

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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ARASHI VISION (U.S.) LLC (D/B/A INSTA360),  
Petitioner,

v.

GOPRO, INC.,  
Patent Owner.

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Case No. IPR2024-01186  
U.S. Patent No. 10,574,894

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**PATENT OWNER'S SUR-REPLY**

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**EXHIBIT LIST**

| <b>No.</b> | <b>Exhibit</b>                                                                                                                                                                                                                                            |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2001       | Declaration of Hassan Foroosh, Ph.D.                                                                                                                                                                                                                      |
| 2002       | <i>Curriculum vitae</i> of Hassan Foroosh, Ph.D.                                                                                                                                                                                                          |
| 2003       | “GoPro Celebrates Surpassing 50 Million Cameras Sold,” produced as GOPRO_00063291 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                       |
| 2004       | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - [REDACTED] in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                              |
| 2005       | “NHL, NHLPA Partner with GoPro To Deliver Hockey Fans Unique Perspectives Of The Game,” produced as GOPRO_00063270 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                      |
| 2006       | Complaint, <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                                                                                                 |
| 2007       | E-mail from Alex S. Yap on October 9, 2024                                                                                                                                                                                                                |
| 2008       | “GoPro Named Exclusive Action Camera of Red Bull Rampage, the World’s Biggest Freeride Mountain Bike Event,” produced as GOPRO_00063323 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400 |
| 2009       | “GoPro and Adobe Collaborate to Bring Unique Content to Adobe Stock Users,” produced as GOPRO_00063341 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                  |

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| 2010 | "73 <sup>rd</sup> Annual Technology & Engineering Emmys," produced as GOPRO_00000009 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                            |
| 2011 | "Believe the Hype: GoPro Showcases Award-Winning HERO7 Cameras at CES 2019," produced as GOPRO_00063251 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400         |
| 2012 | "GoPro Wins Second Emmy® Award for Groundbreaking Digital Imaging Technology," produced as GOPRO_00063339 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400       |
| 2013 | "J.P. Morgan – North America Equity Research (21 September 2018)," produced as GOPRO_00359592 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                   |
| 2014 | "GoPro Hero 9 Black vs Hero 8 Black: 9 key differences you need to know," produced as GOPRO_00010039 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400            |
| 2015 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - [REDACTED]<br>[REDACTED] in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                        |
| 2016 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER – [REDACTED]<br>[REDACTED] served in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400 |

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|------|--------------------------------------------------------------------------------------------------------------------------|
| 2017 | Declaration of Patrick T. Schmidt in Support of Patent Owner's Motion for <i>Pro Hac Vice</i> Admission (March 14, 2025) |
| 2018 | Supplemental Declaration of Hassan Foroosh, Ph.D.                                                                        |
| 2019 | U.S. provisional patent application Ser. No. 61/407,630 filed on Oct. 28, 2010 ("Kwatra provisional application")        |
| 2020 | Transcript of April 4, 2025, Deposition of Petitioner's Expert Dr. Katsaggelos                                           |
| 2021 | Excerpt of ITC Trial Transcript including Testimony of Petitioner's Expert Mr. Goodin                                    |
| 2022 | Screenshot of Dr. Katsaggelos lecture on Coursera                                                                        |
| 2023 | U.S. Patent 10,027,893 ("Bell")                                                                                          |
| 2024 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - [REDACTED]                                               |
| 2025 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - [REDACTED]                                               |
| 2026 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - [REDACTED]                                               |
| 2027 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]                               |
| 2028 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]                               |
| 2029 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]                               |
| 2030 | User Manuel for GoPro HERO7 Black (CX-0522)                                                                              |

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|------|-------------------------------------------------------------------------------------------------------------|
| 2031 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE<br>CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]<br>[REDACTED] |
| 2032 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE<br>CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]<br>[REDACTED] |
| 2033 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE<br>CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]<br>[REDACTED] |
| 2034 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE<br>CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]<br>[REDACTED] |
| 2035 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE<br>CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]<br>[REDACTED] |
| 2036 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE<br>CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]<br>[REDACTED] |
| 2037 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE<br>CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]<br>[REDACTED] |
| 2038 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE<br>CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]<br>[REDACTED] |
| 2039 | CONFIDENTIAL BUSINESS INFORMATION – SOURCE<br>CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED]<br>[REDACTED] |
| 2040 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO<br>PROTECTIVE ORDER – [REDACTED]<br>[REDACTED]                 |

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|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2041 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER – [REDACTED]                                                                                                                                                                                                                         |
| 2042 | Technical Review of HERO8 Black (CX-1388)                                                                                                                                                                                                                                                          |
| 2043 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - [REDACTED]                                                                                                                                                                                                                         |
| 2044 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - [REDACTED]                                                                                                                                                                                                                         |
| 2045 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - [REDACTED]                                                                                                                                                                                                                         |
| 2046 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - [REDACTED]                                                                                                                                                                                                                         |
| 2047 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - [REDACTED]                                                                                                                                                                                                                         |
| 2048 | Insta360 Speeds Up Workflow with New 360 Reframing Tool, Better Stabilization & Quick Reader (CX-0077)                                                                                                                                                                                             |
| 2049 | Transcript of August 28, 2025, Deposition of Petitioner's Expert Dr. Katsaggelos                                                                                                                                                                                                                   |
| 2050 | Redline of Model Protective Order                                                                                                                                                                                                                                                                  |
| 2051 | Stipulated Protective Order                                                                                                                                                                                                                                                                        |
| 2052 | CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER - INITIAL DETERMINATION ON VIOLATION OF SECTION 337 AND RECOMMENDED DETERMINATION ON REMEDY AND BOND (July 10, 2025), <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400 |

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**I. INTRODUCTION**

Petitioner's Reply does not dispute three key facts:

1. Kwatra's inventors avoided *non-linear* optimizations due to computational limits. POR, 21-22; EX2019, 3; EX2018, ¶¶71-73.
2. Kwatra states that smoothing constraints on rotational angle  $\theta$  "may be non-linear" and avoids it. POR, 19-22; EX1005, 17:11–20; EX2018, ¶¶69-73.
3. Kwatra minimizes its cost function only for *linear* motion model parameters like "a" and "b," which control the extent to which feature pairs translate on the two-dimensional image plane. POR, 19-20; EX1005, 17:5-20; EX2018, ¶69.

These facts confirm the ITC ALJ's finding and Dr. Foroosh's explanation: Kwatra does not meet: "*wherein the capture trajectory is determined to include a path that minimizes a combination of rotational velocity and rotational acceleration of the [camera] housing.*"

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**II. KWATRA AVOIDS NON-LINEAR OPTIMIZATION, WHICH INCLUDES MINIMIZING ROTATION**

**A. Kwatra's Minimization Function Does Not Apply To Rotational Velocity And Acceleration**

Petitioner responds that: (1) Patent Owner “misunderstands linear motion model[s]” because they can “characterize rotation” and do not “preclude minimization of rotational movement”; and (2) Kwatra is not limited to linear models. Reply, 3-4. Both arguments fail.

Initially, Petitioner's “not limited” and “does not preclude” arguments are beside the point; prior art focuses on actual disclosures. *See Endo Pharmaceuticals Solutions, Inc. v. Custopharm Inc.*, 894 F.3d 1374, 1380 (Fed. Cir. 2018).

Kwatra indisputably discloses linear models. That those models can represent a single degree of image-plane rotation is not in dispute—and it is a red herring. The critical, undisputed facts are: (1) Kwatra avoided non-linear optimizations due to computational constraints, POR, 16, 21-22, EX2019, 3; EX1005, 1:8-11; EX2018, ¶¶61, 72-73; (2) Kwatra explains smoothing on  $\theta$  may be non-linear and avoids it. POR, 19-22; EX1005, 17:11-20; EX2018, ¶¶69-73; and (3) Kwatra imposes smoothness only on “a” and “b,” not directly

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on scale (s) or rotation ( $\theta$ ). POR, 19-20; EX1005, 17:5-20; EX2018, ¶69.

Thus, Kwatra eschews any non-linear optimization of rotational motion.

The ITC found Kwatra minimizes linear—not rotational—velocity and acceleration (EX2052, 67-68)<sup>1</sup>, consistent with Dr. Foroosh that linear models do not minimize the claimed rotational combination.<sup>2</sup>

**B. “Smoothing” Does Not Demonstrate the Claimed Minimization**

Petitioner's argument that Kwatra “smooths rotation” (Reply, 4) fails to address the disputed claim language: “a path that *minimizes* a combination

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<sup>1</sup> Petitioner did not challenge these findings in its petition to the Commission.

<sup>2</sup> The ALJ construed the disputed phrase to mean “the capture trajectory is determined to include a path that minimizes through calculation, while respecting a set of constraints, a function that combines rotational velocity and rotational acceleration of the housing,” (EX2052, 27) and found no infringement under that construction. Patent Owner has appealed the ALJ's construction and the non-infringement finding to the Commission. Nonetheless, Patent Owner submits that the claims are non-obvious under any construction, including the ALJ's.

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of rotational velocity and rotational acceleration.” Petitioner shows no such minimization.

Dr. Katsaggelos acknowledges Kwatra teaches that “enforcing smoothness on scale (s) and rotation ( $\theta$ )” requires “nonlinear optimization, which is slower and more complex.” EX1017, ¶36, *citing* EX1005, 17:17-19. Thus, “*instead of solving a nonlinear optimization problem* to smooth scale (s) and rotation ( $\theta$ ) directly,” Kwatra “uses the estimated camera path (represented by a linear motion model) to **constrain** how much scale (s) and rotation ( $\theta$ ) vary indirectly.” *Id.*, ¶36 (emphasis added). He opines these operations “smooth,” “bound,” or “control” rotation, but he never opines that this minimizes rotational motion. Dr. Katsaggelos admitted that “smoothing” a trajectory does not necessarily result in the claimed minimization. EX2049, 12:4-13:18.

Dr. Foroosh explained bounding cosine or sine of image-plane rotation is not minimizing the claimed combination of rotational motions of the housing. POR, 19-21; EX2018, ¶¶69-71. This testimony is unrebutted.

Petitioner’s smoothing argument also contradicts Kwatra, which states:

“While constraining smoothness on a, b, **rotation** and scale may **not** remain **smooth**. Since **imposing smoothness constraints on**

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*s and theta may be non-linear*, the estimated camera path can be used to ensure that *s* and *theta* do not deviate too much.”

EX1005, 17:17-20 (emphasis added). While Petitioner relies on Equation 18 to argue smoothing *a* and *b* necessarily smooths  $\theta$  (Reply, 6), Kwatra confirms “rotation and scale may **not** remain smooth.” EX1005, 17:11-18 (emphasis added).

Petitioner alternatively contends bounding scale and rotation constitutes “smoothing” rotation. Reply, 5. But again, Dr. Foroosh explained how bounding scale and rotation (directly or trigonometrically) is not the claimed minimization. EX2018, ¶¶69-71.

Finally, any “rotation” in Kwatra is of image-plane tracked features, not the camera housing rotation required by the claims. POR, 19-21; EX2018, ¶68. Even if image-plane rotation were smoothed via *a* and *b*, it would not minimize the claimed housing rotation. *Id.*

**C. The Provisional Application Confirms Kwatra’s Intentional Avoidance Of Non-Linear Optimization**

The Kwatra provisional confirms the inventors avoided non-linear optimization, including smoothing  $\theta$ , as “not fast enough for real-time performance.” POR, 21; EX2019, 3; EX2018, ¶72.

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Petitioner argues the provisional confirms Kwatra “smooths rotation,” because it notes similarity and affine models include rotation. Reply, 7-9. But, as discussed above, a rotational DOF and mere “smoothing” of different parameters does not establish the claimed minimization of rotational motion, much less rotational motion of the camera housing. Like Kwatra itself, the provisional imposes smoothness only on “a” and “b,” not  $\theta$ . POR, 19-20, EX2019, 5; EX2018, ¶¶69. Thus, “rotation and scale may *not* remain smooth.” EX1005, 17:11-18 (emphasis added).

Petitioner points out that Kwatra’s provisional describes how optimization “can be extended to other linear transforms such as similarity and affine.” Reply at 8, *quoting* EX2019, 5. But Petitioner ignores the remainder of the discussion, which clarifies that it can be extended by imposing smoothness on *only* “a” and “b,” not  $\theta$ .

This confirms Kwatra avoids non-linear computations for minimization. EX2018, ¶¶67-73.

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**D. Kwatra's Figures Confirm It Does Not Minimize Rotational Velocity and Acceleration**

Petitioner argues reliance on Figures 8A and 8B is misplaced, suggesting Figure 5D demonstrates minimization of rotational velocity and acceleration. Reply, 9–10. That is incorrect.

As the ITC found and Dr. Foroosh explained, Figures 8A and 8B illustrate Kwatra's 2D linear framework, showing a smooth path in X and Y image-plane dimensions. POR, 22-24; EX1005, Figs 8A, 8B, 19:4-38; EX2021, 1368:6-1369:7; EX2018, ¶¶74-75. There is tellingly no illustration of any smoothed path as a function of  $\theta$ .

Petitioner cites Figure 5D and Dr. Katsaggelos' one-sentence opinion. Reply, 9; EX1017, ¶45. But Kwatra's Figure 5D description says nothing about minimizing rotational motion, much less the rotation of the housing. EX1005, 14:39-52. It illustrates simultaneous minimization of first, second, and third derivatives of a path reflecting the "choice of the underlying linear motion model." *Id.* That model does not minimize the rotational motion at issue. Kwatra's linear framework avoids the complexities in minimizing rotational dynamics. EX2018, ¶¶46-47; EX1005, 17:11–20.

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The ITC rejected the same argument, crediting testimony that Kwatra minimizes linear—not rotational—velocity and acceleration, citing Figures 8A and 8B. EX2052, 67-68.

**E. Kwatra's 2D Linear Motion Models Do Not Satisfy The Claimed Minimization of Rotational Velocity And Acceleration Of The Camera Housing**

Dr. Katsaggelos conceded 2D linear models cannot model camera housing rotational velocity. EX2020, 79:2-22; POR, 24. Petitioner now argues he meant “translational models.” Reply, 10. Not so. The deposition questioning probed his opinion at ¶108 that Kwatra models 3D motion, despite passages disclosing only 2D. EX2020, 73:3-79:9. Dr. Katsaggelos testified the cited passages *must* disclose a 3D model, because such a model is required to represent the housing angular velocity. *Id.*, 70:2-9. Petitioner therefore cannot now argue 2D vs 3D is a red herring. Reply, 10.

Dr. Katsaggelos' opinion that Kwatra impliedly discloses 3D modeling is also incorrect. Petitioner cites affine and homography (Reply, 10), but in Kwatra, they remain 2D and linear—fitting motion from image-plane features, *not* to represent motion of a physical device. POR, 25-28; EX2018, ¶¶77-85. Kwatra and its provisional exclusively describe 2D linear models:

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- “We fit several 2D linear motion models (translation, similarity, affine) to the tracked features describing the motion of the camera between two frames.” EX2019, 1.
- “The techniques, as presented, first estimate 2D camera path transforms  $C(t)$ .” *Id.*, 6.
- “At block 308, two-dimensional (2D) linear motion models (e.g., translation, similarity, affine) can be fit to the trackable features-matches to describe motion of the camera between video frames . . . .” EX1005, 9:42-56, Fig. 3.
- “Additional methods for determining two-dimensional (2D) linear motion models (e.g., translation, similarity, affine) for the trackable feature-matches are also possible.” *Id.*, 11:3-15.

While affine and homography models can approximate certain 3D effects, Kwatra uses them solely within a 2D image-plane framework and thus does not minimize the 3D rotational dynamics as required. POR, 25-28; EX2018, ¶¶77-85. That the claims do not recite “3D” does not negate that they require minimizing the angular velocity and acceleration of the camera housing, which Dr. Katsaggelos admitted required a 3D model.

Petitioner's fallback: even if Kwatra is limited to 2D, Zhou discloses 3D and could be combined with Kwatra. Reply, 11. But this new argument does not cure Kwatra's deficiency. Petitioner never argued Zhou discloses the claimed minimization. And Petitioner identifies no rationale in either reference for combining Zhou's 3D estimation with Kwatra's 2D optimization

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framework to achieve the claimed minimization with a reasonable expectation of success.

**F. Kwatra Does Not Disclose Minimizing Rotational Motion Of The Camera Housing**

Petitioner claims Kwatra is “not limited to an image-based motion estimation approach” because it uses the open-ended word “may” when disclosing path estimation from trackable video features. Reply, 11. But “may” does not transform Kwatra into a catch-all reference that discloses every method—let alone minimizing housing rotational velocity and acceleration.

Petitioner argues feature movement is “directly proportional” to camera rotation for “inferring” physical motion; precise camera angle is irrelevant if image effect is minimized; and 3D can be reconstructed from 2D. Reply, 11–12. But these generalized assertions lack support in Kwatra whose estimation is strictly image-based, fitting 2D linear models to image-plane features. POR, 25–26; EX2018, ¶¶77–79. Kwatra does not model the physical motion of the camera housing, much less minimize its rotational velocity and acceleration.

Again, Petitioner's new argument that Zhou's 3D modelling fills Kwatra's gap is unpersuasive, because Petitioner identifies no teaching or

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rationale for combining Zhou's 3D estimation with Kwatra's image-based optimization framework with a reasonable expectation of success. Even if combined, the combination would still lack the required minimization of a combination of rotational velocity and acceleration of the housing.

**G. Petitioner's New Theory Based On Kwatra Paper Relies On Statements Taken Out Of Context**

Petitioner argues that GoPro engineers described the objective function in a *different* reference ("Kwatra paper") as minimizing rotational velocity and acceleration before the '894 patent claims existed. Reply, 13-15. This is far removed from the question of whether the Kwatra *Patent* renders the claims obvious. Raising it in Reply deprives Patent Owner the opportunity to offer clarifying testimony from the relevant engineers or its expert, which is unfair.

In any event, this theory completely mischaracterizes GoPro's internal design document via selective quotation. The GoPro document (EX1022) describes a [REDACTED]

[REDACTED] and then states: [REDACTED]

[REDACTED]

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[REDACTED]

[REDACTED] Petitioner speculates the phrase “[REDACTED]

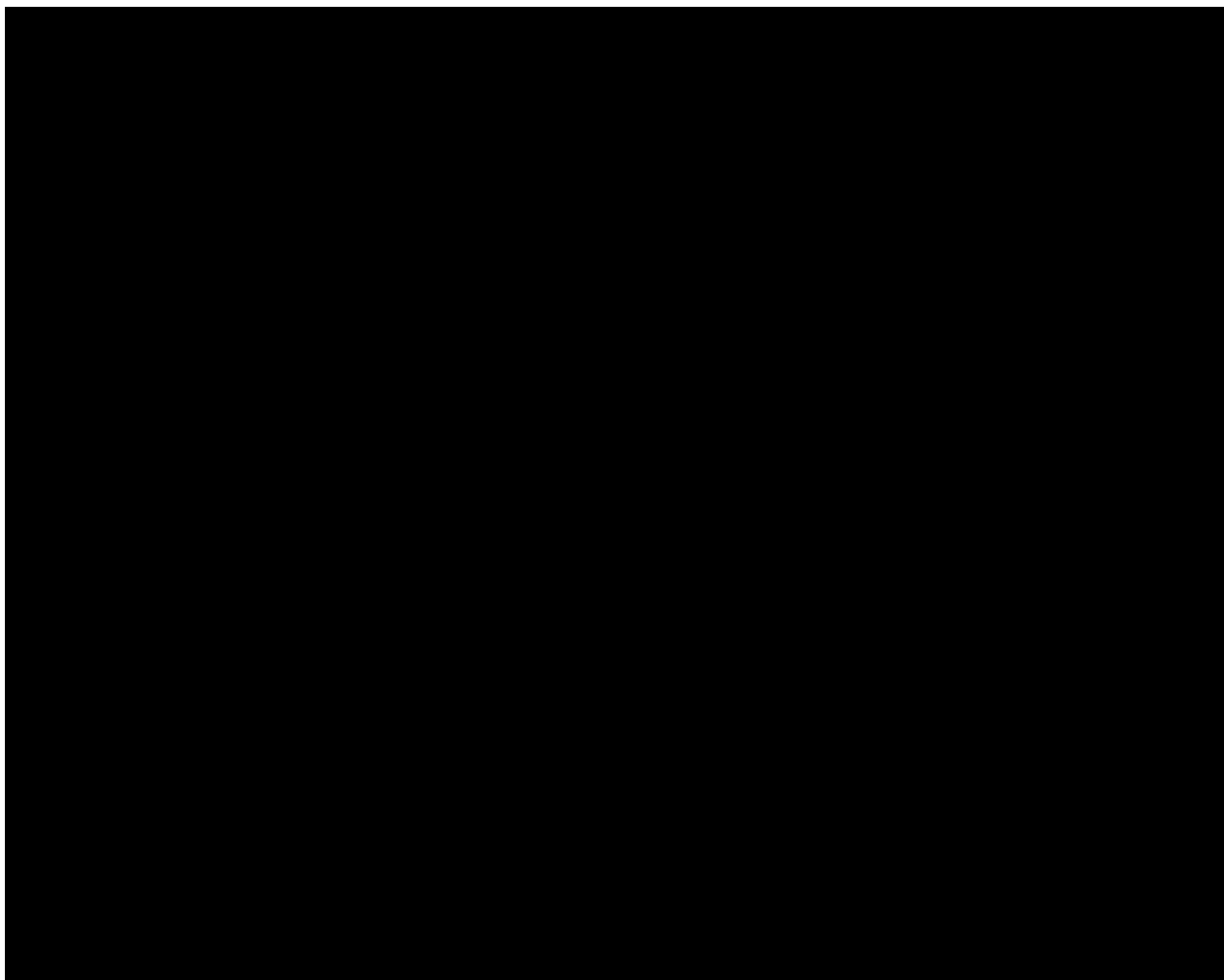
[REDACTED] But this falls apart

when Petitioner’s selective excerpt (red boxed below) is read in its immediate context (*id.*, 18):

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<sup>3</sup> Neither the Kwatra patent nor the Kwatra paper discloses any objective function that operates on angular (i.e., rotational) velocity and acceleration of the camera housing. As explained in the POR, by Dr. Foroosh, and herein, the disclosed cost function minimizes derivatives of a 2D linear path  $P(t)$  applied to tracked image features—using parameters (a, b) related to a linear image-plane transform, not to the rotational motion of a camera housing.

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As the context makes clear, the described



*Id.* The

document



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[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

This refutes Petitioner's theory that [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] The Board should disregard Petitioner's speculative theory.

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**III. PETITIONER FAILS TO ESTABLISH A MOTIVATION TO COMBINE KWATRA'S 2D LINEAR FRAMEWORK WITH ZHOU'S 3D SENSOR-BASED POSITION INFORMATION**

Petitioner attempts to satisfy the additional limitation of claim 5—requiring that “the position information is determined independent of the image information”—by combining Kwatra's 2D, image-based linear framework with Zhou's 3D position sensor data. Reply, 16-18. But substituting 3D angular parameters from Zhou into Kwatra's framework would require non-linear optimization—precisely what Kwatra was designed to avoid due to computational constraints. EX1005, 17:11–20; EX2019, 3.

Petitioner provides no disclosure, rationale, or implementation strategy for how Kwatra's cost function—designed to operate on paths estimated using tracked image features and 2D linear transforms—could be applied to motion trajectories derived from Zhou's gyroscope data. EX2018, ¶¶88–94. Petitioner's argument that Kwatra's minimization operates independently of how the motion path is estimated finds no support in the reference. To the contrary, Kwatra's minimization disclosures are tightly coupled with its image-based estimation process: the same 2D linear transforms used to fit the motion trajectory are the subject of the minimization. *Id.*

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In short, a POSITA would not have been motivated to combine Zhou's sensor-based motion estimation with Kwatra's cost function, which would require discarding Kwatra's linear framework and redesigning it around a different class of input data. *Id.* Claim 5, at a minimum, is non-obvious.

**IV. GROUND 2 FAILS FOR THE SAME REASONS AS GROUND 1**

Petitioner notes that Patent Owner did not separately address Shi in the POR. Reply, 18. That is because Petitioner does not rely on Shi for any limitation relevant to the disputed issues. The claims challenged in Ground 2 depend on the same core limitation as Ground 1 and fail for the same reasons.

**V. PETITIONER FAILS TO ESTABLISH A MOTIVATION TO COMBINE ZHOU (OR SHI) WITH KWATRA**

Petitioner contends that differences between Kwatra's and Zhou's stabilization techniques do not preclude a combination. Reply, 18. But Patent Owner's argument is not merely that the techniques are different—it is that the combination would require fundamentally altering Kwatra's linear, image-based framework to incorporate Zhou (and/or Shi's) 3D sensor-based data. As explained in the POR and Dr. Foroosh's declaration, such a combination is neither taught nor suggested in the references and lacks any technical rationale. POR, 29-33; EX2018, ¶¶88–94. Petitioner's conclusory assertion of

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compatibility fails to address these incompatibilities, establish a reasonable expectation of success, or even explain how the combination would result in the claimed invention. *Id.*

**A. Petitioner Itself Relies On Zhou And Shi's Disclosures Of 3D Sensor-Based Stabilization In Mobile Devices**

Petitioner contends that Patent Owner “mischaracterizes Zhou and Shi” by suggesting they are limited to mobile devices. Reply, 19. But Patent Owner was responding directly to “*[t]he embodiments that Petitioner relies upon from Zhou and Shi* [that] teach video image stabilization strategies, implemented in mobile devices that make use of an on-board position sensor to estimate the 3-dimensional motion of the mobile device itself.” POR, 29-30 (emphasis added).

The Petition's motivation-to-combine arguments are grounded in the fact that both Zhou and Shi use similar components for video stabilization in mobile devices:

- “[I]t would have been obvious to use the known intended motion preservation technique in Shi to improve *Zhou's similar stabilization technique for mobile devices*. (EX1002, ¶225.)” (Petition, 66).
- “*Both Zhou and Shi disclose using similar mobile device components for video stabilization*. (EX1004, 11:55-67, Fig. 7; EX1006, 5:56-6:12, 7:27-8:3, 8:24-39, Fig. 1.)” (*Id.*, 66, 70).

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The Petition also relies on Zhou's disclosure of "gyroscopes or accelerometers" and "time stamped gyroscope data points" as sources of orientation data for stabilization. Petition, 16, 47-49 (citing EX1004, 5:20-24; 11:62-63; EX1002, ¶¶156-159).

Given this framing, Petitioner's claim that Patent Owner "mischaracterized" Zhou or Shi is inaccurate. Patent Owner accurately described the specific embodiments Petitioner relied upon—mobile devices using on-board sensors for real-time 3D motion estimation—and distinguished those from Kwatra's server-based post-processing approach.

**B. Petitioner Also Relies On Kwatra's Disclosure Of Image-Based Stabilization**

Petitioner contends that Patent Owner "mischaracterizes Kwatra" by suggesting it is limited to "a post-processing, server-based approach that estimates motion through feature tracking within the image data." Reply, 19-20. But Kwatra is, in fact, directed to an image-based, post-processing system built on feature tracking and linear modeling. Figure 2 of Kwatra depicts the core processing architecture, including a "Video Hosting Service 200" connected to client "player" devices exclusively through "Network 206." The "Video Hosting Service" comprises the "Video Server 201," "Ingest Server

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212,” and “Video Database.” EX1005, FIG. 2; POR, 29-30; EX2018, ¶89.

These components process uploaded videos using the “Camera Path Translation System 202,” which includes a “Camera Path Estimation Engine 218,” “Video Stabilization and Retargeting Engine 220,” and “Video Translation Engine.” EX1005, 5:21-26; FIG. 2; POR, 29-30; EX2018, ¶89. This depicts a remote, server based architecture, as Dr. Foroosh opined.

While Kwatra uses open-ended language stating that its methods “may be performed by a device, a server, or a combination of the device and the server,” and discloses a generic “computing device 1300,” these disclosures merely support implementing the Figure 2 architecture—not on-board mobile device processing. POR, 30-31; EX2018, ¶90. Nowhere does Kwatra suggest using sensor-based 3D motion data, let alone in a mobile device. *Id.*

Tellingly, Petitioner relies exclusively on Zhou—not Kwatra—for disclosing a “position sensor carried by the [camera] housing,” and “position information that characterizes the positions of the housing.” Petition, 16-17. Those limitations refer to motion sensors such as gyroscopes, accelerometers, and IMU’s that detect real-time 3D motion of a physical camera housing—disclosures absent from Kwatra. *Id.*

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Kwatra's core disclosure is a server-based, post-capture system using 2D image-derived motion estimation. In contrast, Zhou and Shi rely on 3D sensor-based, real-time motion estimation in mobile devices. That architectural distinction informs a POSITA's understanding of the prior art and underscores why one would not be motivated—with a reasonable expectation of success—to combine the fundamentally different approaches taught by these references. POR, 31-33; EX1018, ¶¶90-94.

**C. Kwatra's Image-Based, Multiderivative Trajectory Optimization Problem Was Computationally Intensive**

Petitioner challenges Patent Owner's reliance on Dr. Foroosh's opinion that, around the time of Kwatra (circa 2013), a POSITA would have recognized that Kwatra's image-based, "multiderivative trajectory optimization problem was a computationally intensive process [not] suitable for a resource-constrained mobile device." Reply, 23, *citing* POR, 31. Petitioner contends that Patent Owner fails to explain "how purportedly complex" the optimization problem was or "how resource-constrained" mobile devices were. *Id.*

But the contemporaneous record supports Dr. Foroosh's understanding that image-based, post-processing systems like Kwatra's were

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computationally intensive—particularly compared to motion estimation using on-board sensor data. For example, the Bell patent (U.S. Pat. No. 10,027,893), filed in 2016, explains:

“Filtering and analyzing the motion sensing system measurements in real time requires ***much less processing power [than] trying to estimate camera rotations from the image data after the fact.*** Motion sensing system estimates can be calculated with a relative few multiplications and additions, while ***image-based methods require processing on thousands or even millions of picture elements.***”

EX2023, 6:47-54 (emphasis added).

Dr. Katsaggelos agreed with the general point, conceding that it is “not that [Bell is] saying something that is wrong,” while maintaining only that there “*might* be cases for which image-based methods are comparable” in computational complexity. EX2020, 47:4-19 (emphasis added).

Dr. Katsaggelos’ newly provided Declaration is not to the contrary. It vaguely asserts that “[a]t the time of Kwatra (around 2013), mobile devices were capable of performing many computations.” EX1017, ¶102. But Dr. Katsaggelos provides no evidence that mobile devices from 2013 were capable of solving the multi-derivative optimization problem disclosed in Kwatra on a real-time stream of position information.

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**D. Kwatra's Image-Based Approach Differs Fundamentally From The Gyroscope-Based Motion Estimation Taught By Shi And Zhou**

In the POR, Patent Owner explained that Petitioner's own expert acknowledged Kwatra's image-based motion estimation differs from the gyroscope-based approaches taught by Shi and Zhou. POR, 32; EX2020, 14:12-19; EX2018, ¶¶92. In Reply, Petitioner asserts that Kwatra is not limited to image-based estimation, citing its earlier argument that Kwatra uses open-ended language. Reply, 24. But as discussed above, the mere use of the word "may" does not expand Kwatra's disclosure to encompass fundamentally different estimation methods like 3D sensor-based tracking.

Petitioner next contends that even if Kwatra were limited to image-based estimation, a POSITA would be motivated to combine its minimization approach with Zhou and Shi's sensor-based stabilization. Reply, 24. According to Petitioner, Kwatra's smoothing step and Equation 7 are agnostic to the source of the estimated trajectory. Reply, 24-25. But as Dr. Foroosh explains, Kwatra's inventors deliberately avoided the non-linear optimization that would result from applying its cost function to 3D sensor-derived data—such as angular rotations ( $\theta$ ). EX2018, ¶¶54-55; POR, 11-12. They explicitly

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rejected that approach due to the computational complexity and inability to achieve real-time performance. *Id.*

Finally, Petitioner argues that a POSITA would have been motivated to combine Kwatra with Zhou and Shi because hybrid stabilization systems—combining sensor and image data—were known in the art. Reply, 25. But that argument lacks support in the record.

**E. Patent Owner's Development History Is Legally Irrelevant And, If Anything, Supports A Lack Of Reasonable Expectation Of Success**

Petitioner relies on a GoPro internal development document (EX1022) to argue that a POSITA would have been motivated to combine image-based and sensor-based techniques—specifically Kwatra with Shi and Zhou. Reply, 25–27. But as the ALJ squarely held in the parallel ITC proceeding, such reliance is legally improper. The manner in which Patent Owner developed its invention—whether it considered the Kwatra paper—is irrelevant to the obviousness inquiry under 35 U.S.C. § 103.

The ALJ rejected Insta360's nearly identical arguments, holding that “[f]rom start to finish, Insta360's obviousness arguments, including the testimony of its expert, are undergirded by the fact that GoPro itself considered [the Kwatra paper] when developing the invention.” EX2052, 66.

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According to the ALJ, “[t]he only inquiry is whether the teachings of [the Kwatra patent] would have rendered the claimed invention obvious to one of ordinary skill in the art; this inquiry, as a matter of law, is independent of the motivations that led the inventors to the claimed invention.” *Id.* (citing *Life Techs., Inc. v. Clontech Labs., Inc.*, 224 F.3d 1320, 1325 (Fed. Cir. 2000)). The ALJ concluded that “Insta360’s arguments, are not reliable because they are suffused with hindsight bias” and are “legally improper.” *Id.*, 67 (citing *Otsuka Pharm. Co. v. Sandoz, Inc.*, 678 F.3d 1280, 1296 (Fed. Cir. 2012) (“The inventor’s own path itself never leads to a conclusion of obviousness; that is hindsight.”)).

If anything, the internal development document (EX1022) [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

[REDACTED] EX1022, 4, 18. This record establishes the incompatibility of the references and reinforces Dr. Foroosh’s conclusion that a POSITA would not have had a reasonable expectation of success in applying Kwatra’s cost function to sensor-based, rotational data. EX2018, ¶¶91-94.

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In short, Petitioner's hindsight-driven attempt to convert GoPro's development documentation into evidence of obviousness is foreclosed by both statute and controlling law. Moreover, the evidence, in full context, completely undermines any conceivable motivation to combine.

**VI. AS THE ITC ALJ FOUND, SECONDARY CONSIDERATIONS SUPPORT NON-OBVIOUSNESS**

**A. The HERO7 Practices The Claims Of The '894 Patent**

In the ITC proceedings, Petitioner did not dispute that the HERO7 meets the claims of the '894 patent. EX2052, 72 (“[T]he evidence supports a nexus between the evidence of secondary considerations and the '894 patent. On that point, *it is also worth noting that it is undisputed that GoPro's domestic industry products meet the claims of the '894 patent.*”) (Emphasis added). Dr. Foroosh considered and relied upon this undisputed fact in forming his opinion. POR, 36; EX2018, ¶124.

Further, Dr. Foroosh independently confirmed that the HERO7 practices the '894 patent through a multi-faceted analysis. He first reviewed Patent Owner's domestic industry claim charts from the ITC proceeding (EX2016), then analyzed their source documents, including [REDACTED] [REDACTED] as well as the underlying source code.

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POR, 37, EX2018, ¶127. Based on that analysis, Dr. Foroosh concluded that the HERO7 determines a capture trajectory that minimizes a combination of rotational velocity and rotational acceleration. *Id.* He further found that

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] EX2018, ¶127 (citing EX2026, CX-0609C.0003); *see also* POR, 37-38.

Petitioner isolates a single paragraph of Dr. Foroosh's opinion (¶116), asserting that "Dr. Foroosh's sole reliance on [REDACTED] [REDACTED]" Reply, 29. But Petitioner ignores the remainder—and majority—of Dr. Foroosh's analysis. EX2018, ¶¶97-122. As set forth above, Dr. Foroosh's opinion is not based solely on [REDACTED], but on source code, technical documents, and detailed claim

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charts from the ITC proceeding. Petitioner's selective reading of the record does not undermine the sufficiency of that analysis.<sup>4</sup>

Moreover, even if considered in isolation, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] That conclusion is further corroborated

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<sup>4</sup> Petitioner similarly challenges other limitations (e.g., 1[g(ii)], 1[i]) based on the mistaken premise that Dr. Foroosh relied solely on [REDACTED]. For the same reasons discussed above, those challenges also fail. Dr. Foroosh's analysis incorporated multiple technical sources—including code, documentation, and ITC evidence—and provides sufficient support for his conclusions. *See* EX2018 ¶¶97-122.

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by the accompanying firmware analysis, claim charts, and technical documentation cited by Dr. Foroosh.

**B. Nexus Exists Between The Objective Evidence And The Claimed Invention**

Petitioner's attempt to deny the nexus between the objective indicia and the claimed invention (Reply, 29-31) was rejected by the ALJ in the parallel ITC proceeding. EX2052, 71-73. The ALJ found that "the evidence supports a nexus between the evidence of secondary considerations and the '894 patent." *Id.*, 72. Specifically, she concluded that Patent Owner demonstrated a nexus between the claimed invention and the commercial success and industry praise for HyperSmooth. *Id.* In reaching that conclusion, the ALJ relied on many of the same documents cited by Dr. Foroosh, as well as the testimony of Mr. Lema, who submitted a detailed, *unrebutted* declaration here. (*id.*, 71-73); EX2024.

Petitioner's Reply raises several arguments disputing nexus and the underlying objective indicia, but each lacks merit. Reply, 29-32.

***First***, Petitioner's attempt to dismiss the 2022 Technology & Engineering Emmy® Award (EX2010) by claiming it relates to "EIS technology in 2015" misrepresents the record. Reply, 31. As Mr. Lema

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testified, and a contemporaneous press release (EX2012) confirms, the Emmy was awarded in 2022 for GoPro's HyperSmooth stabilization—not for generic legacy EIS technology. POR, 41; EX2024, Lema Decl. ¶¶13, 22. The National Academy of Television Arts & Sciences recognized “the technology powering GoPro's industry-leading HyperSmooth video stabilization.” EX2012. The ITC ALJ credited this award as industry praise directly tied to the '894 patent's contributions. EX2052, 72-73.

**Second**, Petitioner argues that no nexus exists between the '894 claims and the HERO7 product. But both Dr. Foroosh and Mr. Lema offer affirmative evidence linking the claimed features—including the minimization of rotational velocity and acceleration—to HyperSmooth's commercial success and industry recognition. *See* EX2018, ¶¶124–128; EX2024, ¶¶6, 10, 11, 21. Their unrebutted testimony establishes that the secondary considerations evidence, including the Emmy Award, stem from the unique characteristics of the claimed invention. That is more than sufficient to establish nexus. *See Volvo Penta of the Americas, LLC v. Brunswick Corp.*, 81 F.4th 1202, 1210-12 (Fed. Cir. 2023).

**Third**, Petitioner contends that commercial success and industry praise are attributable to “other features—not the purported novel ones.” Reply, 30-

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31.<sup>5</sup> But this too was rejected in the ITC proceedings. The ALJ found that the evidence of secondary considerations was “the direct result of the unique characteristics of the ’894 and ’840 patents” that enabled GoPro’s award-winning HyperSmooth stabilization. EX2052, 70–72. Also, nexus does not require patented features be the sole reason for commercial success. *Cont’l Can Co. USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1273 (Fed. Cir. 1991).

*Finally*, Petitioner contends that there is no evidence of long-felt need, unexpected results, or copying. Reply, 31-32. But GoPro submitted contemporaneous evidence—including [REDACTED]

[REDACTED]

[REDACTED]

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<sup>5</sup> Petitioner points to Mr. Derbanne’s testimony [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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[REDACTED].<sup>6</sup> This evidence, combined with expert testimony and customer surveys, supports findings of industry praise, unexpected results, and satisfaction of long-felt need. Petitioner offers no competing evidence and does not address the s [REDACTED]. Its conclusory dismissal lacks credibility.

## VII. CONCLUSION

For the foregoing reasons, Patent Owner respectfully requests that the Board uphold the challenged claims.

<sup>6</sup> Petitioner notes that the review concerns HERO9 and HERO8, not HERO7. But Mr. Lema testified—without rebuttal—that HyperSmooth “played a pivotal role in the commercial and critical success of the HERO7 Black *and our HERO camera line more broadly.*” EX2024, ¶24 (emphasis added).

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**CERTIFICATE OF LENGTH (37 C.F.R. §§ 42.24)**

The undersigned hereby certifies that, according to the word-processing system used to prepare the foregoing document, this document has 5,269 words and thus complies with the applicable word limit.

Date: September 4, 2025

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**CERTIFICATE OF SERVICE (37 C.F.R. §§ 42.6(E), 42.105(A))**

The undersigned hereby certifies that the foregoing document was served in its entirety on September 4, 2025 upon the following parties via

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