner relies on the same deficient analysis as to Hipp in the Retterath grounds, and thus its assertions fail for the same reasons described above. *Supra*, VII.A.

**VIII. PATENT OWNER'S SECONDARY CONSIDERATIONS ARE LEGALLY AND FACTUALLY DEFICIENT**

**A. Patent Owner Does Not Demonstrate Nexus Between Any Unique Feature of the '750 Claims and Its Purported Skepticism or Failure of Others**

68. I understand that Patent Owner alleges that secondary considerations render the claims nonobvious even if the Retterath, Imai, and Weimer grounds would have otherwise rendered the claim obvious. In its analysis, Patent Owner and Dr. Janét do not describe “skepticism” and “failure of others” directed to any unique features of the challenged claims. POR, 54-58. For example, the challenged claims are directed to a specific structural arrangement tailored to SPADs with other optical elements and features, but Patent Owner’s discussion is directed to “SPADs in LiDAR systems” generally without considering the optical system of claim 44, for example. POR, 54-58.

**B. Patent Owner's Purported Evidence Ignores The Widespread Teachings of "SPADs in LiDAR Systems" At The Relevant Time**

69. In his declaration, Dr. Janét opines that there are secondary considerations of nonobviousness relevant to the validity of the '750 Patent. Patent Owner and Dr. Janét only discuss two such purported secondary considerations: industry skepticism and failure by others. Janét Decl., EX2009 ¶¶ 244-254. I disagree with Dr. Janét on both points.

70. Patent Owner and Dr. Janét do not point to any publication or other material that demonstrates a widespread belief or opinion within the industry that SPADs could not be used in a LiDAR device, nor was there any such belief in the industry. To the contrary, my initial declaration discusses several patents and papers that proposed the use of SPADs in LiDAR applications, including Borowski (EX1006), Imai (EX1009), Higashi (EX1011), Droz (Ex. 1036), Marino (Ex. 1019), and Matsubara (Ex. 1023). Marino, in particular, describes research performed by MIT Lincoln Labs, which performed extensive research on SPADs and LiDAR systems in the early 2000s.

71. I note that Patent Owner and Dr. Janét asserted that there was industry "skepticism" regarding the use of SPADs in LiDAR systems based on my account of one project *in 2008*, which occurred many years before the critical date of the '750 Patent in 2015. *See* POR 54-58. Others in the industry leading up to 2015 were using SPADs in LiDAR systems, as they provided known benefits at the time. There is no

dispute that Borowski, Imai, and Higashi establish that others described using SPADs in LiDAR systems, as well as their known benefits in LiDAR systems, before the priority date of the '750 Patent. Pet., 12-13, 46-47; EX1003, ¶¶51-62. By 2015, I am confident that SPADs were more advanced and were embraced by the industry as some of the best photodetectors to use in LiDAR systems, depending upon the needs of the design. EX1003, ¶¶51-62, 89-95, 112, 118-122. The use of SPADs in LiDAR systems was not a novel concept, and the recited SPAD claim element in the '750 Patent was certainly not novel in 2015.

72. To be clear, this ubiquitous nature of SPADs in LiDAR systems extended beyond Borowski, Imai, and Higashi. I note one academic article from 2013 provides that “SPADs...are emerging as most suitable photodetectors for...single-photon timing (Lidar...) applications.” EX1045, 2-5. Another 2012 article describes a LiDAR system that combines “a SPAD array with an optical scanning system” to improve performance by mitigating the effect of background light. EX1046, 1-11. Yet another article authored in 2014 discloses that “[a]rrays of single-photon avalanche-diodes (SPADs) are the best candidates” for LiDAR systems “because they have...no excess noise, typical of analog avalanche photodiode arrays.” EX1047, 1-8. Consequently, by the critical date of the '750 Patent, it is clear that many in the industry extolled SPADs as being superior to other kinds of photodetectors for use in LiDAR systems.

73. I understand Patent Owner asserts that “many had sought—but failed—to develop arrays of SPADs for use in LIDAR systems” in 2015. *See* POR 56-57. The many patents and publications above demonstrate this is not the case. In support of Patent Owner’s assertion, Patent Owner cites just one article—the Vinogradov paper—which concludes that “to the best of the author’s knowledge” there were “no attempts” to implement SPAD arrays in a LiDAR. EX2014, 4. I have reviewed the Vinogradov paper, and I disagree that it shows repeated failures by others to develop SPAD arrays for use in LiDAR systems. At most, this paper proves that the author never achieved a commercial LiDAR system in 2015 using SPADs. But Vinogradov’s failure by 2015 to achieve a commercial product does not mean that no others disclosed the solution of how to do so. I note that Sergey Vinogradov is not a prominent or well-known researcher in the field of LiDAR design. It is not clear from his paper or from Dr. Janét’s declaration whether Sergey Vinogradov even has sufficient experience with LiDAR systems to be considered a POSITA.

74. As demonstrated above, it is clear that SPADs were often a preferred option in LiDAR systems for many others in 2015.

## **IX. LEVEL OF ORDINARY SKILL IN THE ART**

75. In my initial declaration, I explained that a POSITA with respect to the ’750 Patent would have had an undergraduate degree in mechanical or electrical engineering or physics and two to three years of experience in the field of LiDAR

design. EX1003, ¶¶72-77. I also provided several reasons why this would have been the level of ordinary skill in the art and would have been typical for a POSITA with respect to the technology underlying the '750 Patent. *Id.*

76. I understand that Dr. Janét agrees with me that a POSITA would have work experience with LiDAR design. Janét Decl. ¶ 60. However, Dr. Janét believes that only one year of work experience is necessary, and need only be supplemented by two to three years of experience with “electro-optical and electro-mechanical devices or systems.” *Id.*, ¶ 60. I disagree with Dr. Janét. A POSITA would have been familiar with the optical, electrical, and mechanical elements of a LiDAR system, specifically, including problems associated with the design and implementation of those components in the context of a LiDAR system and solutions for addressing those problems. EX1003, ¶¶73-77 Such knowledge would be gained through additional experience working with LiDAR systems, but not necessarily through experience with electro-optical and electro-mechanical systems more generally. *Id.*

77. Based on my knowledge of LiDAR technology and my industry experience developing LiDAR systems, I note that Patent Owner’s proposed POSITA definition attempts to shrink the level of skill to accommodate Dr. Janét’s limited LIDAR experience. One example of this is that Patent Owner calls for as little as “one year” of experience with “LIDAR designs.” POR, 4-5. The record lacks

any indication that Dr. Janét's declarant has sufficient LIDAR experience, much less 2-3 years of experience.

## **X. LEGAL PRINCIPLES**

### **A. A Person of Ordinary Skill in the Art**

78. I understand that a POSITA is a hypothetical person who is presumed to be aware of all pertinent prior art, thinks along conventional wisdom in the art, and is a person of ordinary creativity—not an automaton.

79. I understand the level of ordinary skill in the art is evaluated based on various factors, including: the level of education and work experience of persons in the field; the type of problems encountered in the field; and the sophistication of the technology at issue.

### **B. Claim Construction**

80. I understand that, as a general rule, the claim terms of a patent are understood to have their ordinary and customary meaning to a POSITA at the time of the invention when read in the context of the patent and its prosecution history. I understand that there are certain exceptions to the general rule, including lexicography and disavowal, but based upon my review of the '750 Patent, I am not aware of any instances those exceptions in connection with this proceeding.

### **C. Obviousness**

81. I understand a patent claim is still invalid if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the pertinent art at the time the invention was made.

82. I understand an obviousness determination includes the consideration of various factors, including the scope and content of the prior art, the differences, if any, between the prior art and the claimed subject matter, the level of ordinary skill in the art, and the existence of objective indicia of obviousness or nonobviousness.

83. I understand an obviousness determination can be based on a single prior art reference or a combination of multiple prior art references and the knowledge of a POSITA. I understand the prior art itself may provide a suggestion, motivation, or reason to combine or modify the teachings of the prior art, or that such a reason may come from other sources, such as the knowledge of a POSITA, common sense, and market forces. However, I understand it is impermissible to rely on hindsight or to use the claimed invention as a roadmap to reach a finding of obviousness.

84. I understand the following rationales may support a finding of obviousness:

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;
- Use of known technique to improve similar devices (methods, or products) in the same way;
- Applying a known technique to a known device (method or product) ready for improvement to yield predictable results;
- “Obvious to try” – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;
- Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

85. I understand an obviousness finding requires a reasonable expectation of success in achieving the claimed invention. The expectation of success need only

be reasonable; a perfect implementation or commercial embodiment of the invention is not required.

86. I understand that objective indicia of obviousness or non-obviousness may include commercial success attributable to the alleged invention; a long-felt but unmet need for the alleged invention; praise of the alleged invention by others in the field; and skepticism towards the alleged invention by experts. I understand that any secondary considerations must bear a nexus to the alleged invention. I understand the nexus requirement is not satisfied if, for example, the purported commercial success is tied to features of a product that were known in the prior art rather than the alleged invention.

## **XI. CONCLUSION**

87. I currently hold the opinions expressed in this declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

88. I hereby declare that all statements made are of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of the Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this proceeding.

Dated: 10/21/2024

By: James F. Shanley  
Dr. James Shanley, PhD