

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TESLA, INC.,

Petitioner,

v.

INTELLECTUAL VENTURES II LLC,

Patent Owner.

Case No. IPR2025-00222

U.S. Patent No. 9,232,158

**DECLARATION OF DR. ELI SABER IN SUPPORT OF
PATENT OWNER'S RESPONSE**

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I, Dr. Eli Saber, do hereby declare:

I. INTRODUCTION

1. I am making this declaration at the request of Intellectual Ventures II, LLC (“Intellectual Ventures”) in the matter of the *Inter Partes* Review (“IPR”) proceedings before the United States Patent and Trademark Office (“USPTO”) of U.S. Patent No. 9,232,158 (“the ‘158 Patent”) to provide expert technical opinions with respect to the ‘158 Patent.

2. I am being compensated for my work in this matter at my standard hourly rate for such consulting services. My compensation in no way depends on the outcome of this case, and I have no financial interest in the outcome.

3. In preparing this Declaration, I considered the following materials, the subject matter of which are all within the scope of my education and professional experience:

- The ‘158 Patent, Ex. 1001;
- The Petition for *Inter Partes* Review of U.S. Patent No. 9,232,158 (“Pet.”);
- the Declaration of R. Michael Guidash (Ex. 1003);
- JP Application Publication No. JP2003-319231 to Matsushima (Certified English Translation + Declaration + Japanese) (Matsushima) (Ex. 1007);
- U.S. Patent No. 6,611,289 (Ex. 1005)(Yu);
- U.S. Patent No. 7,365,780 (Ex. 1006)(Miyazaki);

- Exhibits 2007-2016; and
- Decision Granting Institution of Inter Partes Review (Paper, 10) (Institution Decision)

II. PROFESSIONAL BACKGROUND

4. Based on my qualifications, education, knowledge, expertise, experience, and work background, I believe I am qualified to offer opinions relating to the technology described in the '158 Patent. Exhibit 2006 is a copy of my current *curriculum vitae* ("CV"), detailing my education and experience. Additionally, the following overview of my background pertains to my qualifications for providing expert testimony in this matter.

5. I am a Professor in the Department of Electrical and Microelectronic Engineering (EME) and at the Chester F. Carlson Center for Imaging Science at the Rochester Institute of Technology (RIT) in Rochester, New York. I also serve as the Director of the Image, Video and Computer Vision Laboratory. I joined RIT's full-time faculty in 2004. I have over thirty-four (34) years of industry and academic experience, thirty (30) of which are in the fields of Computer Vision, Digital Image/Video Processing, Pattern Recognition and Machine Learning.

6. I received a Ph.D. in Electrical Engineering from the University of Rochester in 1996. My concentration was in Signal/Image/Video Processing, Pattern Recognition, and Computer Vision. I received a Master of Science Degree in Electrical Engineering from the University of Rochester in 1992 in the same

concentration as listed above, and I received a Bachelor of Science Degree in Electrical and Computer Engineering, *Summa Cum Laude*, from the State University of New York at Buffalo in 1988.

7. Before becoming a full-time professor, I worked for Xerox Corporation from 1988 to 2004. During my 16 years at Xerox, I was – generally speaking – responsible for: a) delivering color management solutions, image processing innovations, architectures, and algorithms for high-end color printing systems, b) xerographic sub-systems for a variety of color products, and c) control systems for toner production facilities. Among other roles, as an Advanced Development Scientist and Manager, I established the Advanced Design Laboratory – an Imaging/Xerographics lab – and provided technical and managerial leadership for the Electrical, Imaging and Xerographics Department. As a Product Development Scientist and Manager, I led the research and development of color management algorithms and image quality metrics for various product platforms. I also led the Image Science, Analysis, and Evaluation area, with twelve to fifteen direct reports and a budget of approximately \$2 million.

8. From 1997 until 2004, I was an adjunct faculty member at the Electrical Engineering Department of the Rochester Institute of Technology and at the Electrical & Computer Engineering Department at the University of Rochester. I was responsible for teaching undergraduate and graduate coursework in signal, image,

video processing, pattern recognition, and communications and performing research in multimedia applications, pattern recognition, image understanding and color engineering.

9. Since joining RIT full time, I have been responsible for teaching several undergraduate and graduate courses in Digital Signal Processing, Digital Image Processing, Digital Video Processing, Engineering Analysis, Random Signal & Noise, Advanced Engineering Mathematics, Matrix Methods, Pattern Recognition, Communications, Modern Control Theory, and Linear Systems.

10. I proposed, developed and introduced the “Digital Video Processing” and the “Advanced Neural Network and Deep Learning: Part 1” courses; and reestablished the Pattern Recognition course at the Electrical Engineering Department at RIT. These graduate courses were instrumental in providing MS/PhD students with the proper foundation and knowledge in all aspects of the subject areas in order to perform in-depth research in the field and continue to advance the state of the art.

11. The Digital Video Processing course is designed to provide a thorough and comprehensive coverage of the field. Topics covered include the mathematical representation of digital video including motion and time-varying image formation models, spatio-temporal sampling/reconstruction, sampling structure conversions, motion estimation using optical flow, block-based, pel-recursive, Bayesian and point

correspondence type methodologies, segmentation, motion tracking, filtering, restoration, super-resolution and compression.

12. The Pattern Recognition course, on the other hand, covers pertinent concepts in Bayes decision theory, linear and nonlinear classifiers, artificial neural networks, feature selection/generation/extraction and various types of clustering algorithms and techniques.

13. The “Advanced Neural Networks and Deep Learning: Theory, Mathematics and Algorithms: Part 1” is intended to provide an in-depth comprehensive study of the theory, mathematics and algorithms for advanced neural networks and their usage in deep learning. It is primarily targeted for upper graduate students that are planning to pursue advanced studies/research in the field. The course begins with an in-depth study of the mathematical methodologies for neural networks and optimization (zero-, first- and second-order) techniques. It then progresses to provide a thorough study of shallow and deep neural networks architectures and algorithms, activation functions, regression, two- and multi-class classification, unsupervised learning, feature engineering/selection, backpropagation along with applications to a variety of engineering problems.

14. I am currently working to develop a follow-on course (Part 2) to the Advanced Neural Networks and Deep Learning course described above. This course is intended to cover convolutional and recurrent style neural networks, principles of

feature engineering, kernel methods, tree-based learners, attention mechanisms/transformers, reinforcement learning and generative adversarial networks. This course is targeted to debut in Fall 2026.

15. My current research focuses on machine learning for object tracking/remote sensing applications; image/video processing for multimedia, military & biomedical applications; and computer vision and three-dimensional scene reconstruction. As a principal investigator (PI) or co-principal investigator, I have acquired almost \$6 million in research funding since joining RIT and have managed multiple government grants from the Department of Defense as well as several corporate grants from Hewlett-Packard, Lenel, and Data Physics.

16. In 2012, I was awarded the Prestigious Trustees Scholarship, the highest award at RIT with regard to research recognition.

17. I am the author or co-author of 40 peer-reviewed journal publications.

18. I have also authored or co-authored 102 conference and workshop publications and a book entitled Advanced Linear Algebra for Engineers with MATLAB, published by CRC Press in February 2009, and am a named inventor on multiple U.S. and foreign patents.

19. I am a senior member of the Institute of Electrical and Electronic Engineers and a member of the IEEE Signal Processing Society, the Electrical Engineering Honor Society, and Eta Kappa Nu.

20. With respect to the technologies relevant to the '158 Patent, I have extensive experience in developing computer vision and digital image/video processing algorithms and techniques that utilize single and/or multiple RGB as well as hyperspectral/multispectral and/or multimodal camera systems for motion estimation, segmentation, registration, classification, identification, pattern recognition, shape recognition/matching, stereo imaging, facial recognition, biomedical image processing, compression, surveillance systems, 3d scene reconstruction, machine learning, deep learning for a variety of applications including object recognition and tracking, video analysis, video surveillance, change detection, biomedical, color engineering, grayscale and color document processing.

21. A complete statement of my industrial and academic records including a listing of the above publications and patents is included with my curriculum vitae in Exhibit 2006.

III. RELEVANT LEGAL STANDARDS

22. I have been asked to provide my opinion as to whether certain claims of the '158 Patent are obvious over Matsushima, Yu and Miyazaki.

23. The opinions I am expressing in this report involve the application of my knowledge and experience to the evaluation of certain references with respect to the '158 patent. My formal knowledge of patent law is no different than that of any lay person. Therefore, I have requested the attorneys from Volpe Koenig, who represent

Intellectual Ventures, to provide me with guidance as to the applicable patent law in this matter. The paragraphs below express my understanding of how I must apply current principles related to patent validity to my analysis.

24. I understand that an IPR is a proceeding before the USPTO for evaluating the patentability of an issued patent's claims based on prior-art patents and printed publications.

25. I understand that the claims of a patent are reviewed from the point of view of a hypothetical person of ordinary skill in the art ("POSITA") at the time of the filing of the patent. The "art" is the field of technology to which a patent relates.

26. I understand that in determining whether a patent claim is anticipated or obvious in view of the prior art, the Patent Office must apply the Phillips standard to construe the claims.

27. I understand that, in this proceeding, Petitioners have the burden of proving that the challenged claims of the '158 Patent are unpatentable by a preponderance of the evidence. I understand that "preponderance of the evidence" means that a fact or conclusion is more likely true than not true.

28. I understand that there are two ways in which prior art may render a patent claim unpatentable. First, the prior art can "anticipate" the claim. Second, the prior art can render the claim "obvious" to a POSITA. I understand that for an invention claimed in a patent to be patentable, it must not be anticipated and must not

be obvious based on what was known before the invention was made. For purposes of this Declaration only, I have applied the definition of a POSITA proposed in the Petition.

29. I understand that a patent claim may be invalid as “anticipated” under 35 U.S.C. § 102 if each and every limitation of the claim as construed by the court is found, either expressly or inherently, in a single prior art reference, such as a publication or patent, that predates the claimed subject matter. I also understand that a patent claim may be invalid as obvious under 35 U.S.C. § 103 if the differences between the subject matter claimed and the prior art are such that the claimed subject matter as a whole would have been obvious to a POSITA at the time the invention was made. I also understand that several factual inquiries underlie a determination of obviousness. These inquiries include (1) the scope and content of the prior art, (2) the level of ordinary skill in the field of the invention, (3) the differences between the claimed invention and the prior art, and (4) any objective evidence of non-obviousness (i.e., “secondary considerations”).

30. I also understand that, when a party alleges obviousness based on a combination of references, that party should identify a reason why a POSITA would have been motivated to combine the asserted references in the manner recited in the claims and to explain why a POSITA would have had a reasonable expectation of success in making such combinations.

31. I understand that an obviousness analysis permits the application of “common sense” in examining whether a claimed invention would have been obvious to a POSITA. For example, I understand that combining familiar elements according to known methods and in a predictable way may suggest obviousness when such a combination would yield nothing more than predictable results. And I understand a party asserting obviousness should still provide a specific motivation to combine the references as recited in the claims and explain why one would have reasonably expected to succeed in doing so.

32. I understand that one indicator of non-obviousness is when a prior art reference leads in a different direction or discourages that combination, recommends steps that would not likely lead to the patent’s result, or otherwise indicates that a seemingly inoperative device would be produced.

IV. SPECIFICATION OF ‘158 PATENT

A. Background of the ‘158 Patent

33. Background of the ‘158 Patent discusses the problem of capturing a scene with “highly varying illumination,” and the need for sensors with an “intrascene dynamic range” over 4,000:1 to capture such scenes. From the ‘158 Patent:

... Examples of high dynamic scenes range scenes include an indoor room with a window view of the outdoors, an outdoor scene with mixed shadows and bright sunshine, and evening or night scenes combining artificial lighting and shadows. In a typical charge coupled device (CCD) or CMOS active pixel sensor (APS), the available dynamic range is in a range of 1,000:1 to about 4,000:1. Unfortunately, many

outdoor and indoor scenes with highly varying illumination have a dynamic range significantly greater than 4,000:1. Image sensors with intrascene dynamic range significantly greater than 4,000:1 are required to meet many imaging requirements. Ex. 1001, 1:45-56 (emphasis added).

34. The Background of the ‘158 Patent went on to discuss existing techniques for increasing “[t]he dynamic range of an image sensor ... by using multiple exposure times and/or integration times.” *Id.*, 1:57-2:1. In explaining the shortcomings of one of these existing techniques, the Background of the ‘158 Patent explained that the technique suffered from “temporal aliasing” when attempting to capture motion in the scene. From the ‘158 Patent:

... U.S. Pat. Nos. 4,647,975, 5,168,532, and 5,671,013 disclose the use of a selection rule to combine information from the most suitable of the multiple images. The merged pixel information or value is then multiplied by a suitable factor that corrects for the respective exposure times. This method however exhibits undesirable temporal aliasing if the scene or camera is moving because the two or more images having different exposure times are captured using the same image sensor and thus are not captured concurrently. *Id.*, 1:58-2:5 (emphasis added).

35. After discussing existing techniques, the ‘158 Patent concluded that, “[d]espite improvements in solid-state image sensor and digital camera technology, the light signal or brightness range of scenes often exceeds the dynamic range of the sensor.” *Id.*, 2:6-8 (emphasis added).

36. The Background of the ‘158 Patent concluded by discussing the light characteristics associated with scenes, and the requirement of an intrascene dynamic

range of approximately 10,000:1 to capture scenes with highly varying illumination.

From the ‘158 Patent:

Typical scenes imaged by digital cameras have light levels that span a range including low light (1-100 lux), moderate light (100-1000 lux), and bright light (1000-1,000,000 lux) under outdoor conditions. ... To cover a single scene that might involve indoor lighting (100 lux) and outdoor lighting (100,000 lux), the required intrascene dynamic range is approximately 10,000:1, corresponding to 80 dB (14-bits). This exceeds the dynamic range of a single image sensor using a single integration time (typically 3,100:1 corresponding to 70 dB (12-bits)). Ex. 1001, 2:28-40 (emphasis added).

B. Overview of the ‘158 Patent

37. As noted in the Background, the ‘158 Patent is directed to expanding the dynamic range of a camera for capturing “scenes with highly varying illumination.” *Id.*, 1:52-53 (emphasis added). In contrast to prior techniques, which suffered from temporal aliasing when attempting to capture motion in such a scene, the techniques disclosed in the ‘158 Patent minimized such temporal aliasing. From the ‘158 Patent:

... Image capture by the camera is performed using the multiple camera channels, and each camera channel is controlled during a frame under an independent integration time. The integration time for each channel can be automatically controlled and/or controlled in response to a user input. A wide range of integration times are available for use in an embodiment. The images obtained in each channel under the different integration times are obtained simultaneously or nearly simultaneously, so undesirable temporal aliasing from moving scenes or camera motion is minimized. *Id.*, 3:47-57 (emphasis added).

38. Thus, in order to address the shortcomings of prior art techniques, the ‘158 Patent disclosed a camera with an integration time controller for independently

controlling the integration time of each camera channel in a scene. *Id.*, 5:3-15.

Significantly, the ‘158 Patent expressly defined “integration time” in the context of such a scene. From the ‘158 Patent:

... Conventional digital cameras may have a maximum photo-signal storage capacity that limits the dynamic range of the particular system. The photo-signal charge is stored on a capacitor within the pixel area. The charge handling capacity is limited by the maximum voltage swing in the integrated circuitry and the storage capacitance within the pixel. The amount of integrated photo-charge is directly related to the time the image sensor collects and integrates signal from the scene. This is known as integration time. *Id.*, 3:65-4:6 (emphasis added).

39. Thus, the invention of the ‘158 Patent expands the “intrascene” dynamic range limitations of conventional cameras through the use of multiple independent camera channels. As stated in the ‘158 Patent:

The digital camera subsystem 210, also referred to herein as the “DCS” 210, includes one or more camera channels (e.g., four camera channels 260A-260D) and replaces (and/or fulfills one, some or all of the roles fulfilled by) the lens assembly 110, the color filter 112 and the image sensor 116 of the digital camera 100 described above. Ex. 1001, 6:54-59. (emphasis added).

40. These independent camera channels, including independent control of the integration time of each channel, are featured prominently at the beginning of the Detailed Description as part of the overview of the disclosed embodiments. In this regard, the ‘158 Patent states:

Digital camera systems and methods are described below that provide an expanded effective single-frame dynamic exposure range. The digital camera systems and methods, collectively referred to herein as digital camera systems, generally include two or more camera

channels. Each channel includes an optics component and an image sensor having an active area including multiple picture elements (pixels).

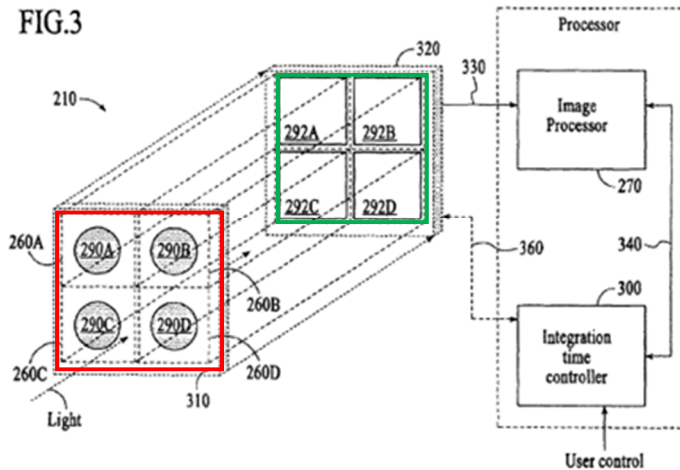
* * *

The digital cameras described herein overcome this dynamic range limitation through the use of multiple camera channels, including multiple optics and image sensors on a single integrated circuit (IC) or semiconductor Substrate. The multiple camera channels are configured to image the same field of view simultaneously, and each operates independently ...

* * *

A digital camera according to an embodiment includes multiple (e.g., two or more) closely spaced image sensor camera channels integrated on or in a common semiconductor substrate. Each sensor camera channel has its own optics, photo-detection and readout mechanism that includes a plurality of picture elements (pixels) with independent signal integration time control ... Ex. 1001, 3:39-45; 4:18-24; and 5:12-15 (emphasis added).

41. Figure 3 (reproduced below, with annotations) illustrates an example of independent camera channels 260A-260D according to the claimed invention. As illustrated in Figure 3, each one of the camera channels 260A-260D includes respective independent optics (Reference Numeral 290A-D – in red box) and a respective independent sensor portion (Reference Numerals 292A-D - in green box). Ex. 1001, 7:17-39.



42. Figure 3 further illustrates a processor that includes an integration time controller (Reference Numeral 300) for independently controlling the integration time of each camera channel. As explained in the patent:

... The camera systems include a processing component coupled to the channels. The processing component is configured to separately and simultaneously control an integration time of each channel. The integration time of at least one channel is controlled relative to the integration time of at least one other channel so that an image formed by combining data of a frame received simultaneously from the channels has a relatively large dynamic range.

A digital camera according to an embodiment includes multiple (e.g., two or more) closely spaced image sensor camera channels integrated on or in a common semiconductor substrate. Each sensor camera channel has its own optics, photo-detection and readout mechanism that includes a plurality of picture elements (pixels) with independent signal integration time control. *Id.*, 5:3-18 (emphasis added).

See also, *id.*, 7:36-39 (“[e]ach camera channel has a selectable integration, and the integration time setting between channels is selected to cover a range of incident

light level onto the digital camera”); *id.*, 8:32-38 (“The digital camera subsystem 210 further includes ... an integration time controller portion 300 (referred to as controller 300). The controller is a component of the variable integration time that provides integration time control for each of the camera channels.”) (emphasis added).

43. Accordingly, in the claimed invention, incident light independently passes through the optics specific to each channel and is received by a corresponding independently controlled sensor in the respective channel.

C. “Exposure Control” And “Integration Time Control” As Described In The ‘158 Patent

44. While the ‘158 Patent expressly defined “integration time” in the context of a scene, e.g., with varying illumination, the ‘158 Patent associated “exposure control” with the taking of photographs. The express definition of “integration time” and the description of exposure control from the ‘158 Patent are contrasted below:

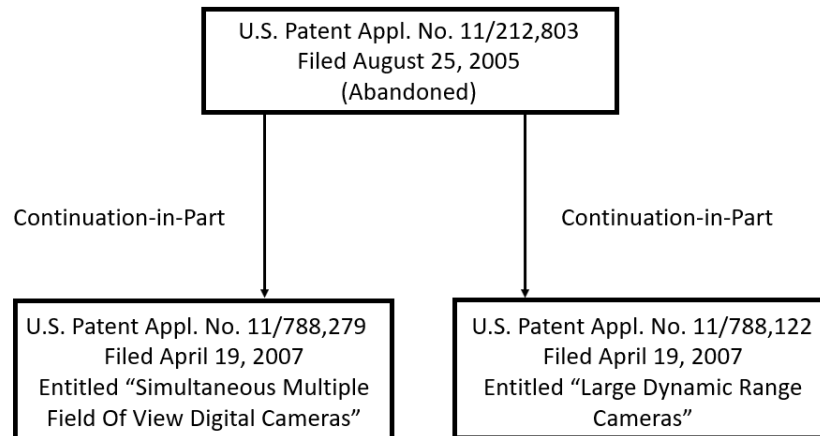
<u>“Exposure Control” (Photographs)</u>	<u>“Integration Time Control” (Scenes)</u>
“Exposure is the total amount of light allowed to fall on a sensor during the process of taking a <u>photograph</u>. <u>Exposure control</u> is control of the total amount of light incident on a sensor during the process of taking a <u>photograph</u>.” Ex. 1001, 4:37-40 (emphasis added).	... The amount of integrated photo-charge is directly related to the time the image sensor collects and integrates signal <u>from the scene</u>. <u>This is known as integration time</u>. Ex. 1001, 3:65-4:6 (emphasis added). <u>In contrast to exposure control</u>, which is used by conventional digital cameras to manage dynamic range, the

	digital camera systems of an embodiment use <u>integration time control to control the time the electrical signal is integrated on a charge storage device (capacitance) within a sensor (pixel)</u> , as described herein. Integration time control, also referred to as “focal plane shutter” control, controls <u>the time the electrical signal is integrated or accumulated by controlling a switch (e.g., charge integration switch) coupled or connected to the sensor</u> or a photo-detection mechanism of a sensor. Ex. 1001, 4:41-51 (emphasis added).
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45. The specification of the ‘158 Patent thus differentiates between controlling light captured during the process of taking a photograph - and “integration time control” which the ‘158 defines as the time the image sensor collects and integrates signal from a scene.

V. PROSECUTION HISTORY OF THE ‘158 PATENT

46. The specification of the ‘158 Patent was originally filed as U.S. Patent Application No. 11/788,122 on April 19, 2007 (the ‘122 Application). Ex. 1031, 146-220. The ‘122 Application was a continuation-in-part of U.S. Patent Application No. 11/212,803, filed August 25, 2005 (the ‘803 Application). Ex. 1030, 985-1423. As illustrated below, the ‘122 Application was one of two continuation-in-part applications filed on the same day (April 19, 2007) that claimed priority to the ‘803 Application.



47. The two continuation-in-part applications filed on April 19, 2007 were directed to different subject matter. The ‘279 Application (bottom left) was directed to the formation of multiple high resolution images in which different fields of view are acquired simultaneously. The disclosure of Application No. 11/788,279 corresponds to U.S. Patent No. 7,916,180 which is the subject of co-pending IPR2025-00339. The other continuation-in-part application filed the same day was the ‘122 Application, which, as explained above, was directed to increasing the dynamic range of digital camera systems in scenes with, e.g., highly varying illumination.

48. There were material differences between the specifications of the ‘122 and ‘803 Applications which are pertinent to these proceedings. These differences are discussed below in connection with a description of the prosecution history of each application.

A. Prosecution History of the ‘803 Application

49. Unlike the ‘122 Application (which has the same specification as the ‘158 Patent), the Background of the ‘803 Application makes no mention of capturing a *scene* with a “*highly varying illumination*,” or any of the challenges associated therewith. The Background of the ‘803 Application similarly makes no mention of the dynamic range of image sensors, or the exposure times or integration times of such devices. The Background of the ‘803 Application does not mention any of these subjects in any context, let alone in the context of a scene with varying illumination.

50. The independent claims filed as part of the ‘803 Application likewise made no mention of independent control of the integration time of multiple sensors in such a scene. For example, original claim 1 of the ‘803 Application recited:

1. A digital camera comprising:
 - a plurality of arrays of photo detectors, including:
 - a first array of photo detectors to sample an intensity of light; and
 - a second array of photo detectors to sample an intensity of light;
 - signal processing circuitry, coupled to the first and second arrays of photo detectors, to generate a composite image using (i) data which is representative of the intensity of light sampled by the first array of photo detectors, and (ii) data which is representative of the intensity of light sampled by the second array of photo detectors; and
 - wherein the first array of photo detectors, the second array of photo detectors, and the signal processing circuitry are integrated on or in the same semiconductor substrate.

Ex. 1030, 1172. The other original independent claim, namely claim 34, also made no mention of independent control of the integration time of multiple sensors in the context of a scene. *Id.*, 1177-1178.

51. In the first Office Action, the Examiner rejected independent claims 1 and 34 as obvious based on U.S. Patent Publ. 2005/0128509 (Tokkonen) (Ex. 2007) in view of U.S. Patent No. 7,123,298 (Schroeder) (Ex. 2008). Ex. 1030, 515-517.¹ Among other techniques, Schroeder disclosed a light sensor with separate regions where “[e]xposure control can be individually applied to the regions of the light sensor to optimize the signal-to-noise ratio of each image signal component.” Ex. 2008, 3:47-49. In this respect, Schroeder disclosed “an exposure control circuit that applies exposure control to each of the regions independently.” *Id.*, 7:21-22. Significantly, however, neither Tokkonen or Schroeder mentioned the term “scene,” or that their devices applied, e.g., to a scene with varying illumination.

52. In response, the Applicant amended the independent claims to recite: “timing and control logic to provide timing and control information to the signal processing circuitry, the first array of photo detectors and/or the second array of photo

¹ The Examiner also applied U.S. Patent No. 6,611,289 (Yu) (Ex. 1005) to certain dependent claims. Ex. 1030, 527-528.

detectors,” and argued that the amended claims were distinguishable from the cited references. Ex. 1030, 38, 44 and 54-58.

53. The Examiner responded with a Final Office Action, wherein he maintained the rejection of the independent claims over Tokkonen and Schroeder. The Applicant subsequently allowed the ‘803 Application to become abandoned in due course. Ex. 1030, 1-2.

B. Prosecution History of the ‘122 Application

54. Prior to the abandonment of the ‘803 Application, the Applicant filed the ‘122 Application as a continuation-in-part of the ‘803 Application. Unlike the ‘803 Application, the Background of the ‘122 Application (which carried forward into the ‘158 Patent) focused on the problem of capturing a *scene* with a “*highly varying illumination*.” See, e.g., Ex. 1030, 150 (explaining that “many outdoor and indoor *scenes with highly varying illumination* have a dynamic range significantly greater than 4,000:1. Image sensors with intrascene dynamic range significantly greater than 4,000:1 are required to meet many imaging requirements,” and discussing prior techniques that suffered from “*undesirable temporal aliasing if the scene or camera is moving*”) and 151 (explaining that “[d]espite improvements in solid-state image sensor and digital camera technology, the light signal or brightness range of *scenes* often exceeds the dynamic range of the sensor” and that in order “[t]o cover a single scene that might involve indoor lighting (100 lux) and outdoor lighting (100,000 lux),

the required intrascene dynamic range is approximately 10,000:1, corresponding to 80 dB (14-bits)” which “exceeds the dynamic range of a single image sensor using a single integration time”).

55. Moreover, in contrast to the Detailed Description of the ‘803 Application, the first paragraph of the Detailed Description of the ‘122 Application described a camera with multiple camera channels where “each camera channel is controlled during a frame under an independent integration time. ... so undesirable temporal aliasing from moving scenes or camera motion is minimized.” *Id.*, 153.

56. Consistent with these changes in the Background and Detailed Description, and in contrast to the independent claims of the ‘803 Application, the independent claims of the ‘122 Application recited separate control of the integration time of each sensor, where the specification explicitly defined integration time in the context of a scene.² For example, claim 1 of the ‘122 Application recited:

1. A digital camera comprising:
 - a plurality of sensors integrated in a semiconductor substrate, each sensor comprising an array of photo-detectors;
 - a plurality of optics component, each optics component configured to pass light to a sensor of the plurality of sensors, wherein each optics component and an associated sensor form one of a plurality of channels; and
 - a processing component coupled to the plurality of channels and configured to separately and simultaneously control an integration time of each sensor during a frame, wherein the integration time of at

² Ex. 1031, 153 (“The amount of integrated photo-charge is directly related to the time the image sensor collects and integrates signal from the scene. This is known as integration time.”) (emphasis added).

least one sensor is relatively shorter than the integration time of at least one other sensor, the processing component configured to combine data from the plurality of sensors received simultaneously during the frame to provide an image having a large dynamic range. Ex. 1031, 189 (emphasis added).

57. In the first Office Action, the Examiner did not apply Tokkonen, Schroeder or Yu -- which did not discuss the problem of capturing a scene with a highly varying illumination. Rather, the Examiner rejected all of the claims as being anticipated by U.S. Patent Publ. 2004/0155175 (McNulty) (Ex. 2009). In contrast to the references applied in the '803 Application, McNulty disclosed "variable integration control of an optical input" as being "especially useful in scenes with widely varying light levels." Ex. 2009, [0034] (emphasis added).

58. In response to the first Office Action, the Applicant amended claim 1 as follows:

1. (Currently amended) A digital camera comprising:
 - a plurality of sensors integrated in a semiconductor substrate, each sensor comprising an array of photo-detectors, wherein each sensor is configured to image the same field of view;
 - a plurality of optics component, each optics component configured to pass light to a sensor of the plurality of sensors, wherein each optics component and an associated sensor form one of a plurality of channels; and
 - a processing component coupled to the plurality of channels and configured to separately ~~and simultaneously~~ control an integration time of each sensor during a frame, wherein the integration time of at least one sensor is relatively shorter than the integration time of at least one other sensor, the processing component configured to combine data from the plurality of sensors received ~~simultaneously~~ during the frame to provide an image ~~having a large dynamic range~~. Ex. 1031, 66.

59. In the accompanying Remarks, the Applicant argued that McNulty was distinguishable from the amended claims:

... McNulty describes a single sensor generating a single image by combining data from a plurality of pixels where the integration time for a pixel or subset of pixels is independently controlled. McNulty fails to even mention use of “a plurality of optics component” and “a plurality of channels.” Thus, McNulty fails to teach, suggest, or describe all of the elements of at least independent Claim 1. Ex. 1031, 75.

60. The Examiner responded with a Notice of Allowance, which provided the following reasons for allowance:

Claims 1-6 and 8-42 are not disclosed or made obvious by the prior art of record, specifically in combination with the limitation of “a processing component coupled to the plurality of channels and configured to separately control an integration time of each sensor during a frame, wherein the integration time of at least one sensor is relatively shorter than the integration time of at least one other sensor, the processing component configured to combine data from the plurality of sensors received during the frame to provide an image.” Ex. 1031, 27.

C. Prosecution History of the ‘236 Application

61. The ‘236 Application (which matured into the ‘158) has the identical specification to the ‘122 Application, and was examined by the same Examiner (Seung C. Sohn). The ‘236 Application claims priority back to the ‘122 Application

through several intervening continuation applications, all of which share the identical specification with each other and the ‘122 Application.³

62. Claim 1 of the ‘236 Application recited:

1. An image capture device comprising:
a plurality of sensors;
a plurality of optics components, wherein each optics component of the plurality of optics components is configured to pass light to a sensor of the plurality of sensors; and
a processing component configured to control an integration time of each sensor.

63. Claim 1 of the ‘236 Application bears a close resemblance to the claim 1 (as allowed) in the ‘122 Application, and while there are some differences⁴ between the claims, none of those differences are material to these proceedings. Both claims recite a plurality of sensors, a plurality of optics components each of which is configured to pass light to a sensor, and a processing component configured to

³ The first paragraph of the ‘236 Application states in pertinent part: “This application is a Continuation of U.S. Patent Application 13/681,603, filed 11/20/2012, which is a Continuation of U.S. Patent Application 13/465,229, filed 5/7/2012 ... , which is a Continuation of U.S. Patent Application No. 12/496,854, filed 7/02/2009 ..., which is a Continuation of U.S. Patent Application No. 11/788,122, filed 4/19/2007.” Ex. 1002, 178 (emphasis added).

⁴ For example, unlike claim 1 in the ‘236 Application, claim 1 (as allowed) in the ‘122 Application recited that the sensors be integrated on a semiconductor substrate, image the same field of view, and that the integration times of the sensors be different.

independently (or separately) control an integration time of each sensor -- where “integration time” is expressly defined in the specification in connection with a “scene.”

64. After indicating on an Information Disclosure Statement that he had considered, *inter alia*, Tokkonen, Schroeder and Yu, the Examiner allowed the ‘236 Application. Ex. 1002, 89-91 and 129-131. In his reasons for allowance, the Examiner stated:

Claims 1-20 are not disclosed or made obvious by the prior art of record, specifically in combination with the limitation of “a plurality of sensors; a plurality of optics components, wherein each optics component of the plurality of optics components is configured to pass light to a sensor of the plurality of sensors; and a processing component configured to control an integration time of each sensor.” Ex. 1002, 95.

VI. CHALLENGED CLAIMS OF THE ‘158 PATENT

65. Petitioner challenges independent Claims 1, 9, and 15, and dependent claims 2, 4-5, 8, 10-11, 13-14, 16 and 19. Independent Claim 1 is representative, and recites:

1. An image capture device comprising:

a plurality of sensors;

a plurality of optics components, wherein each optics component of the plurality of optics components is configured to pass light to a sensor of the plurality of sensors; and

a processing component configured to control an integration time of each sensor.

VII. CLAIM CONSTRUCTION

66. I understand that under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) claim language is not read in isolation. Rather, the claim language, when read in light of the specification and the prosecution history, elucidates the meaning of the claim language.

- A. **“a processing component configured to control an integration time of each sensor” (claim 1), “the processing component is configured to determine an integration time of each channel” (claim 9), and “identifying an integration time for each of a plurality of channels” (claim 15)**

67. Petitioner chose not to propose a formal construction of the term “a processing component configured to control an integration time of each sensor” as recited in independent Claim 1, the term “the processing component is configured to determine an integration time of each channel,” as recited in independent Claim 9, or the term “identifying an integration time for each of plurality of channels,” as recited in Claim 15. *See* Petition at 7-10. However, in its mappings to Matsushima, Petitioner appears to have suggested that these limitations could be met by a processor that lacks independent control of the integration time of each sensor.

68. The specification expressly teaches that “[t]he processor ... provides integration time control for each of the camera channels.” Ex. 1001, 8:33-37. The ‘158 Patent explains that by providing the integration times to each camera channel, the processor is able to “separately and simultaneously control an integration time of each

channel ... so that an image formed by combining data of a frame received simultaneously from the channels has a relatively large dynamic range.” Ex. 1001, 5:5-11; *see also* 5:15-18 (“[e]ach sensor camera channel has its own optics, photo-detection and readout mechanism that includes a plurality of picture elements (pixels) with independent signal integration time control”).

69. In IPR2022-00710 (the ‘710 IPR), the Board interpreted the “processing component” of Claim 1 as follows:

... Consistent with this interpretation, claim 1 also recites “a processing component configured to control an integration time of *each* sensor,” which similarly distinguishes the processing component’s configuration as being able to control the integration time of an individual sensor distinct from the other sensor(s) in the group.

The specification is in accord with this interpretation. For example, the specification states,

The digital cameras described herein overcome this dynamic range limitation through the use of multiple camera channels, including multiple optics and image sensors on a single integrated circuit (IC) or semiconductor Substrate. The multiple camera channels are configured to image the same field of view simultaneously, and each operates independently under a different integration time.

And the specification states,

Each channel includes an optics component and an image sensor having an active area including multiple picture elements (pixels). Each sensor is controlled under or with an independent signal integration time . . .

Toyota Motor Corp. v. Intellectual Ventures II LLC, IPR2022-00710, Paper 13, at 12-13 (October 26, 2022) (emphasis added; citations omitted).

70. In my opinion, a POSITA reading the claims under *Phillips* would give “of each sensor” operative effect consistent with the specification’s architecture. In ordinary engineering usage, “control an integration time of each sensor” denotes per-sensor control authority over the sensor-local charge-integration interval, not a global exposure value broadcast identically to all channels. That understanding aligns with the patent’s express definition of “integration time” as the interval the sensor itself collects charge and with the mechanism of control—focal-plane switching at the sensor—set out in the specification. (EX1001, 3:65–4:6; 4:46–56.)

71. The patent’s method narrative confirms this per-channel reading by describing a pipeline in which the processor selects an integration time for each image-sensor camera channel, then captures under those respective settings, and then combines the simultaneously acquired data into a single frame. (EX1001, 4:21–35; 4:38–45; 5:3–18; 7:36–39.) Because the combination step depends on different in-frame exposures being available, a single common integration-time value would frustrate that design objective and contradict the text stating that “each operates independently under a different integration time.” (EX1001, 4:38–45; 5:3–18).

72. The claims themselves reflect this selection/actuation separation while preserving per-channel independence. Claim 1 addresses actuation (“control ... of

each sensor”), claim 9 addresses selection (“determine ... of each channel”), and claim 15 addresses identification in the method context (“identifying ... for each of a plurality of channels”). (EX1001, 4:21–35; 4:38–45; 5:3–18; 7:36–39.) Reading these in harmony, a POSITA would conclude that the invention requires: (i) separate values to be determined/identified for the respective channels and (ii) separate focal-plane actuation of those values for capture in the same frame window.

73. Dependent claim 3 strengthens that construction. It recites “an interface ... configured to receive the integration time of each sensor as an input to an image capture device.” (EX1001, Claim 3.) If the invention contemplated only one shared value, there would be no reason to claim an interface configured to receive per-sensor values; the term “each” would add nothing. By giving “each” its ordinary meaning, claim 3 makes functional sense in the disclosed architecture, where the processor “provides integration time control for each of the camera channels” and updates those values on a frame-by-frame basis prior to combination. (EX1001, 8:32–38; 7:36–39; 4:21–35; 4:38–45; 5:3–18).

74. Petitioner’s suggestion that “configured to control ... of each sensor” is satisfied by a system that merely addresses sensors individually while forcing the same integration-time value on all channels should be rejected because it collapses the claim’s two degrees of freedom (per-sensor and per-frame) into a single common-mode parameter. That reading is at odds with the specification’s repeated statement

that each channel operates under a different integration time and with the single-frame fusion objective that presupposes non-identical exposures across channels. (EX1001, 4:38–45; 5:3–18; 7:36–39).

75. The intrinsic record also signals the hardware consequences of the claimed control. By defining integration-time control as focal-plane switching at the sensor, the patent directs a POSITA to per-channel control paths capable of actuating the charge-integration switch at each sensor (e.g., distinct gate/clear sequencing or equivalent sensor-local timing). (EX1001, 3:65–4:6; 4:46–56; 8:32–38.) A system that merely computes a single exposure number and distributes it identically lacks the per-sensor actuation the claims require.

76. The claim set is internally coherent under this reading. Claims 11 and 16 introduce relative constraints (“relatively shorter” and “less than”) that make sense only if different per-sensor integration-time values are both determined and controlled within the same frame window—precisely what the specification describes for single-frame fusion. (EX1001, 4:21–35; 4:38–45; 5:3–18; 7:36–39; 8:32–38). A broadcast-one-value system cannot satisfy these relative limitations without rewriting the claim language.

77. Finally, reading “of each sensor” to allow a single broadcast value would render portions of the claim set superfluous (e.g., claim 3’s interface that receives per-sensor values) and would detach the claims from the patent’s explicit definitional

language. Phillips instructs that claims should be construed to stay true to the specification and to the context in which the inventor used the terms. Here, the inventor used “integration time” in a sensor-local, focal-plane sense and repeatedly paired “of each” with independent per-channel operation. (EX1001, 3:65–4:6; 4:46–56; 4:38–45; 5:3–18; 7:36–39; 8:32–38).

78. For these reasons, I conclude that the proper construction—faithful to the patent’s express definition and architecture—requires per-sensor (per-channel) independence both in the determination of integration-time values and in their focal-plane actuation during capture. Any construction that permits a single, common integration-time value broadcast to all sensors would contradict the specification, nullify the role of “each,” and undermine the claimed single-frame fusion of different in-frame exposures. .

B. “an integration time of each sensor” (claim 1), “an integration time of each channel” (claim 9), and “an integration time for each of a plurality of channels”(claim 15)

79. The meaning of integration time in the ‘158 Patent was previously construed in the GM Litigation as “the time the image sensor collected and integrates signal from the scene.” Pet., 8 (emphasis added). The Petition asserts that the prior art references meet this construction, but glosses over the meaning of “scene” in the context of the intrinsic evidence, including the specification which focuses on the

problem of capturing scenes with highly varying illumination, and the prosecution history.

80. As explained above, the ‘158 Patent’s solution -- an integration time controller that independently adjusts the integration time for each camera channel -- was designed to address dynamic imaging challenges, such as transitions between indoor and outdoor lighting and motion-induced temporal aliasing. Moreover, the Examiner’s shift in prior art application during prosecution, from references directed to still images to those described as being “especially useful in scenes with widely varying light levels,” further confirms that “integration time” as defined in the ‘158 Patent is unrelated to the capture of a still image. Ex. 2009, [0034] (emphasis added). Moreover, contemporaneous technical literature, video analysis frameworks, and consumer electronics reinforce this understanding, consistently distinguishing a scene (i.e., a sequence of frames capturing continuous action in time and space) from a photograph or still image. Given this clear distinction, the Petition’s attempt to apply the “integration time” in the ‘158 Patent to photographs or still images contradicts both the intrinsic and extrinsic record.

81. As explained in the Petition, the Court in the GM Litigation construed “integration time” as “the time the image sensor collected and integrates signal from the scene.” Pet., 8, citing Ex. 1015, 49 (emphasis added). The Petition maintains that the relied on references meet this prior construction. Pet., 8. The district court in the

GM Litigation based its claim construction on the provision (discussed above) of the ‘158 Patent which expressly defined “integration time” in the context of a scene:

[T]he specification explicitly defines “integration time” as follows: “The amount of integrated photo-charge is directly related to the time the image sensor collects and integrates signal from the scene. This is known as integration time.” Ex. 1015, 48, citing Ex. 1001, 4:3-6 (emphasis added).

82. The explicit definition of “integration time” in the context of “the scene” is in keeping with the problem to which the ‘158 Patent was directed, i.e., expanding the dynamic range of a camera for capturing “scenes with highly varying illumination.” Ex. 1001, 1:52-53 (emphasis added). As noted above, the ‘158 Patent explained that in order “[t]o cover a single scene that might involve indoor lighting (100 lux) and outdoor lighting (100,000 lux), the required intrascene dynamic range is approximately 10,000:1” and that such “intrascene” requirements exceeded the dynamic range of a single existing sensor. *Id.*, 1:43-45 and 2:34-37 (emphasis added). The ‘158 Patent also explained that existing techniques suffered from “temporal aliasing” when attempting to capture motion in the scene. Ex. 1001, 1:58-2:5. In order to address these shortcomings, including undesirable temporal aliasing from moving scenes (*id.*, 3:47-57), the ‘158 Patent disclosed a camera with an integration time controller for independently controlling the integration time of each camera channel, where the “integration time” was defined in the context of such a “scene.” *Id.*, 5:3-15.

83. The prosecution history underlying the ‘158 Patent also demonstrates that the Examiner appreciated the difference between a “scene,” which can have, e.g., highly varying illumination as well as motion, and a photograph (or still image), in which illumination remains essentially the same during the instant the photograph is taken and motion is not depicted. More specifically, the independent claims of the ‘803 Application -- which made no mention of control of “integration time” -- were finally rejected based on Tokkonen and Schroeder, neither of which mentioned the term “scene,” or that their devices applied, e.g., to a scene with varying illumination. Ex. 1030, 515-517. However, after the Applicant filed the ‘122 Application (as a continuation-in-part to the ‘803 Application) in which (i) the Background section of the application was redirected to the problem of capturing a scene with a “highly varying illumination” (Ex. 1030, 150-151), (ii) the start of the Detailed Description was redirected to a camera with multiple camera channels where “each camera channel is controlled during a frame under an independent integration time. ... so undesirable temporal aliasing from moving scenes or camera motion is minimized” (*id.*, 153), and (iii) the independent claims were reworked to recite separate control of the integration time of each sensor, where the specification explicitly defined integration time in the context of a scene,⁵ the Examiner did not apply Tokkonen and

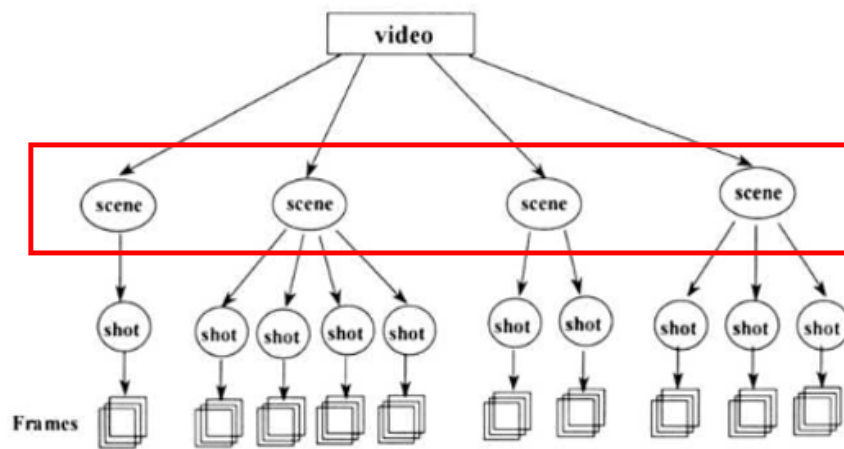
⁵ Ex. 1031, 153 (“The amount of integrated photo-charge is directly related to the time the image sensor collects and integrates signal from the scene. This is known as integration time.”) (emphasis added).

Schroeder, as those references did not relate to a scene as described in the Background of the application. Rather, the Examiner applied McNulty, which related to scenes as described in the Background of the application. Specifically, McNulty disclosed “variable integration control of an optical input” as being “especially useful in scenes with widely varying light levels.” Ex. 2009, [0034] (emphasis added). The shift from application of Tokkonen and Schroeder in the ‘803 Application to McNulty in the ‘122 Application shows that the Examiner appreciated the difference between a “scene” as described in the Background of the ‘122 Application (and the Background of the ‘158 Patent) and a photograph (or still image).

84. The “single scene” described in the ‘158 Patent as including both indoor lighting and outdoor lighting (*id.*, 2:34-37) would, by way of example, include a person walking from inside of a house to outside of the house or vice versa. The contemporaneous literature used the term “scene” in this same way, explaining that a “scene” is a collection of “shots” involving, e.g., a person walking from one place to another:

A shot is an unbroken sequence of frames from one camera. Thus, a movie sequence that alternated between views of two people would consist of multiple shots. *A scene is defined as a collection of one or more adjoining shots that focus on an object or objects of interest. For example, a person walking down a hallway into a room would be one scene,* even though different camera angles might be shown. ... *[P]eople perceive video as a collection of scenes,* not shots. Ex. 2013, 1 (emphasis added).

85. A scene is different from a photograph or still image. Consistent with its usage in the ‘158 Patent, the contemporaneous literature defined a scene as including one or more shots each of which included “a sequence of frames generated during a continuous action in time and space.” Ex. 2011, 267-268 (emphasis added). The literature also explained that a “scene” is part of a hierarchy where frames are at the bottom of the hierarchy, continuous frames form a “shot,” and one or more shots form a “scenes,” as illustrated in the diagram below:



Ex. 2011, 269 (red box added). “[I]ndividual frames may be grouped into *scenes* and *shots*. A *shot* is defined as a sequence of frames generated during a continuous action in time and space. A *scene* consists of one or more shots ...” *Id.*, at 267-268 (emphasis in original).

86. Numerous other authors from the time of the ‘158 Patent applied this same hierarchy of frames, shots and scenes. For example, as one paper explained:

[I]t is worth while to first define the terminologies used in video analysis.

- *Video shot* is an unbroken sequence of frames recorded from a single camera. ...
- *Video scene* is defined as a collection of semantically related and temporally adjacent shots ...

In summary, videos can be represented by using a hierarchy consisting of five levels (video, scene, group, shot, and key frame), from top to bottom increasing in granularity ...

Ex. 2012, at 2-3 (emphasis in original). *See also*, Ex. 2014, Figure 1 (depicting similar hierarchy of frames, shots and scenes).

87. At the time of the ‘158 Patent, the term scene was used in the same way by the general public. For example, DVD players at the time typically displayed a “scene” selection menu, allowing the viewer to jump to a specific scene on the DVD. Ex. 2015, 7:55-8:11, Figure 5 (the “menu option” provides “for selecting individual scenes of the complete title feature film”).

88. Consistent with the problem of varying illumination within a scene identified in the ‘158 Patent, and the usage of the term “scene” in the technical literature and common parlance at the time of the ‘158 Patent, it is clear that a photograph or still image is different from, and outside of the scope of, “the scene” used in the definition of “integration time.” Such a scene requires, for example, “a sequence of frames generated during a continuous action in time and space” -- rather than an isolated photograph or a still image. Ex. 2011, 267-268 (emphasis added).

89. As a result, it is clear that integration time in the ‘158 Patent is fundamentally tied to a scene, which in the context of the ‘158 Patent is entirely different from a static photograph or still image. The patent’s explicit definition, its focus on solving challenges related to varying illumination and motion within a scene, and the prosecution history all reinforce this distinction. Additionally, contemporaneous technical literature, video analysis frameworks, and common usage at the time consistently defined a scene as a sequence of frames capturing continuous action in time and space. Accordingly, in accordance with its explicit definition, “integration time” should be construed as applying to the collection and integration of light “from the scene,” which in the context of the ‘158 Patent, does not include still images or photographs.

C. “an integration time of each sensor” (claim 1), “an integration time of each channel” (claim 9), and “an integration time for each of a plurality of channels”(claim 15)

90. In CCD/CMOS imagers there are two distinct layers of timing: (i) pixel-domain/focal-plane timing that opens and closes the charge-collection path (the “integration gate”), and (ii) driver timing—frame, line, and transfer clocks—that sequence when rows/columns are reset, transferred, sampled, and read out. Adjusting only the latter (frame/line/transfer clocks) can change when the charge is moved but fails to control a pixel’s charge-integration switch.

91. For example, in an interline CCD, photocharge is accumulated under a photodiode and later moved through a transfer gate into a vertical shift register, then clocked out by horizontal clocks. If a controller simply shortens the frame transfer period or initiates vertical transfer earlier, the system can limit how long charge accumulates before transfer. But unless the controller actively gates the integration switch as a shutter, the pixel's charge node was never opened/closed by a focal-plane shutter command.

92. Similarly, in a rolling-shutter CMOS sensor, off-sensor driver logic can advance the row reset/readout cadence (frame/line clocks) so that rows are reset or read sooner. That changes the opportunity to integrate, but unless the per-row reset/transfer gates are commanded as the shutter to define each row's start/stop of charge accumulation, the control remains at the sequencer level, not the focal plane. EX1001 requires the latter—control “of a switch ... coupled or connected to the sensor,” expressly “focal plane shutter control.” (EX1001, 4:46–56).

93. The distinction shows up in edge cases. If a controller triggers readout early via horizontal/vertical clocks while leaving the pixel integrating (no focal-plane stop), the pixel may smear or carry partial charge; the controller has compressed the schedule, but it has not commanded the pixel to stop integrating. Conversely, true integration-time control explicitly opens the integration gate at t_0 and closes it at t_1 ,

creating a well-defined charge-accumulation interval regardless of frame/line clock choices. The former is schedule control; the latter is on-sensor gating.

94. Yu's disclosure fits the off-sensor side of this divide. It describes digital image-processing circuitry that generates exposure-time control signals and "all necessary control signals," delivered to per-sensor control circuits that operate based on histogram feedback; Yu does not identify the focal-plane gate (reset/clear/transfer) as the actuator, nor does it specify per-sensor gate/clear waveforms that open/close the pixel's integration window during the frame. (EX1005, 12:10–19; 13:23–37). Under EX1001's definition, that leaves Yu at the system-level exposure layer, not at integration-time control. (EX1001, 3:65–4:6; 4:46–56).

95. In multi-sensor designs, the difference is outcome-critical. Off-sensor frame/line/transfer clocks can be shared, yielding synchronous operation and effectively the same integration opportunity across sensors. Only per-sensor focal-plane gating can create different in-frame accumulation windows ($T_1 \neq T_2$) simultaneously—what the '158 patent relies on for single-frame fusion. Off-sensor timing alone cannot guarantee that result because it does not exercise the sensor-local switch that defines the actual integration interval. (EX1001, 4:38–45; 5:3–18; 7:36–39; EX1005, 12:10–19; 13:23–37).

96. Accordingly, integration time control" as used in the '158 Patent is in contrast to off-sensor timing signals (e.g. frame, line, transfer, correlated-double-

sampling, or A/D clocks) as those signals can coordinate operation or retrieval, but they do not define when the pixel is integrating photocharge and they do not open or close the charge-integration path at the sensor. Instead, “integration time control” in the ‘158 Patent begins when an integration switch permits charge to accumulate and ends when that switch closes. That is why the specification ties “integration time control” to focal-plane shutter control at the pixel and treats it as distinct from upstream exposure heuristics or downstream readout sequencing.

VIII. A PERSON HAVING ORDINARY SKILL IN THE ART

97. A person of ordinary skill in the art (“POSITA”) as of the effective filing date of the ‘158 Patent would have had a bachelor’s degree in electrical engineering, computer science, computer engineering, physics, or a related subject, and two to three years of work experience in digital imaging.

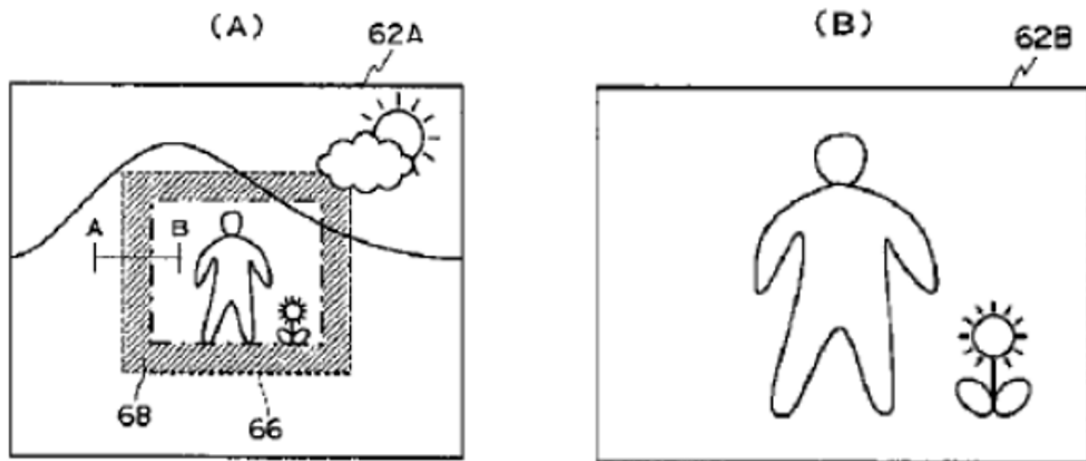
IX. GROUND 1 FAILS BECAUSE MATSUSHIMA DOES NOT DISCLOSE INDEPENDENT INTEGRATION TIME CONTROL AND THE PETITION’S INTERPRETATION MISCHARACTERIZES THE REFERENCE

98. Matsushima discloses a dual-imaging system that captures and synthesizes two images to enhance resolution and image quality, but it does not disclose independent control of integration time for each sensor. The reference describes a process where a wide-angle image and a telephoto image are captured, with the latter scaled down and combined with the former to improve central image clarity.

99. Importantly, Matsushima applies a single charge accumulation time across both sensors, as evidenced by its consistent references to the subject luminance and the charge accumulation time in the singular, indicating a uniform exposure setting rather than independent control. The Petition’s attempt to rely on Matsushima’s timing signals is misplaced, as these signals merely coordinate data retrieval and do not govern exposure settings. Further, the claim of Petitioner’s expert that Matsushima achieves a broad dynamic range through different integration times is not supported by the reference and contradicts prior art, which recognized the challenge of blending images with different exposures without creating unnatural boundaries. Matsushima’s own discussion of boundary correction confirms that it assumes a uniform exposure framework. As discussed below, the Petition mischaracterizes Matsushima’s disclosures and fails to demonstrate that it teaches independent integration time control.

A. Overview of Matsushima

100. Ground 1 relies solely on Matsushima, which discloses “a digital camera having a wide-angle first imaging system and a telephoto second imaging system.” Ex. 1007, 1. The first imaging system captures a first image 62A (left side) with a wide angle lens, and the second imaging system captures a second image 62B (right side) using a telephoto lens with a longer focal length than the lens used in the first imaging system. *Id.*, 1, 3.

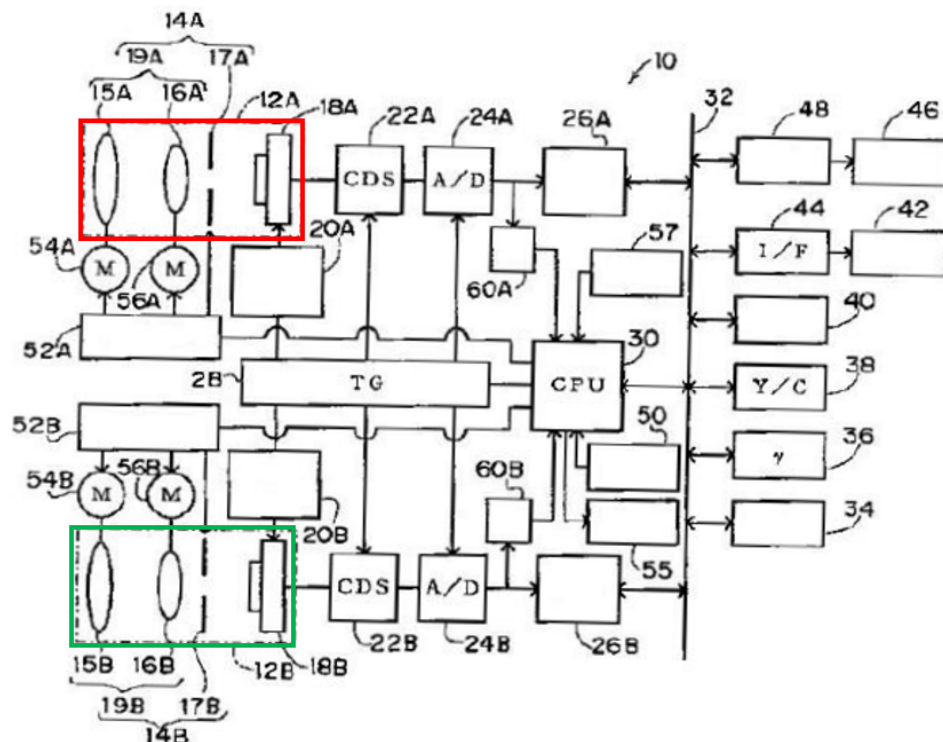


Id., 1. Image 62B (captured by the second imaging system using the telephoto lens) is then “scaled down to the same magnification” as “captured image 62A taken using the first imaging system” and “synthesized with the captured image 62A taken using the first imaging system.” *Id.*, 1. As explained in Matsushima:

The synthesizing means synthesizes the first captured image with the image that has been scaled down using the scale-down means. At this time, an image that has been scaled down using the scale-down means is generated from an image taken with the telephoto second imaging system, so the amount of information is greater than the amount of information in the central portion of the first captured image. This enables the image quality in the center of the image to be improved.

In addition, there is a risk that the boundary between the first image and the image that has been scaled down using the scaling means will be discontinuous, resulting in a deterioration in image quality. Therefore, the synthesizing means corrects the continuity of the image data in the peripheral regions based on the image data of a predetermined peripheral region of the image scaled down by the scale-down means and the image data corresponding to the peripheral region of the first captured image during synthesis. This keeps the images from looking unnatural at the boundary. Ex. 1007, [0011]-[0012].

101. Figure 1 of Matsushima (reproduced below) discloses a first imaging system 12A (red box) and a second imaging system 12B (green box).



First imaging system 12A (red box) includes “[i]maging optics 14A” which “are composed of a first lens group 19A with an imaging lens 15A and a focus lens 16A, and an aperture 17A.” *Id.*, [0019]. Similarly, the second imaging system 12B (green box) includes “imaging optics 14B” which “are composed of a second lens group 19B with an imaging lens 15B and a focus lens 16B, and an aperture 17B.” *Id.* “Lens group 19A is a wide-angle single focal length lens whose shooting angle α is wider than the shooting angle β of lens group 19B.” *Id.*, [0020]. The first imaging system

12A includes CCD 18A, and the second imaging system includes CCD 18B. *Id.*, [0021]. “CCD 18A and CCD 18B can be ... CCDs of the same size, that is, the same number of pixels.” *Id.*

B. Matsushima Fails To Disclose Independent Integration Time Control Of Each Sensor

102. While Matsushima describes a dual-imaging system with separate CCD sensors, its exposure control mechanism applies a single charge accumulation time to both CCDs, indicating that integration time is not independently managed for each sensor. Matsushima’s automatic exposure (AE) control relies on a single luminance value to determine a common aperture setting and shutter speed, which are then applied uniformly to both imaging systems. The Petition attempts to rely on Matsushima’s disclosure of timing signals to suggest independent control, but this argument is flawed. The timing signals merely coordinate data retrieval from the CCDs and do not dictate independent integration times. Even if they influenced the electronic shutters, Matsushima does not disclose any mechanism for setting distinct integration times for each sensor. Instead, Matsushima consistently refers to “the determined shutter speed” and “the charge accumulation time” in the singular, reinforcing that the same integration time is used for both CCDs. Consequently, Matsushima does not disclose the independent integration time control required by the challenged claims, and the Petition fails to demonstrate otherwise.

103. In Matsushima, “CPU 30 performs various calculations such as focus evaluation calculations and AE [automatic exposure] calculations.” *Id.*, [0031]. However, Matsushima makes clear that a single charge accumulation time is used for controlling both CCD 18A and 18B in Matsushima’s two imaging systems. From Matsushima:

For AE control, the subject luminance (imaging EV value) is determined based on integration of the R, G, and B signals in a single frame by the integration circuits 60A and 60B, and the aperture value and shutter speed are determined based on this imaging EV value. The apertures 17A and 17B are driven via the drive circuits 52A and 52B, and the CCD 18A and CCD 18B charge accumulation time is controlled using an electronic shutter to reach the determined shutter speed. ...

During imaging and recording, the AF operation is performed when the release button is “half-pressed,” and the metering operation is repeated several times to obtain the exact imaging EV. The final aperture value and shutter speed for imaging is then determined based on the imaging EV. The apertures 17A and 17B are then driven to the final aperture value when the release button is “fully press”, and the charge accumulation time is controlled by the electronic shutters at the determined shutter speed. *Id.*, [0034]-[0035] (emphasis added).

104. The fact that Matsushima refers to “the charge accumulation time” (in the singular) of both “the CCD 18A and CCD 18B” indicates that the same charge accumulation time is used to drive both devices. Matsushima’s references to “the subject luminance” (singular), one EV value (singular), “the final aperture value” (singular) used to drive for both apertures 17A and 17B, and “the determined shutter speed” (singular), likewise indicate that one luminance (EV value) is determined for the subject, and a common aperture value as well as a common shutter speed are used

in both imaging systems. Matsushima's use of a common accumulation time for both of its CCDs fails to disclose independent control of the integration time of each sensor, as required by all of the challenged claims.

105. The Petition (at 20) relies on the following disclosure in Matsushima discussing timing signals:

A timing signal generating circuit (TG) 28 provides appropriate timing signals to the CCD drive circuits 20A and 20B, the CDS circuits 22A and 22B, and the A/D converters 24A and 24B in response to commands from the CPU 30, and each circuit is driven synchronously by timing signals applied from the timing signal generating circuit 28. Ex. 1007, [0027] (emphasis added).

106. For multiple reasons, this passage fails to disclose independent control of the integration time of each of Matsushima's CCDs. First, Matsushima discloses that these timing signals are used to control the timing of the retrieval of information from the CCDs, rather than the integration time of each CCD. See Ex. 1007, [0023] ("The accumulated signal charges are retrieved by CCD drive pulses applied by CCD drive circuits 20A and 20B, and are sequentially output from CCD 18A and CCD"). Second, even if such timing signals were used to control the electronic shutters on Matsushima's CCDs, Matsushima does not disclose that such timing signals independently control the electronic shutters. The fact that Matsushima describes "the determined shutter speed" (singular) and "the charge accumulation time" (singular) for both CCDs indicates that common (rather than independent) parameter(s) are used to control such devices.

107. While Matsushima describes its imaging systems as “independent” in that “subject images are formed on the light-receiving surfaces of CCD 18A and 18B via imaging optics 14A and 14B, respectively,” Matsushima fails to disclose that the integration time of CCD 18A and CCD 18B is independently controlled. *Id.*, [0017]. Not surprisingly, in its mapping of Element [1.3] in Ground 1, the Petition fails to even allege that Matsushima discloses independent control of the integration time of each CCD. Pet., 17-21.

108. From an imaging-systems standpoint, Matsushima’s block diagram shows a single control domain for both channels. The CPU 30 issues high-level exposure decisions and then drives a single timing signal generating circuit (TG) 28, which in turn feeds timing to both CCD drive circuits 20A and 20B, as well as the common front-end blocks (CDS and A/D). Matsushima is explicit: the TG “provides appropriate timing signals to the CCD drive circuits 20A and 20B, the CDS circuits 22A and 22B, and the A/D converters 24A and 24B in response to commands from the CPU 30,” and “each circuit is driven synchronously by timing signals applied from the [TG] 28.” (EX1007, ¶0027).

109. Technically, once the CPU determines the aperture value and the shutter speed (singular) from the metered EV (singular), the TG 28 materializes that result as a single timing pattern, which is then replicated into both CCD drive chains. Matsushima then describes the downstream actuation in the same singular terms: “the

apertures 17A and 17B are driven ... and the CCD 18A and CCD 18B charge accumulation time is controlled using an electronic shutter to reach the determined shutter speed,” followed by the metering loop that sets “the final aperture value and shutter speed” and controls “the charge accumulation time ... at the determined shutter speed.” (EX1007, ¶0034; EX1007, ¶0035).

110. At the sensor level, Matsushima explains that each CCD includes an electronic shutter (shutter gates and drains), and that the accumulation time (shutter speed) is controlled via shutter gate pulses. (EX1007, ¶0024). In an architecture where one TG sources timing and both CCD drivers are clocked synchronously, the same shutter-gate pulse train (period/duty) is applied to both sensors, yielding the same integration window on both channels—precisely what you would expect for a common AE solution. (EX1007, ¶0027; EX1007, ¶0024).

111. Conversely, to realize independent per-sensor integration-time control (what Petitioner reads in), the system would need per-channel timing with different shutter-pulse periods/duties (or distinct timing generators or de-synchronized clock domains) so that CCD 18A and CCD 18B integrate for different intervals within the same frame window. Matsushima does not disclose that. It discloses the opposite: one CPU, one TG, and synchronous drive of both CCD paths. (EX1007, ¶0027).

112. This control topology aligns with the text that the CPU 30 “performs automatic exposure adjustments (AE)” for the camera as a whole, not separately per

sensor, and that it performs the AE/AF calculations based on the image signals output from CCD 18A and CCD 18B and then drives the lens/aperture actuators accordingly. (EX1007, ¶0029; EX1007, ¶0031). In short: one metered EV → one shutter speed → one TG timing pattern → synchronous shutter pulses to both CCDs. That is a common AE/shutter implementation, not the independent per-sensor integration-time control that Petitioner's mapping presumes. This explains why Matsushima repeatedly speaks in the singular for the AE solution and then applies that same determined shutter speed across both CCDs.

113. As a result, Matsushima does not disclose independent control of integration time for each CCD, as required by the Challenged Claims. Instead, it applies a single charge accumulation time uniformly across both imaging sensors, as evidenced by its consistent references to the charge accumulation time, the determined shutter speed, and the final aperture value -- each in the singular. The Petition's reliance on Matsushima's timing signals is misplaced, as these signals merely coordinate data retrieval rather than independently adjusting integration times. Even if they influenced electronic shutters, Matsushima provides no disclosure of separate integration time control for each CCD.

C. Petitioner's "electronic shutter per sensor" citations do not show independent per-sensor control or in-frame control

114. From an imaging-systems standpoint, independent integration-time control in a multi-sensor camera is not achieved by merely noting that each CCD "has

a so-called electronic shutter function” or that a timing generator “provides appropriate timing signals.” To actually implement different in-frame integration windows on two CCDs that are capturing the same overall frame, a POSITA would expect three concrete ingredients in the disclosure: (i) Independent shutter-gate generation per sensor, (ii) Cross-sensor start/stop orchestration within the frame period and (iii) Downstream synchronization and fusion within a single frame. Each of these will be explained independently in the following paragraphs.

115. Independent shutter-gate generation per sensor. Each sensor must receive its own shutter-gate sequence (or an effectively separate, gated sub-clock domain) whose pulse width and phase define that sensor’s charge-accumulation window. In CCD terms, that means distinct control over the electronic shutter gate/clear signaling (or equivalent shuttering waveform) so that, for example, CCD 18A integrates for T_1 while CCD 18B integrates for T_2 ($T_1 \neq T_2$), within the same frame period. Where a system uses a single TG to fan out timing, the disclosure would need to explain how the TG outputs diverge per channel—e.g., separate shutter pins, channel-specific duty-cycle generation, per-channel registers, or downstream retiming that yields non-identical shutter pulses at the two CCDs. Without that, the default engineering reading is one timing pattern replicated to both sensors.

116. Cross-sensor start/stop orchestration within the frame period. Different integration windows inside one frame require relative phase control: e.g., start CCD

18A at t_0 and CCD 18B at $t_0 + \Delta$, and terminate one before/after the other—all before readout must begin. That implies disclosure of per-channel frame/line gating or comparable sequencing (e.g., per-channel vertical transfer triggers) so that the exposure windows fit inside a common frame while avoiding interference with correlated double sampling (CDS) and A/D timing. A POSITA would expect description of how those offsets are generated and enforced (distinct enable lines, masked sub-clocks, or dual TGs/PLL phases).

117. Downstream synchronization and fusion within a single frame. Once two sensors have different in-frame integration windows, the pipeline must synchronize their readouts, tag or buffer them on a common frame index/time base, and then normalize and fuse the data (gain/black offset/hot-pixel/linearity compensation) to produce one output image for that same frame. A POSITA would expect some acknowledgement of the ISP/processor choreography required to: (i) align the two data streams temporally, (ii) compensate per-channel exposure/gain differences, and (iii) merge them within that frame's processing budget.

118. Matsushima discloses none of this. In the paragraphs Petitioner cites, Matsushima says (i) each CCD has an electronic shutter function and (ii) the single timing signal generating circuit TG 28 “provides appropriate timing signals” to the CCD drive circuits—i.e., the drive/readout clocks that coordinate the imaging path. (EX1007, ¶¶0023–0024). Those passages describe the existence of electronic shutter

capability and a centralized timing source; they do not disclose distinct, per-channel shutter-gate timing that would produce different in-frame integration intervals on CCD 18A versus CCD 18B. (EX1007, ¶¶0023–0024).

119. This centralized, synchronous view is reinforced by Matsushima’s auto-exposure loop: the system meters one imaging EV, sets the aperture and the shutter speed (singular), and then controls “the CCD 18A and CCD 18B charge accumulation time ... to reach the determined shutter speed.” (EX1007, ¶¶0034–0035.) The repeated singulars—“the determined shutter speed,” “the charge accumulation time,” “the final aperture value and shutter speed”—are inconsistent with a design that generates non-identical shutter windows for each sensor during the same frame. A POSITA would not infer independent, per-sensor in-frame integration control from these singular AE statements and a generic “timing signals” fan-out.

120. Put differently: if Matsushima actually implemented different in-frame exposure windows per CCD, one would expect to see at least one of the following disclosed: (a) per-sensor shutter pins or explicitly separate shutter timing channels; (b) per-channel timing registers or parameters (e.g., separate exposure counts/widths) programmed by the CPU; (c) de-synchronized or multi-phase TG outputs with described phase/width differences per channel; (d) readout/processing coordination that names the in-frame offsets and explains how the ISP fuses the two exposures inside the frame period. Matsushima provides none of those specifics. It provides the

opposite: a single TG supplying timing to both CCD drive circuits and a single AE solution whose one shutter value is applied to control both CCDs' accumulation time. (EX1007, ¶¶0023–0024; 0034–0035).

121. Thus, citing the existence of an electronic shutter on each CCD and a TG that issues timing signals does not bridge the technical gap. It confirms only that the hardware is capable of electronic shuttering under common timing—not that the system actually drives different in-frame integration windows for CCD 18A and CCD 18B. (EX1007, ¶¶0023–0024).

D. The Petition Mischaracterizes The Actual Language Of Matsushima

122. In its parenthetical purporting to summarize paragraph [0034] of Matsushima, the Petition mischaracterizes the actual wording of the reference, inserting language that is not present in the text and which alters the meaning of the reference. Petitioner's characterization of paragraph [0034] of Matsushima (from page 20 of the Petition) is set forth below along with the actual wording of the reference.

<u>Petition, at 20</u>	<u>Actual Text Of [0034] Matsushima</u>
Ex. 1007, [0034] (for automatic exposure (AE) adjustment, the integration circuits 60A and 60B determine the subject luminance (imaging EV value) for sensors (CCD) 18A and 18B <u>respectively</u> , and CPU 30 determines “aperture value and shutter	For AE control, <u>the</u> subject luminance (imaging EV value) is determined based on integration of the R, G, and B signals in a single frame by the integration circuits 60A and 60B, and the aperture value and shutter speed are determined based on this imaging EV value. The

speed...based on this imaging EV value.”) (emphasis added)	apertures 17A and 17B are driven via the drive circuits 52A and 52B, and <u>the</u> CCD 18A and CCD 18B <u>charge accumulation time</u> is controlled using an electronic shutter to reach the determined shutter speed.
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123. Petitioner’s addition of the term “respectively” to its characterization of Matsushima has no textual support in the reference itself, and substantially changes the meaning of the actual words used by Matsushima. The fact that the Petition needs to rely on words not actually in Matsushima in attempting to make the case for invalidity underscores why Matsushima is deficient.

E. The Testimony Of Petitioner’s Expert Alleging That Matsushima Uses Different Integration Times Is Unsupported By The Reference

124. Petitioner’s expert asserts that Matsushima discloses images with different integration times, but this claim is unsupported by the actual disclosure of Matsushima. The cited passages do not reference independent integration time control or variation between the two imaging systems. Instead, Matsushima consistently refers to the subject luminance and the charge accumulation time in the singular, indicating that a single exposure control is applied to both CCDs. The expert’s attempt to infer different integration times based on a supposed difference in luminance across fields of view is not grounded in Matsushima’s teachings.

125. In his Declaration, Petitioner’s expert stated;

Further, as explained at [5.0] and [11.0], Matsushima provides improved image quality with a broad dynamic range, by combining images 62A and 62B having different integration times for different regions in a scene. Ex. 1007, [0048]-[0049], [0034].

Ex. 1003, ¶98 (emphasis added). The assertion that Matsushima's images 62A and 62B have different integration times is not supported (either expressly or inherently) in Matsushima. Each of the citations that Petitioner's expert provided for this assertion are examined below.

126. Beginning with paragraphs [0048]-[0049] of Matsushima, these paragraphs state that images 62A and 62B are taken by the first and second imaging system at different shooting angles and synthesized, but make no mention of different integration times. From Matsushima:

[0048] Next, the synthesis processing performed on captured images taken by the two imaging systems will be explained. In the present embodiment, by synthesizing a captured image 62A taken with the first imaging system 12A with a captured image 62B taken with the second imaging system 12B, an image with improved image quality in the center of the captured image is generated.

[0049] For example, when shooting at the widest angle, that is, at shooting angle α , indicated by the zoom operation means, as shown in FIG. 4 (A) and 4(B), a scaled down image 66 is generated from a captured image 62B taken by the second imaging system 12B, which is scaled down to the same magnification (shooting angle) as the captured image 62A taken by the first imaging system 12A, and this is synthesized with the captured image 62A taken by the first imaging system 12A. In other words, both images are synthesized by replacing the image in the center of the captured image 62A corresponding to the scaled down image 66, with the scaled down image 66. This improves image quality in the center of the image.

127. The next citation provided by the expert is to paragraph [0034] of Matsushima, which, as discussed in Section V(B), *supra*, refers to “the charge accumulation time” (in the singular) of both “the CCD 18A and CCD 18B,” which indicates that the same charge accumulation time is used to drive both devices. Nothing in paragraph [0034] of Matsushima expressly or inherently discloses the use of different integrations times by CDDs 18A and 18B.

128. The expert declaration also relies on the discussion of element [5.0] in the declaration to support the assertion that “images 62A and 62B have different integration times.” However, this section of the declaration does not provide any additional support. In discussing element [5.0], the declaration simply repeats its earlier citations to paragraphs [0048]-[0049] of Matsushima for the proposition that “image 62A and image 62B are captured with different exposures (with different integration times).” Ex. 1003, ¶109.

129. Finally, the expert declaration also relies on the discussion of element [11.0] in the declaration to support the assertion that “images 62A and 62B have different integration times.” Here, Petitioner’s expert tacitly acknowledges that Matsushima fails to expressly disclose different integration times, and pivots to the argument that “[a] POSITA would have understood that in Matsushima, the integration times of the image sensors would have different values for different subject luminance of different FOVs.” Ex. 1003, ¶134 (emphasis added). However,

Matsushima says nothing of the sort. Rather, Matsushima refers to “the subject luminance” (singular) and one EV value (singular). Ex. 1007, [0034].

130. In asserting that “[a] POSITA would have understood” that Matsushima disclosed different integration times, Petitioner’s expert states:

A POSITA would have understood that in Matsushima, the integration times of the image sensors would have different values for different subject luminance of different FOVs. This is because the first subject luminance of the shooting angle α and the second subject luminance of the shooting angle β are determined independently (by integration circuits 60A and 60B). Ex.1007, [0034].

Ex. 1003, ¶134 (emphasis added). This analysis is the opposite of what Matsushima actually says. In paragraph [0034], Matsushima refers to “the subject luminance” in the singular -- and makes no mention of “different subject luminance of different FOVs,” “the first subject luminance” or “the second subject luminance.” In making this analysis, Petitioner’s expert has strayed far and wide from what “a POSITA would have understood” from the actual words of Matsushima.

131. In an attempt to justify his reading into Matsushima of “different subject luminance of different FOVs,” “the first subject luminance” and “the second subject luminance,” Petitioner’s expert states:

.. For example, the first sensor imaging the larger FOV (see 62A including the sun, the sky and other background objects) has a different subject illuminance (e.g., a higher subject illuminance) from the second sensor imaging the smaller FOV (see 62B including a person and a flower), thereby a different integration time (e.g., a shorter integration time) is determined for the first sensor. A broad dynamic range is

achieved by combining images 62A and 62B having different integration times for different regions in a scene.

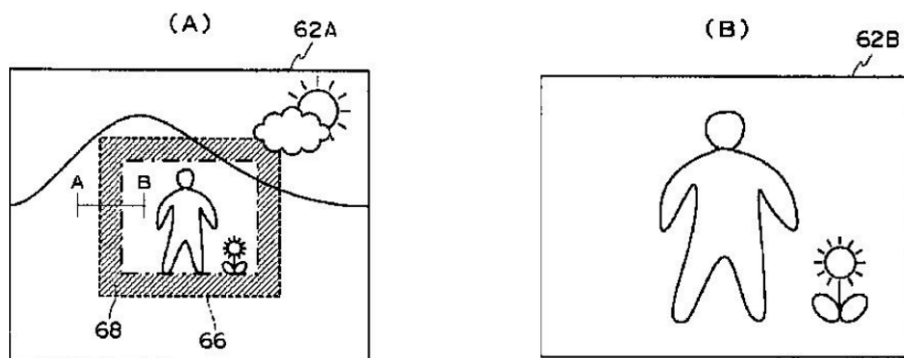
Ex. 1003, ¶134 (emphasis added). Again, the concepts relied on in this analysis are not disclosed in Matsushima. Matsushima refers to “the subject luminance” in the singular -- not “different subject luminance.” Moreover, Matsushima make no mention of the subject of dynamic range in any way, shape or form. The concept of a “broad dynamic range” is one that Petitioner’s expert brought to Matsushima, rather than one grounded in the disclosure of the reference itself.

F. Given The Known Obstacles To Synthesizing Digital Images With Different Exposures, Interpreting Matsushima As Disclosing Different Integration Times Would Be Inconsistent With The Prior Art As A Whole

132. Petitioner’s argument that Matsushima’s images 62A and 62B have different exposure times -- and that this equates to different integration times -- is both inconsistent with Matsushima’s disclosure and contrary to the understanding of the prior art. Matsushima explicitly describes a synthesis process aimed at achieving a natural boundary between combined images, a goal that the prior art recognized as particularly challenging when merging images with different exposures. More specifically, prior research, including studies on image mosaics, highlighted the difficulty of blending images with differing exposures without producing unnatural seams. Thus, Petitioner’s argument that images 62A and 62B in Matsushima have different exposure times (which the Petition equates with different integration times)

is inconsistent with the teachings of the prior art as a whole, which recognized the challenge of achieving a natural boundary (as called for Matsushima) when synthesizing images with different exposures.

133. As shown in Figures 4A and 4B of Matsushima (reproduced below), Matsushima disclosed that “a scaled down image 66 is generated from a captured image 62B” by scaling down image 62B “to the same magnification (shooting angle) as the captured image 62A,” and then “both images are synthesized by replacing the image in the center of the captured image 62A corresponding to the scaled down image 66, with the scaled down image 66.” Ex. 1007, [0049].



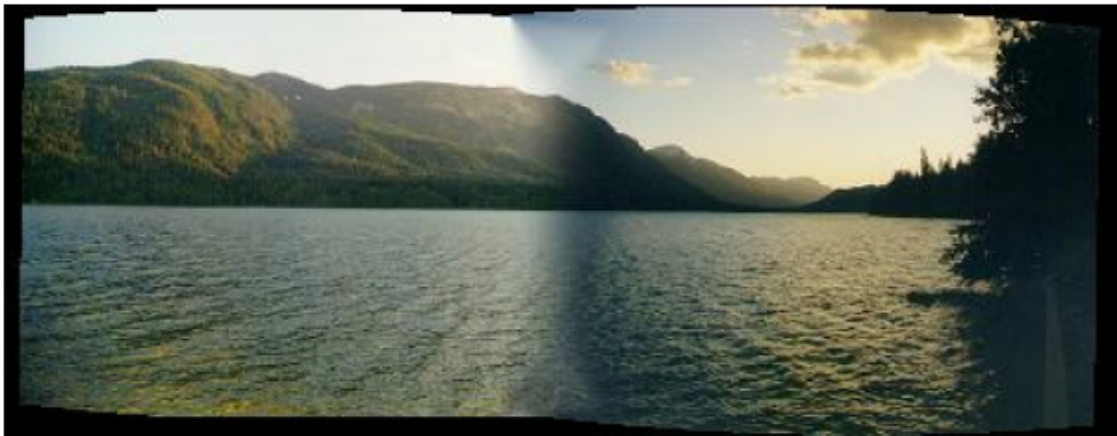
134. Matsushima recognized that “simply replacing the image in the center of the captured image 62A with the scaled down image 66 may result in an unnatural boundary between the two images,” and stated that “correction data is generated to correct the image in the peripheral regions 68 based on the image data in the peripheral region 68 (shaded region) of the scaled down image 66 and the image data in the peripheral region 68 of the captured image 62A.” Ex. 1007, [0050]-[0051] (emphasis

added). The “correction data” is used so that “the boundary between the captured image 62A and the scaled down image 66 can be kept from becoming unnatural.” *Id.*, [0057]. Matsushima’s “correction data” is represented by the “correction curve” illustrated in Figure 5 of the reference, which functions to “blend” the areas of overlap.

135. Matsushima does not state that its techniques were useful for synthesizing images with different exposures. This is not surprising, because synthesizing images with different exposures in a manner that resulted in a natural boundary was a known problem. As explained in one paper from the time (authored by researchers at Harvard and Microsoft):

When capturing images to create mosaics, automatic cameras often change their exposure settings. Even if the images are blended in the areas of overlap, if the exposure difference between images is too high, it will give the panorama a creased look around the edges of the overlap. Feathering [10] the effect of the blend into the rest of the image will help remove creases, but the exposure change will still be too abrupt to appear natural. (Figure 7) Uyttendaele, Matthew, Ashley Eden, and Richard Skeliski. “Eliminating ghosting and exposure artifacts in image mosaics.” *Proceedings of the 2001 IEEE Computer Society Conference on Computer Vision and Pattern Recognition. CVPR 2001*. Vol. 2. IEEE, 2001. Ex. 2016, 4 (emphasis added).

The unnatural boundary after synthesis of the images with different exposures is illustrated in Figure 7(A) of the paper (reproduced below):



(A)

Id., 6. Figure 7(A) (above) shows a two image mosaic where two images with different exposures have been blended and feathered. *Id.*, 4, 6. The boundary between the two images is a highly noticeable and far from “natural” boundary between images 62A and 66 called for in Matsushima. *Id.*, 6 (referring to “the sharp transition between images in the center of the mosaic”).

136. The paper discussed two methods for potentially ameliorating the unnatural boundary shown in Figure 7(A), neither of which resulted in a natural boundary. One method, referred to as a “block based exposure adjustment,” resulted in the image shown in Figure 7(B) of the paper (reproduced below):



(B)

After “block based exposure adjustment,” the boundary between the two images is still highly noticeable and far from “natural” boundary between images 62A and 66 called for in Matsushima.

137. The other method for potentially ameliorating the unnatural boundary method involved the application of an “exposure compensation algorithm” and resulted in the image shown in Figure 7(C) of the paper (reproduced below):



(C)

While somewhat improved, the boundary between the two images is still noticeable and far from “natural” boundary between images called for in Matsushima.

138. Thus, inserting an image (e.g., Matsushima’s high resolution image) captured with one illumination into another image (e.g., Matsushima’s low resolution image) captured with a different illumination would result in a mosaic with an unnatural boundary that could not have been corrected with boundary style algorithms. When viewed in light of the prior art as a whole -- which recognized the challenge of synthesizing images with different exposures in a manner that resulted in the natural boundary called for by Matsushima -- the actual wording of Matsushima makes sense. More specifically, Matsushima’s description of a common charge accumulation for both CCD 18A and CCD 18B would have resulted in images having the same exposure. While Matsushima’s blending of images with the same exposure may indeed have resulted in the natural boundary called for by the reference, there is no description in Matsushima or in the Petition itself of any techniques at the time that could have synthesized images with different exposures in a way that would have resulted in the natural boundary called for by Matsushima. Thus, in addition to deviating from the actual text of Matsushima, Petitioner’s reading of Matsushima is inconsistent with the state of the art, which recognized that achieving a natural boundary between images with different exposures was problematic.

139. In summary, the Petition fails to acknowledge or address Matsushima's repeated descriptions in the singular (for both of Matsushima's imaging systems) of "the charge accumulation time," "the subject luminance," the "EV value," "the final aperture value" used to drive for both apertures 17A and 17B, and "the determined shutter speed." Rather than staying true to the description of these parameters in the singular as set forth in the reference, Petitioner and its expert have attempted to rewrite the reference by introducing features such as "different subject luminance of different FOVs," "the first subject luminance," "the second subject luminance" and a "broad dynamic range" -- none of which have textual support in the reference itself. In so doing, Petitioner and its expert have interpreted Matsushima in a manner that is inconsistent with the prior art as a whole, which understood that achieving a natural boundary between images with different exposures was problematic. For all of these reasons, the Petitioner has failed to demonstrate that Matsushima discloses independent control of the integration time of each sensor.

G. Response to Institution Decision

140. The Board asks why a "processing component configured to control an integration time of each sensor" does not read on a design that merely addresses two sensors individually but forces both to operate with the same shutter value. (Institution, 22). In my opinion, the answer follows directly from the intrinsic record

and how a person of ordinary skill in the art (POSITA) would have understood it at the time.

1. The intrinsic record uses “control [of] an integration time” to mean independent focal-plane (on-sensor) timing per channel, settable differently within the same frame window

141. The ‘158 patent explicitly defines integration time control as focal-plane (on-sensor) control of the charge-integration switch— “the time the image sensor collects and integrates signal from the scene,” implemented by “controlling a switch (e.g., charge integration switch) coupled or connected to the sensor,” and expressly labeled “focal plane shutter control.” (EX1001, 3:65–4:6; 4:46–56).

142. The specification further teaches a multi-channel system that images the same field of view substantially simultaneously, with each channel operating under a different integration time, and a processor “configured to separately and simultaneously control an integration time of each channel,” so that the simultaneously captured channel data can be combined into a single frame with enlarged dynamic range. (EX1001, 4:38–45; 5:3–18; 7:36–39).

143. In that context, the phrase “of each sensor” conveys two degrees of freedom: (i) per-sensor focal-plane timing and (ii) the ability to set those timings differently within the same frame window to create multi-exposure content that the system then fuses in a single output frame. A scheme that always drives the same shutter value to both sensors—even if the controller can “address” them

individually—collapses those two degrees of freedom into one common-mode setting and thus does not provide the independent per-sensor control the patent claims and teaches. (EX1001, 4:38–45; 5:3–18; 7:36–39; 8:32–38).

2. A POSITA would require per-sensor shutter-gate timing (not a shared timing pattern) to meet limitation 1.3

144. In 2004–2005 practice, independent per-sensor integration-time control meant per-sensor shutter-gate generation (distinct gate/clear sequences or gated sub-clocks) so that one CCD’s charge-accumulation window can be varied without varying the other within the same frame period. A design that merely replicates the same shutter pulses to both sensors is not “configured to control [integration time] of each sensor” in the sense used by the patent; it exposes only a single controllable variable shared across sensors, not independent control over each.

145. That is exactly what Matsushima discloses: TG 28 “provides appropriate timing signals” and the drive/readout circuits are operated synchronously, while the AE loop meters one imaging EV, sets the aperture and the shutter speed (singular), and then controls “the CCD 18A and CCD 18B charge accumulation time ... to reach the determined shutter speed.” (EX1007, ¶¶0023–0024, 0034–0035.) Nothing there identifies distinct, in-frame shutter-gate windows per sensor.

H. Claim 2 — “control ... during a frame” requires in-frame focal-plane actuation per sensor

146. Claim 2 further requires that “the processing component is further configured to control the integration time of each sensor during a frame.” Read in light of the specification, a POSITA would understand “during a frame” to mean within the frame-capture window itself—i.e., actuating the focal-plane (charge-integration) switch that opens/closes each sensor’s integration window while that frame’s data are being collected, not merely choosing a value beforehand.

147. The ‘158 patent ties “integration time” to focal plane shutter control of a charge-integration switch— “the time the image sensor collects and integrates signal from the scene,” implemented by “controlling a switch (e.g., charge integration switch) coupled or connected to the sensor,” expressly labeled “focal plane shutter control.” (EX1001, 3:65–4:6; 4:46–56). The patent also teaches that the multi-channel system images the same field of view substantially simultaneously, with channels each operat[ing] independently under a different integration time, and with the processor “separately and simultaneously control[ing] an integration time of each channel,” followed by single-frame combination of those data. (EX1001, 4:38–45; 5:3–18; 7:36–39). In context, “of each sensor” thus denotes two degrees of freedom: (i) per-sensor focal-plane timing, and (ii) the ability to set those timings differently within the same frame window to generate the multi-exposure content that is then fused in one frame.

148. Matsushima’s AE is pre-capture, not in-frame control. Under Ground 1, Petitioner relies on Matsushima’s auto-exposure (AE) sequence—meter → determine the imaging EV (singular) → compute the aperture and the shutter speed (singular) → expose by controlling “the CCD 18A and CCD 18B charge accumulation time ... to reach the determined shutter speed.” (EX1007, ¶¶0034–0035.) Those passages describe a pre-exposure selection of a single shutter value and a subsequent exposure at that value. They do not disclose (or inherently require) any in-frame control event in which the controller actuates different charge-integration windows for 18A versus 18B while the frame is being captured. (EX1007, ¶¶0034–0035). Accordingly, Matsushima’s AE is a pre-capture loop; no in-frame actuation is identified.

149. TG-28 does not supply per-sensor, in-frame shutter gating. Petitioner’s fallback to the timing generator misreads Matsushima. The reference states that TG-28 “provides appropriate timing signals” to the CCD drive circuits and describes the two image paths as being driven synchronously—i.e., frame/line/transfer clocks used to coordinate operation and readout—not distinct per-sensor shutter-gate waveforms that define different integration windows within the same frame. (EX1007, ¶¶0023–0024). Nothing in ¶¶0023–0024 or ¶¶0034–0035 identifies any actuation “during a frame” that sets per-sensor integration time, much less different in-frame windows across the two CCDs. A POSITA would understand TG-28’s “timing signals” as coordination clocks, not per-sensor, in-frame shutter gating. (EX1007, ¶¶0023–0024).

150. A POSITA would distinguish: (i) timing used to sequence exposure/readout (line clocks, vertical transfers, synchronous drive) from (ii) timing that defines the charge-integration interval (the focal-plane shutter gate). The former is consistent with Matsushima’s description of TG-28 (EX1007, ¶¶0023–0024); the latter is what claim 2 requires during the frame as to each sensor under the ‘158 patent’s definition of integration-time control. (EX1001, 3:65–4:6; 4:46–56).

151. Singular AE terms underscore absence of in-frame per-sensor control. Matsushima repeatedly uses singular forms— “the imaging EV,” “the aperture value and the shutter speed,” “the determined shutter speed,” “the charge accumulation time”—and applies them conjunctively to both CCDs. (EX1007, ¶¶0034–0035.) That language is incompatible with the notion that, during the capture of a frame, one CCD is gated differently from the other by an independent controller action.

I. Claims 11 and 16 — Relative integration-time limitations require independent, per-sensor focal-plane control within a frame

152. Claims 11 and 16 add a concrete relative constraint— “the integration time of at least one channel is relatively shorter than ... at least one other channel” (claim 11) and “a first integration time ... is less than a second integration time” (claim 16). Read in light of the specification, these limitations require independent, per-sensor focal-plane control that sets different integration-time windows across sensors within the same frame to produce the multi-exposure content that is then combined into a single frame. The ‘158 patent teaches channels that acquire images

simultaneously, with each operating independently under a different integration time, and a processor that “separately and simultaneously control[s] an integration time of each channel,” followed by single-frame combination. (EX1001, 4:38–45; 5:3–18; 7:36–39; 8:32–38).

153. A POSITA would understand that meeting these relative limitations requires the processing component to furnish per-sensor shutter-gate timing (distinct gate/clear sequences or gated sub-clocks) so that, during the frame, one sensor’s charge-accumulation window is shorter (or longer) than another’s. Absent independent, in-frame focal-plane actuation per sensor, the system cannot realize the claimed relative relationship (“shorter than,” “less than”) within a single frame.

154. Matsushima does not disclose different in-frame integration windows. Petitioner identifies no disclosure in Matsushima that one CCD runs shorter (or longer) than the other within a frame. To the contrary, Matsushima meters “the subject luminance (imaging EV value)” (singular), determines “the aperture value and shutter speed” (singular), and then controls “the CCD 18A and CCD 18B charge accumulation time ... to reach the determined shutter speed”—again singular. (EX1007, ¶¶0034–0035.) That is a common-value regime, not the relative regime claims 11 and 16 require.

155. TG-28’s “timing signals” do not supply the missing per-sensor difference. Petitioner’s fallback to TG-28 misreads the reference. Matsushima

explains that TG-28 “provides appropriate timing signals” to the CCD drive circuits and describes synchronous operation of the two image paths—i.e., frame/line/transfer clocks coordinating drive/readout—not distinct, per-sensor shutter-gate waveforms that define different integration windows within the same frame. (EX1007, ¶¶0023–0024.) Nothing in ¶¶0023–0024 or ¶¶0034–0035 identifies any actuation that sets different in-frame integration times for CCD 18A versus CCD 18B.

156. Petitioner’s “respectively” edit cannot rewrite the reference. Petitioner’s paraphrase that ¶0034 determines luminance “respectively” for 18A/18B is a textual error—the word does not appear in Matsushima—and cannot create the difference between per-sensor integration times that the claims demand. (EX1007, ¶0034). Under 37 C.F.R. § 42.65(a), such unsupported expert gloss is entitled to little weight.

157. On this record, claims 11 and 16 are not met: a system that always drives the same shutter value to both sensors within a frame—as Matsushima describes—does not satisfy the claims’ relative integration-time requirements, which, read with the intrinsic record, demand independent, in-frame focal-plane control capable of setting different integration windows per sensor and then combining those single-frame data. (EX1001, 4:38–45; 5:3–18; 7:36–39; 8:32–38; EX1007, ¶¶0023–0024; 0034–0035).

X. GROUND 2 FAILS TO ESTABLISH OBVIOUSNESS BECAUSE NEITHER YU ALONE NOR THE COMBINATION OF YU AND MIYAZAKI DISCLOSES INTEGRATION TIME CONTROL IN THE CONTEXT OF A SCENE

158. Ground 2 argues that the Challenged Claims are obvious over Yu alone. In the alternative, Ground 2 argues that the Challenged Claims are obvious over Yu in combination with Miyazaki. See, e.g., Pet., 50-54 (arguing that Yu alone meets element [1.3] and 55-63 (arguing that the combination of Yu and Miyazaki renders element [1.3] obvious). The discussion below begins with an overview of Yu and an explanation why Yu fails to meet the limitations of the challenged claims. An overview of Miyazaki is presented next, followed by an explanation why Yu and Miyazaki together fail to render the challenged claims obvious.

A. Yu Alone Fails To Render The Challenged Claims Obvious

159. Yu is directed to improving *digital photography* by enhancing image resolution and color quality to more closely resemble film-based photographs. Yu identifies the limitations of digital cameras compared to film, and proposes a multi-sensor, multi-lens system to produce high-quality, *still images* without significantly increasing costs. Yu consistently describes its invention in the context of *digital photographs* and printed images. Although Yu occasionally uses the term “scene,” the context makes clear that Yu is referring to a single *picture* or *photograph*. Yu’s usage of “scene” is different from the usage of that term in the ‘158 Patent, where a “*scene*”

refers to a sequence of frames generated during a continuous action in time and space, such as a scene with varying illumination.

1. Overview of Yu

160. Yu is directed to “digital photography,” and to a digital camera that takes digital photographs (still images) with colors and details that more closely replicate that of film cameras. Starting with its “Description of Related Art,” Yu describes the capability of film-photography to produce high-resolution images and vivid colors, and explained the shortcomings of existing digital photography techniques that lacked the high-resolution and vivid colors produced by film. From Yu:

Description of Related Art

Digital photography is one of the most exciting technologies to emerge during the twentieth century. With the appropriate hardware and software (and a little knowledge), anyone can put the principles of digital photography to work. Digital cameras are on the cutting edge of digital photography. ...

Digital cameras, however, do not work in the way as the traditional film cameras do. In fact, they are more closely related to computer scanners, copiers, or fax machines. ...

Nevertheless, there are many cases in which digital cameras simply could not be used due to the limited resolutions from today’s digital cameras. Film-based photographs have immeasurably higher resolutions than digital cameras. The comparison magnitude may be somewhere millions of pixels versus tens thousands of pixels in the digital cameras. Although, it is theoretically possible to design a photosensitive chip with multimillion of pixels, the cost of such chip would be a forbidden number and may consequently drag the digital cameras out of the consumer market. ...

To have color images with higher resolutions, the number of photocells in a sensor must be increased. ... Therefore there is a great need for a generic solution that makes digital cameras capable of producing high resolution images without enormously incurring the cost of photosensitive chips with multimillion photocells.

A second noticeable quality between digital cameras and film-based cameras is the dynamic range. Films have the necessary chemical pigments to make colors much more vivid and more adaptive to light conditions than current digital cameras can do. This is largely due to the limited pixel depth the current digital cameras could produce and the limited sensitivity of the photocells in the image sensor. There is thus a further need for digital cameras that produce better colors and details in a greater range. ... Ex. 1005, 1:12-2:16 (emphasis added).

161. After discussing the deficiencies of digital photography as compared to film-based photography, Yu positioned its invention as having “been made in consideration of the above described problems and needs” in order to improve the image resolution and color ranges of existing digital cameras by providing “film-like true color” images “without incurring substantial costs.” From Yu:

SUMMARY OF THE INVENTION

Recent product introductions, technological advancements, and price cuts, along with the emergence of email and the World Wide Web, have helped make digital cameras the hottest new category of consumer electronics products. But the image qualities, noticeably the image resolutions and color dynamic ranges, have limited the popularity of digital cameras among consumers. Under the constraints of improving image qualities without incurring substantial costs to the digital cameras, the present invention discloses improved digital cameras that use multiple image sensors with multiple lenses.

The present invention has been made in consideration of the above described problems and needs and has particular applications to digital cameras that are demanded to produce digital images of high qualities. ... Using a set of digital image processes embedded in a digital

signal processing chip, images from the three color image sensors are processed with reference to the image from the black-and-white image sensor and subsequently produce high quality and film-like true color digital images. Ex. 1005, 2:23-49 (emphasis added).

162. The Detailed Description of The Preferred Embodiments of Yu also emphasized that Yu was directed to a digital camera that, in some cases, had the same look as a “regular film camera” and that could capture digital photographs that could be printed “on glossy paper.” From Yu:

FIG. 4B shows another arrangement of four lenses 402, 404, 406 and 408 in a regular camera lens opening 410 so that the exterior appearance of a digital camera with multiple sensors and multiple lenses may look the same as a regular film camera. Ex. 1005, 6:17-21 (emphasis added).

* * *

For completeness, along with digital image processing circuitry 338, post circuitry 350 includes all necessary circuits to further process vector or color image 340. It is understood to those skilled in the art that some of the functions performed may include image compression in a conventional format such as JPEG and necessary I/O functions so that color images generated by digital camera 300 may be downloaded to other computing devices for further artistic editing/processing and subsequently for printing on glossy paper or publication on the Internet or World Wide Web. Ex. 1005, 7:9-18 (emphasis added).

163. While in several places Yu uses the term “scene,” it is clear from the context that Yu uses “scene” synonymously with a “picture” (a still image or photograph). See, e.g., Ex. 1005, 1:30-36 (“The photosensitive device reacts to light reflected from the scene and can translate the strength of that reaction into a numeric equivalent. By passing light through red, green, and blue filters, for example, the reaction can be gauged for each separate color spectrum. When the readings are

combined and evaluated via software, the camera can determine the specific color of each segment of the picture”), Yu’s usage of “scene” is different from the usage of that term in the ‘158 Patent, where a “scene” refers to a sequence of frames generated during a continuous action in time and space, such as a scene with varying illumination.

2. Yu does not disclose on-sensor (focal-plane) integration-time control

164. Yu discloses feedback-based exposure-time control signals, not on-sensor, focal-plane integration-time gating. Its “digital image processing circuitry” “produces four control signals, each controlling the exposure time of one of said four image sensors,” and “all necessary control signals” are generated in that circuitry and delivered to per-sensor control circuits (342/344/346/348). (EX1005, 6:59–65; 11:39–42; 12:10–14; 12:16–19.) Those passages say nothing about an electronic shutter at the sensor, a charge-integration switch, or gate/clear timing that defines a focal-plane integration window. They are agnostic as to how “exposure time” is implemented (e.g., optical aperture/ND, mechanical shuttering, or electrical integration).

165. The specific lines Petitioner cites describe: (i) generation of exposure-time control signals in the image-processing circuitry, and (ii) delivery of those signals to external per-sensor control circuits. (EX1005, 6:59–65; 12:10–19). Yu does not state that the sensors incorporate or are driven by an on-sensor electronic shutter, nor does it mention charge accumulation period, reset/clear gating, shutter gates, or any

equivalent focal-plane shutter terminology. In short, Yu does not disclose where or how the exposure-time control is implemented—only that exposure-time control signals exist.

166. Petitioner’s substitution of “integration time” for Yu’s “exposure time” is unsupported. The Petition equates Yu’s “controlling exposure time” with “controlling an integration time,” asserting the control signals are “sent to the sensors themselves” and therefore amount to on-sensor control. But the cited text is the same exposure-time language above, plus an annotated figure; Yu never states electronic shutter, charge-integration switch, reset/clear gating, or any equivalent on-sensor shutter feature. (EX1005, 6:52–65; 12:16–19.) In my opinion, the “on-sensor = integration time” leap is attorney/expert gloss—not Yu—and under 37 C.F.R. § 42.65(a) such conclusory substitutions should receive little weight.

167. Yu’s objective differs from the ‘158 patent’s integration-time solution. Yu is a multi-sensor, multi-lens color system that performs histogram-based exposure control and registration/combination to form a virtual color/vector image. (EX1005, 6:59–65; 7:50–53; 13:21–31). Its references to “high dynamic ranges” are tied to that multi-sensor color architecture and post-capture processing flow—not to independent, in-frame, focal-plane timing of multiple sensors. By contrast, the ‘158 patent defines integration time as sensor-level focal-plane shutter control of a charge-integration switch and requires separately and simultaneously controlling the integration time of

each channel so that single-frame fusion of different in-frame exposures can be performed. (EX1001, 3:65–4:6; 4:46–56; 5:3–18; 7:36–39).

168. A POSITA would understand Yu to disclose exposure-time control signals generated in processing logic and routed to sensor-side control circuits, without disclosing on-sensor focal-plane gating that defines and actuates per-sensor integration windows during the frame. Yu therefore does not supply the missing per-sensor focal-plane integration-time control that the ‘158 patent claims and teaches.

3. Yu Alone Fails To Meet All Of The Limitations Of The Challenged Claims

169. Each of the independent Challenged Claims requires control/identification of an “integration time” for each sensor/channel.⁶ The Petition interprets an “integration time” as “the time the image sensor collects and integrates signal from the scene.” Pet., 8. (*emphasis* added). Petitioner’s construction is consistent with the explicit definition of “integration time” in the specification. Ex. 1001, 3:3-6, Petitioner’s construction is also consistent with the purpose of the ‘158 Patent, which was to expand the dynamic range for capturing “scenes with highly varying illumination,” such as “a single scene that might involve indoor lighting (100

⁶ Claim 1 recites “a processing component configured to control an integration time of each sensor”; Claim 9 recites “the processing component is configured to determine an integration time of each channel”; and Claim 15 recites “identifying an integration time for each of plurality of channels.”

lux) and outdoor lighting (100,000 lux)” while minimizing “undesirable temporal aliasing from moving scenes.” *Id.*, 1:52-53, 2:34-37 and 3:47-57 (emphasis added). Simply put, the application of integration time control during a “scene” is not met by Yu which, as explained above, is limited to digital photography, namely, the capture of singular still images.

170. Since Yu fails to disclose integration control in the context of a scene (as required by Petitioner’s own construction), the Petition fails to demonstrate a reasonable likelihood of success in demonstrating that the Challenged Claims are obvious over Yu alone under Ground 2.

B. The Combination Of Yu And Miyazaki Set Forth In The Petition Does Not Render The Challenged Claims Obvious

171. In the alternative, Ground 2 argues that the Challenged Claims are obvious over Yu in combination with Miyazaki. Pet., 55-63. However, Miyazaki is not offered to cure the deficiency in Yu noted above (i.e., Yu’s failure to disclose integration control in the context of a scene). Rather, the Petition relies on Miyazaki’s electronic shutter “[t]o the extent it is argued that Yu’s description of using sensor-level exposure time control” is deficient. Pet., 55. Significantly, the eight pages that the Petition devoted to the proposed combination of Yu and Miyazaki (Pet., 55-62) only mentions the term “scene” one time, and in that instance, the Petition was quoting the district court’s reference to “scene” in the court’s claim construction decision, rather than any disclosure in Miyazaki. Pet., 56, quoting, Ex. 1015, 49. Simply put,

since the Petition fails to even allege that “Yu-Miyazaki” discloses integration time control during a “scene,” the Petition fails to demonstrate a reasonable likelihood of success of demonstrating that the Challenged Claims are obvious over Yu-Miyazaki under Ground 2.

1. Overview of Miyazaki

172. Miyazaki is directed to implementing a digital camera that produces still pictures. Miyazaki identified the problem of an operator missing an opportunity to take a picture due to a delay in the operator’s decision to take the picture or “release time lag” which represents the delay between the time an operator intended to take a picture and the actual time the picture is taken. From Miyazaki:

2. Description of the Background Art

A digital still camera extensively used today uses a CCD (Charge Coupled Device) image sensor or similar solid-state image sensor in place of the traditional silver halide photo sensitive type of film. This kind of camera is capable of storing image data output from the image sensor in a semiconductor memory or similar storage and reproducing it on a monitor in the form of a picture. This allows the operator of the camera, watching the monitor, to confirm the result of a shot immediately after the shot. However, it is not easy for the operator to determine a shutter chance while focusing the camera on a desired subject and selecting the range of a shot at the same time ... For example, the operator is apt to miss a shutter chance due to the delay of operator’s decision or action or the delay of operation particular to the camera. This brings about a release time lag between the intended time for shooting and the time of the actual shot. ...

The release time lag, however, depends on the person to operate the image pickup apparatus. ... Moreover, even the picture taken with due consideration given to the release time lag is not always a picture

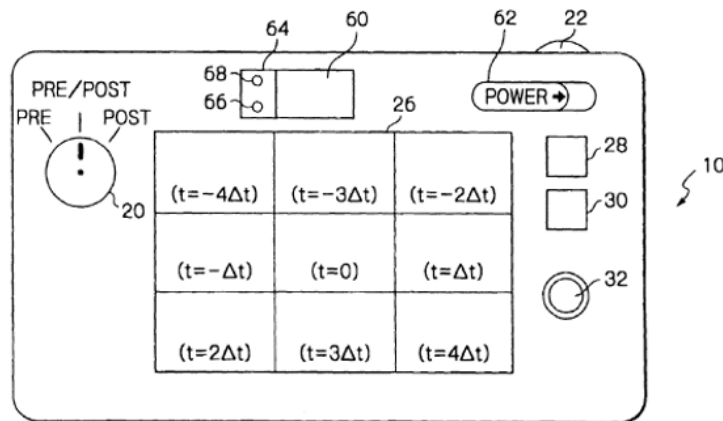
picked up at a desired timing or shutter chance. Ex. 1006, 1:14-51 (emphasis added).

173. Miyazaki next disparaged cameras that continuously pick up a desired scene as wasteful, and ended its discussion of the background art by noting the difficulty of implementing a digital camera capable of producing high-quality still pictures. From Miyazaki:

To allow the operator of a digital still camera to surely take a picture at a desired timing, the camera may be constructed to continuously pick up a desired scene while sequentially recording the resulting successive pictures in a memory in the same manner as a movie camera. However, simply picking up successive pictures and storing the whole data representative of the pictures not only wastes the limited capacity of the memory, but also increases processing loads. This makes it difficult to implement a digital camera capable of producing high-quality still pictures. *Id.*, 1:52-62 (emphasis added).

174. Miyazaki's solution was a digital camera that picked up a plurality (e.g., nine) still images separated in time by a preselected interval (Δt) in order to allow the operator to select the best still picture. *Id.*, 5:10-24; 6:54-55. Figure 1 of Miyazaki (reproduced below), illustrates an LCD display on the back of the camera of the nine successive pictures:

Fig. 1



175. As Miyazaki explains, “the camera 10 displays the successive frames or pictures picked up at consecutive times on an LCD (Liquid Crystal Display) panel or monitor 26 (see FIG. 1) in a multiframe format. The operator, watching the LCD panel 26, selects desired one of the frames on an “F (forward) switch 28, a “B (backward) switch 30, and an enter/store switch 32. In response, the camera 10 writes image data representative of the frame selected by the operator in the external memory 16.” *Id.*, 3:62-4:3.⁷

⁷ Similar to Yu, while in several places Miyazaki uses the term “scene,” it is clear from the context that Miyazaki uses “scene” synonymously with a “picture” (a still image or photograph). *See, e.g., Id.*, 1:15-28 (“A digital still camera ... is capable of storing image data ... and reproducing it on a monitor in the form of a picture. ... This allows the operator of the camera, watching the monitor, to confirm the result of a shot immediately after the shot. However, it is not easy for the operator to determine a shutter chance while focusing the camera on a desired subject and selecting the range of a shot at the same time, and then pick up the scene at a desired timing. For example, the operator is apt to miss a shutter chance ...”)

176. In Miyazaki, exposure control is based in part on the use of a mechanical shutter. *Id.*, 4:16-19 (“the camera 10 controls a shutter speed, i.e., an exposure time at the time of a shot by controlling the mechanical shutter and an electronic shutter available with the CCD image sensor 14”); Pet., 58 (quoting the same passage in Miyazaki). Accordingly, in Miyazaki the mechanical shutter defines a coarse/open interval, while the electronic shutter (on-sensor charge gating) can shorten or fine-tune.”

2. The Purported Combination Of Yu And Miyazaki Fails To Meet All Of The Limitations Of The Challenged Claims

177. Miyazaki’s control of its electronic shutter fails to disclose the application of integration time control during a “scene” because, as explained above, Miyazaki is limited to digital photography, namely, the capture of singular still images. Since neither Yu nor Miyazaki discloses integration control in the context of a scene (as required by Petitioner’s own construction), the Petition fails to demonstrate a reasonable likelihood of success of demonstrating that the Challenged Claims are obvious over Yu-Miyazaki under Ground 2.

178. Miyazaki describes one solid-state image pickup device (a CCD) in a digital still camera whose shutter speed is controlled by a combination of a mechanical shutter and an electronic shutter available with the CCD image sensor; later, it explains generation of an electronic-shutter control signal for that single CCD. (EX1006, 4:16–19; 27:37–44). Thus, the reference teaches how to time the charge-

integration interval of one sensor (optionally coordinated with a mechanical shutter). It does not convert a system into a multi-sensor architecture.

179. Multi-sensor, in-frame focal-plane control requires three concrete mechanisms that Miyazaki does not disclose: (i) Per-sensor shutter-gate generation, (ii) In-frame cross-sensor synchronization and/or (iii) Feedback-to-gate wiring per sensor. Each of these is explained in the following paragraphs.

180. (i) Per-sensor shutter-gate generation. To run multiple sensors with different integration windows within the same frame period, a POSITA would expect independent shutter-gate waveforms (or independently gated sub-clocks) per sensor, so that Sensor A can integrate for T_1 while Sensor B integrates for T_2 ($T_1 \neq T_2$) within that frame. Miyazaki identifies only an electronic shutter for a single CCD and a single electronic-shutter control signal path—no replication, no per-sensor programmability, and no channel-specific gating that would create non-identical integration windows across multiple sensors. (EX1006, 4:16–19; 27:37–44).

181. (ii) In-frame cross-sensor synchronization. With multiple sensors, different integration windows must be phase-aligned to the same frame budget (e.g., start A at t_0 , start B at $t_0 + \Delta$; end A before readout begins; end B at a different Δ'), and readout/CDS/A-D must be sequenced so both sensors' data are available for the same output frame. Miyazaki discusses timing only for one CCD; it does not describe

any mechanism to synchronize different per-sensor gating events within one frame across multiple sensors. (EX1006, 4:16–19; 27:37–44).

182. (iii) Feedback-to-gate wiring per sensor. Ground 2 posits taking Yu’s exposure-time control and “closing the loop” at the on-sensor gates for each sensor. Implementing that requires an explicit signal path from the exposure-control logic to separate gating inputs at each sensor (or each sensor’s driver) so each focal-plane switch can be independently actuated during the frame. Miyazaki shows one electronic-shutter control signal for one CCD; it does not disclose any per-sensor feedback-to-gate wiring for a plurality of sensors. (EX1006, 4:16–19; 27:37–44).

183. Scaling a single-sensor electronic shutter to “multi-sensor, in-frame” control is not a copy-paste. Engineering-wise, moving from Miyazaki’s single CCD to multiple sensors requires: (a) duplicated or multi-channel shutter timing generation with independently programmable widths/phases, (b) guaranteed inter-sensor phase relationships within the frame budget to avoid readout conflicts and motion-induced artifacts, and (c) downstream pipeline alignment so differently exposed streams can be fused in that same frame. None of those multi-sensor mechanisms appears in Miyazaki’s single-sensor disclosure. (EX1006, 4:16–19; 27:37–44).

184. Miyazaki confirms that an electronic shutter can implement integration time—for one CCD. (EX1006, 4:16–19; 27:37–44). It does not teach, suggest, or enable: (i) per-sensor shutter-gate generation for more than one sensor, (ii)

synchronization of different in-frame integration windows across sensors, or (iii) per-sensor feedback-to-gate wiring by which exposure-control outputs would drive on-sensor switches for each sensor. As such, Miyazaki is an insufficient, single-sensor bridge and cannot supply the multi-sensor, in-frame focal-plane gating that Ground 2 needs. (EX1006, 4:16–19; 27:37–44).

185. Yu describes a multi-sensor, multi-lens color camera in which the digital image processing circuitry “produces four control signals, each controlling the exposure time of one of said four image sensors,” and further “generates all necessary control signals,” which are delivered to per-sensor control circuits (342/344/346/348). Yu does not disclose a mechanical shutter at all, nor does it tie its “exposure time” control signals to on-sensor electronic shutters or focal-plane gates. (EX1005, 6:59–65; 12:10–19; 13:23–37).

186. By contrast, Miyazaki is a single-sensor camera that explicitly controls “shutter speed ... by controlling the mechanical shutter and an electronic shutter available with the CCD image sensor,” and later details generation of an electronic-shutter control signal—again for one CCD. (EX1006, 4:16–19; 27:37–44).

187. The Petition asserts the combination would “eliminate any mechanical shutter” from Yu, yet there is no mechanical shutter in Yu to eliminate; mechanical-plus-electronic coordination is a Miyazaki feature. The Petition does not explain why a POSITA would import Miyazaki’s single-sensor shutter scheme into Yu’s multi-

sensor architecture to remove hardware Yu never taught, nor how that importation would produce the per-sensor, in-frame focal-plane timing the claims require. The proffered motivation is therefore internally inconsistent because it presumes the presence of mechanical hardware in Yu that the reference does not disclose and fails to connect the act of “elimination” to the claimed result of independent, in-frame focal-plane control across multiple sensors. (EX1005, 6:59–65; 12:16–19; 13:23–37; EX1006, 4:16–19; 27:37–44).

188. Yu’s exposure loop is histogram-based “exposure time” control generated in the digital image processing circuitry and routed to per-sensor control circuits. Yu is agnostic about implementation modality—optical, mechanical, or electrical—and does not identify electronic shutter gates, charge-integration switches, or reset/clear timing at the sensor. (EX1005, 6:59–65; 12:10–19; 13:23–37.)

189. To satisfy the ‘158 Patent’s definition of “integration time”—focal-plane control of a charge-integration switch—in a multi-sensor system, a POSITA would expect disclosure of per-sensor wiring from the exposure controller to sensor-level shutter gates (or to driver blocks that generate gate/clear sequences) so that each sensor’s integration window is actuated during the frame, and disclosure of cross-sensor synchronization showing how those per-sensor gates are phase-related within the frame budget such that different windows ($T_1 \neq T_2$) can be used in the same frame and then fused. The Petition does not identify such wiring or synchronization; it does

not show where Yu's exposure-time signals would connect to on-sensor gates, how those signals would be timed during the frame, or how different in-frame windows would be maintained across sensors for single-frame fusion. (EX1001, 3:65–4:6; 4:46–56; EX1005, 6:59–65; 12:16–19; 13:23–37).

190. Without a show-your-work path from Yu's histogram-driven exposure signals to per-sensor focal-plane gates that are synchronized and different in-frame, the combination rests on hindsight "could/would" declarations rather than pinpoint disclosure. The record, as cited, shows exposure-time control signals (Yu) and single-sensor electronic shuttering (Miyazaki), but not the multi-sensor, per-sensor, in-frame focal-plane actuation that the claims and EX1001 require.

191. In my opinion, a person of ordinary skill would not equate Yu's exposure-time control signals with the '158 patent's focal-plane integration-time control absent a disclosure of on-sensor charge-integration gating during the frame for each sensor. Petitioner's annotated figures and conclusory statements that Yu's exposure-time control "is" integration-time control merely relabel the missing mechanics and should be accorded little weight under 37 C.F.R. § 42.65(a).

3. The Purported Rationale For Combining Yu And Miyazaki Makes Little Sense

192. Yu is the primary reference in Ground 2.⁸ Yu does not have a mechanical shutter. However, Miyazaki, the secondary, has a mechanical shutter. The Petition argues that it would have been obvious to combine Miyazaki with Yu in order to eliminate any mechanical shutter in the Yu-Miyazaki combination.⁹ The Petition fails to explain why a POSITA starting with Yu (which had no mechanical shutter in the first place) would seek to add Miyazaki (with a mechanical shutter) to Yu for the purpose of eliminating the mechanical shutter from the combination. It makes little sense that a POSITA would have been motivated to combine a secondary reference with problematic moving parts with a primary reference with no moving parts for the purpose of eliminating moving parts from the combination. For this additional reason, the alternative argument in Ground 2 based on the combination of Yu and Miyazaki fails to demonstrate a reasonable likelihood of success.

⁸ For example, in connection with Claim 1, Ground 2 relies solely on Yu for elements [1.0], [1.1] and [1.2]. Pet., 46-50. After arguing that Yu alone satisfies the remaining element [1.3], the Petition argues in the alternative that Miyazaki and Yu satisfy remaining element [1.3]. Pet., 50-63.

⁹ Pet., 59 (“Using on-sensor electronic shutters as taught by Miyazaki allows for the elimination of any mechanical shutter in Yu-Miyazaki, which would allow for a more compact and lightweight camera due to the elimination of mechanical moving parts and the associated manufacturing and maintenance costs.”) (emphasis added).

4. Implementing Miyazaki’s combined mechanical shutter and electronic shutter as to achieve independent “integration time control” for each of Yu’s “channels” would not have been feasible or desirable.

193. Implementing Miyazaki’s combined mechanical + electronic shutter scheme to achieve independent “integration time control” per channel in Yu would not have been feasible or desirable. As a practical engineering matter, outfitting four separate optical paths with four distinct mechanical shutters, each under independent control and each meeting tight timing, alignment, and durability constraints inside an integrated multi-sensor module, would be a significant redesign with no demonstrated benefit. The added moving parts increase size, power, mass, vibration, shutter lag, wear, failure modes, and calibration overhead, and they demand sub-millisecond phase alignment across shutters to avoid inter-channel skew during capture—none of which Yu or Miyazaki discloses or even contemplates. It would require added moving assemblies at each lens path, more size and power, vibration, shutter lag and wear, and tight synchronization across shutters. Neither Yu nor Miyazaki teaches those details. The Petition offers no timing budgets or control scheme and treats the change as routine, which it is not.

194. Yu itself neither discloses nor needs a mechanical shutter; it relies on per-sensor exposure-time control signals generated in digital logic and routed to per-sensor control circuits. There is no evidence that adding four mechanical shutters

would improve Yu's performance in any respect. (EX1005, 6:59–65; 11:39–42; 12:10–19; 12:16–19; 13:23–37).

195. Petitioner then takes the opposite tack and keeps only Miyazaki's electronic portion while discarding the mechanical portion. That is a hindsight carve-out. Miyazaki does not teach an electronic-only exposure system; it teaches coordinated mechanical and electronic shuttering for one CCD and later describes an electronic-shutter control signal for that single sensor. (EX1006, 4:16–19; 27:37–44). As I understand 35 U.S.C. §103, a modification must be supported by a reason with rational underpinnings directed to the problem at hand. Merely labeling electronic shutters "standard" is not a rationale tied to Yu's architecture or to the claimed multi-sensor, per-sensor, in-frame focal-plane control.

196. Even if one were to set aside the mechanical shutter (to be clear, there is no articulated reason to do so), the proposed combination still lacks the multi-sensor mechanics the claims require. Yu does not identify on-sensor electronic shutters, does not disclose a charge-integration switch, and does not show gate or clear waveforms at the sensors. Nor does it show per-sensor shutter-gate generation or wiring that closes Yu's exposure-time loop onto each sensor's focal-plane switch. (EX1005, 6:59–65; 12:16–19; 13:23–37). The Petition's annotated figures simply label certain lines as "electronic shutter control"; that is a conclusion, not a disclosure, and it is not

accompanied by enablement-like detail describing the implementation, coordination, or tolerances across multiple sensors.

197. If a POSITA were to import Miyazaki as taught, the result would be a two-part mechanical + electronic shutter stack for a single sensor—a scheme that, when applied to Yu, would inject camera-level mechanics that Yu neither discloses nor needs and that would tend to defeat per-sensor independence (e.g., by imposing shared mechanical constraints and synchronization across channels). If, to avoid those consequences, Petitioner discards the mechanical part, the combination still fails: Yu lacks the on-sensor focal-plane control that the ‘158 patent requires, and Miyazaki does not scale that control to multiple sensors operating with different in-frame windows for single-frame fusion. Either path leaves Ground 2 without the claimed per-sensor integration-time control in a multi-sensor architecture. (EX1005, 6:59–65; 12:16–19; 13:23–37; EX1006, 4:16–19; 27:37–44).

198. The Petition’s additional assertion that the combination would “eliminate any mechanical shutter” from Yu is internally inconsistent. Yu does not disclose a mechanical shutter in the first place; the mechanical-plus-electronic shutter regime is Miyazaki’s single-sensor design. Petitioner does not explain why a POSITA would import Miyazaki’s single-sensor shutter scheme into Yu’s multi-sensor architecture merely to eliminate hardware not present in Yu, nor how that importation

would yield the claimed per-sensor, in-frame focal-plane timing. (EX1005, 6:59–65; 12:16–19; 13:23–37; EX1006, 4:16–19; 27:37–44).

199. Finally, even if it were permissible to cherry-pick only the electronic portion of Miyazaki and place it into Yu (to be clear, it is not supported by a reasoned motivation), Miyazaki’s generic electronic-exposure disclosures still do not meet the claim language. The ‘158 patent specifies that “integration time control” requires “focal plane shutter control” performed “by controlling a switch (e.g., charge integration switch) coupled or connected to the sensor or a photo-detection mechanism of a sensor,” which regulates the time the image sensor collects and integrates light—i.e., sensor-local gate actuation. (EX1001, 3:65–4:6; 4:46–56). As discussed, exposure control may be implemented by (i) pixel-domain/focal-plane timing that opens/closes the charge-collection path (the true integration gate) or by (ii) driver timing—frame/line/transfer clocks—that merely sequence resets, transfers, sampling, and readout. Miyazaki’s disclosures do not expressly or inherently disclose the former in a multi-sensor context, and therefore do not satisfy claim 1’s requirement for per-sensor integration-time control as defined by EX1001. (EX1006, 4:16–19; 27:37–44; EX1001, 3:65–4:6; 4:46–56).

200. For these reasons, a POSITA would neither retrofit Yu with four independently controlled mechanical shutters nor carve Miyazaki into an electronic-only module. The record lacks a reasoned motivation and probative disclosure to

achieve the claimed per-sensor, in-frame focal-plane integration-time control across multiple sensors, as required by the ‘158 patent. (EX1005, 6:59–65; 12:10–19; 12:16–19; 13:23–37; EX1006, 4:16–19; 27:37–44; EX1001, 3:65–4:6; 4:46–56).

C. Claim 2 Requires In-Frame, Per-Sensor Focal-Plane Control; Neither Yu Nor Miyazaki Discloses It

201. Claim 2 requires that “the processing component is further configured to control the integration time of each sensor during a frame.” Read with the specification, “integration time” is not a high-level exposure label; it is sensor-level, focal-plane control of a charge-integration switch—“the time the image sensor collects and integrates signal from the scene,” implemented by “*controlling* a switch (e.g., charge integration switch) ... also referred to as ‘focal plane shutter control.’” (EX1001, 3:65–4:6; 4:46–56). The patent further teaches channels imaging the same field of view substantially simultaneously, each operating independently under a different integration time, with the processor separately and simultaneously controlling the integration time of each channel and combining the resulting single-frame data. (EX1001, 4:38–45; 5:3–18; 7:36–39).

202. Against that intrinsic backdrop, Yu never identifies per-sensor, on-sensor actuation during the frame. Yu states only that the digital image-processing circuitry “produces four control signals, each controlling the exposure time of one of said four image sensors,” and that it “generates all necessary control signals” delivered to per-sensor control circuits. (EX1005, 6:59–65; 11:39–42; 12:10–19; 12:16–19;

13:23–37). Those passages are agnostic as to how “exposure time” is realized and do not disclose an electronic shutter, a charge-integration switch, or gate/clear timing at the sensor. Petitioner’s mapping of “during a frame” points to Yu’s per-sensor image streams (Fig. 5) rather than to any disclosure of focal-plane gating at each sensor while the frame is being captured. (EX1005, 7:50–53).

203. Miyazaki does not cure that omission. It teaches a single-sensor digital still camera that controls shutter speed by controlling a mechanical shutter together with an electronic shutter available with the CCD image sensor, and later describes an electronic-shutter control signal for that one CCD. (EX1006, 4:16–19; 27:37–44). Nothing in Miyazaki coordinates electronic-shutter actuation across multiple sensors or connects Yu’s exposure-time feedback to per-sensor focal-plane gates for more than one imager.

204. Accordingly, a POSITA would appreciate that a workable multi-sensor architecture would also specify how cross-sensor timing is aligned and toleranced—e.g., jitter/skew budgets, gating waveforms, and sequencing—so that differently timed integration windows can be coordinated across sensors without introducing artifacts or readout conflicts.

205. Therefore, in my opinion, a POSITA would not equate Yu’s exposure-time control signals with the ‘158 patent’s focal-plane integration-time control absent a disclosure of on-sensor charge-integration gating during the frame for each sensor.

Petitioner’s annotated figures and conclusory statements that Yu’s exposure-time control “is” integration-time control merely relabel the missing mechanics and should be accorded little weight under 37 C.F.R. § 42.65(a). (EX1005, 6:59–65; 12:10–19; 13:23–37; EX1006, 4:16–19; 27:37–44; EX1001, 3:65–4:6; 4:46–56).

206. On this record, Ground 2 identifies no disclosure—either in Yu alone or in Yu as modified by Miyazaki—of a processing component that controls the integration time of each sensor during a frame in the manner the claims, and the ‘158 patent’s focal-plane definition, require. The art shows exposure-time control signals (Yu) and single-sensor electronic shuttering (Miyazaki), but not the multi-sensor, per-sensor, in-frame focal-plane actuation that Claim 2 demands.

D. Claim 11 and 16’s Relative Integration-Time Limitation Is Not Met by Yu’s Exposure Signals or Miyazaki’s Single-Sensor Shutter

207. Claim 11 requires an actual relative difference—“the integration time of at least one channel is relatively shorter than the integration time of at least one other channel.” Read with the intrinsic record, “integration time” is not a high-level exposure label; it is the sensor-level, focal-plane charge-accumulation interval. The specification teaches channels imaging the same field of view substantially simultaneously, with “each operat[ing] independently under a different integration time,” and a processor that “separately and simultaneously” controls the integration time of each channel so those different, in-frame exposures can be combined into a

single frame. (EX1001, 4:38–45; 5:3–18; 7:36–39). A person of ordinary skill would therefore read Claim 11’s “relatively shorter” language to require independently set, per-sensor focal-plane timing such that, within the same frame window, at least one channel’s charge-integration window is shorter than another’s.

208. Against that intrinsic backdrop, Yu never discloses that one sensor’s integration time is set shorter than another’s. Yu states only that the digital image-processing circuitry “produces four control signals, each controlling the exposure time of one of said four image sensors,” and that it “generates all necessary control signals” delivered to per-sensor control circuits. (EX1005, 6:59–65; 11:39–42; 12:10–19; 12:16–19; 13:23–37)/ Those passages are agnostic as to whether the commanded “exposure time” values are equal or different, and they do not identify focal-plane control of a charge-integration switch as the ‘158 Patent requires. They are silent on any in-frame, per-sensor actuation that would establish a shorter window on one channel relative to another.

209. Miyazaki does not cure this deficiency. It is a single-sensor digital still-camera reference that controls “shutter speed ... by controlling the mechanical shutter and an electronic shutter available with the CCD image sensor,” and later describes an electronic-shutter control signal for that one CCD. (EX1006, 4:16–19; 27:37–44). A single-sensor teaching cannot establish a relative relationship between two channels’ integration times in a multi-sensor system; it neither discloses nor suggests

setting different, in-frame focal-plane windows across multiple sensors for single-frame fusion.

210. The combination therefore lacks any cited disclosure that, in Yu’s multi-sensor camera, at least one channel operates under a shorter integration time than another channel as Claim 11 requires. Petitioner’s annotated figures that label lines as “electronic shutter” for each sensor are attorney or expert conclusions rather than prior-art disclosures showing different per-sensor integration-time values; under 37 C.F.R. § 42.65(a), such unsupported gloss should be accorded little weight. (EX1005, 6:59–65; 12:10–19; 13:23–37; EX1006, 4:16–19; 27:37–44).

211. In my opinion, on this record Ground 2 fails to meet the “relatively shorter” limitation of Claim 11 because neither Yu nor Miyazaki discloses, individually or in combination, the claimed multi-sensor, per-sensor, in-frame focal-plane control establishing a shorter integration-time window on at least one channel relative to another, as required by the claims and the ‘158 Patent’s definition of “integration time.” (EX1001, 4:38–45; 5:3–18; 7:36–39).

XI. DECLARATION

212. I, Dr. Eli Saber, declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: October 07, 2025

By: _____
Dr. Eli Saber