

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. IPR2024-00984  
U.S. Patent No. 10,015,413

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**PATENT OWNER'S RESPONSE**

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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       | “What is GoPro SuperView?”, available at <a href="https://actioncamphotographer.com/gopro-superview/">https://actioncamphotographer.com/gopro-superview/</a>                                                                                               |
| 2004       | U.S. Pat. No. 7,893,985                                                                                                                                                                                                                                    |
| 2005       | U.S. Pat. App. Pub. 2011/0187903 A1                                                                                                                                                                                                                        |
| 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       | “Hands-on with the GoPro Hero 3+ Black Edition,” February 20, 2014, available at <a href="https://www.dpreview.com/reviews/hands-on-with-the-gopro-hero-3-black-edition">https://www.dpreview.com/reviews/hands-on-with-the-gopro-hero-3-black-edition</a> |
| 2009       | “Stabilization,” available at <a href="https://onlinemanual.insta360.com/x4/en-us/faq/feature/stabilization">https://onlinemanual.insta360.com/x4/en-us/faq/feature/stabilization</a>                                                                      |
| 2010       | “What Is SuperView?,” produced as GOPRO_00009577 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                                                         |
| 2011       | “Niek / superview,” available at <a href="https://github.com/Niek/superview">https://github.com/Niek/superview</a>                                                                                                                                         |
| 2012       | “meekaah / SuperViou” available at <a href="https://github.com/meekaah/SuperViou">https://github.com/meekaah/SuperViou</a>                                                                                                                                 |
| 2013       | “GoPro Hero4 vs. GoPro Hero3+”, October 5, 2014, available at <a href="https://newatlas.com/gopro-hero4-vs-gopro-hero3plus/34090/">https://newatlas.com/gopro-hero4-vs-gopro-hero3plus/34090/</a>                                                          |
| 2014       | “About New Atlas,” available at <a href="https://newatlas.com/about">https://newatlas.com/about</a>                                                                                                                                                        |

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|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2015 | “Here it is – the GoPro Hero 3+ Review from our #GoProAdventures,” available at <a href="https://www.littlestuff.co.uk/here-it-is-the-gopro-hero-3-review-from-our-goproadventures/">https://www.littlestuff.co.uk/here-it-is-the-gopro-hero-3-review-from-our-goproadventures/</a> |
| 2016 | “Superview-like mode,” available at <a href="https://forum.dji.com/thread-198395-1-1.html">https://forum.dji.com/thread-198395-1-1.html</a>                                                                                                                                         |
| 2017 | “Next Firmware what would you like to see corrected added,” available at <a href="https://forum.dji.com/forum.php?mod=viewthread&amp;tid=196725">https://forum.dji.com/forum.php?mod=viewthread&amp;tid=196725</a>                                                                  |
| 2018 | ████████████████████ produced as GOPRO_00019926 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                                                                                   |
| 2019 | ████████████████████ produced as GOPRO_00063381 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                                                                                   |
| 2020 | “Digital Camera D5200 Reference Manual,” produced as INSTA360_1400-PA00001186 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                                                     |
| 2021 | “RAW POV SURFING GLASSY BARRELS OVER SHALLOW REEF!! (MINI SLAB),” available at <a href="https://www.youtube.com/watch?app=desktop&amp;v=yz3-tlL4dvo">https://www.youtube.com/watch?app=desktop&amp;v=yz3-tlL4dvo</a>                                                                |
| 2022 | Statutory Disclaimer for U.S. Pat. No. 10,015,413, dated November 5, 2024                                                                                                                                                                                                           |
| 2023 | Declaration of Patrick T. Schmidt in support of Patent Owner's Motion for <i>pro hac vice</i> admission                                                                                                                                                                             |
| 2024 | Declaration of Pablo Lema                                                                                                                                                                                                                                                           |
| 2025 | Joint Stipulation Regarding Representative Domestic Industry Products, filed in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                                                      |

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|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2026 | Transcript of the Deposition of Dr. Aggelos K. Katsaggelos, taken March 28, 2025                                                                                                       |
| 2027 | Supplemental Declaration of Hassan Foroosh Ph.D.                                                                                                                                       |
| 2028 | “HERO 7 Black,” entered as CX-0522 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                   |
| 2029 | “Photos Taken with a GoPro HERO7 Black,” entered as CX-0526 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400          |
| 2030 | “HERO7 Black: HyperSmooth,” entered as CX-0613C in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                      |
| 2031 | Excerpts of source code file produced as GOPRO_SC0231 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                |
| 2032 | Excerpts of source code file produced as GOPRO_SC0168-190 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400            |
| 2033 | ████████████████████ entered as CX-0939C in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400, with certified translation |
| 2034 | Pages 856-873 of January 15, 2025 transcript of hearing in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400              |
| 2035 | ████████████████████ entered as CX-0846C in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400, with certified translation |
| 2036 | Photo of CES Innovation Award 2019, produced as GOPRO 00000004 in <i>In the Matter of Certain Cameras</i> ,                                                                            |

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|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | <i>Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                                                                                                                |
| 2037 | “Believe the Hype: GoPro Showcases Award-Winning HERO7 Cameras at CES 2019,” entered as CX-0618 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400           |
| 2038 | Photo of LUCIE Technical Award 2019, entered as CX-0026 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                   |
| 2039 | Photo of Emmy, entered as CX-0020 in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400                                                                         |
| 2040 | <br>entered as CX-0590C in <i>In the Matter of Certain Cameras, Camera Systems, and Accessories Used Therewith</i> , Inv. No. 337-TA-1400 |
| 2041 | GoPro Wins Second Emmy Award for Groundbreaking Digital Imaging Technology, entered as CX-0636 in <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**

Founded in 2002 in San Mateo, California, Patent Owner GoPro, Inc. (“Patent Owner” or “GoPro”) is a pioneer in developing cameras and digital imaging techniques, particularly for mountable and wearable use cases. As a company built on innovation, GoPro has received numerous patents protecting its technological improvements, including for wide-angle views. GoPro has become a leader in the industry, receiving scores of industry praise from professionals and consumers alike. Petitioner is a recent entrant into this market that has found significant success by copying GoPro’s designs and innovations, including the patent at issue in this proceeding.

U.S. Patent No. 10,015,413 (the “’413 patent”) discloses a novel camera system for performing aspect ratio conversion of digital photos taken by the camera itself which, amongst other benefits, allows the converted image to be displayed on the camera’s miniature LCD screen. Prior to the invention of the ’413 patent, camera designers sought to avoid introducing distortion to captured images, because distortions were thought to cause objects across the field of view look unnatural and were undesirable.

In designing its action cameras, GoPro came to realize two key principles that differed from the conventional wisdom in digital image

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technology. First, while it may be desirable to avoid distortion for central objects in the field of view, allowing for a degree of distortion at the periphery of the image was acceptable and, in fact, even desirable as it introduced a sense of speed and excitement to action camera footage. Second, capturing an image using a sensor with an aspect ratio of 4:3 allowed for a larger (*i.e.*, taller) field of view that when converted to a typical display aspect ratio of 16:9 actually *increased* the field of view that could otherwise be captured.

GoPro therefore introduced the novel idea of intentionally ***introducing*** distortion to increase the field of view through an in-camera aspect ratio conversion, as compared to other approaches. Using non-linear transformations, GoPro was able to allow users to select modes that minimized distortion in central portions at the expense of greater distortion at the peripheral areas. This also created a “barrel” effect that allowed for a more immersive feel. Since 2013, GoPro has implemented this feature in all of its action cameras under the brand name “SuperView.” SuperView is a feature that has earned widespread industry praise over the years and is widely renowned by GoPro customers.

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Petitioner has copied SuperView to develop its own “ActionView” feature, as demonstrated by its own internal reverse engineering documentation.

In this proceeding, Petitioner contends that the '413 patent is obvious, relying on three alternative grounds using three primary references: Fleming, Obara, and Meulen. As the Board already found, Fleming and Obara lack any disclosure of performing its algorithms within a camera or image capture apparatus. And Petitioner provides no motivation for the claimed in-camera solution given the costs and complexities involved, particularly since the conventional wisdom in the art was to apply simpler, alternative techniques such as cropping, padding, or linear scaling.

As for Meulen, there are a number of issues with Petitioner's obviousness theory. First, while Meulen's device has a camera, Meulen never describes that its aspect ratio conversion is performed on images captured from that camera. Instead, Meulen makes clear that conversion is performed on content from external *media sources*. Second, Meulen's algorithm relies upon a rough, piecewise linear transformation that does not provide the claimed “non-uniform” transformation, which the parties' experts agree requires a non-linear transformation. Third, Meulen fails to teach or suggest

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machine-readable instructions for “determin[ing] a portion” of the image as claimed. Meulen instead relies on algorithms based on a pre-partitioned pixel compression approach. Indeed, Dr. Katsaggelos admitted that the partitioning described in Meulen’s algorithm is a ***design choice***, determined in advance rather than after the image is obtained as required by the claim language. Fourth neither Meulen nor Chao disclose the required “pixel shifting,” and in any event there is a lack of motivation to combine these two references—Meulen is directed to changing the aspect ratio of a photograph to be displayed on a small screen, while Chao is directed to something completely different—preserving graphic design elements within a border when a document to-be printed is resized.

**II. LEVEL OF ORDINARY SKILL IN THE ART**

Petitioners propose that the level of a POSITA at the time of the ’413 patent “would have a bachelor’s degree in engineering or computer science, or equivalent field, and two years of experience working on image or video processing, or digital cameras” or “four years of experience working on image or video processing, or digital cameras.” Pet. 6.

For purposes of this response, Patent Owner applies Petitioner’s proposed level of skill. Ex. 2027, ¶¶19-20. Patent Owner’s expert, Dr. Hassan

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Foroosh, was a POSITA under Petitioner's definition at the time of the '413 patent. *Id.*, ¶21.

**III. CLAIM CONSTRUCTION**

In an *inter partes* review, claim terms receive their plain and ordinary meaning in light of the specification of the patent in which they appear, the same standard as used in district court. 37 C.F.R. § 42.100(b); *see Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). While there are several terms in dispute in the parallel ITC litigation (Pet. 8), none of them need to be resolved by the Board. Ex. 2027, ¶34.

**IV. THE '413 PATENT**

**A. Summary (Ex. 2027, ¶¶35-38)**

The '413 patent is directed to a novel camera apparatus that converts the aspect ratio of an image from an image sensor for display on the apparatus. In particular, the image is “non-linearly warped relative to the input image such that a distortion in the output image relative to the input image is greater in a corner region of the output image than a center region of the output image.” Ex. 1001, Abstract. The '413 patent explains that prior art methods merely removed content (*e.g.* cropping), caused undesirable distortion (*e.g.* linear transformations), or did not fully use the display screen (*e.g.* padding or black bars). *Id.*, 1:6-25.

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The '413 patent's novel aspect ratio conversion is illustrated in Figure 2A, which describes that “an input image is obtained” from an image sensor, after which the center portion of the image “is **chosen** to be the region of interest that is most fully corrected and the distortion increases in each direction as the frame boundary is approached.” Ex. 1001, 3:63-64, 4:19-22. By choosing the region of interest that will be less-distorted, this allows the portion to “dynamically change between images” in order to “follow a moving object.” Ex. 1001, 4:32-36.

The '413 patent also describes that the transformation uses non-uniform pixel shifting, *i.e.* a non-linear transformation. Ex. 1001, Abstract (“[T]he output image is **non-linearly** warped relative to the input image”); Ex. 1001, 3:61-4:13. The pixel-shifting is based on the specific horizontal and vertical positions of the pixel. For example, the patent describes using sixth-order polynomials to calculate how much horizontal and vertical shift to use. For the horizontal shift, the patent provides the following exemplary equation:

$$\Delta h/H = 0.1107h^6 + 0.534h^5 - 1.7813h^4 + 1.3167h^3 - 0.0722h^2 - 0.1073h$$

Ex. 1001, 6:65-7:5. And for the vertical shift, the patent provides **ten** different equations depending on the pixel's horizontal coordinate as a percent of the

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total horizontal image size. *Id.*, 7:5-43. For example, the below vertical-shift equation is used for the first 10% of the image:

$$\Delta v/V_0 = -0.0749v^6 - 0.3167v^5 + 1.0939v^4 - 0.8113v^3 + 0.0408v^2 + 0.0678v$$

Petition's summary of the '413 patent lacks specific discussion of key limitations found in the Challenged Claims. In particular, the Petition focuses exclusively on the **result** of the transformation, ignoring the separate requirement for that a portion be determined after obtaining the image but before applying the transformation. Pet. 3-4. And the Petition describes the transformation as a "compression/enlargement" rather than focus on the actual claimed transformation: non-uniform pixel-shifting using a non-linear transformation. These claimed limitations distinguish the '413 patent from the prior art.

**B. Priority Date**

The '413 patent claims priority to a provisional application filed on August 22, 2013. Ex. 1001, (60). Petitioner does not dispute this claim to priority. Pet. 4-5.

**C. Prosecution History (Ex. 2027, ¶¶39-43)**

During prosecution of the '413 patent, the applicant amended the claims to introduce the step of "determin[ing] a portion within the input image, the

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portion including a subset of the pixels,” instead of merely requiring “the input image includes a portion including a subset of the pixels.” Ex. 1003, 135-36. However, the claims still required that the pixel shift within the image portion was less than the pixel shift outside of that portion. *Id.*; Ex. 2027, ¶¶35-36.

During prosecution of the '413 patent, the examiner issued one rejection, that the submitted claims were obvious over U.S. Pat. 8,218,895 (“Gleicher”) in view of U.S. Pat. No. 7,496,243 (“Oosawa”). Ex. 1003, 46-50. The examiner stated that while Gleicher did not show non-uniform pixel shifting, Oosawa “teaches an image display apparatus and method wherein the amount of shift ... is smaller in the center of the image than in the peripheral of the image.” *Id.* at 48.

Following the rejection, GoPro amended the independent claims to add the step of “determin[ing] a portion within the input image, the portion including a subset of the pixels,” and remove the language that “the input image includes a portion including a subset of the pixels.” Ex. 1003, 32. In other words, GoPro amended the claims to require a step of “determin[ing] a portion within the input image.” GoPro then argued that, while Oosawa may “show[] the amount of shifting to be applied to the center of the image is smaller than the peripheral of the image,” it does not disclose “determining a

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portion (including a subset of pixels) within an input image and non-uniformly shifting the pixels of the input image such that differences between input positions and output positions are less for the subset of the pixels than other pixels of the input image.” Ex. 1003, 39; Ex. 2027, ¶¶37-39. Following this amendment, the examiner allowed the claims. Ex. 1003, 13.

Petitioner asserts that the aspect ratio conversion technology of the '413 patent “involves a transformation that applies different (non-uniform) amounts of compression/enlargement to different regions of the input image.” Pet. at 1. Beyond the fact that the non-uniform transformation requires a non-linear transformation, this over-generalization by Petitioner suggests that the different amount of pixel shifting inside the portion as compared to outside the portion can arise incidentally as a mere result of an entirely passive non-uniform transformation process. That incorrectly seeks to strip meaning from the “determining a portion” limitation, which is not only separately recited by the claims but is a limitation that the examiner found important to patentability.

**D. Challenged Claims**

The Petition addresses claims 1-20 of the '413 Patent. Prior to Institution, Patent Owner filed a Statutory Disclaimer of claims 2-5 and 8-20.

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Ex. 2026. That leaves claims 1, 6, and 7 as the remaining challenged claims (“Challenged Claims”). Ex. 2027, ¶44.

**V. GROUND 4: MEULEN IN VIEW OF CHAO DO NOT RENDER OBVIOUS THE CHALLENGED CLAIMS**

**A. Summary of Prior Art**

**1. Meulen**

Meulen describes a “wireless device” such as a Palm Treo depicted in Figure 1 that receives an image from a “media source” and converts its aspect ratio to fit on the device’s display. Ex. 1007, Abstract. While Meulen does make a passing reference to its device having an embedded camera, it provides no disclosure teaching or suggesting any technique for previewing, much less processing digital images taken by that embedded camera. Ex. 2027, ¶47. In fact, when discussing its digital image compression technology, Meulen only ever describes its techniques being applied to content delivered from an external “media source,” such as a “computer,” “web server,” or “DVD device.” *Id.*, 3:53-67.

Meulen describes a piece-wise linear transformation where certain pre-specified regions are compressed at pre-designated ratios. Ex. 2027, ¶48. For example, in the Table 1 embodiment, the portion covering the middle 200

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horizontal pixels are not compressed, whereas the first and last portions of 10 horizontal pixels are compressed at a “4:1” ratio. Ex. 1007, 6:4-37.

**TABLE 1**

|                   | Region |     |      |     |     | Total |
|-------------------|--------|-----|------|-----|-----|-------|
|                   | 1      | 2   | 3    | 4   | 5   |       |
| Pixels/Region     | 10     | 50  | 200  | 50  | 10  | 320   |
| Compression Ratio | 4:1    | 2:1 | none | 2:1 | 4:1 |       |
| Source Pixels     | 40     | 100 | 200  | 100 | 40  | 480   |

Meulen does not describe that its compression uses pixel shifting—instead, compression is performed entirely using “polyphase filters arranged to sample a line of source pixels and to generate a compressed and/or scaled line of display pixels based on a compression factor.” Ex. 1007, 5:19-23. Such compression essentially takes a group of pixels and averages them into a single pixel, instead of shifting any pixels. Ex. 2027, ¶49.

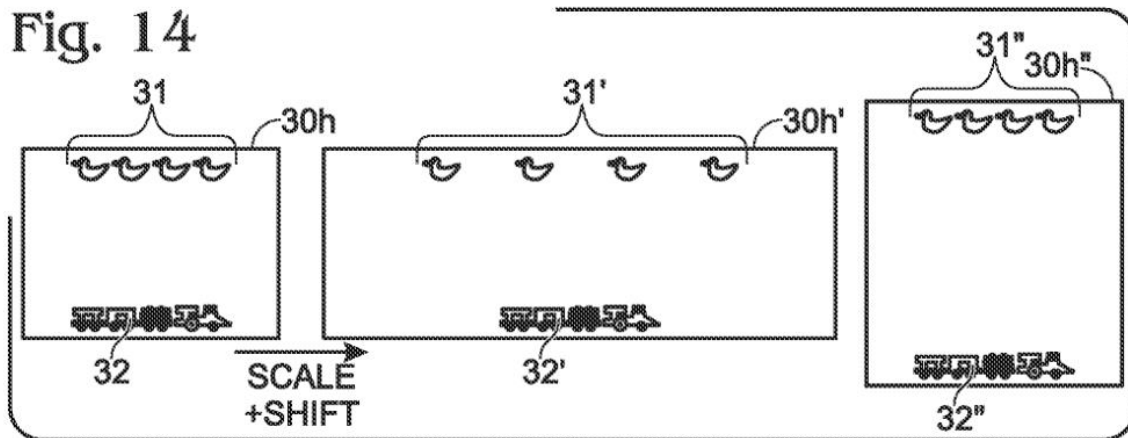
**2. Chao**

Because the Petition recognizes that Meulen does not describe pixel-shifting, the Petition turns to the Chao reference. Chao is directed to resizing documents that are intended to be printed on different sizes of paper. Ex. 1008, Abstract. In particular, Chao is concerned with how graphical design elements such as a pre-designed greeting card “border” can be distorted if the

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image is printed to paper that does not match the size of the original image. Ex. 1008, ¶1 (“For example, people frequently like to incorporate professionally designed borders in their photos, newsletters, postcards, greeting cards and the like.”). Chao therefore introduces a method of separating foreground objects (*e.g.* graphic art found within the border of a postcard) from background objects (*e.g.* the original photo), stretching/resizing the background elements to the new aspect ratio, and then shifting the foreground objects to a new position while maintaining their aspect ratio. Ex. 2027, ¶¶50-51. For example, Figure 14 shows how image 30h is altered to either image 30h' or 30h''. Ex. 1008, ¶91. The ducks and trains (foreground elements) remain “the same size” and shape but are shifted to new locations to maintain their relative spacing across the entire sheet. *Id.*

**Fig. 14**



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**B. Limitation 1[f]/2[d]: Meulen Does Not Disclose Applying A Transformation To An “Input Image” From a Camera or Input Sensor**

Each of the Challenged Claims require that the claimed transformation be applied to an “input image” by the same “image capture apparatus” or “camera” that captured the image. Claim 1 for example recites an “image capture apparatus” comprising an “image sensor configured to capture an input image.” Thus, when limitation 1[f] recites “apply a transformation to the input image,” it is referring to the same input image captured by the image capture device that is applying the transformation. Ex. 2027, ¶¶52-53.

Petitioner alleges that the claimed “input image” is disclosed by Meulen’s “media source content.” Pet. 87. Yet Meulen never discloses that its wireless device obtains “media source content” from the wireless device’s embedded camera or image sensor. Ex. 2027, ¶54. Instead, Meulen is clear that the “media source content” comes from an external source. *Id.*

Specifically, consistent with its plain meaning, Meulen describes that the “media source” is an external source. Ex. 2027, ¶55. Meulen generally describes that the “media source” is “any source capable of *delivering* media source content to the wireless device 100,” which indicates it is an external source. Ex. 1007, 3:51-53 (emphasis added). Examples include “a

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computer,” “server,” “web server,” “television signals,” “DVD device,” “VHS[] device,” “digital camera,” “video camera,” “portable media player,” and “gaming device.” *Id.*, 3:53-67. Meulen further describes that the media source content is received via an interface for external sources, such as “cellular data systems” like “GSM” and “EDGE.” *Id.*, 4:1-12. As shown in Figure 5, Meulen describes that the “media source content” is received “through a communications interface 512,” which couples the device to a “network[]” or “a network device[],” *i.e.* an external source. *Id.*, 13:6-11.

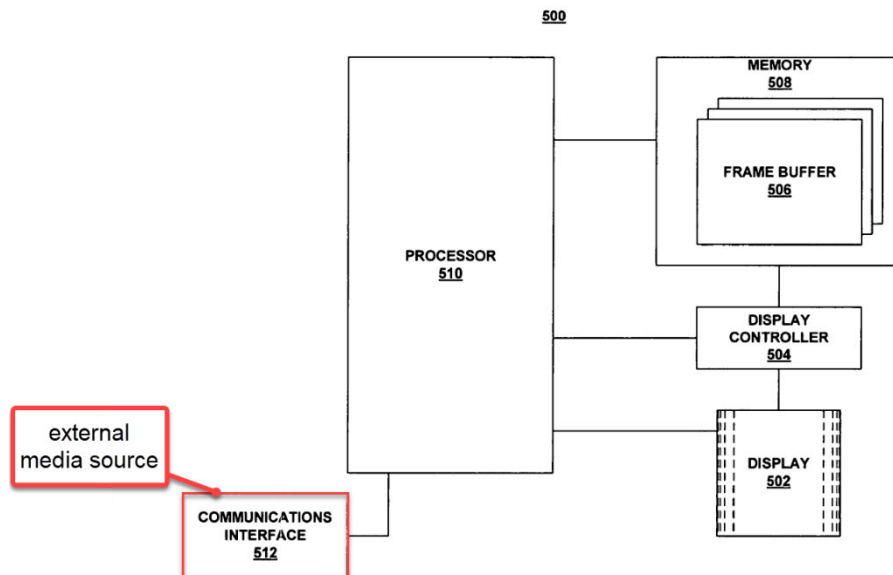


**FIG. 5**

**Meulen, Fig. 5 (annotated)**

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Indeed, Petitioner's expert Dr. Katsaggelos confirmed that the "communications interfaces ... always impl[ies] external source." Ex. 2026, 18:8-16; Ex. 2027, ¶56.

As a result, a POSITA would understand that in Meulen, the "media source content" is media content that comes from an external source. This is reinforced by Meulen's disclosure that the content is "***deliver[ed]*** ... ***to*** the wireless device" by the media source. Ex. 1007, 3:51-53. This description, which is consistent with the plain meaning of "media source," would not include images taken by a camera or image sensor embedded within the device, as such images would be present on the device during capture and not "***deliver[ed]*** ... ***to***" to the device. Ex. 2027, ¶55.

While Meulen does state in its background that a wireless device may have a "digital camera," Meulen provides no further description of the operation of the device's embedded camera. Ex. 1007, 1:6-9. The mere fact that Meulen's wireless device would include a digital camera would not have made it obvious to a POSITA to use that wireless device to apply non-linear transformations to digital images captured by the embedded camera. Ex. 2027, ¶57. As Petitioner's other prior art of record indicates, complex image processing at the relevant time was done, if at all, off-camera using specialized

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post-processing devices and software. *Id.* And, there would have been no obvious reason for a POSITA to even attempt any such complex image processing on Meulen's device. *Id.* For example, Meulen does not describe the aspect ratio of its embedded camera relative to its display screen, and thus there is no indication at all that the embedded camera's images would even need to be transformed for display. *Id.* A wireless device whose internal image sensor is matched to the aspect ratio of the display would have no need or use the transformation recited by the '413 patent.

As Dr. Katsaggelos confirmed, Meulen is directed to "situation[s] where there is a need to change the aspect ratio," and yet even he admits that in Meulen, "it might be the case that there's no need" to transform an image from Meulen's embedded camera. Ex. 2026, 17:17-19, 14:18-15:2. Notably, the examples of "media sources" that Meulen describes as potentially delivering content with aspect ratios requiring conversion all suggest external sources—*e.g.*, "standard television," "web sites," "multimedia products," HDTV," "digital video cameras," and "DVD[] players," *i.e.* external sources. Ex. 1007, 1:16-25.

Additionally, even to the extent there may have been a mismatch between the display screen and an image sensor of a embedded digital camera,

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conventional camera applications for mobile devices like those described in Meulen used much simpler, alternative techniques for dealing with the aspect ratio issue such as cropping, padding, or linear scaling. *Id.*, 1:11-13. These techniques were considered sufficient for previewing content on mobile devices at the relevant time. Ex. 2027, ¶58. In short, it was far from obvious in August of 2013 for a mobile device to apply the complex, non-uniform transformations to digital images captured by an embedded camera of the device itself.

**C. Limitation 1[e]/2[c]: Meulen Does Not Disclose “Determin[ing] a Portion Within the Input Image”**

All of the Challenged Claims recite machine-readable instructions that “determine a portion within the input image, the portion including a subset of the pixels” *after* obtaining the input image but *prior* to the aspect ratio transformation. Ex. 2027, ¶59. Although the limitations in an apparatus claim need not necessarily be performed in the order they are recited, the Challenged Claims imply this specific order because the “determine a portion” requirement operates on “the [obtained] input image” and defines the “portion” that is necessary for the subsequently recited transformation. As Petitioner’s expert explained, these steps must be “different operations.” Ex. 2026, 26:21-23; Ex. 2027, ¶59. Notably, as discussed above in Section IV,

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the claims were amended to add this limitation of determining the portion, to overcome art that merely disclosed an image containing such a portion after a transformation was complete.

For each of the asserted grounds, including Ground 4, Petitioner has failed to provide **any explanation** as to how the prior art discloses a separate, machine-executable instruction that “determine[s] a portion within the input image” after obtaining the input image but before the transformation. Instead, the Petition merely points to teachings of portions that are less distorted than others *after* the transformation is applied. Ex. 2027, ¶60. For example, in Ground 4, Petitioner’s entire analysis is provided below:

“[C]entral display region 140-3 may comprise 200 pixels and require the media source content to undergo no image compression (e.g., 200 source pixels to 200 display pixels).” (EX1007, 6:27-31.) A POSITA would have understood that the central region within the media source content has a corresponding central display region, which includes a subset of the source pixels. (EX1002, ¶¶252-253.)

Pet. 88. The Petition does not even assert that this disclosure meets the limitation, nor does it provide any explanation as to how Meulen’s processor performs the separate step of **determining** the “central display region” *after*

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the image is obtained and **prior** to the transformation of the image. Ex. 2027, ¶61.

The Petition hinges on the faulty assumption that a less distorted portion can merely arise as a result of applying different compression to different portions of an image. But, this would render the separately recited “determine a portion” limitation meaningless, in violation of a fundamental rule of claim interpretation. *See Becton, Dickinson and Co. v. Tyco Healthcare Grp., LP*, 616 F.3d 1249, 1257 (Fed. Cir. 2010) (“Claims must be ‘interpreted with an eye toward giving effect to all terms in the claim.’”).

Petitioner's apparent interpretation of the “determine a portion” requirement also stands in sharp contrast to the '413 patent's specification, which provides numerous examples of the system determining the less distorted portion between receipt of the image and its transformation. Ex. 2027, ¶62. For example, in Figure 2A, “an input image is obtained,” after which the center portion of the image “is **chosen** to be the region of interest that is most fully corrected and the distortion increases in each direction as the frame boundary is approached.” Ex. 1001, 3:63-64, 4:19-22. In addition, the portion “may dynamically change between images” in order to “follow a

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moving object.” Ex. 1001, 4:32-36. Such a determination requires first obtaining the image in order to locate the object that is being followed.

Other means of “determin[ing] a portion” are possible as well. For example, a device may be configured by a user-selected mode that configures a warping function so that less distortion occurs in the center portion, such as in GoPro’s commercial embodiments which allow a user to select between different modes (*e.g.*, Superview or Wide view) that result in a warping grid that yields different, less distorted portions when applied to the image. Ex. 1001, Abstract (“In one embodiment, the output image is non-linearly warped relative to the input image such that a distortion in the output image relative to the input image is greater in a corner region of the output image than a center region of the output image.”), 2:15-20 (same); Ex. 2027, ¶63.

Meulen, by contrast, provides absolutely no disclosure of “determin[ing] a portion,” as claimed. Instead, Meulen merely states that a certain portion of the image has less compression. But nowhere does Meulen suggest or teach that this less-distorted portion was determined as a separate step between receipt of the image and transformation of the image.

In fact, a POSITA would have understood that the various tables in Meulen simply describe different embodiments of ***pre-assigned*** portions that

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are result of the compression itself. Ex. 2027, ¶64. This is made clear by Meulen describing Tables 1-4 as different possible “**implementations**” of the assigned compression ratio for the physical display regions, as opposed to different choices that can be determined after receipt of the image but prior to the alleged transformation. Ex. 1007, 5:31-37. Dr. Katsaggelos confirmed this understanding. Ex. 2026, 20:18-22 (agreeing that “the regions are all pre-assigned some compression ratio”), 23:3-6 (agreeing that Meulen’s examples are different “embodiments”).

Indeed, Dr. Katsaggelos described Meulen’s designation of portions as “a designer’s choice,” a choice by “the person who implement[s]” the algorithm. *Id.*, 22:24-23:2, 23:7-17. As explained by Dr. Foroosh, what this means is that Meulen’s algorithms are designed in **advance** by pre-assigning different compression ratios to different portions of an image. Ex. 2027, ¶65. When the image is delivered to the device, it simply executes an algorithm consistent with the pre-designed portions **without** a separate step of determining the portion. *Id.*

Petitioner’s invalidity theory is based on a flawed understanding of the claims. Even though Dr. Katsaggelos agreed that the “determining” step is a separate operation (Ex. 2026, 26:21-23), he later testified that the

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“determining” step and “transformation” step can be “all done in one step.” Ex. 2026, 28:15-23. Moreover, in response to a question as to whether the claimed “non-uniform shifting of pixels ... necessarily determine[s] a portion,” Dr. Katsaggelos confirmed that his understanding is that “the transformation [step] does both determining the portion and resulting in non-uniform shifts of the pixels” and that “[t]he transformation is the glue that makes everything happen here.” Ex. 2026, 30:2-18. He further testified that “[t]he determination of the portion and the application of a transformation is coupled together” and that they are “integral” and “intertwined” steps. *Id.*, 30:24-31:8. In other words, Petitioner’s invalidity grounds is based on the flawed theory that the “transformation” step necessarily results in the “determination” step. Ex. 2027, ¶66. Yet this is contrary to the law, which requires that limitations be distinct limitations and be construed to have meaning and not be rendered superfluous. *Wasica Fin. GmbH v. Cont’l Automotive Systems, Inc.*, 853 F.3d 1272, 1288 n.10 (Fed. Cir. 2017) (“It is highly disfavored to construe terms in a way that renders them void, meaningless, or superfluous.”). This is especially the case where, as here, the “determining” step was specifically added to the claims to overcome prior art that did **not** recite a separate step.

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In its Institution Decision, the Board noted that “[b]y identifying a central region of 200 pixels, Meulen determines a portion of the input image.” ID, 16. With respect, however, Meulen never discloses a separate machine-executable instruction for “identifying” this central region of 200 pixels. Ex. 2027, ¶67. Meulen makes clear that this is a predetermined region, with a predetermined compression ratio, and thus fails to disclose determining the portion *after* obtaining the image and *before* the transformation, which is what the claims require. Merely disclosing a portion that is less distorted does not meet the limitation, which was added to the claims in order to overcome prior art that merely disclosed a less-distorted portion.

For this reason, Meulen does not disclose or render this limitation obvious.

**D. Limitation 1[g]/2[e]: Meulen Does Not Disclose “Non-Uniform” Transformation**

The Challenged Claims require a transformation that “non-uniformly shifts the pixels.” As confirmed by Dr. Katsaggelos, the “non-uniform” transformation refers to a *non-linear* transformation. Ex. 2026, 34:7-13 (agreeing that “non-uniform shifting ... need[s] to apply a non-linear transformation”); Ex. 1001, Abstract (“[T]he output image is *non-linearly* warped relative to the input image”). Indeed, ’413 patent background

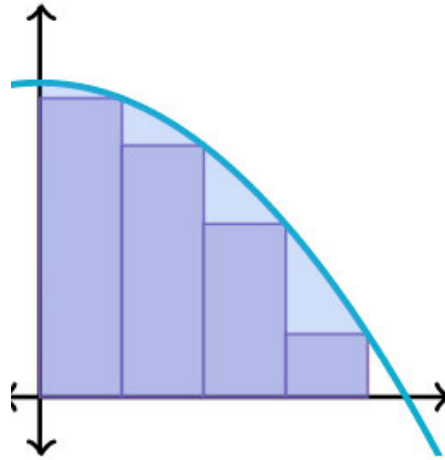
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describes the invention as an improvement over conventional linear scaling techniques which “introduce[d] perceivable distortion into the image.” Ex. 1001, 1:12-18. And, the embodiment described by reference to Figures 2A and 2B distinguishes between a “linear scaling function” and a “non-linear warping process,” teaching that this example of “non-uniform” pixel shifting involves both. Ex. 1001, 3:61-4:13. Thus, the “non-uniform” transformation of the Challenged Claims requires a non-linear transformation. Ex. 2027, ¶¶68-69.

Meulen, however, does not disclose a non-linear transformation—instead, Meulen describes a piece-wise linear transformation that merely approximates a non-linear transformation using multiple linear transformations. Ex. 2027, ¶70.

A piece-wise linear transformation involves the use of multiple linear transformations in an effort to approximate a non-linear transformation. Ex. 2027, ¶71. A classic example is the use of rectangles to approximate the area under a curve. *Id.* Instead of performing a non-linear calculation, the area is divided into multiple rectangles whose areas are significantly easier to calculate using a linear calculation (*i.e.* height \* width). *Id.* Since there are multiple rectangles, this constitutes a piece-wise linear transformation. *Id.*

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Meulen's transformation algorithm is fundamentally a piece-wise linear transformation, which involves applying different compression ratios to different vertical partitions of an image wherein the compression ratio is constant (*i.e.*, linear) within any single partition. Ex. 2027, ¶72. This is reflected, for example, in Meulen's Table 1.

TABLE 1

|                   | Region |     |      |     |     | Total |
|-------------------|--------|-----|------|-----|-----|-------|
|                   | 1      | 2   | 3    | 4   | 5   |       |
| Pixels/Region     | 10     | 50  | 200  | 50  | 10  | 320   |
| Compression Ratio | 4:1    | 2:1 | none | 2:1 | 4:1 |       |
| Source Pixels     | 40     | 100 | 200  | 100 | 40  | 480   |

Meulen's algorithm is a piece-wise linear transformation, because each partition is compressed using a linear transformation, and there are multiple partitions (*i.e.* multiple pieces). *Id.* Dr. Katsaggelos agreed that the

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compression in Table 1 could be interpreted as a piece-wise linear transformation. Ex. 2026, 46:15-22. Indeed, a POSITA would understand that the purpose of partitioning the image like this is to provide a linear approximation of a non-linear transformation. Ex. 2026, 41:9-43:3. This is because a piece-wise linear transformation is computationally “indistinguishable” to a linear transformation. Ex. 2026, 40:19-41:8.

By contrast non-linear transformations are generally complex, making them difficult to calculate and computationally expensive to implement. Ex. 2026, 40:1-7 (agreeing that linear approximations are used to “avoid the complexities of a non-linear calculation”); 38:23-39:3 (“[I]f it’s an extremely complicated non-linear function, it might take longer to implement.”); Ex. 2027, ¶73. Such non-linear transformations are described in the ’413 patent. For example, for horizontal pixel shifting, the ’413 patent provides the following sixth-order polynomial, where  $h$  is the horizontal coordinate. Ex. 1001, 6:65-7:5.

$$\Delta h/H = 0.1107h^6 + 0.534h^5 - 1.7813h^4 + 1.3167h^3 - 0.0722h^2 - 0.1073h$$

Similarly complex sets of equations are also provided for the vertical shift. Ex. 1001, 7:6-42; Ex. 2027, ¶74.

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These equations are applied to *every* pixel, and affect the shift of each individual pixel based on their precise horizontal and vertical position. No two pixels will have the same shift. Ex. 2027, ¶75. And not only would implementing these equations be computationally expensive, calculating the optimal sixth-order polynomial for pixel shifting is also complicated and expensive. *Id.* Dr. Katsaggelos even agreed that analyzing these sixth-order polynomials “is quite involved.” Ex. 2026, 37:21-23.

As a result, there is a significant difference between the piece-wise linear transformations described in Meulen and the non-linear transformations claimed in the '413 patent.

Dr. Katsaggelos at his deposition opined that piece-wise linear transformations, despite their name, are non-linear transformations, because they approximate non-linear transformations. Ex. 2026, 38:11-18. This is not correct, because there are key differences between piece-wise linear transformations and non-linear transformations. Ex. 2027, ¶76. The former merely approximates the latter by using multiple linear transformations. As a result, piece-wise linear transformations are “computationally indistinguishable” from linear transformations. Ex. 2026, 40:19-41:8. Indeed,

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the very reason to use piece-wise linear transformations is because they “avoid the complexities of a non-linear calculation.” Ex. 2026, 40:1-7.

Thus, the piece-wise linear transformations disclosed in Meulen are fundamentally different from the “non-uniform” (*i.e.*, non-linear) transformations required by the Challenged Claims.

**E. Limitation 1[g]/2[e]: The Combination of Meulen and Chao Does Not Render Obvious Pixel Shifting**

The Challenged Claims recites a transformation that “non-uniformly shifts the pixels” between input and output image. Petitioner apparently concedes that Meulen alone does not teach the pixel shifting required by the Challenged Claims. Pet. 91 (“Meulen mentions scaling, but does not disclose the details of how to perform scaling.”). Indeed, Meulen’s transformation is based on “compression,” which involves a *reduction* of pixels. Ex. 2026, 49:3-14. This is distinct from the pixel shifting required by the Challenged Claims.

Petitioner alleges that the combination of Meulen and Chao would render obvious non-uniform pixel shifting. Yet neither Meulen nor Chao describe pixel shifting, and thus the combination fails to render it obvious. Ex. 2027, ¶77.

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**1. Meulen Alone Does Not Disclose Pixel-Shifting**

Meulen describes a method for non-uniformly compressing or scaling an image, wherein a central region is not compressed, whereas the periphery of the image has increasingly higher compression ratios. Ex. 1007, 6:27-37; Tables 2-4. Thus, as described by Petitioner, a central region of 200 pixels is not compressed, whereas the edge regions of 40 pixels are compressed into 10 pixels. Pet. 89-90 (annotating Table 1, reproduced below).

**TABLE 1**

|                   | Region |     |      |     |     | Total |
|-------------------|--------|-----|------|-----|-----|-------|
|                   | 1      | 2   | 3    | 4   | 5   |       |
| Pixels/Region     | 10     | 50  | 200  | 50  | 10  | 320   |
| Compression Ratio | 4:1    | 2:1 | none | 2:1 | 4:1 |       |
| Source Pixels     | 40     | 100 | 200  | 100 | 40  | 480   |

But image compression or scaling is not pixel-shifting. Ex. 2027, ¶¶78-79. The '413 patent makes this clear, where pixel-shifting is described as “an **example** of a ... warping function.” Ex. 1001, 5:28-64 (“[P]ixels on the left half of the image **shifting** to the right”). The '413 patent explains that a pixel is shifted by using a “horizontal distortion **offset**” where “a point in image **moves** in a direction away from the reference edge divided by the image size H.” *Id.*, 5:43-47. In other words, the '413 patent teaches that “pixel-shifting”

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is just one of many examples of image warping, and in particular requires that a pixel **move** (*i.e.* **shift**) to a new location by a certain offset (such as calculated using the sixth-order polynomials discussed above).

Petitioner and its expert similarly describe pixel shifting as “shifting pixel **positions**.” Pet. 91; Ex. 1002, ¶262 (“shifting the pixels from the input positions to the output positions”); Ex. 2026, 80:8-12 (“Shift is a common word. Maybe it’s like **moving** something from one place to another [such as] [p]ixels or objects, foreground objects.”). A method for performing pixel shifting to reduce the number of pixels in an image would, for example, need to algorithmically decide which pixel is shifted, and which pixels are not, and the amount of the offset. Ex. 2027, ¶79.

Meulen does not describe that its image compression or scaling involves **moving** pixels from one position to another. Ex. 2027, ¶80. Instead, Meulen describes that its compression or scaling involves multiple “source pixels” compressed into a smaller number of “display pixels.” Ex. 1007, 6:27-36 (“The lateral display regions 140-1 and 140-5 each may comprise 10 pixels and subject media source content to a 4:1 image compression ratio (e.g., **40 source pixels to 10 display pixels**).”); 7:46-65; 8:12-47; 9:31-10:6. Meulen’s only disclosure for how compression is implemented is that it uses “polyphase

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filters arranged to sample a line of source pixels and to generate a compressed and/or scaled line of display pixels based on a compression factor.” Ex. 1007, 5:19-23. A POSITA would have understood that a polyphase filter involves combining a number of pixels into one pixel using multiple phases that can be reused for subsequent pixels. Ex. 2027, ¶81. Thus, rather than disclose that pixels are moved or shifted, Meulen instead discloses compression or scaling is achieved by combining multiple pixels into a single pixel.

Respectfully, the Board was incorrect to conclude that “by teaching image scaling, Meulen teaches that pixels are shifted based on a scaling factor from the input to output positions.” ID, 19. Indeed, Petitioner concedes that Meulen’s disclosure of image compression or scaling does not expressly describe pixel shifting. Pet. 91 (“Meulen mentions scaling, but does not disclose the details of how to perform scaling. To the extent that Meulen does not teach shifting pixel positions, it would have been obvious.”); Ex. 2027, ¶82.

Petitioner’s only argument that pixel shifting is obvious is its assertion that Chao discloses pixel shifting and that a POSITA would have found it obvious to combine Meulen with Chao. As explained below, however, Chao also does not disclose pixel shifting, the combination would not result in pixel

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shifting, and Petitioner does not provide an adequate rationale to combine the two references.

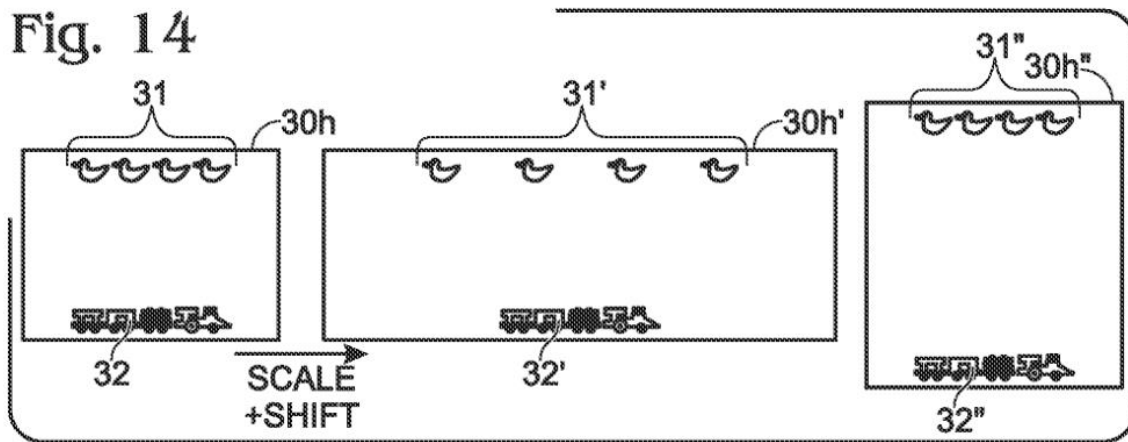
**2. Chao Does Not Disclose Non-Uniform Pixel Shifting**

Chao also does not disclose pixel-shifting, much less non-uniform pixel shifting. Ex. 2027, ¶83. Petitioner relies on Chao's disclosure that a "background element [of an image] is re-sized by stretching or shrinking" which "mean[s] the resizing of an element without regard to the original aspect ratio of the image." Pet. 91-92 (quoting Ex. 1008, ¶¶28, 63). Petitioner then asserts that "[a] POSITA would understand that stretching/shrinking means shifting the pixels' positions." Pet. 92. However, Chao never describes that stretching/shrinking involves shifting pixels, *i.e.* moving pixels from one position to a new position as opposed to adding/subtracting pixels through an interpolation or compression process. Ex. 2027, ¶¶84-85. Petitioner does not cite to anything beyond its expert's conclusory opinion that merely parrots the Petition. Ex. 1002, ¶263 ("A POSITA would have understood that stretching/shrinking means shifting the pixels positions to achieve a different size (resizing).").

The only "shifting" Chao describes is the shifting of *foreground* objects in conjunction with the stretching of the background. Ex. 2027, ¶86. For

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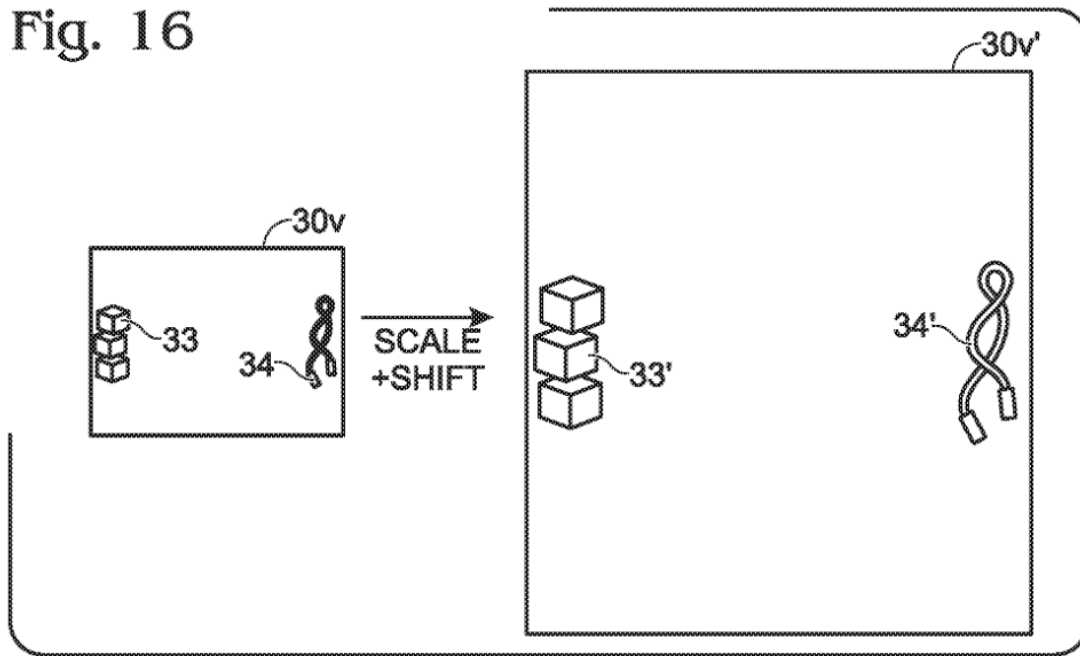
example, Figure 14 states that the transformation from image 31 to image 31' or alternatively image 31'' involves a "SCALE + SHIFT." Chao's specification explains that the foreground duck and train objects are "the same size" but are instead moved (*i.e.* shifted) to a different location. Ex. 1008, ¶91. This shifting is of entire **objects** (*e.g.* the ducks), and does not teach or suggest non-uniform **pixel** shifting, as claimed. Ex. 2027, ¶86.



In another example from Figure 16, the foreground objects 33' and 34' (the cubes and jump rope) are "scaled by a factor of 2x ... while maintaining the original aspect ratio" and then "repositioned." Ex. 1008, ¶94; Ex. 2027, ¶87.

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Fig. 16



Yet Chao makes clear that while the foreground objects may be shifted, this does not involve a non-uniform transformation. Ex. 2027, ¶88. Specifically, foreground objects are modified using “a uniform scaling factor along both the horizontal and vertical direction” such that the objects’ “aspect ratio ... may be **preserved**.” Ex. 1008, ¶93. Indeed, the entire purpose of using a uniform scaling factor and then repositioning is to avoid distortion of the foreground objects that occurred in prior art methods that changed the aspect ratio of the image. *Id.*, ¶2 (“As shown, the ducks that are used as upper border elements 31 have been stretched to fit the width of the image size, **distorting the original proportions** and overall look of the ducks.”).

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Petitioner fails to cite to anything from Chao that teaches or suggests the type of non-uniform pixel shifting required by the Challenged Claims. Thus, the combination of Meulen and Chao does not render obvious pixel shifting.

**3. Petitioner's Rationale to Combine is Conclusory**

Petitioner's combination also fails because Petitioner provides no required rationale for combining the two references. *See KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) ("Rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some **articulated reasoning with some rational underpinning** to support the legal conclusion of obviousness."); *Adidas AG v. Nike, Inc.*, 963 F.3d 1355, 1359 (Fed. Cir. 2020) ("The obviousness inquiry does not merely ask whether a skilled artisan could combine the references, but instead asks whether 'they would have been motivated to do so.'). Petitioner provides no motivation to combine Meulen and Chao, and merely asserts that it "involves combining prior art elements and known techniques." Pet. 92; Ex. 2027, ¶75. In addition, Petitioner does not at all discuss how the combination would reasonably expect to succeed, beyond a conclusory statement that is parroted by its expert. Pet. 92; Ex. 1002, ¶264. Without a rationale explaining a motivation and

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reasonable expectation of success, Petitioner's combination fails. *Regents of Univ. of Cal. v. Broad Inst., Inc.*, 903 F.3d 1286, 1291 (Fed. Cir. 2018) (“An obviousness determination requires finding that [a POSITA] would have been motivated to combine or modify the teachings in the prior art and **would have had a reasonable expectation of success in doing so.**”).

Thus, with respect, the Board was incorrect to conclude that Petitioner “has established a reason to combine Meulen and Chao with a reasonable expectation of success in doing so.” ID, 20. Petitioner's conclusory statements do not support a proper rationale to combine under Federal Circuit and Supreme Court precedent.

Moreover, a POSITA would **not** be motivated to combine Meulen and Chao. Ex. 2027, ¶¶89-90. As an initial matter, a POSITA would not have looked to Chao to modify Meulen. Meulen is concerned with modifying content from a media source to be displayed on a device's screen. Chao, by contrast, is directed to changing the aspect ratio of a document intended for **printing**.

The two references address different problems arising in different contexts. Ex. 2027, ¶91. For example, Meulen's compression is intended to avoid “black bar[s] on square displays” when viewing media source content

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on a display with a different aspect ratio. Ex. 1006, 1:26-29. Thus, the system is predesigned to compress the media content in a way that avoids distortion near the middle where the user's focus is more likely to be placed. Ex. 2027, ¶91. Chao, on the other hand, is directed to “professionally designed **borders** in [] photos, newsletters, postcards, greeting cards and the like.” Ex. 1008, ¶1. Chao thus discloses a graphic design solution aimed at avoiding distortion of **stylized borders** applied to a document that may be printed on differently-sized pages. Ex. 2027, ¶92. This is why Chao describes a method for separating foreground objects from background objects. *Id.* While this method makes sense for graphically designed borders that have usable metadata or discrete, pixel-defined elements (Ex. 1008, ¶25), it is not a suitable approach for resizing and shifting media source content elements for display on a mobile device like Meulen. *Id.*

Chao's approach is also incompatible with Meulen because it involves stretching/shrinking **only** the background and uniformly scaling and shifting entire foreground objects to be arranged in a stylized way suitable for graphic design. Ex. 2027, ¶93. For example, in Figure 14, Chao describes that for modified image 30h', “the ducks are the **same size** as the ducks on page 30h, but have been spread out so that the ducks on page 30h' occupy the same

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relative space as the ducks on page 30 h.” Ex. 1008, ¶91. Having the ducks “occupy the same relative space” between images is a **graphic design** concern, not a concern for adapting externally derived media source content (such as video from a DVD) for display on a fixed-size screen as taught by Meulen. It would simply not make sense for a system like Meulen to try to separate media source content elements and apply different transformations—preserving spacing between some, while imposing distortions on others—where there may be no meaningful way to distinguish between those elements. Ex. 2027, ¶93.

Accordingly, a POSITA looking to improve Meulen's aspect ratio conversion of media source content to be displayed on a screen would not look to Chao's methods for preserving graphic design borders on a document to be printed.

**F. Limitation 1[g]/2[e]: Meulen Does Not Disclose Non-Uniform Pixel Shifting Based On the Pixel's Position on the Horizontal and Vertical Axes**

The Challenged Claims require non-uniform pixel shifting that is “based on (1) the input positions along the first axis, and (2) the input positions along the second axis.” In other words, the amount of non-uniform pixel shift

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must be based on the horizontal and vertical position of the pixel, requiring non-uniform pixel shifting for both directions. Ex. 2027, ¶¶94-95.

Meulen does not disclose non-uniform pixel shifting based on both the horizontal and vertical axes. Ex. 2027, ¶96. As discussed above, Meulen's non-uniform compression is not non-uniform pixel shifting. But even assuming that it is, the non-uniform compression is not performed both horizontally and vertically.

In the various embodiments described by Meulen, its compression ratio only changes in the horizontal direction, not the vertical direction. Ex. 2027, ¶97. For example, in Table 1, each region is a vertical partition “defined by the 320 horizontal pixels of the display,” and therefore each region's compression ratio is only affected by the horizontal position of that region. Ex. 1007, 5:65-67. Thus, as confirmed by Dr. Katsaggelos, the compression ratio changes in a step-wise fashion “in the horizontal direction only.” Ex. 2026, 47:3-13. But in the vertical direction, “the compression ratio ... would stay the same” for a pixel no matter where it is located in the vertical direction. Ex. 2026, 47:14-22.

The Petition provides no explanation for how Meulen discloses non-uniform pixel shifting based on both (1) the input positions along the first axis,

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and (2) the input positions along the second axis. Ex. 2027, ¶98. The Petition instead merely cites (without explanation) Meulen's disclosure that "image compression and/or scaling may be applied in a horizontal direction and/or in a vertical direction." Pet. 91 (quoting Ex. 1007, 10:19-26). Yet Meulen does not disclose that the compression in the vertical direction is performed non-uniformly. Ex. 2027, ¶99. A POSITA recognizes that this cited passage from Meulen merely describes the possibility of applying the previously disclosed piecewise linear horizontal compression followed by a ***uniform*** vertical scaling. *Id.* Indeed, Meulen makes clear that if compression is "applied in both the horizontal and vertical direction," it is still only using the horizontally-aligned "lateral display regions 202-1-4 and 202-6-9." Ex. 1007, 10:21-26.

By contrast, the '413 patent provides an example in Figure 2A where non-linear warping occurs on both axes. Ex. 1001, 4:9-13 ("[A] non-linear warping is applied which results in the circles being stretched/compressed by different amounts ***depending on their horizontal and vertical positions*** resulting in example image 216."). Figure 2A, which is described by language tracking the claim language, clearly shows non-linear warping of the

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circles based upon their input horizontal and vertical positions. Ex. 2027, ¶100.

For these reasons, Meulen does not disclose non-uniform pixel shifting based on both (1) the input positions along the first axis, and (2) the input positions along the second axis.

**VI. OBJECTIVE EVIDENCE FURTHER DEMONSTRATES THAT THE '413 PATENT WAS NOT OBVIOUS**

Objective indicia of non-obviousness “may often be the most probative and cogent evidence in the record.” *Medtronic, Inc. v. Teleflex Innovations Sarl*, 70 F.4th 1331, 1342 (Fed. Cir. 2023). In considering such evidence, the Board should conduct a “a reasoned, collective weighing of its evidence of secondary considerations,” and not rely on “overly vague and ambiguous” “assignments of weight to different considerations.” *Volvo Penta of the Americas v. Brunswick Corp.*, 81 F.4th 1202, 1213-16 (Fed. Cir. 2023). Objective evidence includes “(1) commercial success, (2) copying, (3) industry praise, (4) skepticism, (5) long-felt but unsolved need, and (6) failure of others.” *Id.*, 81 F.4th at 1212.

Patent Owner GoPro markets and sells action cameras. For over a decade, these products have included the SuperView functionality, which embodies the '413 patent. Ex. 2006, ¶20; Ex. 2008. SuperView allows users

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to capture an immersive, wide-angle perspective through dynamic and non-uniform stretching of the video frame aspect ratio. The result is a unique and immersive perspective, providing more content within the output frame than the camera could have captured directly with the desired aspect ratio. SuperView is particularly useful for activities where the camera is facing towards or away from the user and mounted on the user's head, chest, or bike, such as in the cases of skiing, biking, motocross, or other active use cases.

There is strong and indisputable objective evidence of nonobviousness directed to the SuperView functionality found in GoPro's cameras.

**A. SuperView Practices the '413 Patent**

GoPro action cameras with SuperView practice at least claim 1 of the '413 patent. Ex. 2027, ¶130. The below analysis focuses on the GoPro HERO7, [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]

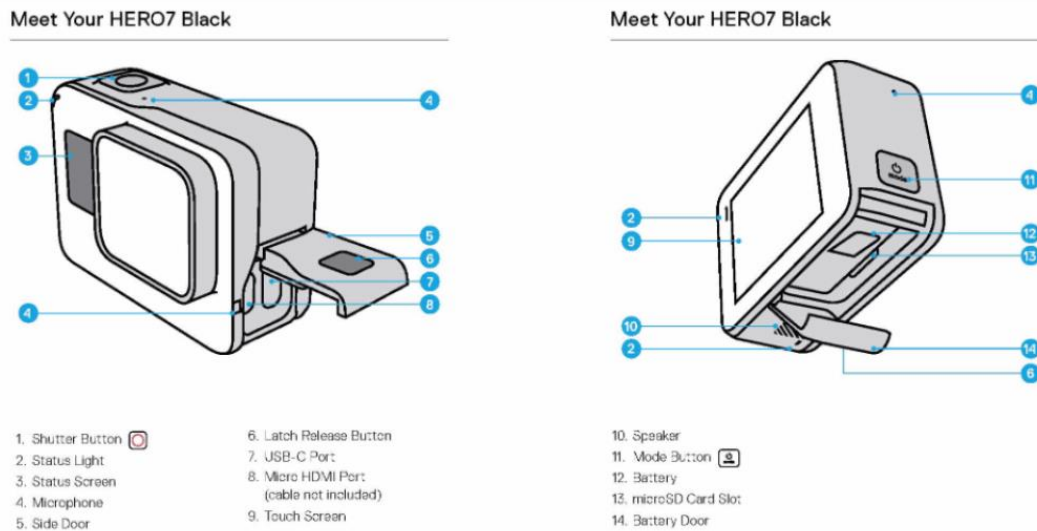
[REDACTED]

In addition, in the ITC litigation, Petitioner did not dispute that the HERO7 practices claim 1.

**1[pre]:** GoPro action cameras with SuperView are image capture apparatuses. Ex. 2027, ¶¶131-32. For example, the GoPro HERO7 has a video camera, and SuperView converts the aspect ratio of the captured video.

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Ex. 2028, 4, 47 (“SuperView stretches 4:3 content to fit a 16:9 screen.”); Ex. 2010, 1 (“Superview allows you to capture an immersive, wide-angle perspective. This mode takes a 4:3 aspect ratio video and dynamically stretches it to a 16:9 aspect ratio video.”).



**1[a]:** GoPro action cameras with SuperView have an image sensor which captures an input image with a source aspect ratio of 4:3. Ex. 2010, 1; Ex. 2027, ¶¶133-34. For example, the HERO7 “has a 12MP sensor that produces images in a 4:3 aspect ratio.” Ex. 2029, 3; Ex. 2028.

**1[b]:** GoPro action cameras with SuperView have a display coupled to a physical processor. Ex. 2027, ¶¶135-36. For example, the HERO7 has a [REDACTED] Ex. 2030, 1.

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**1[c]:** The HERO7 has a [REDACTED] that stores code that runs on the processor. Ex. 2030, 1; Ex. 2027, ¶¶137-38.

**1[d]:** See 1[a]. Ex. 2027, ¶139.

**1[e]:** GoPro action cameras use a warping grid that determines a portion within each frame of a captured video, *i.e.* the input image. Ex. 2027, ¶¶140-41. Different video settings are selectable (SuperView, Wide or Linear), which affects which code is used to compute the warping grid. Ex. 2028, 16.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

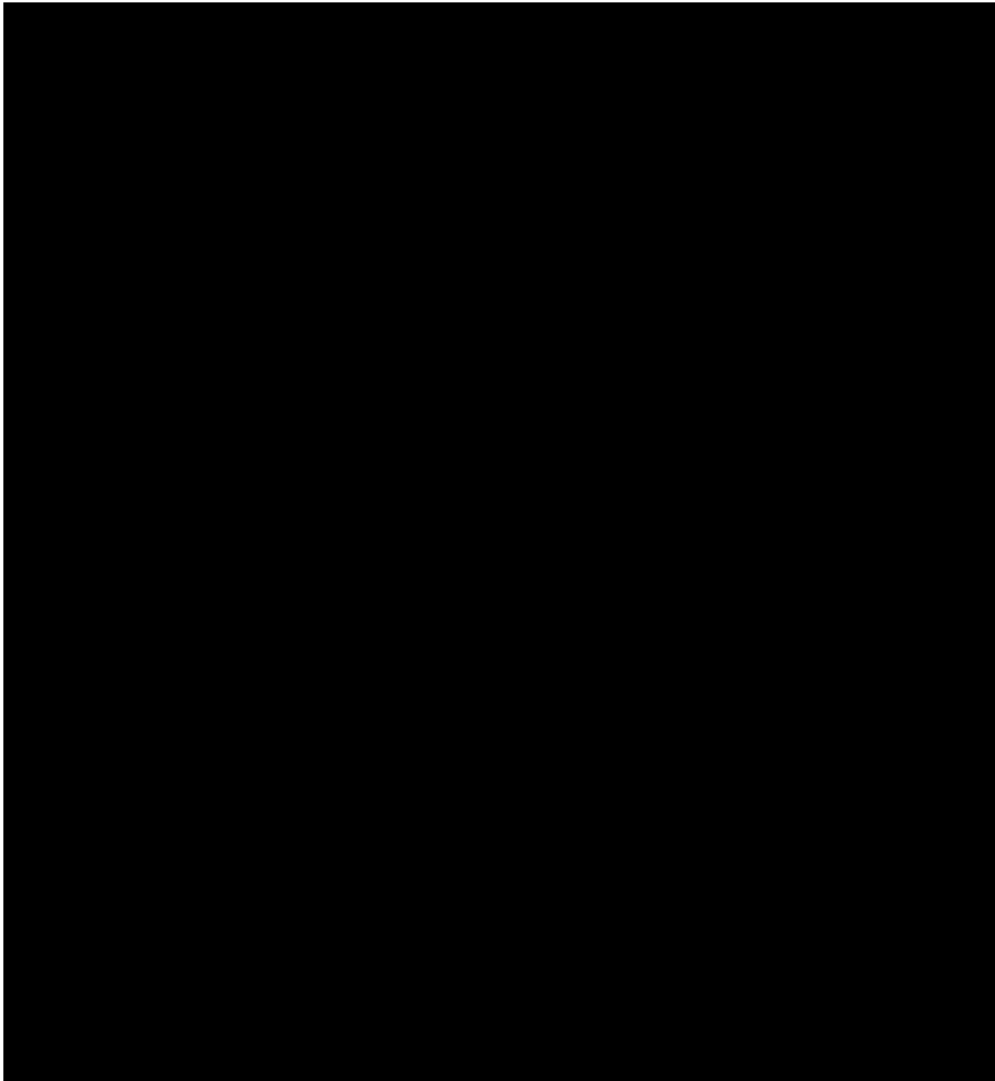
[REDACTED]

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[REDACTED]

[REDACTED]

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[REDACTED]

[REDACTED]

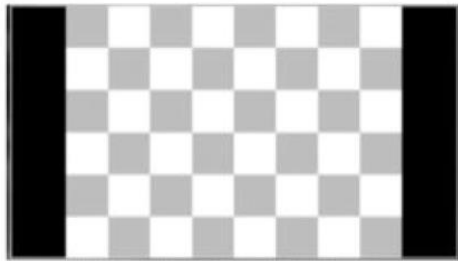
[REDACTED] Ex. 2027, ¶145.

**1[f]:** SuperView converts an 4:3 input image to a 16:9 output image by

[REDACTED]. Ex. 2010, 1 (“This mode takes

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a 4:3 aspect ratio video and dynamically stretches it to a 16:9 aspect ratio video.”); Ex. 2028, 47; Ex. 2027, ¶¶146-47.



Standard 4:3 Aspect Ratio image

- Footage is captured in a tall 4:3 aspect ratio to frame all the action but does not fill the screen when played back



SuperView

- The camera dynamically stretches the footage to a wide 16:9 aspect ratio for full screen playback.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

1[g]: [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

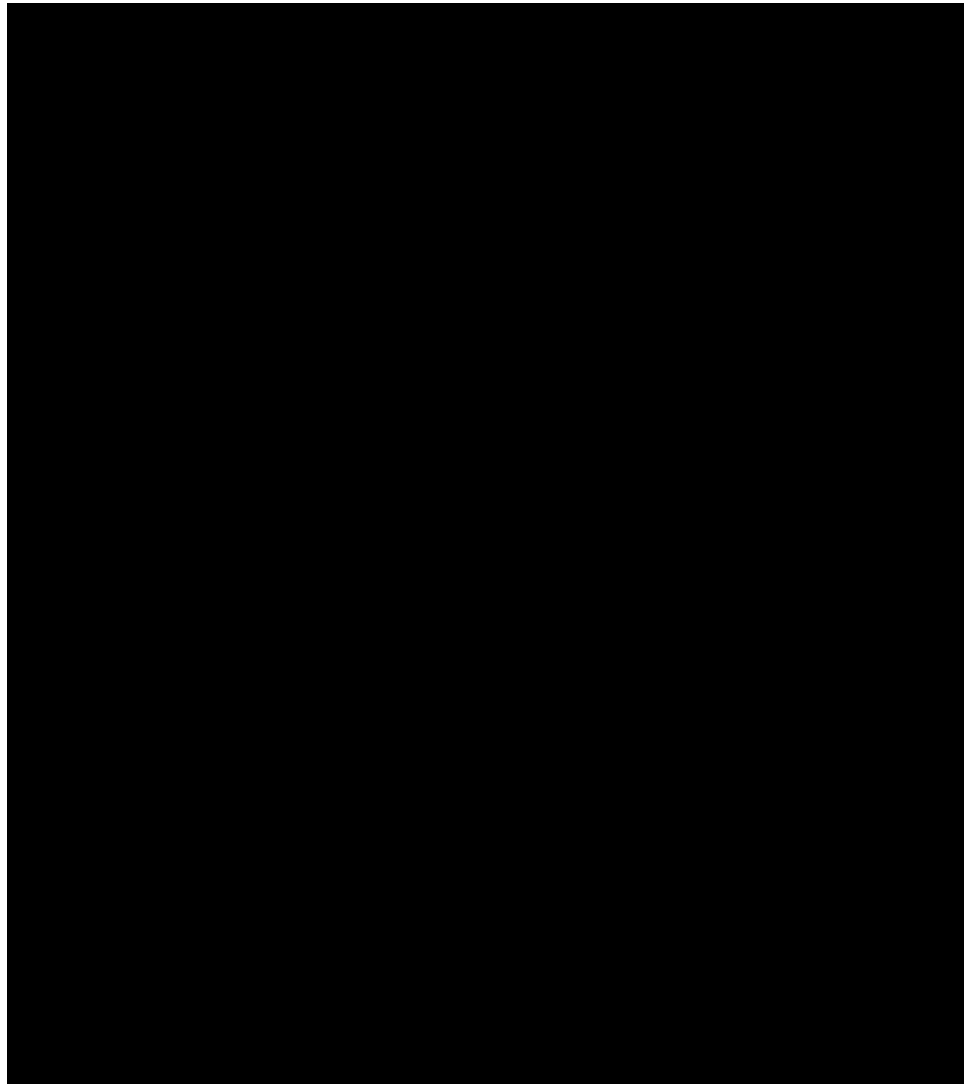
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**1[h]:** [REDACTED]

[REDACTED] [REDACTED] [REDACTED]

[REDACTED]

[REDACTED]



**1[i]:** The SuperView-enhanced image is presented on the display of the action camera. Ex. 2028, 47 (“SuperView stretches 4:3 content to fit a 16:9

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screen.”); Ex. 2010, 1 (“Superview allows you to capture an immersive, wide-angle perspective. This mode takes a 4:3 aspect ratio video and dynamically stretches it to a 16:9 aspect ratio video.”); Ex. 2027, ¶¶153-54.

**B. Nexus**

As explained by Patent Owner's Senior Vice President of Product Pablo Lema, there is a direct nexus between SuperView and the objective evidence. Ex. 2024. Beyond the industry praise and copying of SuperView by others, including Petitioner, SuperView was a key reason for the success of GoPro's HERO7, which was released in September 2018 and “fundamentally transformed both GoPro and the broader action camera market.” Ex. 2024, ¶¶6, 10 (“Internally, we considered HERO7 Black to represent a clear before-and-after moment for GoPro and for the action camera market more broadly.”). The HERO7 was the first action camera to release a separate feature called “HyperSmooth” (which embodies other patents owned by GoPro) which was complemented and enhanced by the preexisting SuperView feature. Ex. 2024, ¶¶7-8 (“GoPro's approach of ***embracing distortion***, rather than avoiding it, allowed us to achieve surprising results, enhancing the dynamic and immersive feel of videos.”).

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As a result of this approach, “HERO7 Black became the fastest-selling product launch in GoPro’s history at the time,” with sales jumping 170% compared to HERO6. *Id.*, ¶11.

GoPro also performed a hardware segmentation study in 2022. *Id.*, ¶¶14-19; Ex. 2040. The purpose of the study was to segment GoPro’s customers into four groups, and to evaluate which features mattered most to each group. Ex. 2024, ¶16. While the study focused on the relative importance of 33 features, GoPro considers *all* of those 33 features its key drivers of customer demand. *Id.*

The “Advanced video stabilization” feature encompassed HyperSmooth and Horizon Leveling, and the “Wide variety of modes and settings” category encompassed GoPro’s SuperView feature. *Id.*, ¶17. Among the “Core HEROes” segment, for example, “Advanced video stabilization” was ranked the most important, and “Wide variety of modes and settings” was ranked 7<sup>th</sup>. Ex. 2040, 10. These categories were also ranked highly for other segments representing GoPro’s historical customer base (Lightweights, Overcapturers, and Easygoing HEROes). *Id.*, 12-14; Ex. 2024, ¶¶19, 15. This confirms that SuperView is a driver of GoPro’s commercial success.

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In another GoPro study conducted at the end of 2022, actual purchasers of the HERO11 Black were surveyed to identify which features drove their purchase decisions. Ex. 2024, ¶20; Ex. 2019. HyperSmooth was the top reason for purchase, and SuperView ranked twelfth. Ex. 2019, 14.

Because of these features, including SuperView, the HERO7 Black received industry recognition, including the Technology & Engineering Emmy award in 2022, the CES Innovation Award in 2019, and the Lucie Technical Award for best special-purpose compact camera. Ex. 2024, ¶22.

**C. Copying**

Copying is “strong evidence of nonobviousness.” *Volvo Penta*, 81 F.4th at 1213 (quotation and citation omitted). Importantly, “the relevant copying inquiry involves a comparison of the competitor’s product with the allegedly copied product, rather than the patent’s claims.” *Medtronic*, 70 F.4th at 1340. Copying can be established by circumstantial evidence such as access to and development of a substantial similar product. *Id.* at 1340.

Here, there is significant direct evidence of copying, including by Petitioner. Ex. 2027, ¶¶156-57. Petitioner’s products use a remarkably similar-sounding feature called ActionView, which Petitioner describes as “optimized specifically for action PoV shots, with a taller height” and that it

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should be used for shots that have an “immersive first-person view, ideal for skiing, cycling and more.” Ex. 2009. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Others have also copied GoPro's SuperView. Ex. 2027, ¶159. For example, a “superview” project is described as “[a] small program that takes a 4:3 aspect ratio video file, and transforms it to a 16:9 video using the GoPro SuperView method.” Ex. 2011. Another called “SuperViou” is similarly described. Ex. 2012.

**D. Industry Praise**

GoPro has received significant industry praise for its cameras and SuperView functionality. Ex. 2027, ¶160. For example, in an industry article dated October 5, 2014, it characterizes SuperView as a “clever” feature that

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“is designed to capture a more immersive wide angle perspective.” Ex. 2013.

The article's publisher, New Atlas, is a significant presence in the industry, having a readership of “approximately four million unique visitors a month” and covers “advances in technology, science, transportation, architecture, design, and many other disciplines.” Ex. 2014.

Users of GoPro's products have also provided significant praise for the SuperView functionality. Ex. 2027, ¶161. One reviewer described “GoPro's unique Superview lens” which provides “a ridiculously wide angle which allowed even a selfie taken from just arms reach to capture all six of our family!” Ex. 2015. Users of a competitor product have also expressed a desire for competitors to copy GoPro's SuperView feature, such as the follow quotations from September 2019 through 2022. Ex. 2027, ¶162.

- “Hello, is there **any chance on getting a Superview-like mode** like the one in the Hero 7? Asking this because i bought the Osmo Action but since i'm a biker i think **it's a very important feature** and now i feel like i want to send the osmo back and buy a Hero 7.” (Post #1)
- “Hi, thank you for bringing this query for us. **As of the moment, we don't have this feature for the DJI Osmo Action.**” (Post #2)
- “Can you explain what ‘superview mode’ is?” (Post #4)

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- **“It's the famous GoPro mode** that enable the camera to record video in 4:3 to gain FOV and then stretch the image to reach the 16:9 ratio.” (Post #5)
- **“Thanks very much for the info and links. Technology is amazing** - they stretch out the sides or edges to fill the frame - **neat trick.**” (Post #7)
- **“2020 already, please for Superview Mode”** (Post #19)
- **“Any updates of when the superview like feature for Osmo action might land? That would be a game changer** and many of **my friends want to buy Osmo action but are retreating** because of this missing feature” (Post #21)
- **“Hi, wondering if this was ever considered?** I ended up buying a few of the original Osmo Action cameras and **this would be an awesome feature.** Converting in post is just torture. **A superview for motovlogging is a must.**” (Post #26)

Ex. 2016. Another post from the same forum describes SuperView as “essential” for the competitor add to the next firmware. Ex. 2017 (post #28 and 30); Ex. 2027, ¶163.

For its HERO7 Black achievements, of which SuperView contributed as discussed above, GoPro won the 2019 Consumer Electronics Show (“CES”) award, as well as the prestigious “Lucie” award, recognizing significant achievement in the photographic industry. Ex. 2036; Ex. 2037; Ex. 2038. GoPro also won the 73<sup>rd</sup> Technology and Engineering Emmy award. Ex. 2039; Ex. 2041; Ex. 2027, ¶164.

As discussed above, Mr. Lema testifies that GoPro saw significant success with the HERO7 Black, which SuperView contributed to. Ex. 2024, ¶¶5-13; *Cont'l Can Co. USA, Inc. v. Monsanto Co.*, 948 F.2d 1264, 1273 (Fed. Cir. 1991) (“It is not necessary ... that the patented invention be solely responsible for the commercial success, in order for this factor to be given weight appropriate to the evidence, along with other pertinent factors.”). ■■■

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“maintain[] the full field of view” but would “introduce[] perceivable distortion into the image.” *Id.*, 1:16-18.

At the time of the '413 patent, conventional wisdom was that introducing distortion into images was undesirable. Ex. 2027, ¶¶168-69; Ex. 2026, 87:21-23 (“If one has to choose distortion or non-distortion, one probably would choose the non-distortion option.”). For instance, distortion, particularly geometric distortion, can stretch or compress parts of the image in an uneven way, making faces or bodies look elongated, squished, or warped. *Id.* This effect is especially undesirable in personal or group photos, where people expect to see a realistic representation of themselves. Because of these reasons, photographers and camera designers traditionally seek to avoid or minimize distortion to maintain the integrity, realism, and appeal of their photos. *Id.* Indeed, GoPro explains on its website that Superview should not be used in conventional camera settings: “Avoid using SuperView when people are on the edges of the frame since they will be stretched a bit.” Ex. 2010, 1.

Given these challenges, a user of a camera was generally limited to capturing images with an output field of view having the same aspect ratio of the intended display or if aspect ratio conversion was performed it was done

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so as to avoid distortion. Ex. 2027, ¶170. For instance, in the ITC litigation, Petitioner relies on the Nikon D5200 Digital Camera as prior art. The D5200 manual is consistent with the '413 patent's description of the art. It applies conventional cropping based on user selection to create an associated image for a preview function (for video files), or a rote aspect ratio change (for image file). Ex. 2020, 120-21 ("Rotate the command dial to switch between aspect ratios of ratio 3:2, 4:3, 5:4, 1:1, and 16:9."; "Use multi selector to position the crop."); Ex. 2027, ¶170. In other words, the D5200 reflects the conventional understanding of how cameras should perform aspect ratio conversion when displaying images on the camera by teaching the type of conventional cropping that the specification of the '413 patent improves upon. Ex. 1001, Abstract, 1:7-25, 5:9-13.

While conventional cameras seeks to eliminate distortion when displaying on the preview screen, GoPro took a 180-degree approach: introducing distortion when displaying on the screen. Ex. 2027, ¶171. In particular, GoPro's SuperView invention utilizes a sensor that captured an image in one aspect ratio (4:3) so that the image can be "taller," and then allowed it to be displayed and previewed on the screen in aspect ratios that are more commonly used in video settings (*e.g.*, 16:9). To do this, however,

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GoPro had to intentionally introduce distortion into the image. SuperView thus applies a warping function that distorts the edges while eliminating distortion in the center. GoPro's unconventional approach arises from the fact that GoPro's cameras are directed at action sports, not conventional photography. Ex. 2027, ¶171. GoPro recognized that video for certain action sport scenes, like skiing, surfing and bicycling, result in persons being centered in the middle of the shot, with no persons on the edges. This means that the periphery can be distorted in an acceptable manner. In fact, GoPro recognized that the peripheral distortion was *beneficial*, leading to more immersive and exciting action video footage.

Consider surfing as one example. Ex. 2027, ¶172. A surfer capturing himself in a "barrel" benefits from a taller image because he or she can see more of the wave, and the distortion at the periphery is not only acceptable but provides a more immersive video shot, conveying speed and motion at the edges:

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Ex. 2021.

Thus, the SuperView functionality met the long-felt need of producing high-quality, wide-angle video for action cameras through the use of non-linear distortion, which was an unexpected result. Ex. 2027, ¶173.

**VII. THE REMAINING GROUNDS ALSO FAIL**

The Board correctly concluded that Grounds 1 and 3<sup>2</sup> fail to establish unpatentability of claims 1, 6, and 7, and Petitioner cannot present any new evidence to cure the deficiencies identified by the Board. Ex. 2027, ¶101.

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<sup>2</sup> Ground 2 challenges claims that were disclaimed and therefore is no longer part of this proceeding.

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In particular, the Board correctly concluded that “Petitioner does not appear to rely on any evidence in Grounds 1 and 3, other than [] Dr. Katseggelos’s testimony, for its assertion that in 2013, cameras captured images in one aspect ratio and stored or displayed those images in a different aspect ratio.” *Id.*, 35. Thus, because Petitioner’s motivation to combine “rests on a specific factual assertion,” Dr. Katsaggelos’s testimony “would be given little weight in the obviousness analysis.” *Id.* (citing 37 C.F.R. § 42.65(a)).

For these and other reasons, Grounds 1 and 3 also fail.

**A. Ground 1: Fleming Does Not Render Obvious the Challenged Claims**

**1. Summary of Fleming**

Fleming is directed to a computer system that adjusts an image’s aspect ratio for an external device. Thus, in Fleming’s computer system, a video signal is received from an external device, such as an “RGB” video connection. The computer system converts the aspect ratio of the image, which is then displayed on an external display. Fleming does not disclose that its computer system contains a camera or other image sensor for capturing images. Ex. 2027, ¶102.

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**2. Fleming Does Not Render Obvious Performing Non-Uniform Shifting on an “Image Capture Apparatus” or “Camera”**

The Challenged Claims require that the transformation be performed by the image capture apparatus itself. Ex. 2027, ¶¶103-04. For example, claim 1 requires that claimed machine-readable instructions be contained within an “image capture apparatus” and that they apply a transformation to the “input image” that is captured by the “image sensor” of the same “image capture apparatus.” Claims 6 and 7 likewise require that the machine readable instructions for applying the transformation be “included within a camera.” For all grounds, including Ground 1, Petitioner focuses on claim 6 first, and then relies on its claim 6 analysis for claim 1’s limitations of “image capture apparatus” and “image sensor.”

Petitioner does not contend that Fleming discloses a “camera” or an “image capture apparatus.” Pet. 28-29 (analyzing claim 6), 37 (relying on claim 6 analysis). Instead, Petitioner asserts “[i]t would have been obvious for Fleming’s data processing system (including its GPU and CPU) to be included within a camera.” Pet. 28. In particular, Petitioner asserts it would have been obvious to use Fleming’s non-linear distortion techniques in order to convert the aspect ratio of the captured image to the aspect ratio of the

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image as a stored file or when displayed on an LCD included with the camera. *Id.* However, Petitioner's obviousness theory is fundamentally flawed for several reasons. Ex. 2027, ¶¶105-06. *First*, Petitioner provides no evidence that any camera in 2013 used different aspect ratios for capturing images and displaying them on a preview screen. *Second*, Petitioner's alleged "motivation" is conclusory and not in any way related to non-linear distortion. *Third*, Petitioner does not contend that the combination would have a reasonable expectation of success.

*First*, Petitioner does not provide a single shred of evidence that any cameras in 2013 had an "aspect ratio of the captured image [that] was different than the aspect ratio of the stored file or the LCD display included in the camera." Pet. 28. Without such a difference in aspect ratio, there would be simply no reason to use Fleming's system for converting aspect ratios. Ex. 2027, ¶107. Camera designers in 2013 did not contemplate capturing images in one aspect ratio and storing or displaying them in a different aspect ratio—a POSITA recognizes it would, in fact, be "less burdensome, cheaper, and save[] time" to use the same aspect ratio. *Id.* Indeed, as Dr. Katsaggelos admitted, conversion of aspect ratio will ***always*** involve some distortion. Ex. 2026, 87:24-88:5.

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Moreover, as discussed above, non-linear transformations were expensive to design and implement, and required significant processing power to execute. Portable devices and cameras in 2013 had limited processing power and battery life that a POSITA would find undesirably wasted if every photograph had to have its aspect ratio converted due to a mismatch between the image sensor and the display screen. Ex. 2027, ¶108. As a result, a POSITA would have found it much more preferable for the camera and display to have the same aspect ratio in order to avoid distortion of the image and the expensive non-linear transformations claimed in the '413 patent. *Id.*

Petitioner's lack of evidence on this fundamental point is fatal to its obviousness theory. *See Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1363 (Fed. Cir. 2016) (“[W]hile ‘common sense’ can be invoked, even potentially to supply a limitation missing from the prior art, it must still be **supported by evidence** and a reasoned explanation. ... [O]ur search for a reasoned basis for resort to common sense **must be searching.**”). The Board made a similar conclusion in its Institution Decision. ID, 35.

Even assuming for the sake of argument that some different capture/display aspect ratios were used, Petitioner ignores that the conventional approach to dealing with these types of aspect ratio mismatches

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in 2013 was to apply cropping, linear scaling, or padding, which all would have been adequate for the type of preview screens embodied in digital cameras in 2013. Ex. 2027, ¶109. As discussed above, *supra* Section VI.F, this was the approach used by the prior art Nikon D5200 Digital Camera. Any argument by Petitioner that different image sensor and preview display aspect ratios necessarily obviate the claimed invention rests on impermissible hindsight.

*Second*, Petitioner's terse and conclusory "motivation"—that "hav[ing] on-camera processing and display capabilities because it would have been less burdensome, cheaper, and saves time"—is not in any way tied to the teachings of Fleming that Petitioner relies on—specifically its use of non-linear distortion to convert aspect ratios from an image on a camera to an external display device such as a television. Ex. 2027, ¶110. It is Petitioner's burden to prove some motivation for a POSITA to incorporate Fleming's non-linear distortion into a camera, not generic "on-camera processing and display capabilities" which a conventional digital camera from 2013 almost certainly already had. Petitioner provides no such motivation.

Indeed, it would have been "less burdensome, cheaper, and save[ more] time" to not perform the claimed aspect ratio conversion that requires non-

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linear distortion. Ex. 2027, ¶111. As discussed above, a POSITA would have understood that the claimed non-linear transformations are generally complex, making them difficult to calculate and computationally expensive to implement. Ex. 2026, 40:1-7 (agreeing that linear approximations are used to “avoid the complexities of a non-linear calculation”); 38:23-39:3 (“[I]f it’s an extremely complicated non-linear function, it might take longer to implement.”). This is why prior art like Meulen used piece-wise linear transformations on its portable device that could only at best approximate non-linear transformations, which are “computationally indistinguishable” from linear transformations. Ex. 2026, 40:19-41:8. Indeed, the very reason to use piece-wise linear transformations is because they “avoid the complexities of a non-linear calculation”. Ex. 2026, 40:1-7.

Moreover, at the time the ’413 patent was filed in 2013, it was understood that performing non-linear distortion was undesirable for a device like Fleming that took still images of scenery. Ex. 2027, ¶112; Ex. 2026, 87:21-23 (“If one has to choose distortion or non-distortion, one probably would choose the non-distortion option.”). This is because non-linear distortion results in distortions that would make the scene look unnatural—especially if there are persons in the field of view. *Id.* Indeed, Chao itself

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indicates that distortion is not desirable, and therefore provided a method where foreground objects in an image are not distorted in order to “maintain[] the original design intent of the image.” Ex. 1008, ¶¶2, 3.

For example, Exhibit 2003, which is a discussion of the feature that is embodied by the '413 patent, GoPro SuperView, provides examples of how the distortion from SuperView can look unnatural for still images. For example, the first image below does not use non-linear distortion, whereas the second one does, which has highly visible and jarring distortions. Ex. 2027, ¶112.



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The article concludes that this functionality is “not especially useful for ... any time that the highly distorted and compressed look is going to appear strange,” such as “standard people shots.” Ex. 2003, 6. Instead, the non-linear distortion is more appropriate for “body- and gear-mounted shots” where one may be “shooting in a tight space” or “want to make sure that your subject remains in the frame.” *Id.*; Ex. 2027, ¶113.

In addition, it was well-known that wide angle shots were typically shot with fish-eye lenses, which resulted in distorted images. Ex. 2027, ¶114. There are numerous prior art references that discuss processing such images to **remove** such distortions. See, e.g., Ex. 2004, Abstract (“A wide angle lens system **distorts the image** and conveys it to an image sensor, which converts

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the image to an electronic signal and conveys it to image processing circuitry. The image processing circuitry ***corrects the distortion*** or transforms it to human recognizable image forms.”); Ex. 2005, Abstract (“A digital photographing apparatus for ***correcting image distortion*** performs an image distortion correcting method.”). Thus, a POSITA would have understood that distortions were undesirable. Ex. 2027, ¶114.

Thus, not only would the claimed non-linear distortion not be “less burdensome, cheaper, and saves time” as Petitioner asserts, it would instead result in a highly distorted, unnatural look to the still photographs of scenery that Fleming contemplates. Ex. 2027, ¶115.

*Third*, Petitioner does not assert nor provide any evidence that a POSITA would have had a reasonable expectation of success incorporating Fleming’s teachings into a camera. Ex. 2027, ¶116. As a result, Petitioner has not provided a *prima facie* case for obviousness and this ground must be denied. *Regents of Univ. of Cal. v. Broad Inst., Inc.*, 903 F.3d 1286, 1291 (Fed. Cir. 2018) (“An obviousness determination requires finding that [a POSITA] would have been motivated to combine or modify the teachings in the prior art and ***would have had a reasonable expectation of success in doing so.***”); *NJOY, LLC et al. v. JUUL Labs, Inc.*, IPR2024-00267, Paper 15

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at 38-39 (June 12, 2014) (denying institution because “Petitioner never mentions a reasonable expectation of success”).

For these reasons, Petitioner's rationale to incorporate Fleming's system into a camera is fundamentally flawed and should be rejected.

**3. Fleming Does Not Render Obvious “Determine a Portion Within the Input Image”**

As discussed above for Ground 4, the challenged claims each recite a separate step of “determin[ing] a [less-distorted] portion within the input image” *after* obtaining the image and *prior* to the transformation of the image. This limitation was added to the claims to overcome prior art that merely disclosed transformation of an image resulting in a less-distorted portion.

Petitioner's analysis for Ground 1 is as flawed as its analysis for Ground 4. For Ground 1, Petitioner relies on Fleming's “graphics processing unit” and “central processing unit” as performing the claimed steps. Pet. 12. Yet for the “determin[ing]” step, Petitioner provides *no explanation* as to how the GPU or CPU perform a separate “determine a portion within the input image” step after receiving the image and prior to transformation. Pet. 14-15. Instead, the entirety of Petitioner's analysis is reproduced below:

Fleming discloses “maintain[ing] the original aspect ratio in an area of interest (e.g., at the center of the image).” (EX1004, 4:39-40.) In Figure 2 (below), for example, “a square region at the center of image

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271 is mapped (or scaled).” (EX1004, 5:1-2, 5:17-66, Figs. 2, 3.) A POSITA would have understood that a region at the center of the image includes a subset of the pixels within the input image. (EX1002, ¶¶59-62.)

Pet. 15.

Notably missing from Petitioner's analysis is any discussion of how Fleming teaches that the GPU or CPU “determine[s]” the less distorted portion of the image after it obtains an image and prior to transformation. Ex. 2027, ¶¶117-120. Indeed, Fleming discloses that an “area of interest” or a “square region at the center” has minimal or no distortion, that simply describes the effect of the transformation, not a separate “determine” step prior to the transformation. Ex. 2027, ¶120. Instead, a POSITA would understand that Fleming's “area of interest” is simply programmed as part of the specific implementation of Fleming's nonlinear scaling without an earlier determination step. Ex. 2027, ¶121. This is why Fleming describes the undistorted “area of interest” as part of the process of “scal[ing] nonlinearly” the image. *See, e.g.*, Ex. 1004, 4:49-51 (“In the example of FIG. 2, image 271 is scaled nonlinearly in the horizontal direction”). As discussed above, Petitioner's invalidity theory is based on a flawed understanding of the patent that does not treat the “determine” step as a separate step and renders it superfluous.

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This is in sharp contrast to the disclosures of the '413 patent discussed above, where based on numerous factors such as characteristics of the image and desired overall distortion, the system creates a “resolution remapping” where some portions are less distorted and other portions are more, and the “remapping” is then applied as a transformation to the image. Ex. 1001, 3:39-45; Ex. 2027, ¶122.

Accordingly, Petitioner has failed to establish that Fleming teaches or renders obvious “determin[ing] a portion” that will be less distorted.

**B. Ground 3: Obara Does Not Render Obvious the Challenged Claims**

**1. Summary of Obara**

Obara is also directed to a “personal computer” that performs AV processing similar to “audio/video (AV) apparatuses such as DVD (Digital Versatile Disc) players and TV apparatuses.” Ex. 1006, ¶9. Thus, in Obara, the image that is processed is “received by the TV tuner.” *Id.*, ¶34; Ex. 2027, ¶124.

**2. Obara Does Not Render Obvious Performing Non-Uniform Shifting on an “Image Capture Apparatus” or “Camera”**

Petitioner's assertions for Obara for this limitation are largely identical as its assertions for Fleming in Ground 1. Petitioner does not contend Obara

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discloses a “camera” or an “image capture apparatus.” Pet. 71-72 (analyzing claim 6), 78-79 (relying on claim 6 analysis). Petitioner argues it would have been obvious “for Obara’s image processing unit and CPU 111 to be included within a camera” for the same reasons as given for Fleming. Pet. 71-72. These arguments fail for the same reasons discussed for Ground 1—namely, that Petitioner does not provide any evidence of cameras that performed aspect ratio conversion on-camera, and that a POSITA would not find it desirable to perform non-linear distortion on the still images captured by Obara’s device. Ex. 2027, ¶¶125-26. And Petitioner again fails to assert that the combination would have a reasonable expectation of success. *Id.* Accordingly, Petitioner’s arguments are flawed for the same reasons discussed for Ground 1.

**3. Obara Does Not Render Obvious “Determine a Portion Within the Input Image”**

Petitioner relies on Obara’s “CPU” as performing the claimed steps. Pet. 51. Yet as with Ground 1, Petitioner does not provide any explanation as to how the CPU performs a separate step of “determin[ing] a portion within the input image.” Pet. 55-58; Ex. 2027, ¶¶127-28. Petitioner merely quotes Obara’s disclosure that the “non-linear scaling module 215 vertically divides the original image data (A) into, for example, eight image blocks” where

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“blocks 3, 4, 5 and 6 which belong to the central area.” Pet. 56. Petitioner then asserts that “blocks 3-6 at the central area” is the claimed portion. Pet. 56. No discussion is given as to how Obara’s CPU determines that those blocks are the claimed portion, or how it is a separate step performed after receiving the image and before the transformation. Ex. 2027, ¶128. Again, this is in sharp contrast to the disclosures of the ’413 patent wherein the less distorted portion and the more distorted portion are determined as a “resolution map[]” based on a number of factors which is then applied as a transformation to the image, and that the remapping can change depending on said factors. Ex. 1001, 3:39-45.

Accordingly, Petitioner has failed to establish that Obara teaches or renders obvious “determin[ing] a portion” that will be less distorted.

**VIII. CONCLUSION**

For the foregoing reasons the Board should deny institution of this petition.

Date: April 18, 2025

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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 13,090 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 April 18, 2025 upon the following parties via Electronic Mail:

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