

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MOBILEYE GLOBAL, INC., and
ZF ACTIVE SAFETY AND ELECTRONICS US LLC¹

Petitioners

v.

FACET TECHNOLOGY CORP.,
Patent Owner

Inter Partes Review No. IPR2024-01111
U.S. Patent No. 9,671,328

PATENT OWNER'S SURREPLY

¹ ZF Active Safety and Electronics US LLC, which filed a petition in IPR2025-00749, has been joined as a petitioner in this proceeding.

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<i>Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.</i> , 821 F.3d 1359 (Fed. Cir. 2016)	15, 20
<i>Interactive Communications International, Inc. v. Blackhawk Network Inc.</i> , IPR2024-00465, Paper 40 (USPTO Director Oct. 9, 2025)	10, 17
<i>Netflix, Inc. v. DivX, LLC</i> , 84 F.4th 1371 (Fed. Cir. 2023)	15, 20
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PATENT OWNER'S EXHIBIT LIST

Exhibit	Description
2001	Exclusive Patent License Agreement between Facet Technology Corp. and Mandli Communications, Inc. (and patent assignment coversheet), recorded at Reel No. 062371, Frame 0313
2002	Statutory Disclaimer of certain claims filed in file wrapper of U.S. Patent No. 9,671,328
2003	U.S. Provisional Patent Appl. No. 60/296,596
2004	Docket Control Order filed in <i>Facet Tech. Corp. v. Mobileye Glob., Inc.</i> , No. 2:24-cv-00058 (E.D. Tex.)
2005	Excerpts from U.S. District Court — Judicial Caseload Profile (2024 Ed.), <i>available at</i> https://www.uscourts.gov/file/78884/download
2006	Complaint Filed in <i>Facet Tech. Corp. v. Mobileye Glob., Inc.</i> , No. 2:24-cv-00058 (E.D. Tex.)
2007	Cover Pleading to Plaintiff's Disclosure Of Asserted Claims And Infringement Contentions, as served on August 26, 2024 in <i>Facet Tech. Corp. v. Mobileye Glob., Inc.</i> , No. 2:24-cv-00058 (E.D. Tex.)
2008	Cover Pleading to Defendant's Invalidity Contentions, as served on November 4, 2024 in <i>Facet Tech. Corp. v. Mobileye Glob., Inc.</i> , No. 2:24-cv-00058 (E.D. Tex.)
2009	Intentionally Omitted
2010	Intentionally Omitted
2011	Intentionally Omitted
2012	Intentionally Omitted
2013	Intentionally Omitted
2014	Intentionally Omitted

Exhibit	Description
2015	Plaintiff Facet Technology Corp.'s Opposed Motion For Leave To Join Additional Parties, filed as Dkt. No. 32 in <i>Facet Technology Corp. v. Mobileye Global, Inc.</i> , Case No. 2:24-cv-00058-RWS-RSP (E.D. Tex.).
2016	Defendant Mobileye Global, Inc.'s Opposition To Facet's Motion For Leave To Join Additional Parties, filed as Dkt. No. 35 in <i>Facet Technology Corp. v. Mobileye Global, Inc.</i> , Case No. 2:24-cv-00058-RWS-RSP (E.D. Tex.).
2017	Complaint For Declaratory Judgment Of Noninfringement And Demand For Jury Trial, filed as Dkt. No. 1 in <i>Mobileye Vision Technologies Ltd. et al v. Facet Technology Corp.</i> , Case No. 0:24-cv-04149-NEB-DLM (D. Minn.)
2018	Complaint for Patent Infringement, filed as Dkt. No. 1 in <i>Facet Technology Corp. v. General Motors LLC</i> , Case No. 2:24-cv-00035-RWS-RSP (E.D. Tex.)
2019	Docket Control Order, filed as Dkt. No. 22 in <i>Facet Technology Corp. v. General Motors LLC</i> , Case No. 2:24-cv-00035-RWS-RSP (E.D. Tex.)
2020	Mobileye, "Fact Sheet: Mobileye Advanced Driver-Assistance Systems (ADAS)" (July 19, 2020) (available at https://www.mobileye.com/blog/fact-sheet-mobileye-advanced-driver-assistance-systems-adass/)
2021	SEC, "Mobileye to Offer User-Generated Mapping for Autonomous Driving" (January 6, 2016) (available at https://www.sec.gov/Archives/edgar/data/1607310/000157104916010521/t1600008_ex99-1.htm)
2022	Joseph White, "GM Has 'Heightened Partnership' with Mobileye for Autonomous Cars" (October 1, 2015) (available at https://www.reuters.com/article/us-gm-investors-mobileye-idUSKCN0RV4ZC20151001/)

Exhibit	Description
2023	Declaration Of Nikolaos Papanikolopoulos, Ph.D. In Support Of Patent Owner's Response
2024	Curriculum Vitae of Nikolaos Papanikolopoulos, Ph.D.
2025	Transcript of Deposition of Dr. Thorpe, taken in IPR2024-01110 on May 30, 2025
2026	Transcript of Deposition of Dr. Thorpe, taken in IPR2024-01111 on May 29, 2025
2027	Definition of "photodiode," A Dictionary of Physics, Oxford University Press. (6 ed.) <i>available at</i> , https://www.oxfordreference.com/display/10.1093/oi/authority.20110803100324432?p=emailAIVd1F/alp5o2&d=/10.1093/oi/authority.20110803100324432&print
2028	National Institute of Standards and Technology, OSAC Lexicon, Definition of "Lux," <i>available at</i> https://www.nist.gov/glossary-term/26871
2029	Fiorentin, P. & Iacomussi, Paola & Rossi, Giuseppe. (2005). Characterization and Calibration of a CCD Detector for Light Engineering. Instrumentation and Measurement, IEEE Transactions on. 54. 171 - 177. 10.1109/TIM.2004.834055., <i>available at</i> https://www.researchgate.net/publication/3090945_Characterization_and_Calibration_of_a_CCD_Detector_for_Light_Engineering
2030	U.S. Patent No. 6,266,442 to Laumeyer et al.
2031	Thorpe, Chuck, et al. "Dependable perception for robots." (2001). https://kilthub.cmu.edu/articles/journal_contribution/Dependable_Perception_for_Robots/6552518/1/files/12033863.pdf
2032	Nov. 5, 2024 NHTSA Investigation Notice of Tesla, available at https://static.nhtsa.gov/odi/inv/2024/INIM-PE24031-27346.pdf

Exhibit	Description
2033	Transcript of Deposition of Dr. Thorpe, taken in IPR2024-01111 on Oct. 14, 2025 at 12:02 pm CST.

I. INTRODUCTION

Petitioner's reply only demonstrates that each of Petitioner's grounds fails. As to Ground 1, the Patent Owner Response ("POR") demonstrated that Gallagher does not disclose or suggest the claimed distinct "detect" and "determine" steps of claims 1 and 9, nor does it disclose or suggest the two distinct "determine" steps of claim 1. In reply, Petitioner argues that Gallagher's step (d) is a "detect" step. But Gallagher's step (d) merely provides an indication of "which light sensor 6 is [currently] reading the highest reflectance reading." And Gallagher's step (g)—the alleged "determine" step—identifies road markers directly from the data collected in Gallagher's step (a), not any purported detection from step (d). As to the "location" steps of claims 1 and 9, the POR identified that Petitioner and its expert *admitted* that Gallagher's GPS does not determine the location of road markers. Petitioner's reply simply ignores its own prior admission. And the POR demonstrated that the Gallagher-Schofield combination would be unpredictable as of the '328 Patent's 2001 priority date, as that the proposed combination would require sensor fusion of very different types of sensors. In its reply, Petitioner's examples of purported prior art sensor fusion are plainly not comparable.

As to Ground 2, the POR demonstrated that the Petition ignored claim 15's requirement to "determine exemplary angular displacements" "*as part of the assessment of the discrete location of the road marker within the field of view.*" In

reply, Petitioner has no substantive response and merely points back to its Petition—which plainly fails to provide those details. The POR also noted that the Petition failed to show multiple “exemplary angular displacements” for each light intensity measurement from a particular reference position. Petitioner’s reply argument—that proof of dependent claim 16 is somehow proof of claim 15—ignores the plain language of those claims. Finally, the POR showed that adding Frank to the Gallagher-Schofield combination would only create more problems—with Frank’s laser making the “peak” detection in Gallagher infeasible. The reply contains no meaningful response.

As to Ground 3, the POR demonstrated that the angle identified in the Petition is plainly not an entrance angle. In reply, Petitioner tries to change its theory based on its expert’s deposition testimony. This is not only procedurally improper, but it also fails on the merits. As the POR explained, *determining* an entrance angle is not the same as simply assuming the roadway sign is pointed in the wrong way. Petitioner’s fallacious theory to just assume that all traffic signs are perpendicular to the road contradicts the specification’s explanation of what an entrance angle is, as well as the ordinary meaning of “determine.”

As to ground 4, Petitioner’s reply is perfunctory and makes no meaningful effort to rebut Patent Owner’s technical arguments.

Thus, the Board should find each challenged claim patentable.

II. ARGUMENT

A. CLAIM CONSTRUCTION

The POR focused on claim construction regarding the order of the “detect” and “determine” steps of claims 1 and 9 and whether they had to be distinct steps. Paper 25 (“POR”), 14-23. Petitioner now concedes that they are distinct. Paper 28 (“Reply”), 9-10. Moreover, Petitioner’s reply focuses on Gallagher’s step (d) for the “detect” step, and Gallagher’s step (g) for the “determine” steps. Reply, 9-10, 14. Those arguments fail, as discussed below. But because those are primarily issues of the proper interpretation of Gallagher, rather than claim construction, Patent Owner’s surreply will focus on the operation of the prior art. However, Patent Owner stands by its claim construction arguments set forth in the POR.

B. PETITIONER’S GROUND 1 FAILS

1. The Cited Art Does Not Disclose or Suggest the “Detect” and “Determine” steps of Claim 9 (limitations 9D and 9E)

In the POR, Patent Owner argued that in limitations 9D-9E, the “determin[ing]” step must be performed on “object[s] of interest” which have already been previously “detect[ed]” in the “detect object of interest” step. The POR explained that Gallagher’s step (d) and step (g) cannot satisfy that relationship because: (1) step (d) performs no analysis and instead simply indicates “which light sensor 6 is [currently] reading the highest reflectance reading” and

(2) the indicator generated by step (d) is never used again and thus cannot provide a basis upon which a later “determin[ation]” is performed. POR, 25-26.

In reply, Petitioner argues that Gallagher’s step (d) performs an object detection because it occurs after steps b-c, which involve filter and calibrating. Reply, 12. But that misses the point—the point was that step (d) performs nothing that one of skill in the art would consider to be “detect[ing] objects of interest within the field of view” because it is not “analyzing any recorded data.” POR, 25, Ex. 2023 ¶102. Gallagher’s calibrating and filtering steps are not analyzing data or detecting objects. Ex. 2026, 85:25-86:6.

Petitioner also argues that “step d” must perform object detection because it presents a visual indicator. Reply, 10-11. But step (d) merely “detects which light sensor 6 is reading the highest reflectance reading,” which is not object detection. POR, 25. There will always be a sensor with a “highest” reading, even on a patch of roadway with no reflectors (i.e. with no objects to detect). Ex. 2023 ¶102. Petitioner does not dispute this in its reply. *See also*, Ex. 2033, 10:23-11:14 (characterizing Gallagher as “silent” to that scenario). Petitioner argues that step (d) involves a detection because it allegedly “distinguishes” between “background reflectance levels on non road marking sections of the road” and “reflectance levels indicating a road marking” in step (d). Reply, 12-13 (citing Ex. 1005, [0060]). But that is not a reasonable interpretation of Gallagher—Gallagher does

not even “determine[e] the background reflectance level” until step (f). Ex. 1005, [0065]. And, Gallagher’s Figure 4 demonstrates that the steps are taken in order. Ex. 1005, [0029], [0053], Fig. 4. Thus, step (d) cannot “distinguish” “background reflectance levels,” as those levels have not yet been determined.

Indeed, contrary to Petitioner’s argument, Gallagher’s step (d) merely explains that *in general*, “background reflectance levels on non road marking sections of the road are low and road markers 2 are relatively high,” and thus the visual indicator in step (d) can “detect which light sensor 6 is reading the highest reflectance reading.” *Id.*, [0060]. That is, even though no actual background level has been determined yet, and no object has been detected yet, simply indicating which light sensor is currently reading the highest will usually be good enough for the driver, as there is usually a big difference in reflected light intensity between “non road marking sections” and “road markers.” Indeed, Petitioner’s theory that step (d) actually assesses reflected light to detect objects is contradicted by its expert’s admission that “Gallagher is not specific as to how he tests the reflectivity” for “step (d).” Ex. 2033, 7:15-8:1. Thus, Petitioner’s expert lacks a reasoned foundation for concluding that Gallagher’s step (d) performs object detection.

And, as noted, the indicator generated in Gallagher’s step (d) is not used in the later steps, demonstrating the absence of a detection followed by performing a

determination on an already detected object, as claimed. POR, 6; Ex. 2023 ¶¶65.

Petitioner argues that Gallagher's step (e) somehow evidences that object detection has been performed in step (d). Reply, 13. But, as discussed in the POR, step (e) merely records the vehicle position from the vehicle gearbox revolution sensor.

POR, 24; Ex. 2023 ¶¶101; Ex. 1005, [0063]. Petitioner quotes Gallagher's paragraph [0064], stating that the "gearbox revolution sensor" data is "is used to tag or identify the road markers tested along a stretch of road." However, that merely states that the gearbox data recorded in step (e) will *later* be used in *subsequent* steps, i.e. in Gallagher's step (i) in paragraph [0068], which actually performs the tagging and identifying. Ex. 1005, [0068]; Ex. 2033, 18:22-19:1. Paragraph [0064] says nothing about whether object detection has occurred yet (i.e. in step (d)). Indeed, later, step (j) is able to collate the "location" (as provided by GPS or gearbox data) with the identification of a road marker performed *in step (g)* (not in step (d)). Ex. 1005, [0069], [0066].

Petitioner also places great significance on Gallagher's Figure 5 and the embodiment where both "Front Face" and "Rear Face" of markers are tested. Reply, 14. But, Figure 5 does not demonstrate that "Gallagher's computer detects road markers, determines their location, determines that they have front and rear reflective surfaces, determines the reflectance level in CIL of each reflective surface, and associates that information together in storage." *Id.* (citing Ex. 1005,

[0078]-[0079]). Rather, Figure 5 is entirely consistent with combining the front and rear reflectance data *after* step (g) has been performed. Ex. 1005, [0074] (“an additional processing step in the algorithm can be used to match the reflectance levels measured from the bi directional faces of a road marker to be analysed, stored and displayed.”), Ex. 2033, 25:12-26:3. Indeed, Petitioner’s expert does not dispute that Gallagher is silent as to *how* it is actually matches the front and rear surfaces shown in Figure 5. *Id.*, 22:12-14. In any event, Petitioner cannot rely on the step of creating Figure 5 (i.e. Gallagher’s [0074]) because it was not identified in the Petition for limitations 9D or 9E. Pet., 20-23.

Additionally, Petitioner’s arguments that a detection in Gallagher’s step (d) is evident from step (e) and Figure 5 also fail because the Petition does not rely on those disclosures for the “determine” step. Rather, the Petition relies on Gallagher’s step (g) for the “determine” step. Pet., 22-23. However, step (g) in Gallagher expressly states that it is performed by “selecting, from data obtained in **step a.**” Ex. 1005, [0066] (emphasis added); POR, 26. Thus, even if Gallagher’s step (e) or Figure 5 reflected some detection prior to step (g)—they do not—step (g) itself evidences that the disclosures in Gallagher cited by the Petition do not perform a detection followed by a determination performed on an already detected objection. Indeed, Petitioner articulates no reason why it believes that the

same road marker will necessarily both generate an indicator in step (d) and also generate a “peak response” in step (g).

Thus, because Gallagher's step (d) does not perform object detection, Petitioner cannot identify the claimed *distinct* “detect” and “determine” steps in Gallagher. Petitioner admits that the same step cannot perform both claim steps. Reply, 9-10. Thus, the cited art does not disclose or suggest the structure of limitations 9D-9E, regardless of the construction of those limitations.

2. The Cited Art Does Not Disclose or Suggest the “Detect” and “Determine” steps of Claim 1 (limitations 1E-1G)

The POR explained that Gallagher fails to suggest or disclose limitations 1E-1G for the same reasons as 9D-9E. POR, 30-32. Petitioner's reply arguments that Gallagher discloses limitations of 1E-1G thus fail for the same reasons discuss above. *Supra* II.B.1.

Moreover, the POR noted that although the Petition cited Schofield in 1E, it only relied on Schofield for the “image capture sensor.” POR, 30. In particular, it noted that the conclusory statement in the Petition's section on limitation 1E that “Schofield's imaging sensor module to further improve the detection of objects of interest” did not suggest or motivate performing a determination on an already determined object of interest, as the Petition only cited Gallagher in step 1F. POR, 31. Although the Reply discusses Schofield at length as to limitation 1E, it does

not dispute that the Petition does not cite Schofield as disclosing or suggesting performing a determination on an already detected object of interest. Reply, 16-19. Thus, Petitioner's reply arguments for the "detect" and "determine" steps of claim 1 fail.

3. The Cited Art Does Not Disclose or Suggest the "location" Steps of Limitations 1H or 9F

The POR explained that the cited art fails to disclose or suggest the "location" limitations in 1H of claim 1 or 9F of claim 9. POR, 28, 33. As discussed, the sole argument in the Petition for limitation 1H—which is also an alternative argument for limitation 9F—is that Gallagher's GPS or vehicle gearbox sensor determines the location of a road marker. Pet., 41, 25-26. As the POR noted, the Petition and Petitioner's expert *expressly admitted* in Ground 4 that Gallagher's "GPS position of the vehicle corresponds to the location of the active sensor" and "[a]ccordingly, a POSITA would have recognized that additional steps would have been necessary to also determine the location of the markers." POR, 33 (citing Pet., 70; Ex. 1003 ¶176). Petitioner's reply fails to address this admission. Reply, 19-20.

Instead, Petitioner attempts to present a new expert declaration that contradicts this admission. Ex. 1030 ¶¶43-44. These new opinions should be rejected because they plainly contradict Petitioner's expert's prior statements:

Thorpe Decl. (Ex. 1003 ¶176)	Thorpe Reply Decl. (Ex. 1030 ¶43)
“[A] POSITA would have understood that [Gallagher’s] GPS position of the vehicle corresponds to the location of the active sensor. Accordingly, a POSITA would have recognized that additional steps would have been necessary to also determine the location of the markers.”	“I disagree with Patent Owner and Dr. Papanikolopoulos that Gallagher only discloses giving ‘the location of the vehicle, the time the road marker is detected,’ not the location of the road marker itself.”

Petitioner’s expert’s unexplained, contradictory statements about Gallagher’s location functionality renders all of his testimony unreliable. *See Interactive Communications International, Inc. v. Blackhawk Network Inc.*, IPR2024-00465, Paper 40, 3 (USPTO Director Oct. 9, 2025) (“The Board abused its discretion by improperly crediting expert testimony that has multiple material contradictions Having determined that [an expert] is not credible as to multiple material aspects of his testimony, it would be inappropriate in this instance to rely on this testimony for the other grounds”).

Moreover, Petitioner’s expert’s new theory relies on a modification of Gallagher that is not disclosed in the Petition, and thus is improper as a reply argument. Ex. 1030 ¶43 (“it would have been a simple matter of translation to convert the GPS location information to the location of the road marker.”); *see Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1331 (Fed. Cir. 2019). Also, Petitioner’s arguments are based on disclosures in Gallagher which were not

cited in the Petition for this limitation and thus are improper new arguments.

Compare Ex. 1030 ¶44 *with* Pet., 25-26, 41.

As to Petitioner's alternative argument for 9F based on Schofield's "spatially separated regions," that argument also fails. Pet., 23-25. As discussed in the POR, Schofield's spatially separated regions have nothing to do with determining the discrete location of an object in the field of view, little less doing so by analyzing a light intensity value. POR, 28-29. In reply, Petitioner criticizes this argument as "improperly attack[ing] Schofield and Gallagher individually." Reply, 20. To the contrary, for this theory of 9F, the Petition relies on "Schofield's [purported disclosure of a] determination of a light source's location within the field of view." Pet., 23, 24. Thus, it is entirely proper to argue that Schofield's spatially separated regions do not disclose or suggest this limitation.

Moreover, Petitioner's reply arguments that Schofield discloses the "location" limitation of 9F are without merit. In particular, Petitioner argues that "Schofield uses the light source's location within the scene to help confirm its identification." Reply, 20; Ex. 2023 ¶45. But, as noted in the POR, that simply is not "analyz[ing] the at least one light intensity value to determine an assessment of a discrete location of the road marker within the field of view," as claimed, but is instead "essentially the opposite of this claim limitation." POR, 1-2, 28-29.

Petitioner and its expert have no meaningful response in reply.

4. The Cited Art Does Not Disclose or Suggest Limitations 1F and 1G of Claim 1

The POR explained that the Petition improperly identifies the same step in limitations 1F and 1G. POR, 32. Petitioner's reply concedes that multiple steps in claim 1 or 9 cannot "be satisfied with a single step." Reply, 9-10. Petitioner's concession is fatal for its claim 1 arguments. In particular, the Petition expressly identifies Gallagher's paragraph [0066] (Gallagher's step (g)) as satisfying both limitations 1F and 1G. Pet., 40-41; Ex. 1003 ¶¶ 113, 115. Petitioner's only response is the new and plainly erroneous argument that Gallagher's "step g includes multiple parts." Reply, 21. To the contrary, Gallagher's step g is abundantly simple:

Process step g. involves selecting, from data obtained in step a., which reflectance levels indicate a road marker. In the case of road markers the peak responses sensed are determined as the highly reflective surfaces of a road marker.

Ex. 1005, [0066]. The second sentence simply provides further detail to explain how the first sentence is performed—the "reflectance levels [which] indicate a road marker" are selected by identifying the peak responses.

However, Petitioner argues that the second sentence in "step g" is really more than one step because it involves a separate step of "determining whether each reflective surface corresponds to a painted line or a raised pavement marker," which it argues corresponds to limitation 1G. Reply, 22. This is plainly an

improper new reply argument: the Petition does not mention Gallagher distinguishing between painted lines or raised pavement markers in its discussion of step 1G. Pet., 40-41; Ex. 1003 ¶¶114-115. Moreover, it is inconsistent with Gallagher itself—all of the enumerated steps in Gallagher’s algorithm are expressly limited to the example of “raised pavement markers.” Ex. 1005, [0033]. Accordingly, Gallagher’s step (g) cannot be reasonably interpreted as distinguishing between painted lines and raised pavement markers. Thus, Gallagher does not disclose separate steps of “determin[ing] whether the object of interest includes a reflective surface based on the light intensity values” and “determin[ing]” whether the reflective surface is a road marker based on an assessment of the reflective surface” as recited in limitations 1F and 1G of claim 1.

5. Petitioner Fails to Demonstrate That a POSITA Would Be Motivated to Combine the Disclosures of Gallagher and Schofield in the Manner Claimed

a) Petitioner’s Improper New Reply Theories Regarding *How* Gallagher and Schofield are to be Combined Demonstrate that the Petition was Defective

In the POR, Patent Owner presented a number of fundamental problems with Petitioner’s proposed combination of Gallagher and Schofield. In particular, the POR noted that the Petition failed to include sufficient details regarding the contemplated workings of the proposed combination, in violation of the Federal Circuit *Personal Web* decision. POR, 33-34. In reply, Petitioner and its expert

introduces new theories regarding how it proposes Gallagher and Schofield be combined. In particular, Petitioner's expert states that POSITA would be motivated to combine Gallagher's "visual indicator" with Schofield in order to improve the accuracy of Gallagher's visual indicator by incorporating "data from multiple sensors and more advanced processing technique." Ex. 1030 ¶35 (cited by Reply, 16-17). He also argues that "one way to combine Gallagher and Schofield" is for "Schofield's camera [to] have provided a field of view that covered the field of view of Gallagher's light sensor array." Ex. 1030 ¶37 (cited by Reply, 18). And he argues that "incorporating Schofield's camera data would have improved the system's ability to detect objects of interest with reflectance levels so far below the minimum acceptable level that using reflectance levels alone might mistake them for background." *Id.* Each of these theories is an improper new reply argument. *Henny Penny Corp.*, 938 F.3d at 1331.

These are exactly the kind of details that Petitioner was obligated to put in the Petition under *Personal Web*, but failed to do so. Petitioner's late introduction of a panoply of new theories for combining Schofield with Gallagher only demonstrates that the Petition was legally inadequate from the beginning, and thus all of Petitioners' grounds must be rejected. *Netflix, Inc. v. DivX, LLC*, 84 F.4th 1371, 1377 (Fed. Cir. 2023) ("Ultimately, it is the petitioner's burden to present a

clear argument.”); *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016); 37 C.F.R. § 42.104 (b)(4); 35 U.S.C. § 312(a)(3).

Indeed, allowing Petitioner to make up the details of its obviousness theory as it goes along is directly prejudicial to Patent Owner. For example, during the first deposition of Petitioner’s expert, Patent Owner asked him details of *how* he was proposing to combine Gallagher and Schofield, and in particular, the field of view of each of the sensors in the proposed combination. Ex. 2026, 71:18-73:8, 53:4-54:4, 105:8-106:25. Although he was vague, Dr. Thorpe eventually stated that, in the proposed combination, Gallagher’s photodetectors are pointed down, while Schofield’s camera is “looking out, the world in general.” *Id.*, 106:15-25. In the POR, Patent Owner relied on such statements by Dr. Thorpe, opining why combining Gallagher and Schofield using two different points of view would be impractical and unpredictable, as it would require tracking an object between two different fields of view using disparate types of sensors. POR, 34-35. In its reply declaration, rather than responding to that argument, Petitioner’s expert reinvents his combination, now asserting that the field of view of Schofield’s camera “cover[s]” the field of view of Gallagher’s photodiode sensor array in the proposed combination. Ex. 1030 ¶37. By delaying the disclosure of the details of the operation of its proposed combination until its reply, Petitioner has deprived Patent

Owner from the ability to submit expert testimony addressing Petitioner's actual obviousness theories, violating Patent Owner's due process and statutory rights.

Moreover, Petition's expert's repeated inconsistencies as to how he is proposing to combine Gallagher and Schofield renders all of his testimony unreliable. POR, 34; Ex. 1003 ¶¶77-79, 102-107, 110-111; Ex. 2026, 105:2-115:18; Ex. 1030 ¶¶35-37; *Interactive Communications*, IPR2024-00465, Paper 40, 3.

b) Petitioner Fails to Rebut Patent Owner's Showing that the Proposed Combination Would be Unpredictable

In the POR, Patent Owner demonstrated that it would not be predictable to combine Schofield and Gallagher as of the 2001 priority date of the '328 Patent, as it would require sensor fusion of very disparate types of sensors operating at highway speeds. POR, 34-36. In response, Petitioner and its expert cite to purportedly contemporaneous examples of "sensor fusion" in the form of "stereo fusion" (i.e. fusing two cameras) and the fusing of "range and camera data." Ex 1030 ¶¶40-42 (citing Exs. 1031-1033). But none of those examples are similar to fusing Schofield's camera-based approach with Gallagher—which uses peak responses from photodiodes to identify the presence of road markers. Ex. 1005, [0038]-[0039], [0066]. Indeed, Petitioner's expert admits that "sensor fusion" was "demonstrated successfully" only "for *particular combinations of sensors*" before

the '328 Patent. Ex 1030 ¶39. Petitioner's expert's inability to identify any examples of sensor fusion analogous to Petitioner's combination only demonstrates that Patent Owner's expert was correct: the combination would be unpredictable.

Moreover as noted in the POR, Petitioner's expert himself stated in a publication that "perception" of objects at highway speeds using sensor fusion was "incomplete" in 2001. POR, 36 (citing Ex. 2031, 1, 6; Ex. 2023 ¶95). Dr. Thorpe attempts to distinguish his prior statements from his proposed Gallagher-Schofield combination, characterizing those statements as about "general perception systems" that need to detect and distinguish among different objects. Ex. 1030 ¶39. But Dr. Thorpe fails to explain how that is meaningfully different from claims 1 and 9, which require "detect[ing] objects of interest within the field of view and for each object of interest" "determin[ing] whether the object of interest" is a road marker. '328 Patent, cls. 1, 9; POR, 23-27, 30-32. Contrary to Petitioner's arguments, Dr. Thorpe's paper expressly noted that perception was a problem for a variety of vehicular systems with sensors (e.g. factory robots, delivery robots, public transportation systems, etc.). Ex. 2031, 1. And it noted that the perception problem applied whenever: (1) the environment was not clean, or (2) where the vehicle did not move slowly. *Id.* Dr. Thorpe does not dispute that those two problematic situations both apply to Gallagher and Schofield's systems. Thus, Petitioner has failed to meet its burden of showing that the proposed

combination of Gallagher and Schofield was predictable or would have a reasonable expectation of success.

C. PETITIONER'S GROUND 2 FAILS

1. **The Cited Art Does Not Disclose or Suggest Determining “exemplary angular displacements” “*as part of the assessment of the discrete location of the road marker within the field of view*”**

The POR argued that Ground 2 also failed because Petitioner did not demonstrate that the cited art “determine[s] exemplary angular displacements of incident light” “*as part of the assessment of the discrete location of the road marker within the field of view*” POR, 37-39. In reply, Petitioner argues that the “as part of” limitation is somehow self-evident from the structure of the Petition. In particular, it argues that the Frank-Gallagher combination of Ground 2 “only added to the previously discussed Gallagher-Schofield combination and did not change the functionality” “discussed in [9F].” Reply, 22-23. But, as discussed, the Petition presents two, *alternative* theories for 9F: Schofield’s spatially separated regions, or Gallagher’s GPS / gearbox revolution sensor. Pet., 23-26. Ground 2 of the Petition mentions nothing about Schofield in Ground 2 other than mentioning that Schofield’s array could be the sensor. Pet., 51. And, the Petition does not mention Gallagher’s GPS or gearbox revolution sensor at all in Ground 2. Pet., 44-51. Notably, the Petition fails to make any effort to even mention the language “as

part of the assessment of the discrete location of the road marker within the field of view” outside of the text quotation of the entire language of claim 15 in the header for the section. Pet., 47. In reply, Petitioner does not even try to explain *which* of its alternative theories for limitation 9F is being contemplated in the combination of Ground 2 for claim 15, little less explain how the proposed combination works for each of those alternative theories.

Moreover, as noted in the POR, the Petition relies on Frank’s measurement of “angle θ ” for the remainder of claim 15. Pet., 44-51, However, the Petition does not present any obviousness theory explaining how Frank’s measurements of angle θ would be combined with the disclosures of Gallagher or Schofield the Petition relies on for limitation 9F. *Id.*; POR, 37-39. For example, the Petition does not explain how to use Frank’s angle θ measurements with Schofield’s spatially separated regions, or why a POSITA would be motivated to combine them. *Id.* In reply, Petitioner does not even try to explain how its Ground 2 theories relating to Frank’s angle θ are consistent with its theories for limitation 9F.

This plainly falls far short of Petitioner’s obligations to adequately identify the grounds. *Netflix*, 84 F.4t h, 1377; *Intelligent Bio-Sys.*, 821 F.3d, 1369 (Fed. Cir. 2016); 37 C.F.R. § 42.104 (b)(4); 35 U.S.C. § 312(a)(3).

2. The Cited Art Does Not Disclose or Suggest Determining Multiple “exemplary angular displacements” for Each Light Intensity Measurement from a Particular Reference Position

The POR also demonstrated that the cited art in Ground 2 does not “determine” multiple “exemplary angular displacements” for each light intensity measurement from a particular reference position, as recited in claim 15. In its reply, Petitioner’s only responsive argument is that claim 15 must be satisfied by the combination because it supposedly satisfies claim 16, which Petitioner alleges provides a “narrower definition of ‘exemplary angular displacements.’” Reply, 23. This argument is both improperly new and non-sensical. Claim 16 provides that “**each** of the exemplary angular displacements of incident light comprises an observation angle to one of a plurality of distances of the light source from the road marker.” Thus, claim 16 narrows what kind of exemplary angles are required, but it in no way rebuts Patent Owner’s argument that claim 15 requires multiple “exemplary angular displacements”—plural—“for each light intensity measurement from a reference location.” POR, 39-40.

3. Petitioner Fails to Demonstrate That a POSITA Would Be Motivated to Combine the Disclosures of Gallagher, Schofield and Frank in the Manner Claimed

In the POR, Patent Owner presented a number of fundamental problems with Petitioner’s Ground 2 combination. In particular, Frank’s laser is

incompatible with Gallagher because Gallagher relies on identifying a “peak” result by using photodiodes with broad regions. POR, 41-42. In response, Petitioner argues that one could simply use Frank’s photodiode array in the same manner as Gallagher. Reply, 24 (citing Ex. 1007, 10:67-11:4, 13:64-14:15). But this does not solve the problem—Frank’s photodiode array works to calculate angle θ by identifying the photodiode that received the laser signal. Ex. 1007, 7:27-50. Thus, in the combination, Gallagher’s system has no way of knowing, at any point in time, whether a received laser reflection is merely the laser reflection from the background roadway or the laser reflection from a photoreflector—it can no longer simply assume that a peak can be identified as being significantly higher than the rest of the readings. In particular, the POR noted that the combination would unpredictably increase the intensity of reflections from the road markers. POR, 42-43. Petitioner responds that this would only require “adjusting the calibrations.” Reply, 25. But that misses the point—Frank’s laser radar, with its high scanning rate, is *unpredictable*—Gallagher’s system will not know whether or when one of its photodiode is receiving the increased intensity from a laser hitting a road marker, from ambient light hitting a road marker, or from a laser hitting background roadway. In short, Petitioner makes no meaningful effort to explain how Gallagher’s method of identifying and measuring retroreflectors works when combined with Frank’s laser system.

D. PETITIONER'S GROUND 3 FAILS

The POR demonstrated that the angle in Frank cited by the Petition (angle α) is plainly not an entrance angle. POR, 44-45. Indeed, Petitioner's expert admitted in his deposition that angle α is not an entrance angle. *Id.* (citing Ex. 2026, 140:14-17). Despite learning of this defect at that deposition on May 29, 2025 (Ex. 2026), Petitioner still has not attempted to file a corrected petition or a corrected declaration. *See* 37 CFR § 42.104(c). Rather, in its reply, Petitioner asserts that it can rely on Frank's angle θ as the claimed entrance angle instead, based solely on a few statements in Petitioner's expert's *deposition*. Reply, 25-26.

Petitioner's "angle θ " theory is plainly an improper new argument. The Petition defines the grounds, not an expert's deposition. 35 U.S.C. § 312(a)(3); *SAS Institute Inc. v. Iancu*, 584 US 357, 361-364 (2018). Moreover, Petitioner's argument that this was a mere "typo" is contradicted by the Petition's and Petitioner's expert's *detailed explanation* of angle α and the *repeated* statements identifying only angle α as the purported entrance angle of claim 14. Pet, 45, 59, 60; Ex. 1003 ¶¶128, 154-156. Thus, Petitioner is foreclosed from relying on anything other than Frank's angle α as the entrance angle, which is undisputedly *not an entrance angle*.

Even if Petitioner were permitted to rely on Frank's angle θ as the claimed entrance angle, the POR explains that argument also fails. POR, 45-47. In

particular, angle θ is not an entrance angle. Frank's angle θ is the angle between the *vehicle's normal vector* and the incident light on the sign. *Id.* By contrast, an entrance angle is the angular displacement of the incident light relative to the *normal vector from the object face surface*. *Id.* In reply, Petitioner argues that angle θ is good enough because *if* one were traveling parallel to the lanes of the road, *and if* the sign was perpendicular to the road, then angle θ could be *converted* into the angle that is equivalent to the entrance angle. Reply, 26-27. However, that is not “determin[ing] an entrance angle,” it is merely *assuming* an entrance angle. POR, 44-47. Petitioner articulates no reason to assume that signs will be perpendicular to the roadway.

Indeed, as noted, the entire point of *determining* the entrance angle is that the assumption method is inaccurate because the assumption about the signs angle is often not true. POR, 47 (citing ‘328 Patent, 7:55-61, 14:16-22, 15:23-46). Petitioner's citation to the specification's statement that “knowing the normal vector 180 to a sign 190 face is not required” is misplaced. Reply, 26 (citing ‘328 Patent, 14:6-18). In the context of the sentences that precede it, that passage is merely stating that the normal vector is not required *to calculate* R_A (the coefficient of retroreflectivity)—it says nothing to suggest that assuming the normal vector of the sign is the same as *determining* an entrance angle. To the contrary, the specification unequivocally states that “[e]ntrance angles are impacted by the

angular position 200 of a sign 190 relative to the highway 150.” ‘328 Patent, 7:57-61, Fig. 2; *see also* Ex. 2003, 9-10, 21-22, 39, 40, 50, 37, Figs. 2, 14, 16 (incorporated by reference into the ‘328 Patent at 1:18-27). Thus, Petitioner’s theory is inconsistent with the specification’s definition of entrance angle.

E. PETITIONER’S GROUND 4 FAILS

The POR explained that the cited art does not disclose or suggest the limitations of claim 5. POR, 52-54. In response, Petitioner submits no reply expert declaration and no substantive response. Reply, 29. The POR also explained how Leonard and Popovich fail to provide benefits to the Gallagher-Schofield combination. POR, 54-56. Again, Petitioner submits no substantive response. Reply, 29. Thus, the Board should reject Petitioner’s arguments for claims 5-7.

III. CONCLUSION

The Board should find all challenged claims to be patentable.

Dated: October 22, 2025

Respectfully submitted,

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CERTIFICATE OF SERVICE

The undersigned certifies that on October 22, 2025, I will cause true and correct copies of the foregoing **PATENT OWNER'S SURREPLY** and all associated exhibits or appendices referred to therein, to be served electronically upon the following attorneys who have consented to service via email. Pet. at 75-76.

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