

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

GOPRO, INC.,
Patent Owner.

Case No. IPR2024-01164
U.S. Patent No. 10,958,840

PATENT OWNER'S SUR-REPLY

PUBLIC VERSION

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EXHIBIT LIST

No.	Exhibit
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 rd 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] [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] [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 CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED] [REDACTED]
2032	CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED] [REDACTED]
2033	CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED] [REDACTED]
2034	CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED] [REDACTED]
2035	CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED] [REDACTED]
2036	CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED] [REDACTED]
2037	CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED] [REDACTED]
2038	CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED] [REDACTED]
2039	CONFIDENTIAL BUSINESS INFORMATION – SOURCE CODE - SUBJECT TO PROTECTIVE ORDER - [REDACTED] [REDACTED]
2040	CONFIDENTIAL BUSINESS INFORMATION SUBJECT TO PROTECTIVE ORDER – [REDACTED] [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. CLAIM CONSTRUCTION

A. “Low-Light High-Pass Parameter” Has A Plain And Ordinary Meaning

Petitioner asserts for the first time that “low-light high-pass parameter” is a “coined” term with no ordinary meaning. Reply, 1. This contradicts the Petition, which stated that each claim term “carries its ‘ordinary and customary meaning.’” Petition, 5-6.

Petitioner's expert admitted he applied plain and ordinary meaning in his original Declaration. EX2049, 26:18-27:6. Indeed, Dr. Katsaggelos previously explained that a POSITA “would understand that blurs can be caused by *low-light* conditions because a shutter is open for a longer time . . . causing movement to add more blur.” EX1003, ¶111 (emphasis added). He admitted the term “low-light” has an ordinary meaning, (EX2049, 52:16-53:13), and previously confirmed that “high-pass” indicates a system allowing more high-frequency information through while attenuating low-frequencies. EX2020, 94:6-15; EX1003, ¶109; EX2022. PO's construction is based on these ordinary meanings.

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Only after PO showed the deficiencies in the prior art did Petitioner suddenly claim a lack of ordinary meaning and a need to resort to what Petitioner claims is a broader understanding in the specification.

Petitioner's new position contradicts precedent. In *Malvern Panalytical Inc. v. TA Instruments-Waters LLC*, the Court vacated construction of “pipette guiding mechanism,” finding it was not “coined” and had a plain meaning. 85 F.4th 1365, 1372 (Fed. Cir. 2023). The Court held: “It is appropriate to construe this term by looking to the words “pipette,” “guiding,” and “mechanism” individually. *Id.*, citing *Littelfuse, Inc. v. Mersen USA EP Corp.*, 29 F.4th 1376, 1381 (Fed. Cir. 2022) (proper to construe “fastening stem” by looking to the meaning of the words “fastening” and “stem”).

Petitioner claims PO's construction disregards “the inventor's intention, as expressed in the specification,” which “is regarded as dispositive.” Reply, 6, citing *Phillips*, 1316. But Petitioner's quote concerns “intentional disclaimer, or disavowal”—which Petitioner does not allege here. *Id.* Petitioner asserts it is improper to rely “on single words . . . as opposed to the limitation[] as a whole.” Reply, 6, citing *Apex*, 1372. But the quote addresses a means-plus-function analysis, where the court prematurely ended its analysis after determining the term “circuit” lacked sufficient structure,

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without considering the “additional adjectival qualifications further identifying sufficient structure.” *Id.*, 1373-74. That is not this case.

Under well-settled precedent, “it is highly disfavored to construe terms in a way that renders them void, meaningless, or superfluous.” *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 809-810 (Fed. Cir. 2021). Petitioner’s construction violates this principle. Under Petitioner’s construction, the term “low-light high-pass parameter” becomes a generic blur compensation parameter that applies regardless of lighting and with no regard for whether more high-frequencies are preserved.

B. The Claimed Parameter Is Based On Low-Light Indicated By Exposure Time

Petitioner proposes a broad construction: “a parameter that controls the amount or strength of smoothing used in motion blur compensation.” Reply, 1. It emphasizes the parameter ranges between 0 (full smoothing) to 1 (no smoothing), managing the trade-off between motion smoothing and blur compensation. *Id.*, 1-2. But these points are not disputed.

What Petitioner ignores is how the ordinary meanings of “low-light” and “high-pass” limit the parameter to one that addresses blur (1) ***based on*** low-light conditions indicated by longer exposure times, and (2) by

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controlling a high-pass system. POR, 24-25; EX2018, ¶¶38-39. The claim does not recite a generic “motion blur parameter.”

The specification links low-light to longer exposure time: “***longer exposure time*** may be used with ***low light*** conditions,” (EX1001, 19:18-21), and “[h]igher exposure time” . . . “may result in ***greater amount of motion blur.***” *Id.*, 19:25-26 (emphasis added); EX1003, ¶111. Petitioner’s expert conceded that there is a correlation between lighting conditions and exposure time. EX2049, 50:11-25.

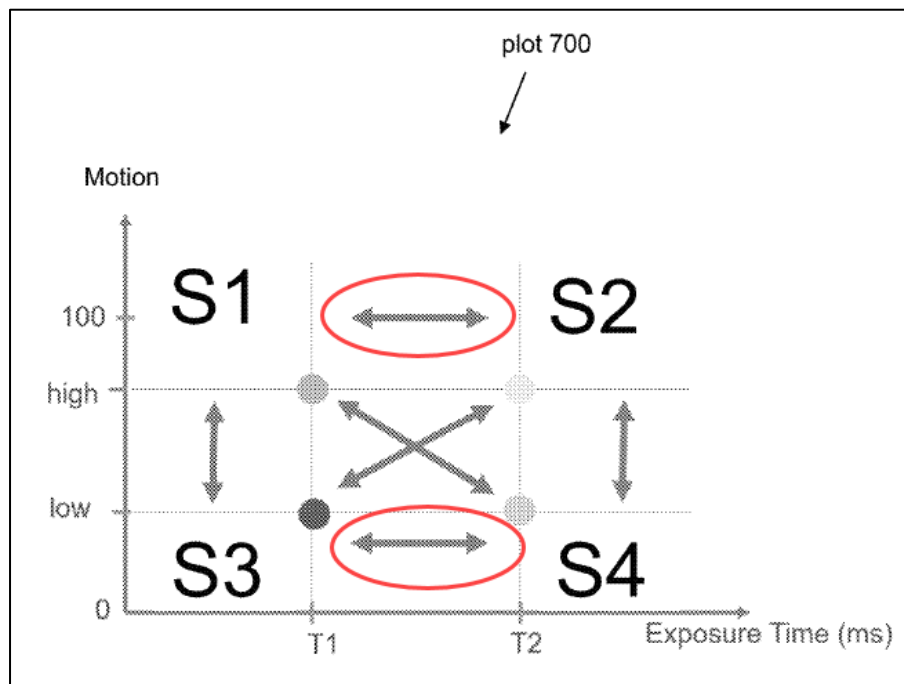
The specification also teaches reducing smoothing based on low-light. For example, the specification teaches “***deactivation of the stabilization*** of the captured visual content ***when the exposure time is longer than T2***” and that “the smoothing value may change linearly between 0 and 1 ***as the exposure time increases*** from T1 to T2.” EX1001, 19:34-40.

Petitioner cites Figure 7. Reply 3-4, *citing* EX1001, 18:62-19:25. But Figure 7’s description does not mention the “low-light high-pass parameter”—it certainly does not equate the parameter with every blur scenario in Figure 7. *See August Tech. Corp. v. Camtek, Ltd.*, 655 F.3d 1278, 1285 (Fed. Cir. 2011) (“The mere fact that there is an alternative embodiment disclosed . . . that is not encompassed by our claim construction does not

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outweigh the language of the claim”); *TIP Systems, LLC v. Phillips & Brooks/Gladwin, Inc.*, 529 F.3d 1364, 1373 (Fed. Cir. 2008) (“Our precedent is replete with examples of subject matter that is included in the specification, but is not claimed.”).

In fact, Figure 7 supports PO’s construction, illustrating scenarios where smoothing strength changes *solely* due to exposure time (e.g., transitions from S1 to S2, and S3 to S4):



EX1001, Fig 7. These transitions are governed by the “low-light high-pass” parameter. As the Figure 7 description states: “[t]he smoothing value may change linearly *between 0 and 1* as the exposure time increases from T1 to

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T2.” *Id.*, 19:38-40; *see also id.*, 22:8-10 (teaching how “low-light high-pass parameter” may range *between 0 and 1* to compensate for motion blur).

Petitioner cites no definitional or disavowal language that would justify ignoring the “low-light” qualifier in the plain claim language.

C. “High-Pass” Allows More High-Frequencies

Petitioner contends the claim does not “require the parameter to allow more high frequencies to pass through.” Reply, 4. But that is what “high-pass” means to a POSITA. EX2020, 94:6-15.

This understanding is consistent with the specification: “high frequencies in the input *may be kept* based on the image capture configuration, such as exposure start time and exposure duration time,” to compensate for “motion blur and/or lowlight image capture conditions.” EX1001, 17:61-18:9. The specification describes *preserving* high-frequency motion to mask blur. *Id.*, 22:8-25 (“[T]he output motion *may include high frequencies* that mask motion blur”).

Petitioner latches onto the case where the smoothed trajectory is the “same” as the observed trajectory—claiming here that both high- and low-frequency motion are preserved. Reply, 4. But PO’s construction does not preclude preservation of low-frequency motion; it merely requires “allowing

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more high frequencies to pass based on low-light conditions.” EX1001, 17:64-66 (“Certain portions of high frequencies in the input may be kept based on the image capture configuration, such as exposure start time and exposure duration time . . .”). The sentence following the one Petitioner relies on confirms the full-blur compensation case reflects a “high-pass” system:

“The low-light high-pass parameter of 1 may result in the smoothed trajectory being same as the (observed) trajectory during the exposure periods. *That is, the output motion may include high frequencies* that mask motion blur within the visual content.”

EX1001, 22:14-18 (emphasis added); EX2018, ¶39.

D. The Provisional Supports The Plain Meaning

Petitioner misinterprets the provisional contending it discloses a broader “motion blur masking control” unrelated to lighting or high-pass filtering. Reply, 5.

First, Petitioner ignores the first sentence in its excerpt: “*Taking into account the exposure time of every frame*, Hypersmooth decomposes the observable camera motion in two categories . . .” EX1021, 22. This confirms the parameter is based on exposure time to identify intra-frame motion causing blur. The document describes no other mechanism (*e.g.*, no pixel-

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motion analysis as in Petitioner's prior art). This supports that the low-light high-pass parameter is based on low-light conditions.

Second, Petitioner misreads the statement that the low-light high-pass parameter “does not need to evolve in function of the exposure time.” EX1021, 22. Petitioner claims this means “no matter the exposure time—and thus regardless of the lighting condition—the parameter stays the same and performs blur compensation.” Reply, 6. That is nonsensical. Exposure time is the only mechanism described for measuring intra-frame motion. Petitioner's reading would render the parameter constant, defeating its purpose.

The cited statement actually means the parameter need not evolve *over the duration* of the exposure. This is supported by the context of the following two bullets, which provide that in a “highly illuminated scene,” the exposure is short, meaning there is no need to further adjust the parameter during exposure. Similarly, in a scene with minimal motion, any necessary correction for intra-frame displacement is limited regardless of the exposure duration. In other words, PO determined that exposure time *alone* sufficed to set the parameter for each frame and there was no need for the parameter to further “evolve” (*i.e.* change) over the duration of the exposure. This is exactly why it is called a “*low-light* high-pass parameter.”

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Third, the provisional confirms the parameter controls a high-pass filter to adjust the extent of motion blur compensation:

There is a positive scalar parameter controlling the gain of the corresponding *high-pass filter*.

* * *

When set to 1, the entire camera displacement during the exposure periods is preserved. The output motion *contains high frequencies* that mask motion blur.

In sum, the prosecution history supports PO's construction, not Petitioner's.

E. Extrinsic Evidence Supports PO's Construction

Contrary to Petitioner (Reply, 6), Dr. Katsaggelos' testimony supports PO's construction. As discussed above, Dr. Katsaggelos demonstrated a clear understanding of the terms' ordinary meanings. POR, 25-26; EX2018, ¶¶40-42; EX2020, 94:6-15; 103:22-104:8; EX2022. Those meanings are reflected in PO's construction.

Petitioner claims "no software-only technique can selectively mitigate blur based solely on lighting conditions." Reply, 7. This is a red herring. PO's construction does not require that blur compensation be perfectly tailored to correct only blur arising from low-light. PO's construction merely requires

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that the amount of blur compensation be based on low-light, and that the attenuation of smoothing strength operate in a high-pass manner.

Finally, Petitioner claims Dr. Foroosh's analysis of GoPro's HERO7 undermines PO's construction. Reply, 7. But Petitioner overlooks Dr. Foroosh's testimony that the [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] EX2018, ¶198 (emphasis added). Petitioner also overlooks the

[REDACTED]

[REDACTED]

(emphasis added).

II. GROUND 1 FAILS ON THE MERITS¹

A. Shi Applies Smoothing Before Separately Compensating For Blur

Petitioner claims Shi's smoothing process includes blur compensation. Reply, 7-9. Not so. Even under Petitioner's account, Shi's second virtual

¹ The ITC finding of anticipation was based on system prior art not at issue here; PO has petitioned for review.

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camera position is the result of transformation that applies stabilization and smooths motion using a look-ahead. EX1007 12:44-13:15. The third virtual camera position is the result of a separate, distinct, and optional transformation that compensates for blur. *Id.* 13:15-23; *see also* 14:25-30 (“[D]epending on the implementation, some of the interpolations and adjustments used to create virtual camera positions $V_0(T)$ to $V_4(T)$ may be omitted.”). Unlike the approach in Shi, the claims plainly require the low-light high-pass parameter control both operations in a single transformation. EX1001, claims 1 & 14.

B. Shi’s Blur Coefficient Is Neither Based On “Low-Light” Nor A “High-Pass” Approach

Petitioner does not dispute that Shi’s blur coefficient is not based on low-light conditions. Reply, 9. Its assertion that Shi “addresses blur, which can arise from low-light conditions” is irrelevant—Shi’s blur kernel is calculated without regard to lighting. POR, 31; EX2020, 103:22-104:8.

Nor does Petitioner dispute that Shi uses interpolation to address blur, reintroducing both high- and low-frequency motion equally. Reply, 9-10; POR, 32; EX2018, ¶107. Petitioner disputes that SLERP is a “low-pass filter,” but provides no evidence that it controls a high-pass system in accordance

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with Petitioner's expert's understanding of that phrase. *See* POR, 26; EX2020, 94:6-15; EX2018, ¶42. Shi does not do so. POR, 32; EX2018, ¶107.

Petitioner challenges Dr. Foroosh's opinion that "differences between Shi and the claimed technique have real world implications," asserting both systems "apply to mobile phones and cameras and do not prioritize blur compensation over smoothing." Reply, 10. But Dr. Foroosh merely identified how differences between GoPro's commercial use case and those of conventional cameras help explain the different trade-off that GoPro makes between smoothing strength and blur compensation. POR, 33; EX2018, ¶109. That unique trade-off is reflected in the plain language of the low-light high-pass parameter. POR, 33-34, EX2018, ¶¶109-110.

C. Petitioner Fails to Show Motivation Or Reasonable Expectation Of Success

Petitioner fails to address how Bell's system could incorporate Shi's blur coefficient without disrupting Bell's balance between dampening and accelerating virtual camera motion. Instead, it asserts that because both adjust the virtual camera to stay within image frame boundaries, a POSITA would have been motivated to combine them. Reply, 10-11. But neither Petitioner nor Dr. Katsaggelos address Dr. Foroosh's specific technical concern that

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modifying Bell's smoothing logic would undermine its stabilization. POR, 34-35; EX2018, ¶¶111-113.

Petitioner proffered this same combination in the ITC, contending that Bell's mixing weight could be modified to address blur based on Shi. The ITC rejected the combination, adopting PO's argument that Petitioner failed to establish a proper motivation or expectation of success given that modifying Bell's mixing weight to be a low-light high-pass parameter would "frustrate the purpose of Bell's system, not improve it." EX2052, 109-110.

D. Bell/Shi Do Not Disclose "Temporal Horizon Enabling Approximation Of Intentional Motion"

1. Bell's look-ahead is not used to approximate intentional motion

Petitioner claims PO "overlooks" Bell's goal "to define a new virtual camera that stays static when the motion is so small that *the intention* is probably that the camera should remain static" and that "Bell's discussion of a 'small buffer of future frames'—the claimed 'temporal horizon' immediately follows that disclosure." Reply 11, 12. But the two statements are unconnected. Bell's smoothing is based on past data; the look-ahead is used for a different purpose—to predict whether the virtual camera will approach the frame boundary. POR, 40; EX2018, ¶¶122-123.

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Petitioner contends avoiding “sharp changes” and providing a “preemptive nudge in the right direction” both disclose approximating intentional motion. Reply, 12. But Bell *only* avoids sharp changes and provides a nudge to avoid edge collisions; the claim requires approximation of intentional motion in the smoothing process. POR, 39-40, EX2018, ¶¶120-123.

Petitioner asserts PO “misses the point” about the import of Bell’s changes of velocity to calculate the next frame—claiming Bell looks ahead “to adjust the virtual camera’s motion, ensuring it approximates intentional motion.” Reply, 13. Not so. When Bell’s look-ahead determines a future collision is likely, it does *not* adjust the position of the current frame to approximate intentional motion. Rather, it adjusts the velocity used in calculation of future frames to avoid the collision, without regard to user intent. Of course, if Bell’s look-ahead determines no collision is likely, the look-ahead does not influence the trajectory whatsoever. This proves Bell uses its look-ahead for a different purpose.

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2. Shi's look-ahead does not approximate intentional motion

Petitioner cites Shi's use of look-ahead frames to "gradually prepare for large changes in movement" and to "evaluate whether consistent movement, such as panning" is occurring. Reply, 13-14. But Shi's look-ahead serves a different purpose: spreading motion across frames to avoid sudden changes—not approximating whether a given motion was intentional. POR, 41-42; EX2018, ¶126. Petitioner's only response is that "Shi explains that sudden movements are often unintentional." Reply, 13, *citing* EX1007, 1:9-12. That is not what Shi says, and it is only Petitioner's hindsight reasoning that links Shi's generic background statement to motion-spreading embodiments. Petitioner also offers no response to PO's argument that Shi's motion spreading approach is based on *alteration* of the current frame to "*introduce apparent movement*," EX1007, 10:46–54, which is the opposite of approximating intentional motion. POR, 41-42; EX2018, ¶126.

Regarding Shi's discussion of a "predetermined, consistent motion pattern," Reply, 14, *citing* EX1007, 13:35–40, this passage does not disclose an evaluation of experienced motion over a temporal horizon to enable approximation of intentional motion. POR, 42-43; EX2018, ¶127. Rather, it

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describes a heuristic approach that imposes a fixed pattern post hoc. *Id.* That Shi's fixed consistent motion pattern "*may be potentially* intended by a user of the recording device," EX1007 13:35-40, merely confirms that Shi lacks any actual mechanism to approximate intentional motion based on observed motion over time. EX2018, ¶127; POR, 42–43.

III. GROUNDS 2-4 AND 6-7 FAIL FOR THE SAME REASONS AS GROUND 1

See POR, 43; EX2018, ¶ 128.

IV. KWATRA AVOIDS NON-LINEAR OPTIMIZATION

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

Petitioner argues PO "misunderstands basic concepts" because linear models "characterize rotation," do not "preclude minimization," and Kwatra is "not limited" to linear models. Reply, 14-15.

Initially, Petitioner's arguments miss the point; prior art focuses on disclosures. Kwatra discloses only linear models, including single degree of image-plane rotation.

The critical facts are:

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- (1) Kwatra avoided non-linear optimizations due to computational constraints. POR, 21-22, 48-50, EX2019, 3; EX1012, 1:8-11; EX2018, ¶¶89-90, 142-143.
- (2) Kwatra explains smoothing θ may be non-linear and avoids it. POR, 47-48; EX1012, 17:11-20; EX2018, ¶¶138-140.
- (3) Kwatra imposes smoothness on “a” and “b,” not θ . POR, 47; EX1012, 17:5-20; EX2018, ¶139.

Thus, Kwatra avoids non-linear optimization, including smoothing image-plane rotation.

The ITC found Kwatra minimizes linear—not rotational—motion (EX2052, 67-68),² consistent with Dr. Foroosh that linear models do not minimize the claimed rotational combination.

B. “Smoothing” Does Not Demonstrate The Claimed Minimization

Petitioner argues Kwatra “smooth[s] rotation” (Reply, 15-16), ignoring claim 14’s requirement to “*minimize*” rotational motion of the housing.

² Petitioner did not appeal this finding.

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Dr. Katsaggelos acknowledges Kwatra teaches “enforcing smoothness on scale (s) and rotation (θ)” requires “nonlinear optimization, which is slower and more complex.” *Id.* ¶141, *citing* EX1012, 17:17-19. “[I]nstead of solving a nonlinear optimization problem to smooth scale (s) and rotation (θ) directly,” Kwatra “uses the estimated camera path (represented by a linear motion model) to **constrain** how much scale (s) and rotation (θ) vary indirectly.” *Id.*, ¶141 (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—unrebutted—explained bounding image-plane rotation is not minimizing housing rotation. POR, 47-48; EX2018, ¶¶137-141.

Kwatra contradicts Petitioner’s “smooths” argument:

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

EX1012, 17:17-20 (emphasis added).

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While Petitioner relies on Equation 18 to argue smoothing a/b necessarily “smooths” θ (Reply, 16), Kwatra confirms “rotation and scale may *not* remain smooth.” EX1012, 17:11-18.

Petitioner contends bounding scale and rotation constitutes “smoothing” rotation. Reply, 16. But again, Dr. Foroosh explained how bounding scale and rotation (directly or trigonometrically) is not the claimed minimization. EX2018, ¶¶137-141. Any “rotation” in Kwatra is image-plane of tracked features, not the camera housing rotation required by the claims. POR, 53-55; EX2018, ¶¶151-157. Even if smoothed via a/b, it would not minimize housing rotation. *Id.*

C. The Provisional Confirms Kwatra Avoided Non-Linear Optimization

The provisional confirms the inventors avoided non-linear optimization, including smoothing θ , as “not fast enough for real-time performance.” POR, 48-50; EX2019, 3; EX2018, ¶¶142-144.

Petitioner argues the provisional confirms Kwatra “smooths rotation,” because it notes similarity and affine models include rotation. Reply, 18. But a rotational DOF and mere “smoothing” of different parameters does not establish minimization of housing rotation.

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Like Kwatra itself, the provisional imposes smoothness only on a/b , not θ . POR, 47, EX2019, 5; EX1012, 17:5-20; EX2018, ¶139. Thus, “rotation and scale may *not* remain smooth.” POR, 47; EX1012, 17:11-18 (emphasis added); EX2018, ¶139.

Petitioner says Kwatra's provisional describes how optimization “can be extended to other linear transforms such as similarity and affine.” Reply, 18, *quoting* EX2019, 5. But it omits the full discussion, which clarifies extension means *smoothing* a/b , not θ . This confirms Kwatra avoids non-linear computations for minimization. EX2018, ¶¶139-144.

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

Petitioner claims Figures 8A/8B are one embodiment, suggesting Figure 5D demonstrates minimization of rotation. Reply, 19. Not so.

As the ITC found and Dr. Foroosh explained, Figures 8A/8B illustrate Kwatra's linear framework, showing a smooth path in X/Y image-plane dimensions. POR, 50-51; EX1012, Figs 8A/8B, 19:4-38; EX2021, 1368:6-1369:7; EX2018, ¶¶145-146. There is tellingly no illustration of any smoothed path as a function of θ .

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Petitioner relies on Dr. Katsaggelos' one-sentence opinion. Reply, 19; EX1017, ¶149. But Kwatra's Figure 5D description says nothing about minimizing rotational motion, much less housing rotation. EX1012, 14:39-52. It illustrates minimization of a path reflecting the "underlying linear motion model." *Id.* That model avoids non-linear minimization of rotation. EX2018, ¶¶81-82; EX1012, 17:11–20.

The ITC rejected the same argument, crediting testimony Kwatra minimizes linear—not rotational—motion. EX2052, 67-68.

E. Kwatra's 2D Models Do Not Minimize 3D Housing Rotation

Dr. Katsaggelos conceded 2D models cannot model housing rotation. EX2020, 79:2-22; POR, 51-52. Petitioner claims he meant "translational models." Reply, 20. Not so. The questioning probed his ¶108 opinion that Kwatra models 3D motion, despite citing only 2D passages. EX2020, 73:3-79:9. He testified those passages *must* disclose 3D modeling because angular velocity requires it. *Id.*, 70:2-9. Petitioner cannot now dismiss the 2D/3D distinction. Reply, 20.

Dr. Katsaggelos' opinion that Kwatra impliedly discloses 3D modeling is also incorrect. Petitioner cites affine/homography (Reply, 19-20), but in Kwatra, they are fit to 2D image-plane features—***not*** housing rotation. POR,

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52-55; EX2018, ¶¶148-157. Kwatra and its provisional describe only 2D models. EX2019, 1, 6 (“We fit several 2D linear motion models”; The techniques . . . estimate 2D camera path transforms”); EX1012, 9:42-56; 11:3-15.

While affine/homography can approximate some 3D effects, Kwatra uses them solely in a 2D framework and does not minimize 3D rotational dynamics as required. POR, 52-55; EX2018, ¶¶147-157.

That the claims do not recite “3D” does not negate that they require minimizing the rotational velocity and acceleration of a housing, which Dr. Katsaggelos admitted required a 3D model. *Id.*

Petitioner's fallback—Bell/Shi disclose 3D—does not cure Kwatra's deficiency. Petitioner never argued Bell/Shi disclose minimizing rotation or identified any rationale to combine their 3D estimation with Kwatra's 2D framework with a reasonable expectation of success.

F. Kwatra Does Not Disclose Minimizing Housing Rotation

Petitioner claims Kwatra is “not limited to an image-based motion estimation approach” because it uses “may” when describing image-based estimation. Reply, 21. But “may” does not transform Kwatra into a catch-all disclosing every method—let alone minimization of housing rotation.

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Petitioner asserts feature movement is “directly proportional” to camera rotation; precise angle is irrelevant if image effects are minimized; and 3D can be reconstructed from 2D. Reply, 21–22. But these generalities lack support in Kwatra whose estimation is strictly image-based. POR, 51–53; EX2018, ¶¶147–150. Kwatra does not model the physical motion of the camera housing, much less minimizing its rotational motion.

Again, Petitioner's new argument that Bell/Shi's 3D modeling fills Kwatra's gap is unpersuasive, because Petitioner identifies no rationale for combining Bell/Shi's 3D estimation with Kwatra's image-based optimization with a reasonable expectation of success. Even if combined, it would still lack the required minimization of housing rotation.

G. Petitioner's New Theory Fails

Petitioner argues that GoPro engineers described the objective function in a *different* reference (“Kwatra paper”) as minimizing rotation before the '840 patent existed. Reply, 22-24. This is far removed from whether the Kwatra *patent* renders the claims obvious. Raising it in Reply deprives PO the opportunity to offer clarifying testimony from its engineers or expert. The theory stems from selective quotation and mischaracterization of GoPro's design document. Reply, 24.

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The document (EX1022) describes a [REDACTED]

[REDACTED]

[REDACTED] followed by: [REDACTED]

[REDACTED]

[REDACTED]³ (Emphasis added). Petitioner speculates [REDACTED]

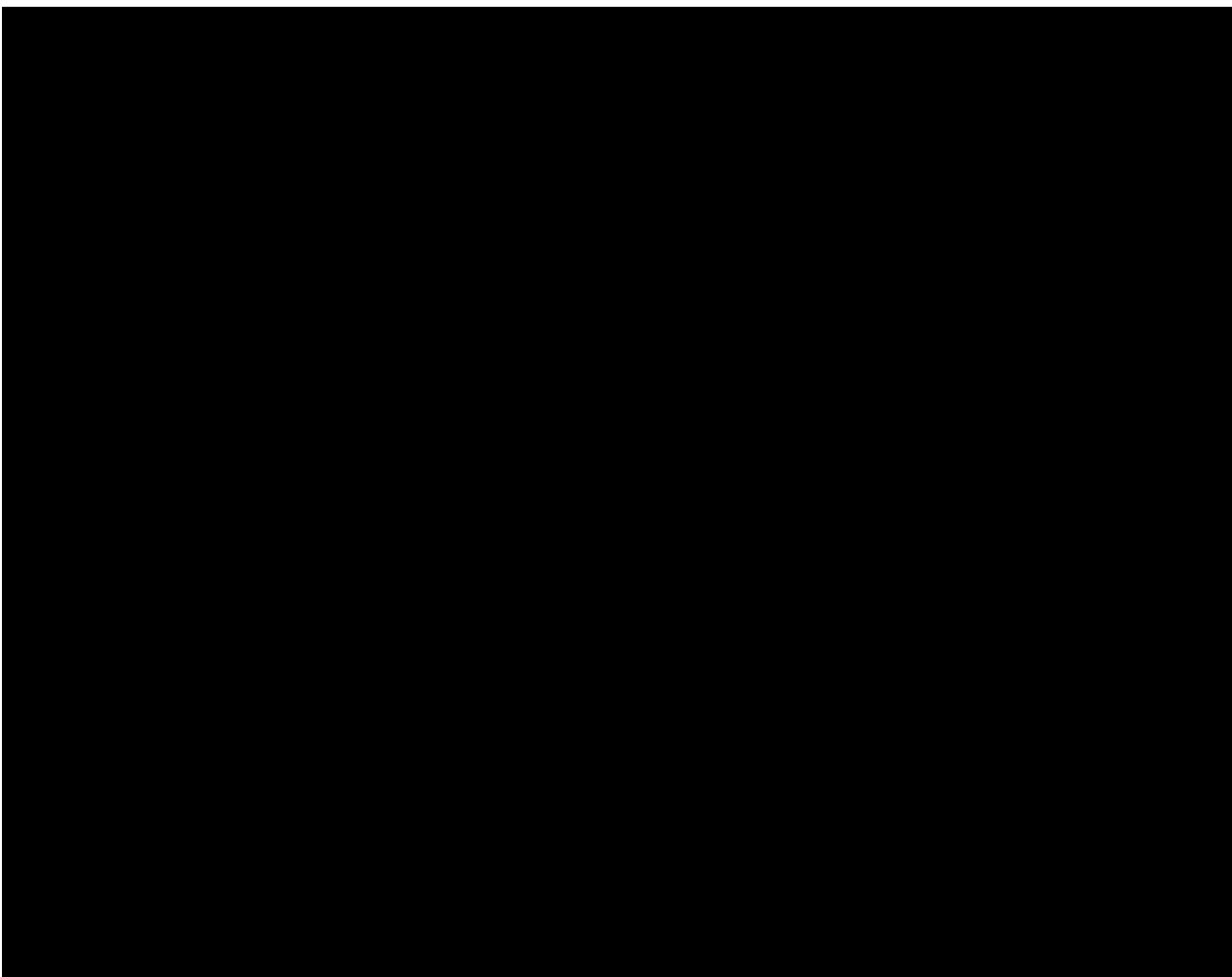
[REDACTED]

[REDACTED]

[REDACTED]

³ Neither Kwatra nor the paper discloses any objective function that operates on housing rotation. The disclosed cost function minimizes a linear path applied to tracked image features—using parameters (a/b).

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The document



This broader context refutes Petitioner's theory. The Board should disregard it.

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V. PETITIONER'S MOTIVATION TO COMBINE FAILS

Petitioner argues combining Bell/Shi and Kwatra would have been obvious. Reply, 23. But substituting 3D angular parameters from Bell/Shi into Kwatra's framework would require non-linear optimization—precisely what Kwatra avoided. EX1012, 17:11–20; EX2019, 3.

Petitioner claims PO “mischaracterize[es] Kwatra” as directed to “fundamentally different image stabilization techniques.” Reply, 24. But Kwatra discloses an image-based, post-processing system built on feature tracking and linear modeling. Figure 2 shows the core processing architecture, including a “Video Hosting Service 200” connected to client devices via “Network 206,” comprising a “Video Server 201,” “Ingest Server 212,” and “Video Database.” EX1012, FIG. 2; POR, 56-57; EX2018, ¶159. These process uploaded videos using the “Camera Path Translation System 202,” including a “Camera Path Estimation Engine 218,” “Video Stabilization and Retargeting Engine 220,” and “Video Translation Engine.” EX1012, 5:21-26; FIG. 2; POR, 56-57; EX2018, ¶159.

Kwatra's generic references to how its methods “may be performed by a device, a server, or a combination,” and to a “computing device 1300,” merely support implementing the Figure 2 architecture—not on-board mobile

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device processing. POR, 56-57; EX2018, ¶159. Nowhere does Kwatra suggest using sensor-based 3D data in a mobile device. *Id.*

Tellingly, Petitioner relies exclusively on Bell—not Kwatra—for disclosing a “position sensor carried by the [camera] housing,” and “position information that characterizes the positions of the housing.” Petition, 17-20. These refer to motion sensors like gyroscopes and IMU’s—disclosures absent from Kwatra.

Kwatra’s core disclosure is a server-based, 2D image-derived, post-capture system. In contrast, Bell/Shi rely on 3D sensor-based motion estimation in mobile devices. That architectural distinction informs a POSITA’s understanding and weighs against combining the references. POR, 56-59; EX1018, ¶¶158-164.

Petitioner challenges Dr. Foroosh’s opinion that Kwatra’s multiderivative trajectory optimization was “computationally intensive” and unsuited for 2013 mobile devices. Reply, 26 (citing POR, 57). Petitioner claims PO did not explain “how complex” the optimization was or “how limited” mobile devices were. But Bell itself confirms that image-based post-processing was more computationally intensive than using motion sensors:

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“Filtering and analyzing the motion sensing system measurements in real time requires *much less processing power in comparison to 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).

Even Dr. Katsaggelos conceded Bell's point was “not ... wrong,” noting only that some image-based methods “might” be “comparable” in complexity. EX2020, 47:4-19.

Dr. Katsaggelos new declaration does not contradict this. It vaguely asserts 2013 mobile devices could perform “many computations” (EX1017 ¶192) but offers no evidence supporting the conclusion that they could handle a multi-derivative optimization problem in real-time on sensor data.

Petitioner also contends Kwatra's smoothing step and Equation 7 are “agnostic” to the trajectory source. Reply, 27. But, as Dr. Foroosh explains, applying Kwatra's cost function to 3D sensor-derived data—such as angular rotations (θ) would require non-linear optimization—precisely what Kwatra avoided due to computational complexity. EX2018, ¶¶89-90; POR, 21-22.

Petitioner's fallback—that hybrid sensor/image systems were known is unsupported. Reply, 27-28.

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Finally, Petitioner invokes GoPro's development document (EX1022) to argue a POSITA would have been motivated to combine image and sensor data. Reply, 28-29. But this is legally irrelevant. The ITC rejected the same argument, holding: "[f]rom start to finish, Insta360's obviousness arguments . . . are undergirded by the fact that GoPro itself considered [the Kwatra paper] when developing the invention." EX2052, 66. "The only inquiry is whether the teachings of [Kwatra] would have rendered the claimed invention obvious . . . this inquiry, as a matter of law, is independent of the motivations that led the inventors to the claimed invention." *Id.* The ITC concluded that "Insta360's arguments were "suffused with hindsight bias" and "legally improper." *Id.*, 67.

If anything, the development document confirms the incompatibility of Petitioner's references. As discussed, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] This record establishes the incompatibility of the reference and reinforces Dr. Foroosh's conclusion that a POSITA would not have had a reasonable expectation of success. EX2018, ¶¶160–164.

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VI. SECONDARY CONSIDERATIONS SUPPORT NON-OBVIOUSNESS

A. HERO7 Practices The '840 Patent

In the ITC, Petitioner did not dispute HERO7 practices claims 1, 13, and 14, other than “temporal horizon” of claim 1, which the ITC found was met. EX2052, 99-101. Dr. Foroosh relied on this in forming his opinion. POR, 61-62; EX2018, ¶200.

Dr. Foroosh also independently confirmed HERO7 practices the claims. He reviewed PO's DI charts (EX2016), analyzed [REDACTED] [REDACTED] and code. POR, 61-62, EX2018, ¶¶166-204.

Petitioner isolates two paragraphs (¶¶186, 192), asserting for limitations 1[g](ii) and 1[h] he cited only [REDACTED] Reply, 29. But Petitioner ignores the majority of his analysis. EX2018, ¶¶166-198, 200-202.

B. Nexus Exists

Petitioner's attempt to deny nexus (Reply, 30-32) was rejected by the ITC, finding: “[t]he record supports that evidence of secondary considerations were the direct result of the unique characteristics of the '894 and '840 patents.” EX2052, 70-72, 107, 111. The ITC relied on many of the same

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documents cited by Dr. Foroosh, and testimony of Mr. Lema, who submitted a detailed, *unrebutted* declaration here. *Id.*, 70-72; EX2024.

Petitioner's arguments disputing nexus and the underlying objective indicia lack merit. Reply, 30-32.

First, Petitioner misrepresents the record in attempting to dismiss the 2022 Technology & Engineering Emmy® Award (EX2010) as relating to “EIS technology in 2015.” Reply, 31. As Mr. Lema testified, and a contemporaneous press release (EX2012) confirms, the Emmy was awarded in 2022 for GoPro's HyperSmooth stabilization—not for generic legacy EIS. POR, 65-66; 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 credited this award as industry praise directly tied to the '840 patent. EX2052, 72-73, 111.

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Second, Petitioner contends commercial success and praise are attributable to “other features—not the purported novel ones.” Reply, 31.⁴ But the ITC found that it was “the direct result of the unique characteristics of the ’894 and ’840 patents.” EX2052, 70–72.

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

[REDACTED]

[REDACTED]

[REDACTED].⁵ Combined with expert testimony and surveys, this supports findings

⁴ Petitioner points to Mr. Derbanne’s testimony [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

⁵ Petitioner notes the review concerns HERO9 and HERO8. But Mr. Lema testified—without rebuttal—that HyperSmooth “played a pivotal role in the

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of industry praise, unexpected results, and long-felt need. Petitioner offers no rebuttal and ignores the [REDACTED].

Date: September 4, 2025

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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 5,360 words and thus complies with the applicable word limit.

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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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