

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. IPR2023-01457
U.S. Patent No. 11,190,750

**PATENT OWNER'S
PRELIMINARY RESPONSE
UNDER 37 C.F.R. §42.107**

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The Board should not institute *inter partes* review of claims 44-48 and 50 (the “challenged claims”) of U.S. Patent No. 11,190,750 (the “’750 patent”).

I. OVERVIEW

Ouster’s ’750 patent describes and claims an innovative technology that has transformed the burgeoning field of light detection and ranging (“LIDAR”). Hesai now challenges Ouster’s patent using impermissible hindsight, unsupported and unsupportable assertions by Hesai and its expert, and positions that directly contradict Hesai’s litigation positions regarding the meaning of the claims. The Board should deny review as to all of Hesai’s asserted grounds.

Ouster was founded in 2015 to pursue a new and innovative approach to LIDAR design. Prior to Ouster, the conventional wisdom viewed a strong signal and a high signal-to-noise ratio as substantial contributors to a successful design. As a result, conventional LIDAR devices prior to 2015 combined a high wattage laser emitter with avalanche photodiode (“APD”) sensors able to filter out all but the strongest signals. Ouster, however, demonstrated that with the right optical design, a LIDAR sensor could be built upon a pairing of low-power vertical-cavity surface-emitting lasers (“VCSELs”) to single-photon avalanche diodes (“SPADs”), resulting in a highly efficient, accurate, and low-cost system. Ouster’s design, including its unique optical components, yields a smaller and more compact sensor, reduces cross-talk and background noise, and improves the ability to record an image at a

distance in detail.

Hesai seeks to challenge the patents Ouster has earned on its innovative technology through an *à la carte* approach in which it uses the very claims it challenges to assemble combinations of disparate components it has clipped from the prior art. In so doing, Hesai relies upon references that teach away from each other and combinations that defy common sense, and still does not even manage to find prior art structures to match all the elements of the challenged claims. Further, Hesai ignores the difficult realities of designing systems that rely on VCSELs and SPADs and instead, offers only the conclusory *ipse dixit* of its expert witness in support of a reasonable likelihood of success. The only motivation driving these combinations is Hesai's litigation needs; no POSITA would have had a reasonable expectation of success in the outcome since no POSITA would ever have contemplated the proposed combinations in the first place.

Further, Hesai's petition ignores claim construction positions Hesai has taken in prior litigation between Ouster and Hesai. In 2023, Ouster brought a Section 337 investigation against Hesai before the International Trade Commission (ITC)—*Certain Lidar (Light Detection and Ranging) Systems and Components Thereof*, Inv. No. 337-TA-1363—in which Ouster asserted the challenged claims of the '750 patent. In that investigation, Hesai insisted that resolution of the parties' dispute required construction of 9 *terms* of the claims of the '750 patent. (Ex. 2001.) Hesai

now generally asserts that “the prior art renders the challenged claims obvious under the constructions advanced by both parties,” so “no formal claim constructions are necessary.” (Pet. at 3-4.)

However, despite Hesai’s claim to the contrary, its petition and accompanying expert declaration *fail* to account for its claim construction positions before the ITC. Before the ITC, Hesai proposed the following construction for the term “field of view”: “detection area defined by an aperture or lens tube.” (Ex. 2002 at 2.) But now, Hesai fails to identify an “aperture” or “lens tube” required by its own construction in *any* of the combinations it asserts.¹

Hesai’s selective approach to claim construction is just the latest in a long line of inconsistent positions Hesai has taken before different forums. For example, Hesai’s filing of IPRs against Ouster’s patents come after Hesai argued before the ITC—leading to termination of the investigation—that Hesai and Ouster’s dispute over patents, including the patent Hesai challenges here, must be arbitrated.²

¹ Hesai’s position here is similar to its refusal to apply its own definition of “aperture” to the prior art it asserts against Ouster’s U.S. Patent No. 11,175,405 in Case No. IPR2023-01421.

² It should be noted that Ouster denies that the parties are subject to an arbitration agreement. The ITC has referred the question of a duty to arbitrate to arbitration.

Arbitration between the parties proceeds, but now Hesai has apparently changed its tune and decided that a non-arbitration panel—the Board—should decide this dispute between the parties.

The Board should deny review of all of Hesai’s asserted grounds.

II. BACKGROUND

A. Level of Ordinary Skill in the Art

For the limited purpose of this Preliminary Response, Patent Owner adopts Petitioner’s definition of a POSITA as having an undergraduate degree in mechanical or electrical engineering or physics and two to three years of experience in LIDAR design. (Pet. at 3.)

B. Specification Overview

The ’750 patent discloses a “new and useful optical system for collecting distance information in the field of optical sensors.” (Ex. 1001, 1:22-25.) Figure 1, reproduced below, shows an embodiment:

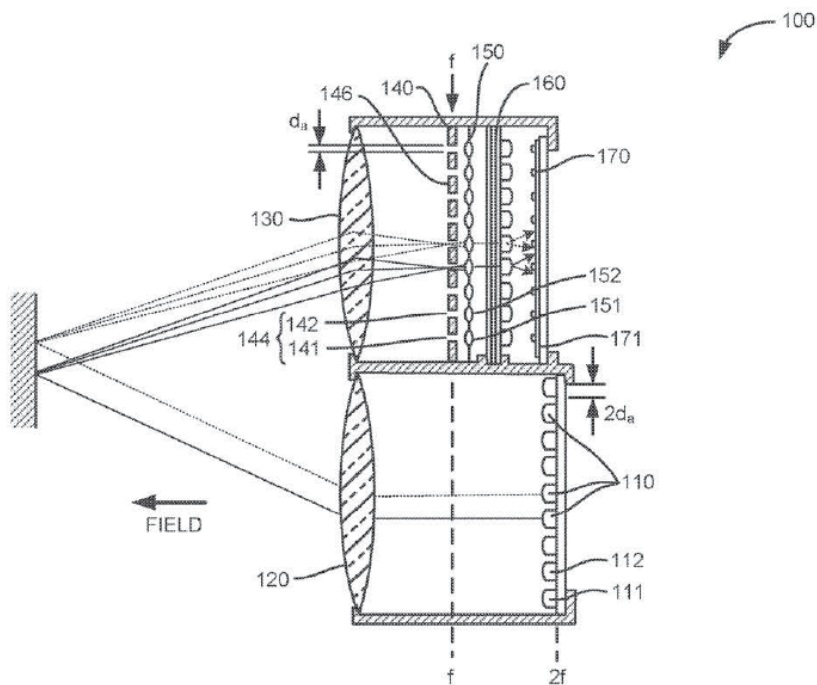


FIG. 1

(*Id.*, Fig. 1.) Light beams are shown emitting from illumination sources **110** and being directed into the external field via a bulk transmitting optic **120**. (*Id.*, 5:20-31.) Illumination sources **110** can consist of an array of VCSELs. (*Id.*, 10:65-11:2.) The light beams deflect off of objects in the field and are directed into the receive side of the device through bulk imaging optic **130**. (*Id.*, 2:3-4.) The beams pass through aperture layer **140** consisting of stop regions **146** around apertures **144**, which define a field of view coincident with a “discrete spot output by a corresponding illumination source” in the field. (*Id.*, 2:4-14.) Then, the beams pass through lenses **150**, which are aligned with the apertures in aperture layer **140**. (*Id.*, 2:14-21.) After passing through optical filter **160** and diffusers **180**, the light beams

reach pixels **170**, which detect the light. (*Id.*, 2:22-29.) The pixels can be made up of single-photon avalanche diode detectors (“SPADs”). (*Id.*, 9:1-38.)

III. PETITIONER’S ASSERTED PRIOR ART

A. Retterath (Ex. 1005)

U.S. Patent No. 10,203,399 B2 (“Retterath”; Ex. 1005) teaches LIDAR systems using “an array of emitter/detector sets . . . where each emitter/detector set is configured to receive reflected light energy that is on a given coincident axis[.]” (Ex. 1005, 2:66-3:5.) Retterath does not disclose the types of detectors used in its system, instead indicating that “[e]ach detector of detector elements **200** can be configured as a photoreceptor such as a photodiode or phototransistor which converts light into an electrical signal.” (*Id.*, 6:57-59.)

Retterath discusses disadvantages of various LIDAR approaches. (*Id.*, 1:18-2:62.) Retterath indicates that “problems remain in developing effective LiDAR units that can address the interference challenges and operate reliably in an environment where hundreds or thousands of like devices are operating simultaneously.” (*Id.*, 2:58-62.)

For example, Retterath indicates that “[f]lash LiDAR devices[,]” which “illuminate an entire 2D field of view with a blanket of light and measure the return value time for each photoreceptor location in the field of view[,]” are “relegated to very close proximity applications due to the low incident laser power for each location in the field of view.” (*Id.*, 1:54-61.) For flash LIDAR systems at longer

ranges, Retterath warns that “the usable field of view is typically too small for applications like autonomous vehicle navigation without the use of high performance cameras operating in the picosecond range for exposure times.” (*Id.*, 1:61-65.)

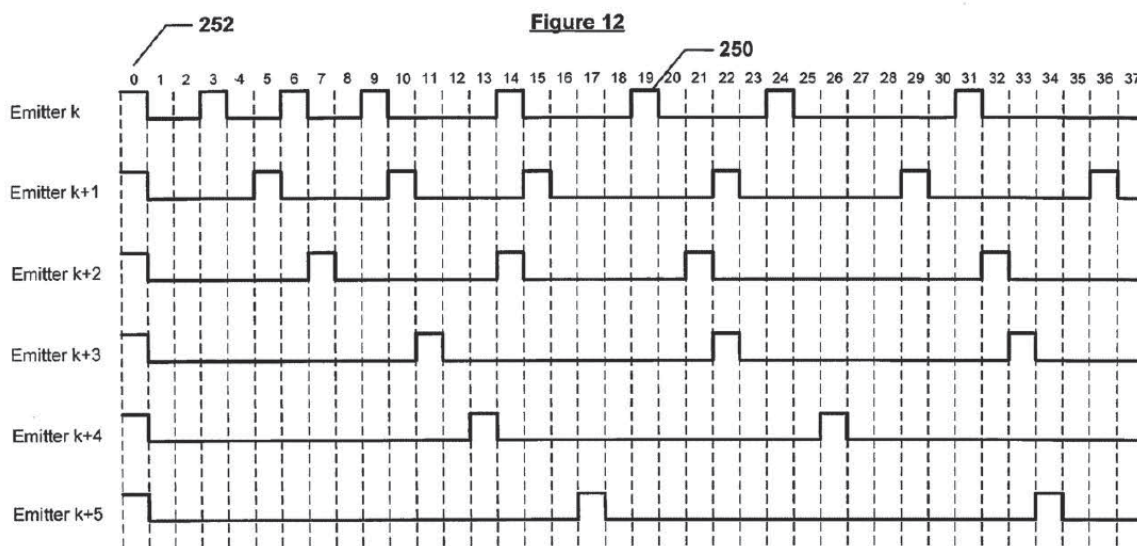
Further, Retterath warns of the dangers of cross-talk in “[s]canning LiDAR units”: “Care must be taken to ensure that signals received by the photoreceptor are reflected light from the desired emitter source.” (*Id.*, 2:10-12.) “Two LiDAR units, call them A and B, operating with lasers at the same wavelength have the potential to experience crosstalk.” (*Id.*, 2:12-14; *see also id.*, 2:14-17.) “In an application like autonomous vehicle navigation with multiple LiDAR sensors per vehicle on a busy roadway, the potential for crosstalk among pulsed-laser LiDAR units is quite high.” (*Id.*, 2:17-20.) Such crosstalk interference among LIDAR units will cause “one or more distances being computed as lower than the actual distances or failure to find a signal, resulting in no value being reported for an individual point.” (*Id.*, 2:29-32; *see also id.*, 2:33-35.)

Retterath teaches that “time division synchronization between the units” can reduce crosstalk interference, but it is “impractical when the individual units are integrated with separate, independently-controlled systems.” (*Id.*, 2:21-28.)

Retterath addresses the cross-talk issues with LIDAR systems using emitter/detector channels and a unique “multi-bit sequence of emitter pulses for each

emitter/detector cycle . . . wherein the bit sequence differs from the bit sequences for emitters whose coincident axis/vectors are in close proximity.” (*Id.*, 3:10-15.) Retterath discloses that “[b]y selecting locally unique bit patterns for each emitter, the interference from other emitters and other similar LiDAR devices is dramatically reduced[,]” as well as interference from “non-LiDAR devices that are transmitting or reflecting energy at the target detector wavelength.” (*Id.*, 3:15-21.)

Figure 12 of Retterath shows an example of a pulse timing sequence scheme for use with neighboring emitter-detector channels:

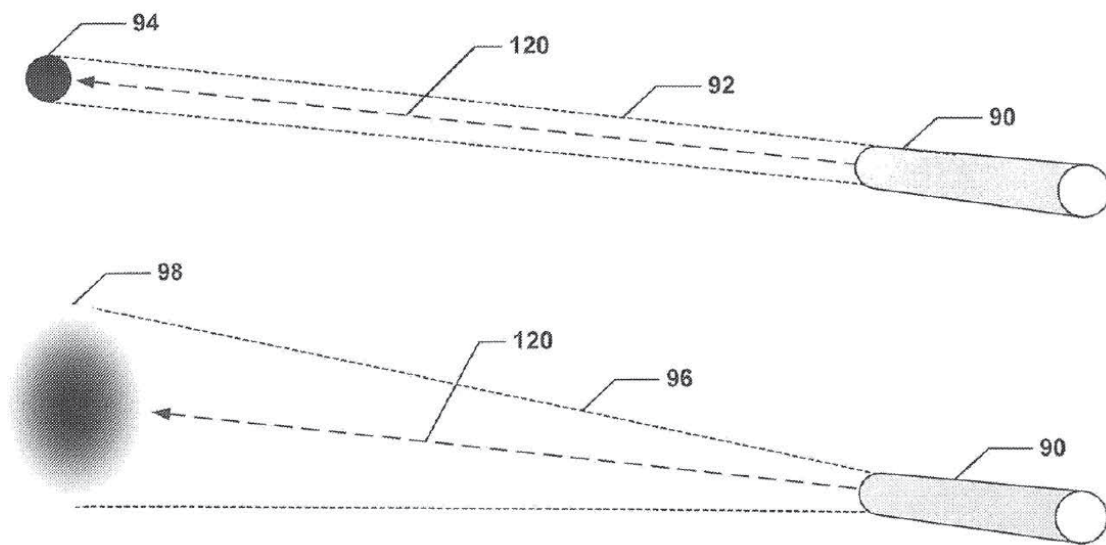


(*Id.*, Fig. 12; *see also id.*, Figs. 13-16, 11:26-16:56.) Retterath indicates that “[s]ince the vectors are similar, emitted energy from one emitter will possibly be received at a detector that is not its pair.” (*Id.*, 11:33-35.) Accordingly, “[t]he circuitry for each paired detector is configured to detect the pulse sequence from its paired emitter.” (*Id.*, 11:37-39.) Retterath teaches the use of “sparsely populated” pulse sequences,

“[t]o accommodate detection of pulse sequences from a detector’s paired emitter.”
(*Id.*, 11:35-37.)

Retterath further discusses the use of different beams for emitters, as shown in Figure 7:

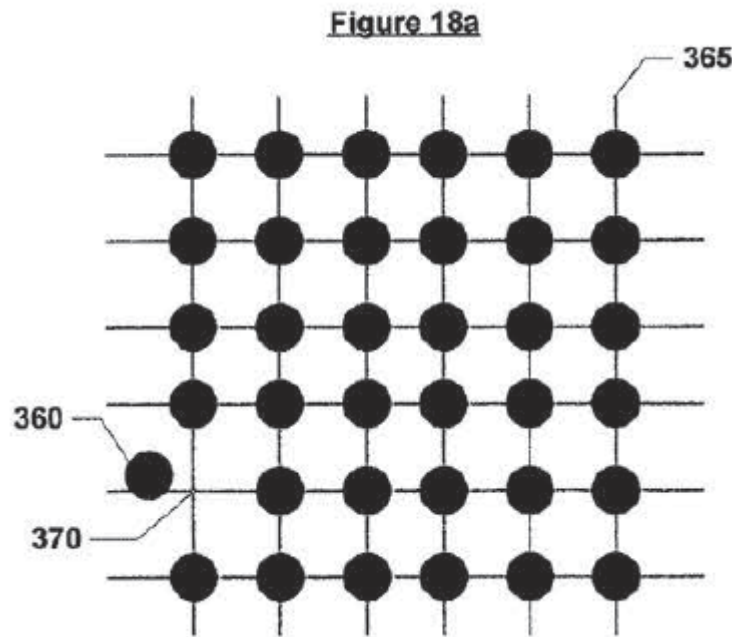
Figure 7



(*Id.*, Fig. 7; *see also id.*, 9:29-52.) Retterath indicates that the bottom diagram is the “more typical beam profile,” which “diverges as it travels through space,” and “[t]he spot **98** on the surface of the reflected object is elliptical in shape.” (*Id.*, 9:44-46.) Further, “[t]he light intensity is non-uniform throughout the surface of the spot **98**” and “[t]he point of greatest intensity will not always be the center point of the spot **98**.” (*Id.*, 9:47-48, 9:51-52.) Retterath teaches that the top diagram in Figure 7 shows a beam that has advantages in “precision LiDAR systems.” (*Id.*, 9:35-36.)

Retterath indicates that the top diagram beam is a “perfectly collimated beam **92** that produces a round spot **94** on the surface of the reflecting object,” where “[t]he beam intensity is uniform throughout the round spot **94**, and the intensity of the light transitions sharply at the edge of the round spot **94**.” (*Id.*, 9:30-35.)

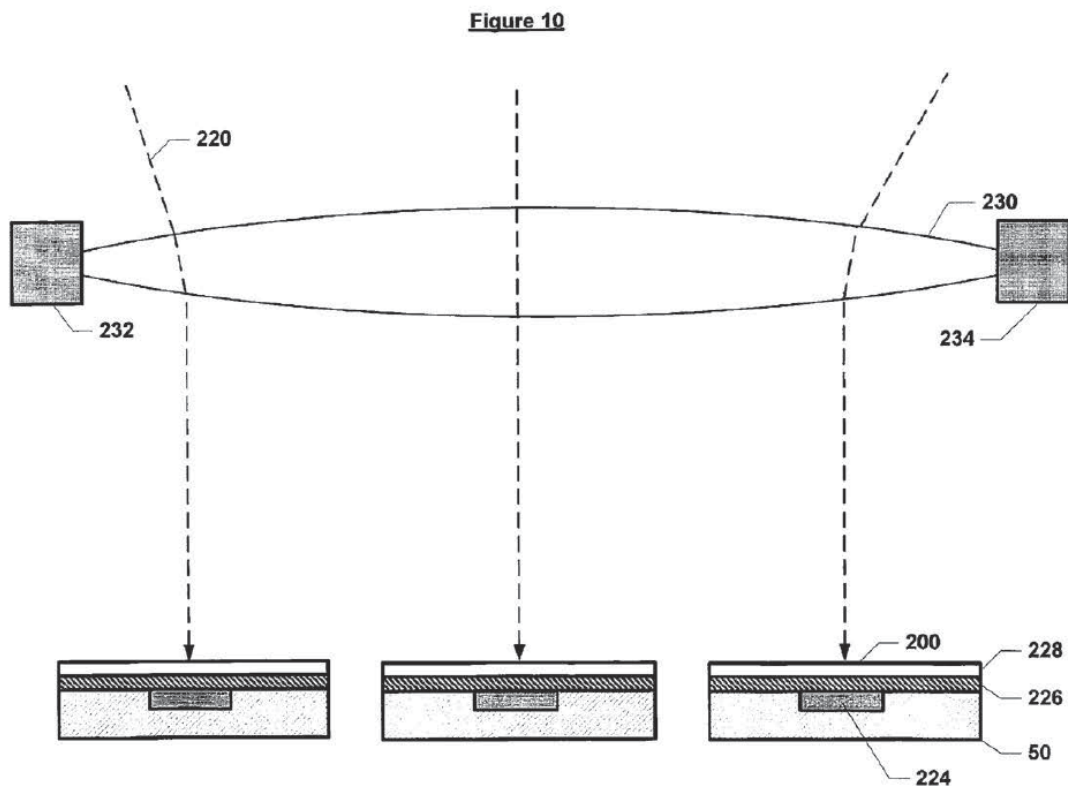
In Figure 18a, Retterath illustrates “a grid **365** showing an ideal location **370** for emitted beams,” which “could be used for device characterization.” (*Id.*, 17:11-14.)



(*Id.*, Fig. 18a; *see also id.*, 17:11-42.)

Further, Retterath discusses LIDAR systems that can use either (1) waveguides or (2) a macro lens in the receive path for light reflected back into Retterath’s system. (*Id.*, 17:46-48 (“The dense detector array **290** can be utilized with waveguide detectors or with macro lens detectors.” (emphasis added)), 3:58-

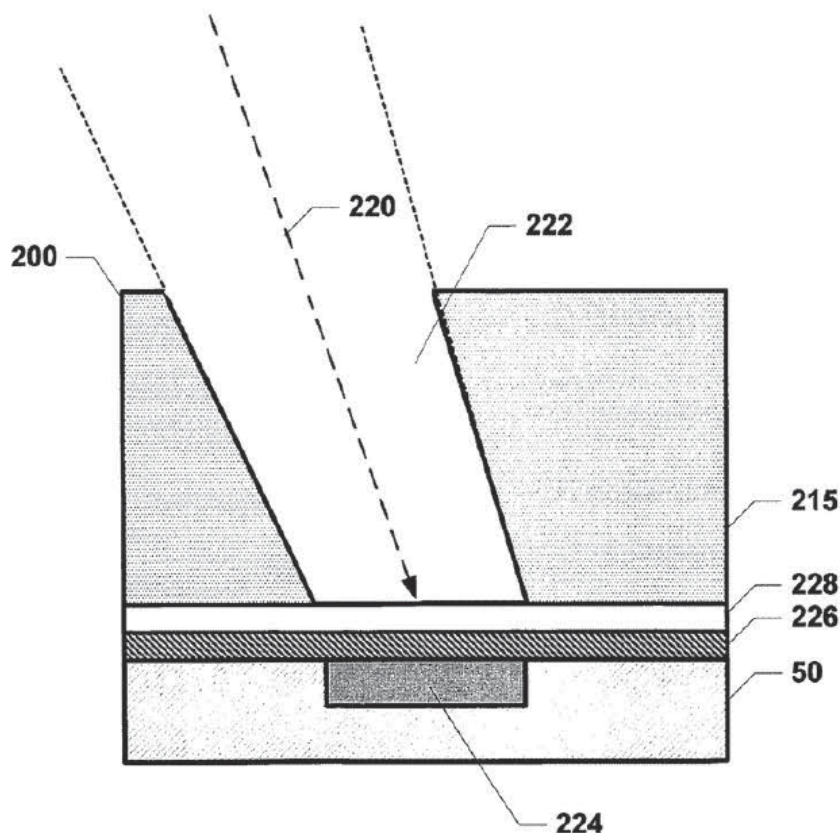
4:12 (disclosing “waveguides” and “macro lens” detectors in separate embodiments).) Retterath indicates that “[i]nbound optical energy that is more than slightly-non-parallel to the receive detector vector (coincident axis) **220** will be substantially blocked by the detector waveguide or directed elsewhere by the macro lens.” (*Id.*, 9:62-65; *see also id.*, Fig. 8, 3:58-4:12, 17:46-48.) Figure 10 of Retterath shows an embodiment using a macro detector lens **230**:



(*Id.*, Fig. 10; *see also id.*, 10:23-39.) Figure 9 of Retterath shows an embodiment using a waveguide, which consists of waveguide material **215** and waveguide **222**, which “shall be an air gap or . . . shall consist of a material that is substantially non-reflective for the wavelength or range of wavelengths of the emitted light.” (*Id.*,

10:9-17.)

Figure 9



(*Id.*, Fig. 9; *see also id.*, 10:4-22.) Figure 9 also shows bandpass filter layer **226**, protective layer **228**, and photoreceptor **224**. (*Id.*, 10:9-12.)

B. Borowski (Ex. 1006)

U.S. Patent Application Publication No. 2013/0300838 A1 (“Borowski”; Ex. 1006) discloses “a method that catches a 3D scene in a time as short as possible[.]” (Ex. 1006, [0029].) Borowski discusses using “ultra-sensitive SPADs.” (*Id.*, [0014].) “A large number of pulses are emitted toward each point on the object,” which “creates the advantage of a large reduction of the uncertainty of the

3D pixel position linked to the SPAD's inherent timing jitter (around 30 to 90 picoseconds for a single measurement).” (*Id.*) Borowski further teaches that “[t]he pulse spacing in the used pulse trains would normally be limited by the recovery time of the SPADs,” which is “of the order of 20 ns.” (*Id.*, [0044].) But Borowski indicates that “this limitation can [] be eliminated by using multiple SPADs in parallel in combination with a diffuser, which distributes the received light to these SPADs.” (*Id.*) Borowski further discloses that a “SPAD detector array comprises” at least one of the following:

- a quenching circuit;
- a pulse conditioner;
- at least a time to digital converter;
- a local (i.e., close to the detector) digital signal processor, with several subcomponents like:
 - a blanking circuit controlled by said local digital signal processor;
 - a statistical processing circuit comprising at least one counter of the detected events at the SPAD diode, and a D-latch and a multiplier connected to an inverse calculus and eventually to a local correcting circuit;
 - a digital time and/or space averaging circuit;
 - a digital nonlinear averaging circuit.
 - a smart bias correction circuit using data received from the global DSP.

(*Id.*, [0056]-[0065].)

C. Weimer (Ex. 1008)

U.S. Patent No. 8,736,818 (“Weimer”; Ex. 1008) discloses “electronically steered flash LIDAR systems and methods in which illumination within a scene is adaptively controlled[.]” (Ex. 1008, 1:5-8.)

Figure 3A of Weimer illustrates an embodiment of a flash LIDAR system in a spacecraft **108**, in which laser light is sent through transmit optics **318**, bounces off a target scene **112**, and is received through receiver optics **322** to “Flash Detector Array” **324**. (*Id.*, 8:48-10:45.)

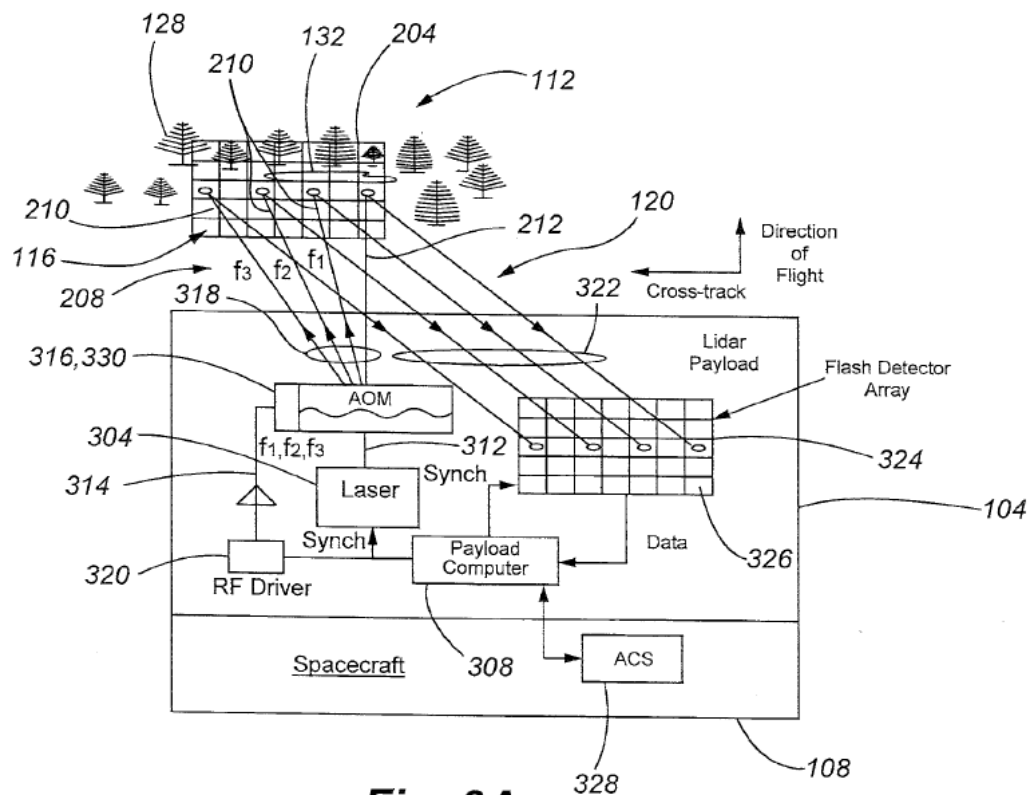
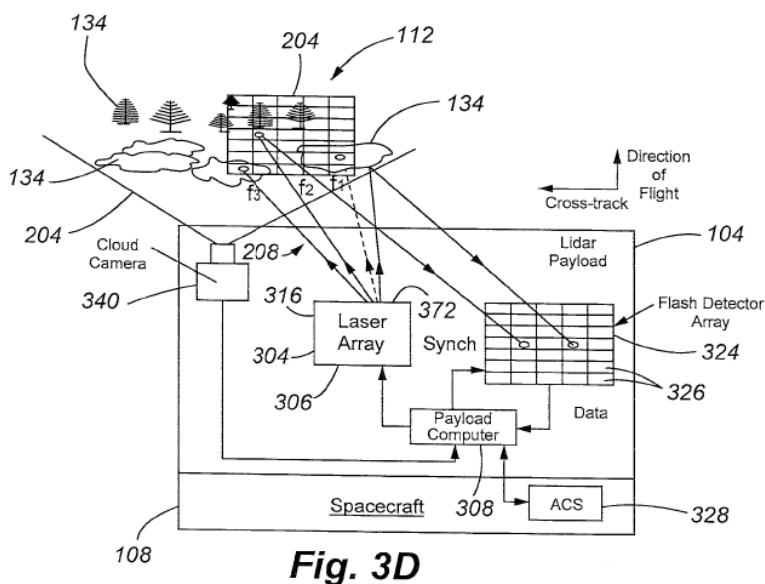


Fig. 3A

(*Id.*, Fig. 3A.)

Weimer illustrates a separate embodiment in Figure 3D, which includes a



(*Id.*, Fig. 3D.)

Weimer discusses using its system in spacecraft and aircraft applications, including satellites, landers, rovers, and airplanes. (*E.g.*, Figs. 1A-D.) Weimer indicates that space applications include “rendezvous and docking, robotic rovers, planetary mapping, terrain relative navigation for future landers, and long range target position and range tracking.” (*Id.*, 1:20-23.) Weimer teaches away from the use of various types of LIDAR systems given the requirements of these application contexts. For example, Weimer teaches that “[a]n along track vegetation LIDAR design preferably has continuous coverage by the laser and a 25 meter footprint,” which requires a “laser repetition rate of approximately 250 Hz” when carried by a satellite. (*Id.*, 1:24-27.) Weimer further discloses that 250 Hz “is a relatively high repetition rate, and has a significant impact on laser reliability because of the high

number of laser shots required for the mission (e.g., 10 billion).” (*Id.*, 1:27-30.) Weimer indicates that “[t]he high repetition rate also means that, in order to keep the average output power reasonable to improve laser reliability, the peak power per shot must be kept relatively low (e.g., 15 mJ).” (*Id.*, 1:30-33.) Accordingly, Weimer warns that “such a system may have insufficient power to make measurements through clouds and heavy aerosol layers.” (*Id.*, 1:33-35.)

Weimer discloses that some LIDAR approaches do not fit the requirements of its system’s application contexts. For example, Weimer teaches that “covering a large across-track swath on the ground using a staring LIDAR approach with multiple lasers is prohibitive in terms of available electrical power in space.” (*Id.*, 1:48-51.) Further, Weimer discusses that large fields of view for detectors are not desirable due to “more background light,” which reduces the signal to noise ratio—but generating fields of view slightly larger than laser spot size can require “accurate boresighting” via “mechanical” means that “can be heavy and are expensive to produce and test.” (*Id.*, 1:53-61.)

Further, Weimer indicates that proposed “complex laser transmitter optics that shape or form the beam into patterns or mechanical scanning systems[]” are undesirable. (*Id.*, 1:62-65.) Weimer warns that “such mechanisms typically result in the wastage of photons in at least some configurations, and introduce elements that can be subject to mechanical failure and/or misalignment.” (*Id.*, 2:7-10.)

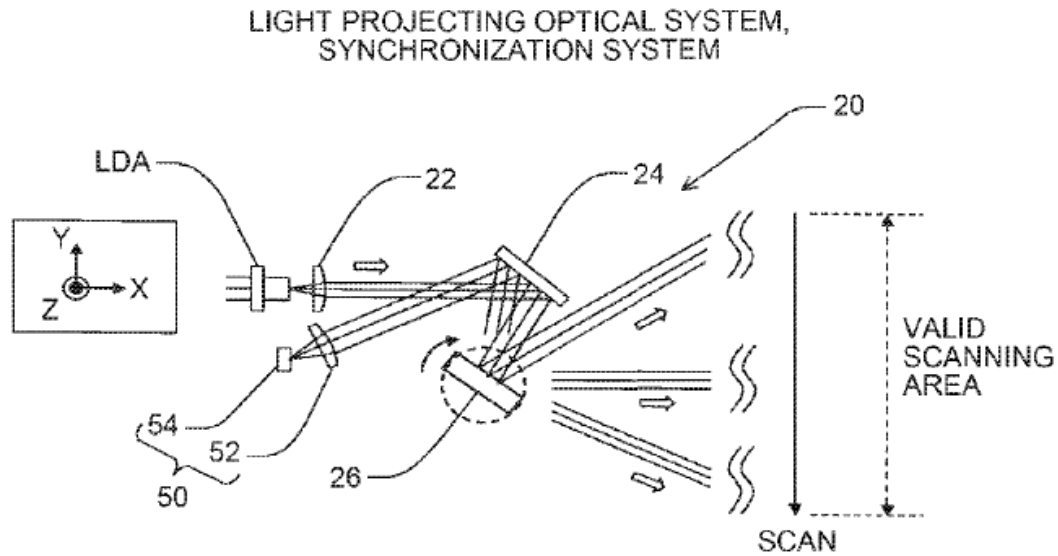
Further, Weimer discloses that “[t]hese systems [] have the effect of shifting the effective dynamic range of the overall detector, rather than broadening that dynamic range.” (*Id.*, 2:10-13.)

D. Imai (Ex. 1009)

U.S. Patent Application Publication No. 2016/0274223 A1 (“Imai”; Ex. 1009) discloses an “object detecting device.” (Ex. 1009, [0008].) Petitioner relies on JP2015-055314 in asserting that Imai is prior art to the ’750 patent. (Pet. at 2-3.)

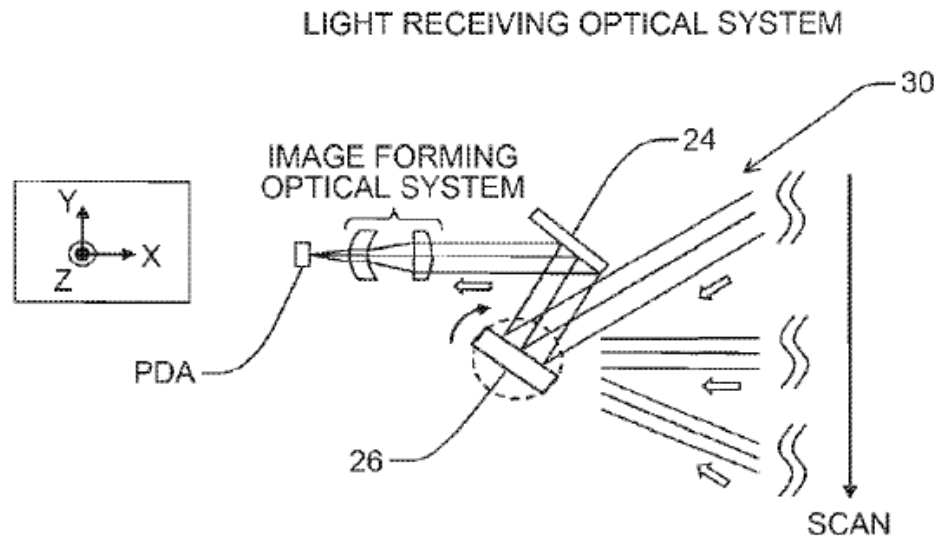
Imai indicates that its object detecting device consists of “a light source which includes a plurality of light emitting units arranged in a sub-scanning direction; a deflector which deflects light from the light source; and an optical detector which includes a plurality of light receiving units arranged in the sub-scanning direction so as to correspond to the plurality of light emitting units, and receives light deflected by the deflector and reflected by an object.” (Ex. 1009, [0008].) Imai discloses a rotating mirror system for emitting light as shown in Figure 2(A) below:

(A)



(*Id.*, Fig. 2(A); *see also id.*, [0031]-[0037].) A laser diode array (“LDA”) is shown emitting light through coupling lens **22**, which reflects off of reflecting mirror **24** and is shined into the external world via rotary mirror **26**. (*Id.*, [0032].) Imai further discloses a rotating mirror system for receiving light, as shown in Figure 2(B) below:

(B)

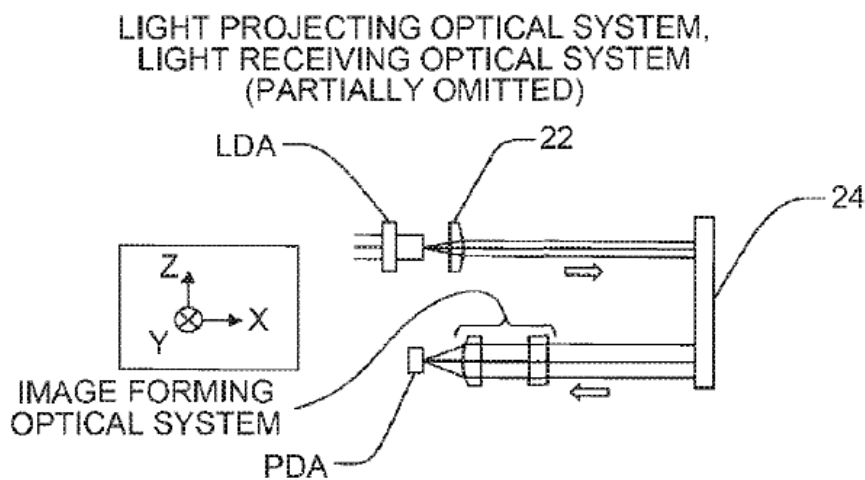


(*Id.*, Fig. 2(B); *see also id.*, [0040]-[0041].) Imai discusses a photo diode array

(“PDA”) receiving light reflected from the environment through an image forming optical system, which consists of two lenses in Figure 2(B).

Figure 2(C) of Imai shows a “partially omitted” diagram of an embodiment. (*Id.*, Fig. 2(C), [0038].)

(C)

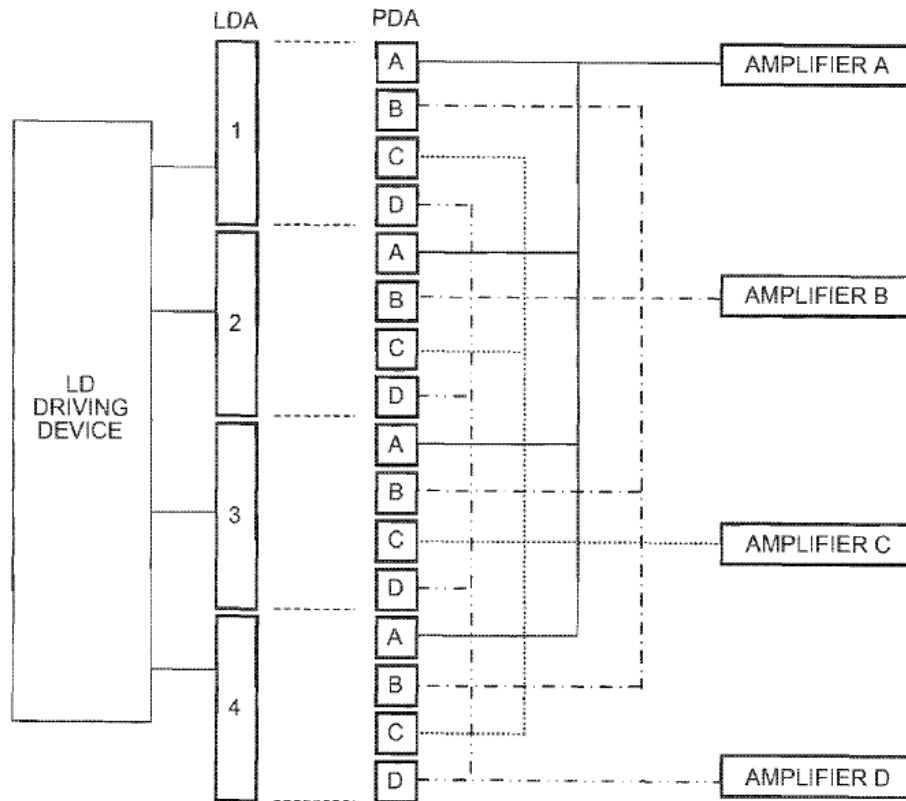


(*Id.*, Fig. 2(C).) Imai generally discusses the “light projecting optical system **20** and the light receiving optical system **30**” as “overlapped in the Z-axis direction.” (*Id.*, [0039].) However, it is clear from Figure 2(C) that it is not an accurate representation of the spatial relationship between elements of Imai’s system. For example, light rays extend straight from the LDA and PDA units to reflecting mirror **24**, such that no light would escape Imai’s system and reflect off objects in the external world if implemented according to the above diagram.

Imai discloses PDAs and LDAs arranged in a vertical, “sub-scanning” direction, as shown in Figure 10. (*Id.*, Fig 10; [0036], [0096], [0098].)

FIG.10

FIRST MODIFICATION



(*Id.*, Fig. 10.) Imai indicates that

[e]ach of the four LDs of the LD1 to LD4 is turned on periodically (herein, with the same lighting period T) at different timings among the LDs, and switching time of the LD to be turned on, that is to say, time after the lighting of one LD finishes until the lighting of the next LD starts is set to be shorter than the lighting period.

(*Id.*, [0116].) Imai further discusses that this off-set timing scheme “inhibit[s] heat generation and deterioration in light emission quantity of the LD” and makes it

“possible to make a lifetime of the LD longer.” (*Id.*)

Further, Imai indicates that “[t]he irradiation range of each LD is set to be slightly larger than [sic] corresponding light receiving ranges of the four PDs[,]” such that “light reception quantity in the light receivable range may be increased and detection accuracy and a detection distance may be improved.” (*Id.*, [0101].)

E. Other Asserted Prior Art

Petitioner also relies on U.S. Patent No. 7,787,105 (“Hipp”; Ex. 1007); JP Publication No. 2015-078953 (“Higashi”; Ex. 1010 (original); Ex. 1011 (English translation); U.S. Patent Application Publication No. 2017/0040368 (“Grzesik”; Ex. 1012); and U.S. Patent Application Publication No. 2014/0211194 (“Pacala”; Ex. 1013) in its asserted grounds. Since these references merely add to proposed combinations that, as shown below, cannot be sustained, discussion of the additional references is currently unnecessary.

IV. CLAIM CONSTRUCTION

No claim construction rulings have issued in the pending litigation between Petitioner and Patent Owner. However, Petitioner proposed a claim construction before the ITC that, among other reasons, show that the Board should not institute *inter partes* review of the challenged claims of the ’750 patent.

A. “field of view” (claim 44)

In Patent Owner’s ITC case against Petitioner, Petitioner proposed the following construction for the term “field of view” in claim 44 of the ’750 patent:

“detection area defined by an aperture or lens tube.” (Ex. 2002 at 2.) Petitioner cited extrinsic evidence in support of its proposed construction of the “field of view” term. (Ex. 2003 at 2.)

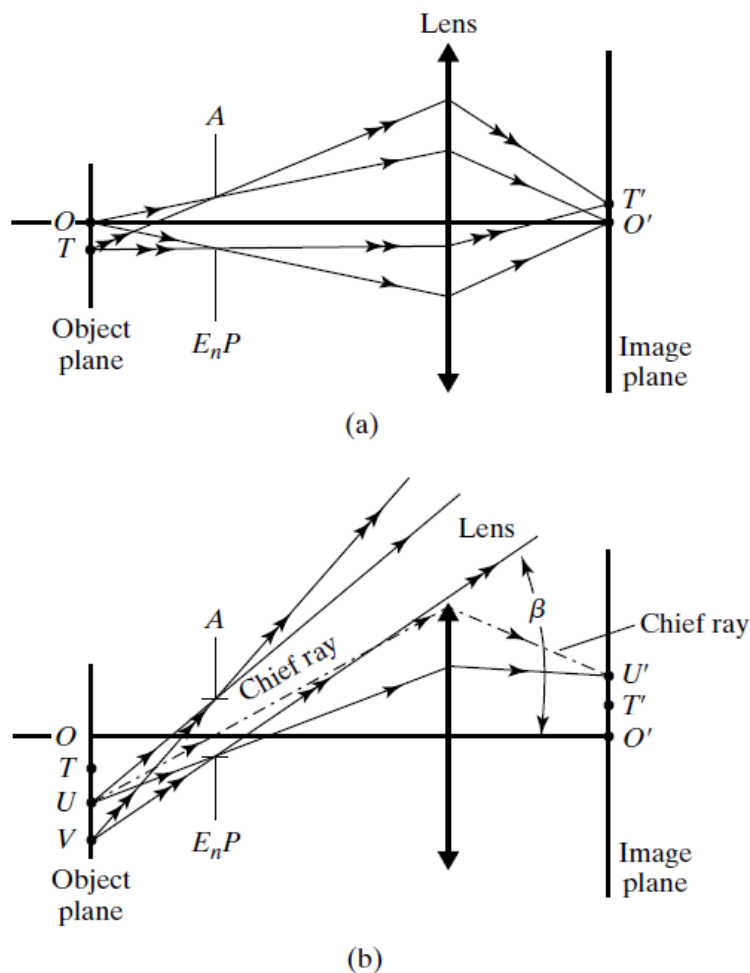
Petitioner relied on Rudolf F. Graf, *Modern Dictionary of Electronics* (7th Ed., 1999), which defines “field of view” as: “The maximum angle of view that can be seen through a lens or optical instrument.” (Ex. 2004 at 282.)

Further, Petitioner relied on Frank L. Pedrotti *et al*, *Introduction to Optics* (3d Ed. 2006) (“Pedrotti”; Ex. 2005), which discusses limiting “field of view” via apertures. For example, Pedrotti discloses that “[t]he presence of apertures in an optical system influences its image-forming properties . . . by limiting the *field of view*,” which “determines how much of the surface of a broad object can be seen by looking back through the optical system.” (Ex. 2005 at 51 (emphasis in original).) Pedrotti compares the field of view of an optical system to the limited view created by a window:

A simple experience of a limitation in the field of view is that of looking through an ordinary window. The edges of the window determine how much of the outdoors we can see. This field of view can be described in terms of the lateral dimensions of the object viewed, or in terms of the angular extent of the window, relative to the line of sight. One can talk about the field of view in terms of the object being viewed or in terms of the image formed at the viewer (on the retina, in this example).

(*Id.* at 54.) Pedrotti further indicates that its Figure 3—reproduced below—shows

“how an aperture restricts the field of view.” (*Id.* at 55.)



(*Id.*, Fig. 3(a)-(b).) For Figure 3(b), Pedrotti indicates that apertures cause “vignetting”—*i.e.*, “partial shielding of the outer portion of the image by the aperture for off-axis object points.” (*Id.* at 55.) As a result, “[t]he lateral field of view processed by this optical system is at most a circle of radius OV.” (*Id.*; *see also id.* at 56 (“limitation of the field of view using an aperture”), 70.)

Petitioner also relied on Ulrich Kubitscheck (Ed.), *Fluorescence Microscopy* (2nd Ed. 2017) (“Kubitscheck”; Ex. 2006) in support of its construction of “field of

view.” Kubitscheck discloses that “[t]he observable object field is limited in the primary image plane by a field stop,” which is an “aperture” that has a diameter referred to as the “*field number* or *field-of-view number*.” (Ex. 2006 at 28 (emphasis in original).)

V. THE BOARD SHOULD DENY REVIEW OF ALL GROUNDS

A. Overview of Petitioner’s Asserted Grounds

1. Ground 1A: Claims 44, 45, 48, and 50 in light of Retterath and Borowski

Petitioner relies on Retterath as the primary reference for Ground 1A. (Pet. at 9-18.) Since Retterath does not disclose the use of SPADs or multiple detectors per pixel, Petitioner relies on an obviousness combination with Borowski in an attempt to import into Retterath the use of multiple SPADs in place of each of Retterath’s detectors. (*Id.* at 13-18.)

As discussed below, Petitioner fails to show a reasonable likelihood of success as to Ground 1A because (1) Petitioner fails to show that Retterath discloses or renders obvious the use of both a “bulk imaging optic” for limitation 44(b) and an “aperture layer comprising a plurality of apertures separated from each other by a stop region” for limitation 44(d); and (2) Petitioner fails to provide any evidence to support that Retterath teaches a “field of view” per Petitioner’s construction for limitation 44(c) or 44(f). Since Petitioner is only challenging independent claim 44 and claims that depend from claim 44, Petitioner’s failure to show a reasonable

likelihood of success as to either of these claims means that review not be instituted as to Ground 1A.

2. Ground 1B: Claims 44-48 and 50 in light of Retterath in view of Borowski and Weimer

For Ground 1B, Petitioner supplements the Retterath-Borowski combination with Weimer, arguing that a POSITA would have imported from Weimer VCSEL emitters and SPAD macro-cells. (Pet. at 35-40.) Petitioner contends the VCSEL emitters would meet the requirements of dependent claims 46 and 47 while Petitioner points to the SPAD macro-cells as meeting the requirements of limitations 44(c), 44(e), and 44(f) related to “field of view.” (Pet. at 35-40.)

As discussed below, Petitioner fails to show a reasonable likelihood of success as to Ground 1B because, in addition to the reasons discussed for Ground 1A: (1) Petitioner fails to provide any evidence to support that Weimer teaches a “field of view” per Petitioner’s construction for limitations 44(c) and 44(f); and (2) Retterath teaches away from flash LIDAR systems like those disclosed by Weimer. Accordingly, review should not be instituted as to Ground 1B.

3. Ground 1C: Claims 44, 45, 48, and 50 in light of Retterath in view of Borowski and Hipp

Adding to the Retterath and Borowski combination, for Ground 1C, Petitioner relies on the shadow mask of Hipp in an attempt to satisfy the “aperture layer” requirement of limitation 44(d) and claim 45. (*Id.* at 40-44.)

As discussed below, Petitioner fails to show a reasonable likelihood of success

as to Ground 1C because, in addition to the reasons discussed for Ground 1A, Petitioner fails to provide adequate motivation to combine Retterath with Hipp.

4. Ground 1D: Claims 44-48, 50 in light of Retterath, Borowski, Weimer, and Hipp

Adding to the Retterath-Borowski-Weimer combination with essentially no analysis, for Ground 1D, Petitioner apparently relies on Hipp for the same “aperture layer” requirements discussed above for Ground 1C. (*Id.* at 44.) Review should not be instituted as to Ground 1D for the same reasons articulated as for Grounds 1B and 1C.

5. Ground 2: Claims 44-48, 50 in light of Imai, Higashi, and Grzesik

Petitioner relies on Imai as the primary reference for Ground 2. (*Id.* at 44-53.) Petitioner relies on a combination with Higashi in its effort to import the use of multiple SPADs for each detector Imai for limitation 44(c). (*Id.* at 47-50) Petitioner relies on Grzesik for the “aperture layer” requirements of limitation 44(d) and claim 45. (*Id.* at 50-53.)

As discussed below, Petitioner fails to show a reasonable likelihood of success as to Ground 2 because (1) Petitioner fails to provide any evidence to support that Imai teaches a “field of view” per Petitioner’s construction for limitations 44(c) and 44(f); and (2) Petitioner fails to show that Imai teaches a “bulk transmitting optic disposed adjacent to the bulk imaging optic” for limitation 44(e). Accordingly, review should not be instituted as to Ground 2.

6. Ground 3: Claims 44-48 and 50 in light of Weimer, Borowski, and Hipp

Petitioner relies on Weimer as the primary reference for Ground 3. (*Id.* at 69-72.) Since Weimer does not disclose the use of SPADs or multiple detectors per pixel, Petitioner relies on an obviousness combination with Borowski in an attempt to import into Weimer the use of multiple SPADs in place of each of Weimer's detectors. (*Id.* at 72-73.) Further, since Weimer does not disclose an "aperture layer" per limitation 44(d), Petitioner seeks to import Hipp's "shadow mask" into Weimer's system through an obviousness combination with Hipp in an effort to argue that the combination would satisfy limitation 44(d). (*Id.*)

As discussed below, Petitioner fails to show a reasonable likelihood of success as to Ground 3 because (1) Petitioner fails to show that Weimer teaches a "field of view" per Petitioner's construction for limitations 44(c) and 44(f); (2) Petitioner fails to identify a "bulk imaging optic" for limitation 44(e); (3) Petitioner fails to show how the asserted "plurality of emitters" for limitation 44(f) would be incorporated into the embodiment of Weimer Petitioner otherwise relies on; and (4) Weimer teaches away from high-speed laser pulse systems like Borowski's. Accordingly, review should not be instituted as to Ground 3.

B. There is no reasonable likelihood that Petitioner will prevail on the basis of Grounds 1A to 1D

- 1. Petitioner fails to show that Retterath discloses or renders obvious the use of both a “bulk imaging optic” for limitation 44(b) and an “aperture layer comprising a plurality of apertures separated from each other by a stop region” for limitation 44(d)**

For Grounds 1A and 1B, Petitioner relies on Retterath alone for the “bulk imaging optic” requirement of limitation 44(b) and the “aperture layer comprising a plurality of apertures separated from each other by a stop region” requirement of limitation 44(d). However, Retterath discloses that the structures that Petitioner points to in its attempt to satisfy limitations 44(b) and 44(d)—*i.e.*, Retterath’s macro detector lens 230 and its “waveguides”, respectively—are mutually exclusive. Retterath does not disclose these elements together in an embodiment, and instead discloses that they serve the same purpose, so only one or the other should be present in a system—not both. Accordingly, Retterath *teaches away* from using both of these elements together in a system, because it indicates that they would be redundant if used together in a system. As a result, review should not be instituted as to Petitioner’s Grounds 1A and 1B.

Petitioner asserts that the “aperture layer” required by limitation 44(d) of the ’750 patent is satisfied by Retterath’s “waveguides.” (Pet. at 24-27.) Further, Petitioner asserts that the “bulk imaging optic” required by limitation 44(b) of the ’750 patent is satisfied by Retterath’s “macro lens 230.” (*Id.* at 19-20.)

However, Retterath makes clear that *either* waveguides *or* macro detector lens 230 can be used in its system. (*Id.*, 17:46-48 (“The dense detector array **290** can be utilized with waveguide detectors or with macro lens detectors.” (emphasis added)), 3:58-4:12 (disclosing “waveguides” and “macro lens” detectors in separate embodiments); *see also id.*, Figs. 9-10.) Retterath indicates that waveguides and a macro detector lens serve the same purpose—blocking light non-parallel to the “receive detector vector”—so there is no evident reason to include them both in a single system. (Ex. 1005, 9:59-65.)

Apparently recognizing that Retterath does not disclose waveguides and a macro detector lens being used in the same embodiment, Petitioner attempts to argue that it would have been obvious to a POSITA to use both structures in the same system. (Pet. at 25-26; Ex. 1003, ¶¶ 157-61.) However, Petitioner’s asserted motivations to combine ignore the fact that Retterath explicitly teaches away from using both structures in the same system, as discussed above. (Ex. 1005, 17:46-48, 3:58-4:12, Figs. 9-10.) Retterath discloses that its macro detector lens and waveguides serve the same purpose—so a POSITA would have understood based on Retterath that there is no reason to use both structures in a single system. (*Id.* 9:59-65.)

Petitioner asserts that a POSITA would have been motivated to use both structures to “block[] out extraneous optical energy from background/unintended

sources.” (Pet. at 25.) But this is *exactly* the purpose that Retterath discloses can be served by either the macro detector lens *or* waveguides. (*E.g.*, *id.*, 9:59-65; *see also id.*, 17:46-48, 3:58-4:12, Figs. 9-10.) Petitioner argues that a POSITA would have been motivated to use both macro detector lens and waveguides because “the blocking material 215 surrounding the waveguides 222 would have advantageously reduced internal reflections from among the neighboring detector elements/protective layer[.]” (Pet. at 26.) However, this only appears to be a motivation to use Retterath’s waveguides in a system—not to use those waveguides *alongside* a macro detector lens. Further, Petitioner asserts that “Retterath expressly suggests” using both a macro detector lens and waveguides in a single system—since Retterath includes the following generic boilerplate: “elements described with respect to one embodiment can be implemented in other embodiments even when not described in such embodiments unless otherwise noted.” (*Id.*; Ex. 1005, 19:55-20:12.) This boilerplate disclaimer does not fairly teach that one should combine in the same system two alternative components that perform essentially identical roles. *See Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1329, 1331-32 (Fed. Cir. 2019) (affirming no motivation to combine where combination “would introduce additional complexity and inefficiencies” that “outweighed” any benefits); *South-Tek Sys., LLC v. Engineered Corrosion Sols., LLC*, 748 F. App’x 1003, 1006-1007 (Fed. Cir. 2018) (affirming lack of motivation to combine to add redundant feature);

Ex Parte James Pinon, No. 2017-005566, 2018 WL 1287471, at *4 (P.T.A.B. Mar. 9, 2018) (finding no motivation to combine references where addition of feature based on secondary reference’s disclosures would be redundant).

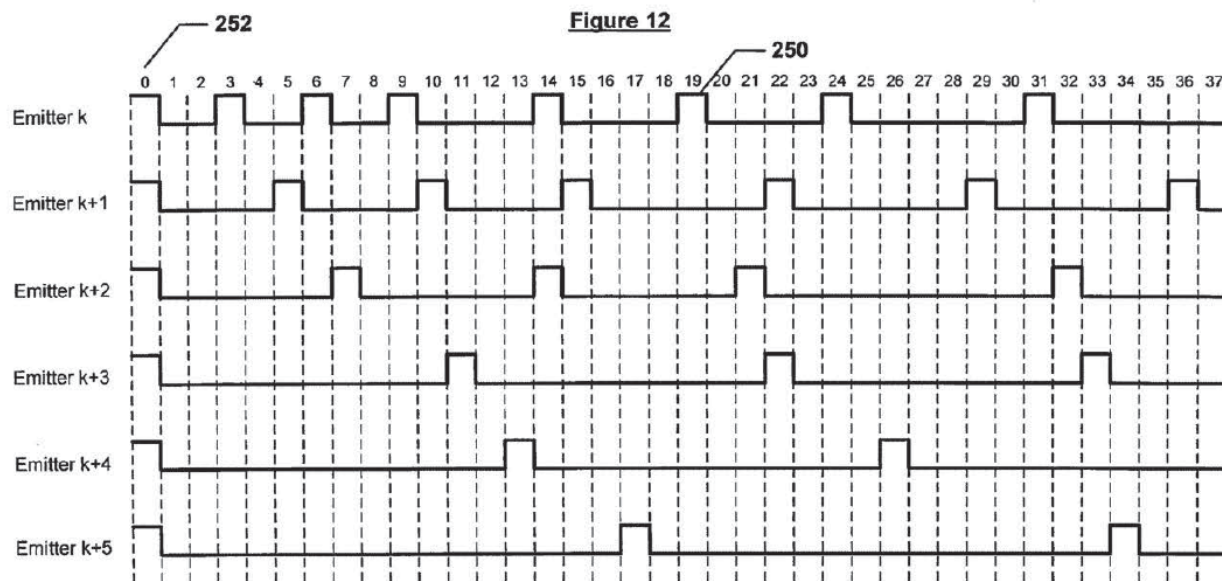
Since Petitioner fails in its showing that Retterath teaches or renders obvious the use of both a macro detector lens and waveguides, Petitioner cannot show that elements 44(b) and 44(d) are both satisfied by Retterath. Accordingly, the Board should decline to institute review based on Petitioner’s Grounds 1A or 1B.

2. Petitioner fails to provide adequate motivation to combine Retterath with Hipp

Apparently recognizing the fatal issue in Retterath’s disclosures discussed above, Petitioner asserts an additional reference—Hipp—for the “aperture layer” limitation of limitation 44(d) in Grounds 1C and 1D. Petitioner asserts that it would have been obvious to import Hipp’s “shadow mask” into Retterath, and Petitioner asserts that in the Retterath-Hipp combination, the shadow mask would constitute an “aperture layer” per limitation 44(d). Petitioner asserts that a POSITA would have been motivated to combine Retterath with Hipp’s “shadow mask” for two reasons: (1) to reduce cross-talk between detector channels and (2) to limit interference from unwanted light sources. (Pet. at 42.)

However, neither of these motivations to combine can be sufficient—because Retterath already provides ample disclosures related to addressing crosstalk and interference using unique laser pulse timing sequences between different emitter-

receiver channels. For example, Figure 12 of Retterath shows that neighboring emitters can use different pulse timing sequences recognized by their corresponding detectors, ensuring that a detector only detects light pulses from its paired emitter and not from other sources:



(Ex. 1005, Fig. 12.) Retterath makes clear that this pulse timing sequence method eliminates interference caused by crosstalk between channels and other light sources:

By selecting locally unique bit patterns for each emitter, **the interference from other emitters and other similar LiDAR devices is dramatically reduced**. The use of multi-bit emitter sequences also results in reduced interference from non-LiDAR devices that are transmitting or reflecting energy at the target detector wavelength.

(Ex. 1005, 3:10-21 (emphasis added); *see also id.*, 11:26-39.)

Further, as discussed above, Retterath indicates that waveguides or a macro

detector lens can be used to address interference and cross-talk. (*See supra* § V.B.1.) Retterath’s disclosure that waveguides or a macro detector lens provide further reasons why a POSITA would not have looked to a reference such as Hipp for ways to limit cross-talk and interference in Retterath’s system.

Given Retterath’s disclosures regarding pulse timing sequences, waveguides, and a macro detector lens, there is no apparent reason why a POSITA would import Hipp’s “shadow mask” into Retterath’s system. Neither Petitioner nor its expert even acknowledge the disclosures in Retterath about pulse timing sequences, for example—let alone explain why a POSITA would have chosen to use Hipp’s “shadow mask” instead of or in addition to Retterath’s pulse timing sequences. Accordingly, Petitioner fails to make an adequate showing of a motivation to combine Retterath with Hipp. *South-Tek*, 748 F. App’x at 1006-1007; *Ex Parte James Pinon*, 2018 WL 1287471, at *4.

Without any adequate motivation to combine Retterath with Hipp provided, Petitioner’s Grounds 1C and 1D, which rely on that combination, must fail. Accordingly, the Board should decline to institute as to these grounds.

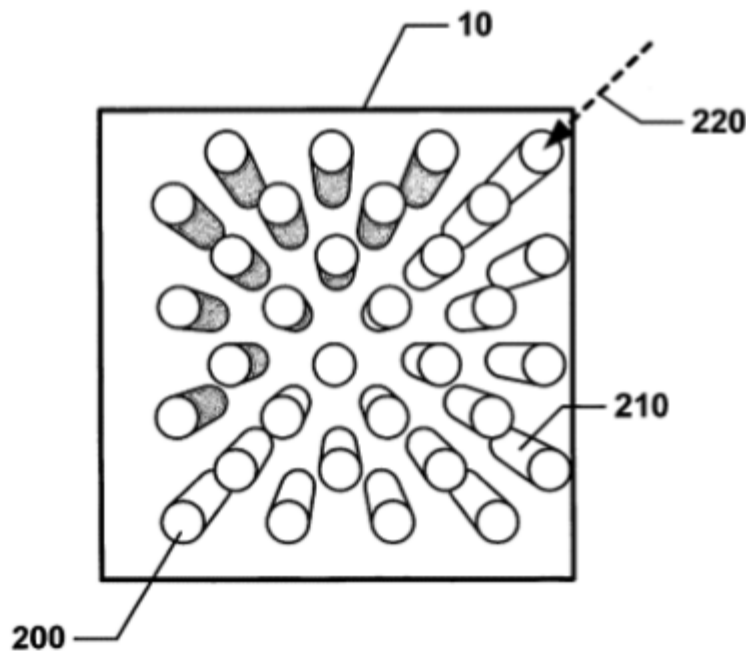
3. Petitioner fails to provide any evidence to support that Retterath or Weimer teaches a “field of view” per Petitioner’s construction for limitations 44(c) and 44(f)

For Grounds 1A to 1D, Petitioner relies on Retterath or Weimer in its effort to show that the following limitations were taught by the prior art: (1) “each pixel

in the plurality of pixels comprises a plurality of single photon avalanche diodes (SPADs) and has a field of view that is non-overlapping beyond a threshold distance in a field external to the optical imaging system with fields of view of all other pixels in the plurality of pixels” (limitation 44(c)) and (2) “electromagnetic radiation output from each emitter in the illumination pattern is coincident with a field of view of a corresponding pixel in the plurality of pixels” (limitation 44(f).) Petitioner fails to—and cannot—raise any evidence to support that Retterath or Weimer satisfies a “field of view” per Petitioner’s construction of that term: “detection area defined by an aperture or lens tube.” (Ex. 2002 at 2; *see supra* § IV.A.)

As discussed above in Section IV.A., in an ITC investigation involving the challenged claims of the ’750 patent, Petitioner proposed the following construction for “field of view” as it is recited in 44 the ’750 patent: “detection area defined by an aperture or lens tube.” (Ex. 2002 at 2.) Petitioner provided several extrinsic evidence documents in support of its construction, which are discussed above in Section IV.A. (Ex. 2003 at 2.)

For Retterath, Petitioner argues that each detector 200 “has a field-of-view over which it receives light beams 210, each of which is centered along a unique vector 220.” (Pet. at 21.) Petitioner asserts that Retterath’s Figure 8 shows the “FOV arrangement of Retterath’s detector[.]” (*Id.*)



(Ex. 1005, Fig. 8.) Petitioner also points to language from Retterath indicating that “emitter and detector vectors are coincident” as evidence that “the field-of-view for each pixel in the Retterath-Borowski combination is non-overlapping beyond a threshold distance in a field external to the optical imaging system with fields of view of all other pixels.” (Pet. at 22.) Petitioner’s expert declaration mirrors the petition. (Ex. 1003, ¶¶ 147-154.)

Absent from any arguments or evidence provided by Petitioner or its expert is any explanation of how Retterath satisfies the requirements of Petitioner’s construction for “field of view.” Neither Petitioner nor its expert provides any indication of how the identified portions of Retterath teach a “detection area defined by an aperture or lens tube.” (Ex. 2002 at 2.) Neither identifies an “aperture” or a

“lens tube” anywhere in the disclosures they identify as teaching detectors with fields of view in Retterath that indicates a detector’s “field of view” to be coincident with allegedly corresponding emitters. (Pet. at 20-23; Ex. 1003, ¶¶ 147-154.) For example, Petitioner relies on Figure 8 as teaching the “field of view” limitation of limitation 44(c). But no “aperture” or “lens tube” is shown in Figure 8. The written description accompanying Figure 8 identifies emitter/detector array **10** surface, detector elements **200**, light **210**, and detector vector **220**. (Ex. 1005, 9:53-59.) However, neither Petitioner nor its expert provides any explanation for how any of these elements constitutes an “aperture” or a “lens tube.”

Petitioner and its expert point to excerpts from Retterath disclosing lenses. However, there is no indication that any of these lenses satisfy Petitioner’s “field of view” construction, *i.e.*, “detection area defined by an aperture or lens tube.” (Ex. 2002 at 2.) For example, Retterath discloses lenses in the path of laser emitters. (Ex. 1005, 8:36-40 (“emitter lens **66**”), 10:54-57 (“micro lens [] used for emitter elements **100**”).) But lenses in the emitter path could only define an emission area and not a “detection area” as required by Petitioner’s construction. Further, Retterath discloses bulk lenses that are shared by multiple emitters and/or detectors. (*Id.*, 9:59-65 (“macro lens”), 10:23-30 (“macro detector lens”), 10:50-51 (“a single global lens can be utilized for both emitter elements **100** and detector elements **200**”), Fig. 10.) However, the claims require “each pixel” to have a field

of view coincident with a corresponding detector. Since Petitioner asserts that each detector in Retterath is a “pixel” (Pet. at 21), it is unclear how a “field of view” could be defined for multiple detectors by a single bulk lens. Rather, Petitioner’s construction requires that each pixel’s “field of view” be defined by “an aperture or lens tube”—*i.e.*, each field of view is defined by an aperture or lens tube *separate* from the apertures or lens tubes used to define *other* fields of view. Furthermore, there is no indication that any bulk lenses disclosed by Retterath constitute an “aperture” or a “lens tube.”

Retterath also discloses “waveguides.” But throughout the petition and its Petitioner’s expert’s discussion of Retterath relating to limitations 44(c) and 44(f), there is not a single mention of Retterath’s “waveguides”—let alone any attempt to explain how Retterath’s “waveguides” satisfy Petitioner’s construction of “field of view.” (Pet. at 20-23, 28-31; Ex. 1003, ¶¶ 147-54, 168-72.) Petitioner cites Retterath’s “waveguides” only in the context of limitation 44(d), arguing that these waveguides constitute the required “aperture layer.” (Pet. at 24-27, Ex. 1003, ¶¶ 155-62.) Neither Petitioner nor its expert provides *any* explanation attempting to link Retterath’s “waveguides” in the context of limitation 44(d) to its arguments as to limitation 44(c) or 44(f). (*Id.*) Accordingly, the discussion of waveguides in the context of element 44(d) has no bearing on whether Petitioner has shown that Retterath teaches structures that correspond to elements 44(c) and 44(f).

Petitioner's limited discussion of waveguides fails to demonstrate that Retterath meets the "field of view" requirement for a second reason. As discussed above in Section V.B.1, Retterath does not disclose, teach or provide motivation for combining both waveguides and the macro detector lens in the same system. Petitioner has already relied on the macro detector lens for element 44(b). Thus, Petitioner cannot rely on any discussion of waveguides in an effort to show satisfaction of its "detection area defined by an aperture or lens tube" construction of "field of view" for Retterath.

For Grounds 1B and 1D, Petitioner also asserts that to the extent Retterath on its own does not satisfy the requirement that each pixel have a field of view coincident with the emission region of its paired emitter, then that limitation would have been obvious based on Retterath in light of Weimer. But Petitioner does not provide any explanation for how Weimer—or the combination of Retterath with Weimer—involves a field of view for each alleged pixel that is "defined by an aperture or lens tube." (Pet. at 34-39; *see also infra* Section V.D.1.) Rather, Petitioner merely makes conclusory assertions such as, "Weimer also teaches a pixel array 324, where each pixel 326 has a field-of-view that matches a corresponding beam 208 from the illumination source." (Pet. at 38.) But nothing in the cited disclosures from Weimer for this proposition—*i.e.*, Fig. 3A and 10:17-45—discloses an "aperture" or a "lens tube" as required by Petitioner's construction for "field of

view.” And Petitioner provides no guidance or explanation as to what it considers to be the required “aperture” or “lens tube” in Weimer’s disclosures. (Pet. at 35-39; *see also* Ex. 1003, ¶¶ 187-90 (mirroring petition).)

Given Petitioner’s complete failure of proof in its showing regarding its construction for the “field of view” limitation of elements 44(c) and 44(f), the Board should decline to institute review based on any of Grounds 1A to 1D. *See KioSoft Techs., LLC v. PayRange Inc.*, CBM2020-00026, Paper 11, 17-18 (P.T.A.B. Mar. 22, 2021) (denying institution and citing “the potential problems inherent in the inconsistent claim constructions set forth by Petitioner between the Petition and its proposals at the district court”).

4. Retterath teaches away from flash LIDAR systems like those disclosed by Weimer

An additional reason that Petitioner fails to show a reasonable likelihood of success for Grounds 1B and 1D is Petitioner the lack of motivation to combine Retterath and Weimer, given that Retterath teaches away from Weimer.

Weimer discloses a “flash LIDAR system.” (Ex. 1008, 1:5-8 (“An electronically steered flash LIDAR is disclosed. More particularly, electronically steered flash LIDAR systems and methods in which illumination within a scene is adaptively controlled are provided.”).) Moreover, Weimer discloses that its system is for use in long range applications. For example, Figure 3A—which Petitioner relies on heavily for Grounds 1B and 1D (*see, e.g.*, Pet. at 35)—indicates that the

flash LIDAR system is located on a “[s]pacecraft” and is being used to scan terrain with trees on it. (Ex. 1008, Fig. 3A; *see also id.*, Figs. 1A-1D. 8:48-10:45.)

Retterath teaches away from “flash LiDAR” systems. Retterath indicates that flash LIDAR is “relegated to very close proximity applications due to the low incident laser power for each location in the field of view.” (*Id.*, 1:59-61.) Further, “[f]or flash LiDAR at longer ranges,” Retterath discloses that “the usable field of view is typically too small for applications like autonomous vehicle navigation without the use of high performance cameras operating in the picosecond range for exposure times.” (*Id.*, 1:61-65.)

Petitioner’s generalized asserted motivations to combine are insufficient to overcome the explicit teaching away of Retterath from flash LIDAR systems. Petitioner generally claims that a POSITA would have sought to improve Retterath’s signal-to-noise ratio and reduce interference. (Pet. at 35-37.) But Petitioner fails to indicate that these broad, generic motivations to combine would have been sufficient to overcome Retterath’s clear teaching away from flash LIDAR systems like Weimer’s. In fact, neither Petitioner nor its expert accounts for Retterath’s teaching away from flash LIDAR systems like Weimer’s at all. (Pet. at 35-37; Ex. 1003, ¶¶ 179-86.)

Since Petitioner fails to provide adequate motivation to combine Retterath and Weimer, review should not be instituted for Grounds 1B or 1D—each of which relies

on the Retterath-Weimer combination. *See Chemours Co. FC, LLC v. Daikin Indus., Ltd.*, 4 F.4th 1370, 1376-77 (Fed. Cir. 2021).

C. There is no reasonable likelihood that Petitioner will prevail on the basis of Ground 2

1. Petitioner fails to provide any evidence to support that Imai teaches a “field of view” per Petitioner’s construction for limitations 44(c) and 44(f)

Similar to the deficiencies of Grounds 1A-1D discussed above related to the “field of view” term (*see supra* § V.B.3.), Petitioner and its expert fail to provide any explanation for how Imai satisfies the requirements of Petitioner’s claim construction for “field of view” for Ground 2. While Petitioner’s construction for “field of view” requires an “aperture or lens tube” to define the “detection area” for a pixel, Petitioner fails to point to any apertures or lens tubes defining the field of view for Imai’s detectors. Instead, Petitioner relies exclusively on disclosures in Imai that indicate that light from certain laser diodes is received by certain photodiodes—with no indication of what facilitates this process or whether any apertures or lens tubes are involved. (Pet. at 54-56.)

For example, Petitioner and its expert rely on paragraph [0099] of Imai as allegedly teaching the requirements of limitations 44(c) and 44(f) regarding “field of view.” (Pet. at 55, 62.) Paragraph [0099] of Imai states:

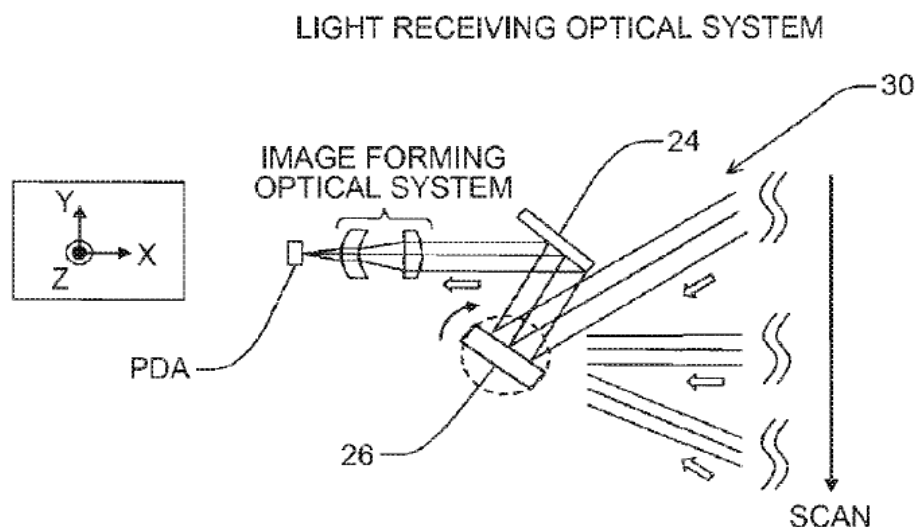
An irradiation range of the LD1 corresponds to light receivable ranges of the PD1 to PD4, the irradiation range of the LD2 corresponds to the light receivable ranges of the PD5 to PD8, the irradiation range of the

LD3 corresponds to the light receivable ranges of the PD9 to PD12, and the irradiation range of the LD4 corresponds to the light receivable ranges of the PD13 to PD16.

(Ex. 1009, [0099].) Nothing in this paragraph indicates how the irradiation range of a given LD “corresponds to” a given PD. No indication is provided as to how any aperture or lens tube is involved. Accordingly, there is no indication of how Imai meets limitation 44(c) or 44(f) with “field of view” as construed by Petitioner—*i.e.*, “detection area defined by an aperture or lens tube.”

To the extent Petitioner argues that its brief reference to a single lens in Imai’s image forming system is sufficient to show that Imai satisfies Petitioner’s construction of “field of view,” this argument is misplaced. (Pet. at 54-55; Ex. 1003, ¶¶ 221-23.) Petitioner fails to provide *any* explanation for how any lens in Imai’s image forming system is a “lens tube” or an “aperture.” And nothing in Imai indicates that anything that could be considered a “lens tube” or “aperture” is present. For example, the following diagram from Imai shows the “image forming optical system”:

(B)



(Ex. 1009, Fig. 2(B).) As the above diagram indicates, no “lens tube” or “aperture” is present in Imai’s system. Without any explanation from Petitioner or its expert as to what constitutes a “lens tube” or “aperture” in Imai’s disclosures, Petitioner has failed to show any reasonable likelihood that limitation 44(c) or 44(f) as construed by Petitioner is satisfied by Imai.

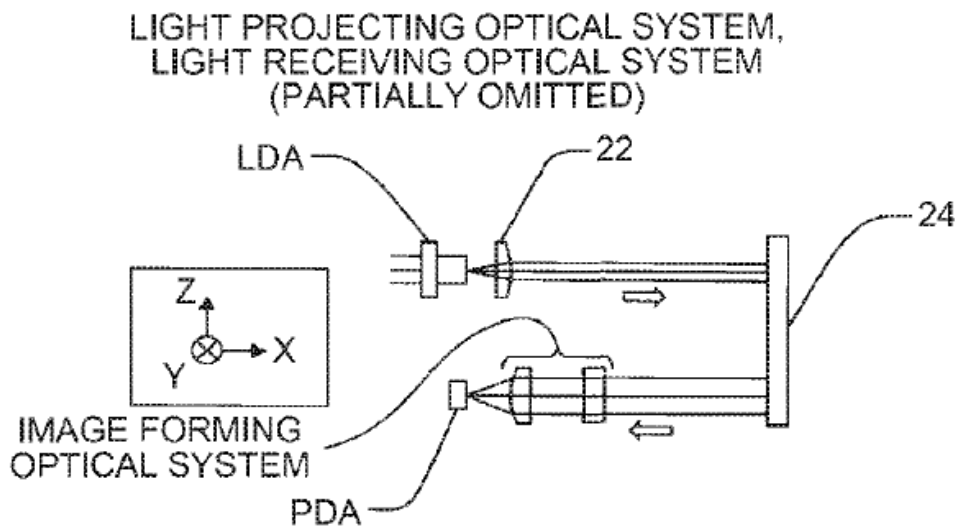
Accordingly, there is a complete failure of proof as to limitations 44(c) and 44(f) for Petitioner’s Ground 2. Petitioner has failed to show—or in any way to attempt to show—that its own construction of “field of view” is met. The Board should decline to institute review as to Ground 2 as a result. *See KioSoft*, CBM2020-00026, Paper 11, 17-18.

2. Petitioner fails to show that Imai teaches a “bulk transmitting optic disposed adjacent to the bulk imaging optic” for limitation 44(e)

Petitioner fails to show that Imai satisfies the requirement of limitation 44(e) of a “bulk transmitting optic disposed adjacent to the bulk imaging optic.” Petitioner relies on a *single figure* of Imai in its contention that limitation 44(e) is satisfied—a figure that indicates it is incomplete and not demonstrative of the actual structure of a system and which is clearly simplified and missing essential elements. This single, deficient figure is insufficient to show a reasonable likelihood of showing that Imai satisfies limitation 44(e). Accordingly, the Board should not institute review as to Petitioner’s Ground 2.

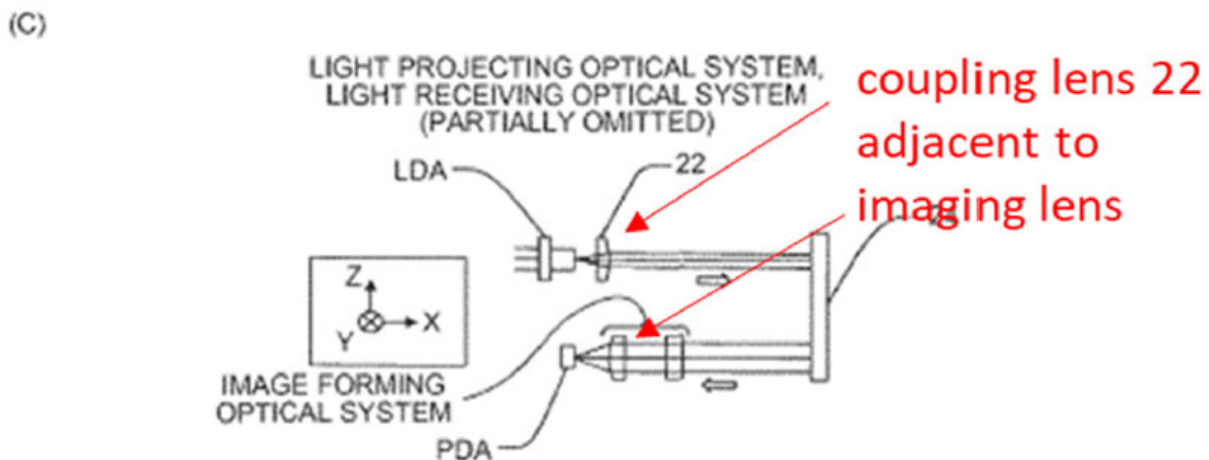
Petitioner asserts that limitation 44(e) is met solely based on Figure 2(C) of Imai. (Pet. at 59-61.) Imai’s Figure 2(C) is reproduced below:

(C)



(Ex. 1009, Fig. 2(C).) Petitioner contends that the alleged “bulk transmitting optic”

is coupling lens 22. (Pet. at 61.) Further, Petitioner vaguely asserts that the “bulk imaging optic” in Imai is an “imaging lens on the light receiving optical system.” (*Id.*) Two lenses are shown in the receive path of Figure 2(C), and Petitioner makes no effort to explain which of these lenses it is asserting to be the “bulk imaging optic”—or whether it is asserting that the two lenses, collectively, constitute the “bulk imaging optic.” Petitioner’s entire analysis for why it asserts that Imai discloses a “bulk transmitting optic disposed adjacent to the bulk imaging optic” appears in the below annotated version of Imai’s Figure 2(C) that appears in the petition and the accompanying expert declaration:



(Pet. at 66.) Petitioner’s expert declaration mirrors the petition. (Ex. 1003, ¶¶ 231-34.)

Imai’s Figure 2(C) cannot serve as an adequate basis for Petitioner’s showing as to limitation 44(e) of the ’750 patent—because Imai clearly indicates that Figure

2(C) is not representative of the actual structure of an embodiment of its system. The text of Figure 2(C) explicitly indicates that the design of Imai's system is "partially omitted." (Ex. 1009, Fig. 2(C); *see also id.*, [0038] ("[T]he 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.").) And it is evident that essential parts of Imai's system are missing. For example, there is no indication as to where light rays are sent into the external environment to reflect off objects. (*Id.*, Fig. 2(C).) Light rays are merely shown being emitted from an LDA, hitting "reflecting mirror 24," and returning to a PDA via reflecting mirror 24. (*Id.*) The written description for Figure 2(C) indicates that there is also a "rotary mirror 26" in the Figure 2(C) system, which is not shown in Figure 2(C) at all. (*Id.*, [0039].)

Since several elements are missing from Imai's Figure 2(C), there is no indication that the spatial arrangement of elements in Figure 2(C)—including the lenses Petitioner is relying on as the "bulk transmitting optic" and "bulk imaging optic"—is an accurate or reliable demonstration of how those elements would be arranged in Imai's system. For example, if element 24 is a "reflecting mirror," the way it appears in Figure 2(C) is nonsensical—with light passing through it at the top and coming back through it on the bottom as if it were a lens. (*Id.*, Fig. 2(C).) This obvious flaw in Figure 2(C) indicates that the spatial arrangement of elements is not

accurate. But Petitioner’s showing for limitation 44(e) exclusively relies on the spatial arrangement of the elements in Imai’s Figure 2(C) being an accurate depiction of how a POSITA would have understood those elements to be arranged. (Pet. at 59-61.)

Even if there was any indication that Figure 2(C) of Imai could be relied on as an accurate demonstration of how elements in Imai are related, neither Petitioner nor its expert provide any explanation of how the identified lenses are “disposed adjacent” to another as required by claim 44(e). As discussed above, Petitioner does not identify what it is asserting the “bulk imaging optic” *is* in Imai’s Figure 2(C)—*i.e.*, whether it is one of the two depicted lenses, or the combination of the two. (Ex. 1009, Fig. 2(C); Pet. at 59-61.) Further, Petitioner provides no explanation of why it considers any “bulk transmitting optic” or “bulk imaging optic” in Imai’s disclosures to be “disposed adjacent” to each other as they are pictured in Figure 2(C). (Pet. at 59-61.) Accordingly, even if there is any argument that Imai’s Figure 2(C) is reliable enough to suggest how the depicted lenses are spatially arranged, Petitioner has not met its burden for showing how that arrangement is one in which the lenses are “disposed adjacent” to each other.

Accordingly, the Board should not institute review based on any of Petitioner’s Ground 2, because Petitioner has failed to show a reasonable likelihood of success as to limitation 44(e).

D. There is no reasonable likelihood that Petitioner will prevail on the basis of Ground 3

1. Petitioner fails to show that Weimer teaches a “field of view” per Petitioner’s construction for limitations 44(c) and 44(f)

Petitioner fails to provide any evidence that Ground 3 satisfies limitation 44(c) or 44(f), because Petitioner fails to explain how Weimer satisfies the “field of view” requirement of these limitations as construed by Petitioner—*i.e.*, “detection area defined by an aperture or lens tube. (Ex. 1002 at 2.) Since Petitioner does not adequately explain how Weimer meets the “field of view” limitation per Petitioner’s own construction of the “field of view” term, Petitioner has failed to show a reasonable likelihood of success of invalidating any of the challenged claims via Ground 3. Accordingly, the Board should decline to institute IPR review as to Ground 3.

In support of the “field of view” requirements of limitations 44(c) and 44(f), Petitioner points to Figures 2A and 3A, reproduced below:

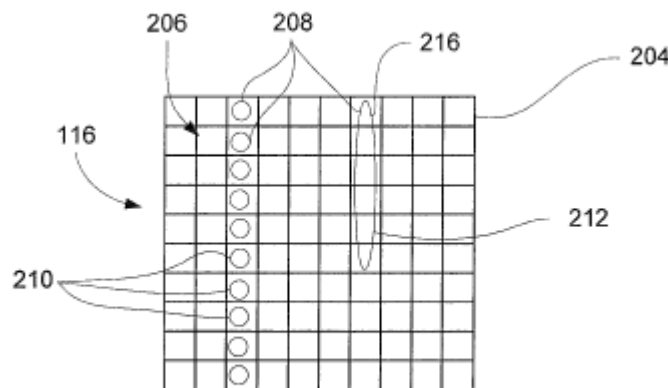
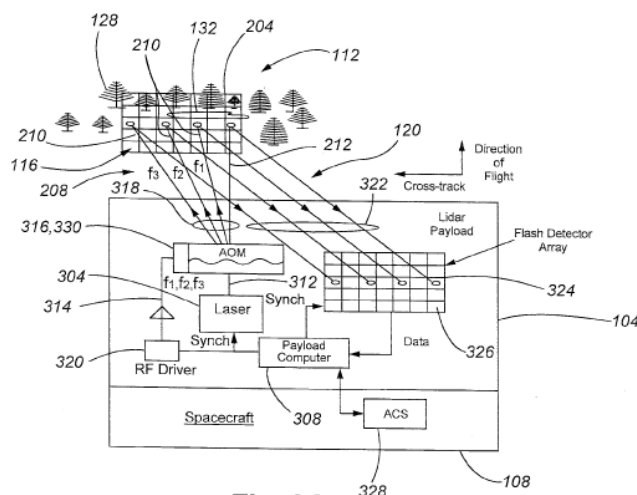


Fig. 2A

(Ex. 1008, Fig. 2A.)



(*Id.*, Fig. 3A.) Additionally, Petitioner points to disclosures regarding correspondence between emission and detection regions. (*Id.*, 1:56-59; 4:56-58; 10:17-45.)

None of Petitioner's identified evidence for the "field of view" limitations discloses an "aperture" or a "lens tube," as required by Petitioner's "field of view" construction. Figure 2A of Weimer only shows an illumination pattern—not any optical components. Figure 3A of Weimer shows lenses, but there is no indication—and Petitioner provides no explanation—how any of these constitute a "lens tube," or how they are involved with defining a "detection region" per Petitioner's construction. Further, the excerpts from Weimer's specification that Petitioner identifies only discuss correspondence between emission and detection regions—not how any such correspondence is generated or what optical components that

process involves. (*Id.*, 1:56-59; 4:56-58; 10:17-45.)

Accordingly, Petitioner fails to show that its construction for “field of view” is met by Weimer. Thus, review should not be instituted for Ground 3. *See KioSoft*, CBM2020-00026, Paper 11, 17-18.

2. Petitioner fails to identify a “bulk imaging optic” for limitation 44(e)

Limitation 44(e) of the ’750 patent requires a “bulk transmitting optic” disposed adjacent to a “bulk imaging optic.” For Ground 3, Petitioner asserts that Weimer alone satisfies limitation 44(e). But Petitioner fails to identify a “bulk imaging optic.” (Pet. at 76-77; Ex. 1003, ¶¶ 276-77 (mirroring petition).) Petitioner contends that “transmit optic 318” in Weimer’s Figure 3A embodiment is a “bulk transmitting optic.” (Pet. at 76-77.) Petitioner then asserts that transmit optic 318 is “disposed adjacent to the bulk transmit optic 31.” (*Id.* at 76.) However, there is no element “31” referenced in Figure 3A or anywhere else in Weimer. (*See, e.g.*, Ex. 1007, Fig. 3A.)

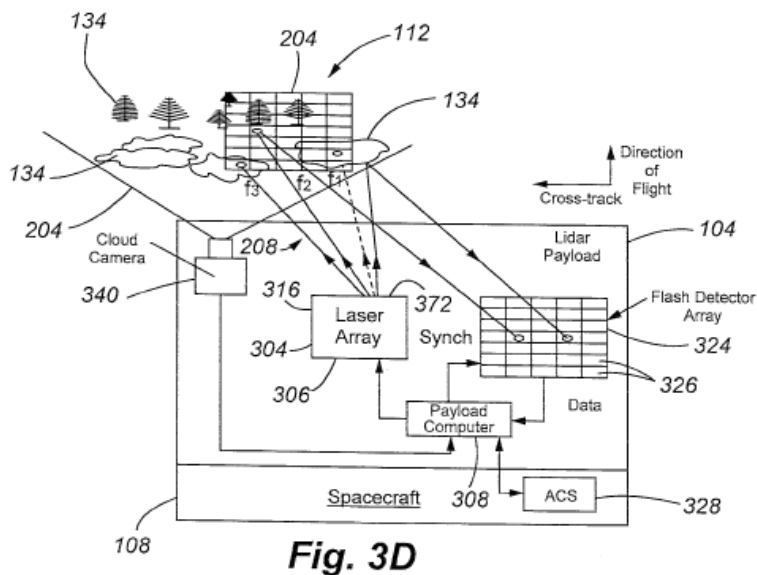
Petitioner may claim that its reference to “bulk transmit optic 31” was a typo. But even if that were so, the only “transmit optic” referenced by Weimer is transmit optic 318—the very element Petitioner identifies as the “bulk transmitting optic” for limitation 44(e). Petitioner does not explain how a single structure—bulk transmit optic 318—can be both the “bulk transmitting optic” and “bulk imaging optic” requirements of limitation 44(e). *Becton Dickinson & Co. v. Tyco Healthcare Grp.*,

LP, 616 F.3d 1249, 1254 (Fed. Cir. 2010) (“Where a claim lists elements separately, the clear implication of the claim language is that those elements are distinct component[s] of the patented invention.”). Additionally, neither Petitioner nor its expert provide any explanation for how transmit optic 318 could constitute a “bulk imaging optic,” when Weimer indicates that it is a “transmit” optic located in the transmit path of Weimer’s emitters. (Ex. 1007, Fig. 3A, 10:3-4 (“The LIDAR system **104** may additionally include transmit optics **318** and/or receive optics **322**.”).)

Accordingly, Petitioner does not show that limitation 44(e) is satisfied by the Weimer-Borowski-Hipp combination for Ground 3. Review should not be instituted as to Ground 3.

3. Petitioner fails to show how the asserted “plurality of emitters” for limitation 44(f) would be incorporated into the embodiment of Weimer Petitioner otherwise relies on

Petitioner relies solely on the embodiment shown in Weimer’s Figure 3D in support of the contention that the Weimer-Borowski-Hipp combination satisfies limitation 44(f). (Pet. at 77-78; Ex. 1003, ¶¶ 278-79.) Figure 3D is reproduced below:



(Ex. 1008, Fig. 3D.) Petitioner asserts that laser array 306 in Figure 3D is the “plurality of emitters” for limitation 44(f). (Pet. at 77-78.)

However, for other limitations of claim 44—limitations 44(b), 44(c), and 44(e)—Petitioner relies solely on the embodiment shown in Weimer’s Figure 3A, reproduced below. (*Id.* at 73-77.)

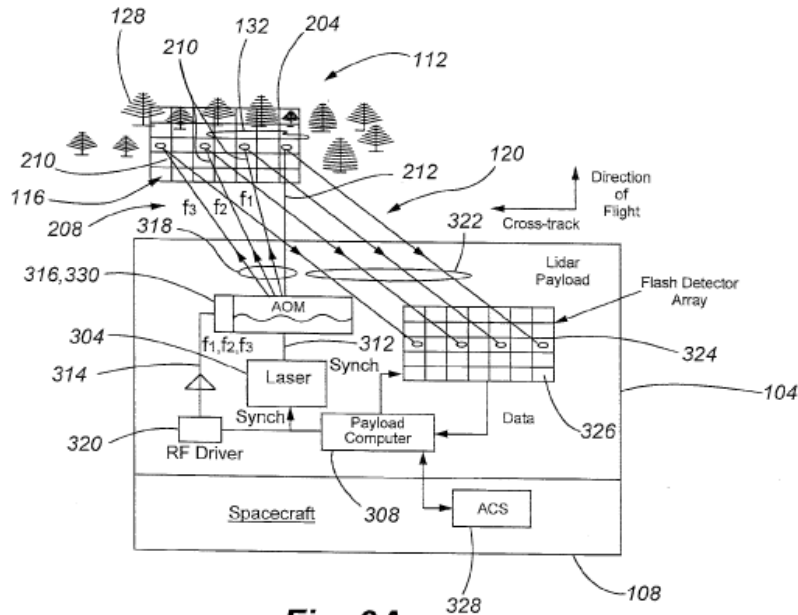


Fig. 3A

(Ex. 1008, Fig. 3A.)

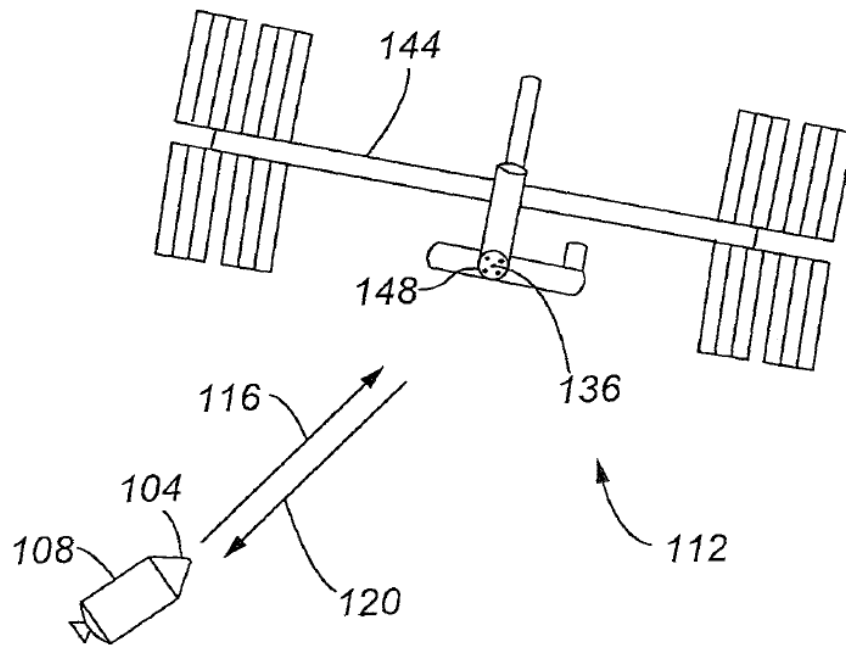
Neither Petitioner nor its expert provide any explanation of how—or why—a POSITA would have incorporated laser array 306 from Weimer’s Figure 3D embodiment into Weimer’s Figure 3A embodiment. (Pet. at 77-78; Ex. 1003, ¶¶ 278-79.) Accordingly, Petitioner has failed to show a reasonable likelihood of success as to limitation 44(f) for Ground 3, and review should not be instituted.

4. Weimer teaches away from high-speed laser pulse systems like Borowski’s

Petitioner’s Ground 3 is based on the combination of the Weimer and Borowski references. (Pet. at 69-72.) Specifically, Petitioner asserts that it would have been obvious in light of Borowski to use multiple SPADs per pixel in Weimer’s system. (*Id.*) However, Petitioner’s asserted motivations to combine are insufficient

to overcome fundamental incompatibilities between Weimer and Borowski's systems. Weimer discloses systems for use in aircraft and spacecraft like satellites where energy conservation is paramount, which limits functionality like laser pulse rate. Borowski, on the other hand, uses SPADs in the context of a system that uses rapid, short, and high-energy pulses. These incompatibilities between Weimer and Borowski's disclosed systems indicate that a POSITA would not have looked to Borowski to improve Weimer's system—as Petitioner asserts. Petitioner's generalized and hindsight-driven asserted motivations to combine Weimer and Borowski are insufficient to overcome the incompatibilities between these systems.

Weimer discloses flash LIDAR systems for use in aircraft and spacecraft. Figures 1A to 1D show various embodiments in “exemplary operating environments,” (Ex. 1008, 3:43-45.), including an airplane, a landing craft for space flight, an autonomous rover, and a satellite, as shown in Figure 1D reproduced below:



(*Id.*, Fig. 1D.) Weimer makes clear that operating conditions like these come with limitations on usable LIDAR systems. For example, Weimer discloses the following:

An along track vegetation LIDAR design preferably has continuous coverage by the laser and a 25 meter footprint. For a LIDAR carried by a satellite, this drives a laser repetition rate of approximately 250 Hz. This is a relatively high repetition rate, and has a significant impact on laser reliability because of the high number of laser shots required for the mission (e.g., 10 billion). The high repetition rate also means that, in order to keep the average output power reasonable to improve laser reliability, the peak power per shot must be kept relatively low (e.g., 15 mJ). Accordingly, such a system may have insufficient power to make measurements through clouds and heavy aerosol layers.

(*Id.*, 1:24-35; *see also id.*, 1:47-51 (indicating LIDAR approach that is “prohibitive

in terms of available electrical power in space”).) Thus, Weimer discloses that applications for its LIDAR system limit the laser repetition rate, the amount of power per laser pulse, and the amount of energy the LIDAR system can practically consume. Specifically, Weimer discloses that a laser repetition rate of 250 Hz is a “high repetition rate” for its application context. (*Id.*, 1:24-35.)

In contrast, Borowski is directed to “[m]ethods and devices for generating a representation of a 3D scene at **very high speed**.” (Ex. 1006, Title (emphasis added).) Borowski’s disclosed speeds are orders of magnitude faster than what Weimer’s disclosure indicates is a “high repetition rate”—*i.e.*, 250 Hz. (Ex. 1008, 1:24-35.) While a repetition rate of 250 Hz indicates cycles that last on the order of milliseconds for Weimer’s system, Borowski’s disclosures discuss laser pulses that last nanoseconds and picoseconds and repetition rates in the gigahertz range. (*E.g.*, Ex. 1006, [309]-[317].)

The speed differences between Weimer and Borowski’s system undermine the alleged motivation to combine Weimer and Borowski that Petitioner asserts. For example, Petitioner combines Weimer and Borowski in an attempt to import SPADs into Weimer’s system. (Pet. at 69-72.) For example, Petitioner asserts that a POSITA would have been motivated to use SPADs in Weimer’s system because of the “high data-rate output,” “detection capability,” and “fast data acquisition” associated with SPADs. (*Id.* at 71.) But it is unclear how any such aspects of SPADs

would be advantageous in a system like Weimer's where system speed is so limited, as Weimer's disclosures indicate. (Ex. 1008, 1:24-35.)

Further, Petitioner combines Weimer and Borowski in arguing that it would have been obvious to use *multiple* SPADs per pixel in Weimer. (Pet. at 70-72.) But Borowski indicates that the advantage of using multiple SPADs per pixel is related to the requirements of high-speed systems—*i.e.*, SPADs need on the order of 20 ns to recover, so systems that require faster detection speeds may need to use multiple SPADs such that “[e]ven if some of the SPADs have been triggered already, the remaining SPADs can still receive light.” (Ex. 1006, [0044].) But none of these considerations make sense in a lower-speed system like Weimer's, where a recovery time of 20 nanoseconds is significantly faster than the system's repetition rate. (Ex. 1008, 1:24-35.)

Petitioner's motivation to combine Weimer and Borowski is particularly implausible in light of Weimer's disclosure of heavy power limitations for its system and the significant electrical requirements of SPADs disclosed by Borowski. For example, Borowski provides a laundry list of circuits for use with SPAD arrays:

- a quenching circuit;
- a pulse conditioner;
- at least a time to digital converter;
- a local (*i.e.*, close to the detector) digital signal processor, with several subcomponents like:
- a blanking circuit controlled by said local digital signal processor;

a statistical processing circuit comprising at least one counter of the detected events at the SPAD diode, and a D-latch and a multiplier connected to an inverse calculus and eventually to a local correcting circuit;
a digital time and/or space averaging circuit;
a digital nonlinear averaging circuit.
a smart bias correction circuit using data received from the global DSP.

(Ex. 1006, [0056]-[0065].) Weimer, in contrast, discloses that power in its system may be “insufficient” for certain LIDAR applications, and some applications may be “prohibitive in terms of available electrical power in space.” (Ex. 1008, 1:24-35, 1:47-51.)

Given Petitioner’s failure to show adequate motivation to combine Weimer and Borowski, review should not be instituted based on Ground 3. *See Henny Penny*, 938 F.3d at 1329; *Chemours*, 4 F.4th at 1376-77.

VI. CONCLUSION

In light of Petitioner’s failure to show a reasonable likelihood of success in showing the unpatentability of any of claims 44-48 and 50 of the ’750 patent, the Board should not institute *inter partes* review as to the challenged claims.

Dated: January 3, 2024

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CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that Patent Owner's Preliminary Response complies with the type-volume limits of 37 C.F.R. § 42.24(a)(1)(i) because it contains 10,821 words, according to the word-processing system used to prepare Patent Owner's Preliminary Response, excluding the parts of Patent Owner's Preliminary Response that are exempted by 37 C.F.R. § 42.24(a) (including the table of contents, a table of authorities, mandatory notices, a certificate of service or this certificate word count, appendix of exhibits, and claim listings).

DATED: January 3, 2024

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CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. Sections 42.6 and 42.105, that a complete copy of the attached **PATENT OWNER'S PRELIMINARY RESPONSE**, including all exhibits (**Nos. 2001-2006**) and related documents, are being served via electronic mail on the 3rd day of January 2024, upon the following counsel of record:

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