

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SONY CORPORATION,
Petitioner,

v.

YISSUM RESEARCH DEVELOPMENT COMPANY OF THE HEBREW
UNIVERSITY OF JERUSALEM,
Patent Owner.

Case IPR2013-00218
Patent 6,665,003 B1¹

Before SALLY C. MEDLEY, KARL D. EASTHOM, and
JAMES B. ARPIN, *Administrative Patent Judges*.

EASTHOM, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

¹ *Sony Corp. v. Yissum Research Co.*, Case IPR2013-00326 (“IPR2013-00326”) has been joined with instant Case IPR2013-00218. IPR2013-00326, Paper 15 (PTAB Sept. 24, 2013). This Final Written Decision is entered in both cases.

I. INTRODUCTION

Challenging U.S. Patent No. 6,665,003 B1 (Ex. 1001, “the ’003 Patent”), Petitioner, Sony Corp., filed Petitions requesting *inter partes* review of claims 1–3, and 22 (IPR2013-00218, Paper 1, “Petition” or “Pet.”), and claims 4, 5, and 34 (IPR2013-00326, Paper 10).² In response, Patent Owner, Yissum Research Development Co. of the Hebrew University of Jerusalem, filed Preliminary Responses. Paper 12 (“Prelim. Resp.”); IPR2013-00326, Paper 13.

We joined IPR2013-00326 to IPR2013-00218 (*see* IPR2013-00326, Paper 15) and instituted *inter partes* review of claims 1–5, 22, and 34 on several grounds of unpatentability, as listed below. *See* Paper 16 (“Dec. on Inst.”); IPR2013-00326, Paper 14. Pursuant to the joinder decision, the parties filed all papers in IPR2013-00218. Subsequent to institution and joinder, Patent Owner filed a Patent Owner Response (Paper 29, “PO Resp.”), and Petitioner filed a Reply (Paper 31, “Pet. Reply”) thereto.

In addition, Patent Owner filed a Motion for Observation (Paper 37) on the cross-examination testimony of Petitioner’s declarant, Dr. Darrell, and a Motion to Exclude certain evidence (Paper 38). Petitioner filed a Response to the Motion for Observation (Paper 45) and an Opposition to Patent Owner’s Motion to Exclude (Paper 44). Patent Owner filed a Reply to Petitioner’s Opposition. Paper 46.

Petitioner also filed a Motion to Exclude certain evidence (Paper 40), Patent Owner filed an Opposition to Petitioner’s Motion to Exclude (Paper 43), and Petitioner filed a Reply to Patent Owner’s Opposition (Paper 47). The parties requested and appeared at an oral hearing before the panel on June 18, 2014. The record includes a transcript of the hearing. Paper 52 (“Tr.”).

² Unless otherwise indicated, reference hereinafter is to papers and exhibits filed in IPR2013-00218.

We have jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73, addresses issues and arguments raised during trial.

For the reasons that follow, we determine that Petitioner has proved, by a preponderance of the evidence, that claims 1–5, 22, and 34 of the '003 Patent are unpatentable.

A. The '003 Patent

The '003 Patent describes generating and displaying stereoscopic panoramic images by using a rotating camera. *See* Ex. 1001, Abstract, Fig. 2 (reproduced below). In one embodiment, left and right panoramic image generators, respectively, generate left and right panoramic mosaic images from a series of recorded images, which correspond to different respective angular positions of the rotating camera. *See id.* at Abstract, Figs. 2 and 3; col. 3, l. 63–col. 4, l. 64.

According to the '003 Patent, systems for creating and displaying non-panoramic stereoscopic images were known in the prior art, but “currently, there are no such arrangements for generating and displaying stereoscopically *panoramic* images.” *Id.* at col. 1, ll. 41–43 (emphasis added). Relevant dictionary definitions corroborate that stereoscopic image systems were known prior to the filing date of the '003 Patent. For example, a “stereoscope” is defined as “[a]n optical instrument used to impart a three-dimensional effect to two photographs of the same scene taken at slightly different angles and viewed through two eyepieces.” Ex. 3002 (THE AMERICAN HERITAGE DICTIONARY OF THE ENGLISH LANGUAGE 1264 (1976)). The term “stereoscopic” means “[o]f or pertaining to stereoscopy; especially, three-dimensional,” or “[o]f or pertaining to a stereoscope.” *Id.*

Figures 2 and 3, reproduced below, depict various aspects of an embodiment of the rotating camera system employed to create panoramic stereoscopic images:

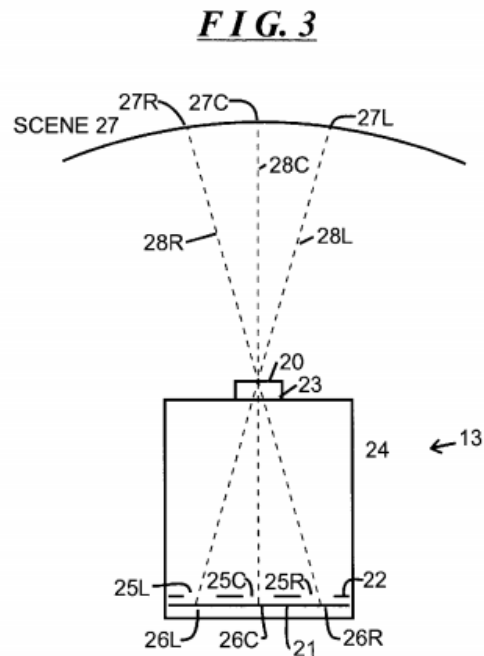
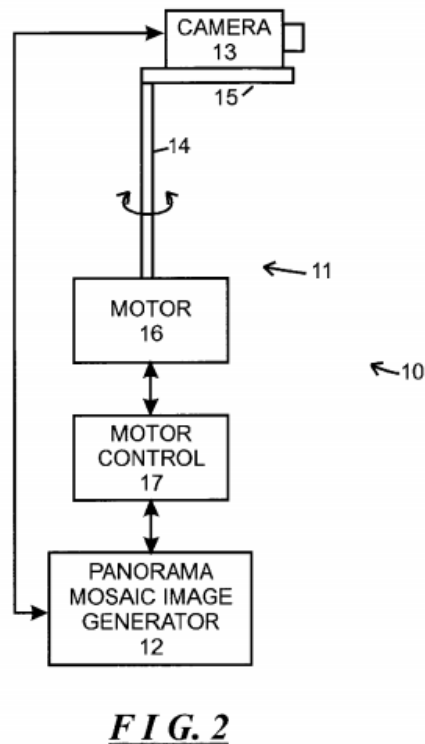


Figure 2 depicts a generic block diagram of the system, which involves rotating camera 13. Figure 3 depicts a top plan view of camera 13. *See* Ex. 1001, col. 2, ll. 8–13.

Figure 3 depicts how left and right portions of scene 27 are captured on different film portions 21 during a fixed position of rotating camera 13. Employing shutter 23 and screen 22 in rotating camera 13, this embodiment attempts to mimic how a person's left and right eyes would view the panoramic scene as a stereoscopic image. *See id.* at col. 4, l. 40–col. 5, l. 67.

The '003 Patent describes viewing stereoscopic images as follows:

A person can see stereoscopically because his or her eyes are displaced horizontally (when standing) which, will provide a perception of depth when viewing a scene, which would not be present otherwise. Stereoscopic images comprise two images

recorded of a scene recorded from slightly displaced positions, which, when viewed simultaneously by the respective eyes, provides a perception of depth.

Ex. 1001, col. 1, ll. 32–39.

According to the '003 Patent, “to view the panoramic image stereoscopically,” a viewer wears “polarized glasses 145,” or “goggles” 121L and 121R included in display system 120, which align the images. Ex. 1001, col. 11, ll. 38–67, col. 12, ll. 62–64. As discussed further below, the claims at issue here are directed to creating, but not viewing, images. According to well-known stereoscopic viewing principles as applied to a panoramic viewing embodiment disclosed in the '003 Patent, a viewer sees selected portions of left and right image strips in the left and right eyes, respectively, to obtain depth perception. *See* Ex. 1001, col. 1, ll. 32–39, col. 11, ll. 60–65.

B. Illustrative Claim

Of the challenged claims, claims 1 and 34 are independent. Each of the dependent claims at issue, claims 2–5, and 22, depends directly from claim 1. Method claim 34 is similar in scope to system claim 1. Challenged claim 1 follows:

1. A system for generating a stereoscopic panoramic mosaic image pair comprising:

A. a strip generator module configured to generate two series of image strips, all of said image strips in each series comprising strips of a series of images of a scene as would be recorded by a camera from a respective series of positions relative to the scene, the image strips of the respective series representing strips of the respective images displaced from one another by at least one selected displacement; and

B. a mosaic image generator module configured to mosaic the respective series of images strips together

thereby to construct two panoramic mosaic images, the panoramic mosaic images comprising the stereoscopic panoramic mosaic image pair providing a stereoscopic image of the scene as recorded over the path.

C. References, Declarations, and Depositions

Petitioner and Patent Owner primarily rely upon the following references and declarations:³

Exhibit	References and Declarations
1003	Kawakita et al., <i>Generation of Panoramic Stereo Images from Monocular Moving Images</i> , SIG-CyberSpace, Virtual Reality Society of Japan (VRSJ) Research Report, VCR 97-12 (Nov. 27, 1997) (“Kawakita”)
1004	Ishiguro et al., <i>Acquiring Omnidirectional Range Information</i> , 23 Systems and Computers in Japan, 47–56 (Denshi Joho Tsushin Gakkai Ronbunshi trans.) (1992) (“Ishiguro”)
1006	Inoue, JP 8-159762 (June 21, 1996) (“Asahi”)
1010	Declaration of Dr. Trevor Darrell (“first declaration”)
1038	Declaration of Dr. Darrell (“third declaration”)
1040	Wikipedia article entitled “Stereoscopy”
1043	Deposition of Dr. Irfan Essa
1044	Second Declaration of Dr. Darrell (“second declaration”)
2008	First Deposition of Dr. Darrell
2010	Declaration of Dr. Essa
2014	Second Deposition of Dr. Darrell
2019	Declaration of Mr. Barton
2020	Deposition of Mr. Barton

³ Unless otherwise noted, each of “Kawakita” (Ex. 1003) and “Asahi” (Ex. 1006), refers to a respective certified English language translation of a Japanese language document provided by Petitioner.

D. Grounds of Unpatentability

This *inter partes* review involves the following grounds of unpatentability:

References	Basis	Claims
Kawakita	35 U.S.C. § 102(a)	1, 2, 4, 5, and 34
Ishiguro	35 U.S.C. § 102(b)	1, 2, 4, 5, and 34
Asahi	35 U.S.C. § 102(b)	1–5, 22, and 34
Kawakita	35 U.S.C. § 103(a)	22
Ishiguro	35 U.S.C. § 103(a)	22

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, “[a] claim in an unexpired patent shall be given its broadest reasonable construction in light of the specification of the patent in which it appears.” 37 C.F.R. § 42.100(b); *see also Office Patent Trial Practice Guide*, 77 Fed. Reg. 48,756, 48,766 (Aug. 14, 2012) (*Claim Construction*). Under the broadest reasonable construction standard, a claim term is presumed to have an ordinary and customary meaning as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). A patentee may act as his or her own lexicographer by providing a special definition for a claim term in the specification with “reasonable clarity, deliberateness, and precision.” *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Generally, in the absence of such a special definition or other consideration, “limitations are not to be read into the claims from the specification.” *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993).

“stereoscopic panoramic mosaic image pair providing a stereoscopic image of the scene as recorded over the path”

Independent claims 1 and 34 recite the limitation quoted above. The preamble in claim 1 introduces the phrase and recites “[a] system for generating a stereoscopic panoramic mosaic image pair comprising . . . a mosaic image generator module.” Method claim 34 is similar in scope to system claim 1.

Focusing on the “stereoscopic image,” and “image pair,” the Petition proposes that

[t]he term “stereoscopic . . . image pair” should be construed to mean two images of a scene recorded from slightly displaced positions, which, when viewed simultaneously by the respective eyes, provides a perception of depth. This construction is consistent with the definition of the term “stereoscopic images” set forth in the ’003 Patent at column 1:36-39.

Pet. 12.

In our Institution Decision, we initially determined that Petitioner’s proposed construction tracks the ordinary meanings and the ’003 Patent Specification. We noted that Patent Owner proposed a similar definition for “stereoscopic image” and similarly cited to the ’003 Patent. *See* Prelim. Resp. 15–16; Dec. on Inst. 3 (citing Ex. 3002, dictionary definition of “stereoscope” and “stereoscopic”), 7–8 (discussing “stereoscopic image”). In our Institution Decision, we also noted that “Petitioner and Patent Owner agree that a stereoscopic image requires at least a pair of images recorded from slightly displaced positions, which provide a perception of depth.” *Id.* at 8.

In its Patent Owner Response, Patent Owner attempts to broaden the term “stereoscopic image,” as interpreted in the prior art:

To a person of ordinary skill in the art, the term “stereoscopic image” [in the prior art] is not by itself limited to an image that provides a perception of depth to a person. *Instead, the term*

“stereoscopic image” is a broad term that includes images that are used by computers or machines to measure distance to an object.

PO Resp. 4 (citing Ex. 2008, 26:11–16, 28:25–29:2, 31:2–5, 31:14–17; and citing, Ex. 2010 ¶ 55) (second emphasis added). Patent Owner similarly argues that the term “‘stereoscopic image’ [and similar terms used in Asahi] [are] not limited to an image that provides a perception of depth” to a human. *See* PO Resp. 37.

Further, Patent Owner’s declarant, Dr. Irfan Essa, states that “the term ‘stereoscopic image’ is a broad term, which generally refers to a pair of images that view a scene from two different viewpoints.” Ex. 2010 ¶ 55. Petitioner’s declarant, Dr. Trevor Darrell, agreed with this construction during his deposition, as follows: “‘Stereoscopic image’ is a broad term but most naturally would be defined as a pair of images that view a scene from [at least] . . . two different viewpoints.” Ex. 2008, 26:11–14. The parties, therefore, agree, and we determine, that the term “stereoscopic image” carries the broad and ordinary meaning, as outlined by the experts, which does not require viewing of the stereoscopic image or human depth perception.

Although Patent Owner argues for a broad construction in general, Patent Owner argues that the broad construction does not apply to the claims. PO Resp. 4. Contrary to Patent Owner’s argument, the record does not show that the inventors of the ’003 Patent acted as lexicographers to rebut the ordinary meaning, by conveying a narrower definition with “reasonable clarity, deliberateness, and precision.” *In re Paulsen*, 30 F.3d at 1480. Rather, according to the ’003 Patent, “the invention may find utility in connection with robotics and computer video games.” Ex. 1001, col. 14, ll. 19–20. Patent Owner’s argument quoted above, that the use of stereographic “images . . . by computers or machines” (PO Resp. 4), coupled with the disclosed use of such images in robots or computers, as described in the ’003 Patent, shows that the inventors did not intend to limit the term

“stereoscopic image” to the desirable feature of human depth perception. Instead, skilled artisans would have interpreted the intended broad use of this term, as disclosed in the ’003 Patent, to coincide with the ordinary meaning, such that the term encompasses stereoscopic images that are capable of providing depth information to a computer, robot, or human. It follows that the “specification . . . does not clearly redefine [‘stereoscopic image’] such that one of ordinary skill in the art would deem it to be different from its common meaning.” *See Paulsen*, 30 F.3d at 1480 (holding that the applicant did not clearly limit “computer” to one of its “numerous definitions” to distinguish it over a prior art calculator, noting that “[t]he specification merely describes in a general fashion certain features and capabilities desirable in a portable computer.”). *Id.*

Figure 4 of the ’003 Patent, reproduced below, supports the broader construction that does not require human perception or human viewing:

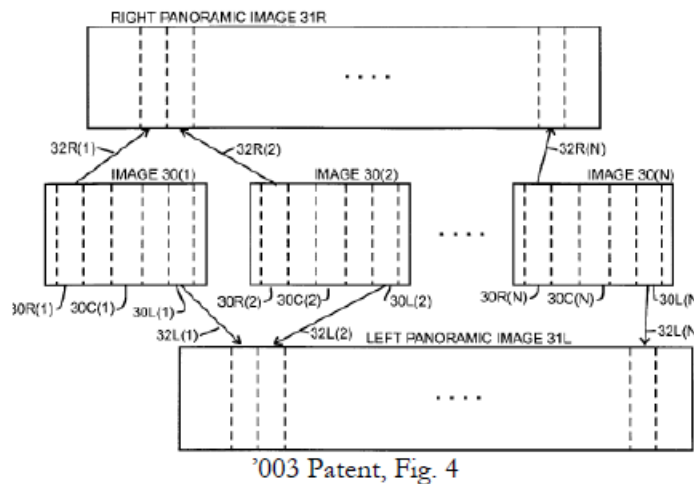


Figure 4 depicts “RIGHT PANORAMIC IMAGE 31R” and “LEFT PANORAMIC IMAGE 31L.”

Claim 1 recites a mosaic image generator module that generates “two panoramic mosaic images . . . comprising the stereoscopic panoramic image pair.” This image pair in claim 1 corresponds to the right and left panoramic images

represented in Figure 4, respectively 31R and 31L.

Considering the embodiment of Figure 4, the “mosaic image generator” of claim 1, in context, follows:

a mosaic image generator module configured to mosaic the respective series of images strips together thereby to construct two panoramic mosaic images, the panoramic mosaic images comprising *the stereoscopic panoramic mosaic image pair providing a stereoscopic image of the scene as recorded over the path.*

(Emphasis added). According to claim 1, the mosaic image generator “mosaics” (i.e., joins) the image strips together to form the image pair (for example, 31R, 31L) that is, or becomes, the “stereoscopic image,” as recited in claim 1. The ’003 Patent discloses that panoramic mosaic image generator 12 first forms the image pair, and during formation, or thereafter, “the images may be formed or stored in any convenient medium such as paper or film, in digital form in . . . data storage, or other media.” Ex. 1001, col. 6, ll. 51–55. After this generation by the image generator and image storage, displaying the images necessarily includes retrieval and subsequent alignment of the previously stored images for viewing. *See id.* at col. 11, l. 60–col. 12, l. 8 (disclosing alignment, discussed below).

In other words, this displaying step constitutes another aspect of the disclosed invention that is not recited in the challenged claims. “In particular, the invention provides systems and methods [1] for generating stereoscopic panoramic images of a scene, and [2] *for displaying the images to an observer in a manner so that the viewer can view the panoramic images stereoscopically.*” *Id.* at col. 13, ll. 8–12 (bracketed numerals and emphasis added). The claims at issue here correspond to item 1, but not to item 2.

According to the ’003 Patent, the unclaimed *display apparatus* enables depth perception (stereoscopic viewing). In particular, “[t]he invention is *further*

directed to *systems for displaying* the left and right panoramic images 31L and 31R (FIG. 4) *generated by the panoramic mosaic image generator 12 to a viewer, thereby to enable the viewer to view the panorama represented thereby stereoscopically.*” *Id.* at col. 11, ll. 38–42 (emphases added). Figures 11 through 12B represent “[s]everal . . . panoramic image display systems,” all of which are not disclosed necessarily as part of panoramic mosaic image generator 12. *See id.* at col. 11, ll. 42–44.

For example, the ’003 Patent states that “to view the panoramic image stereoscopically,” a viewer wears polarized glasses 145. *Id.* at col. 12, ll. 62–64. These display mechanisms (goggles, polarized glasses, etc., and perhaps controllers) basically align and isolate the left and right image pair to create or enable depth perception.⁴ The ’003 Patent briefly describes viewing and alignment, as follows:

The left and right display controllers, 123L and 123R, under control of the display control module 122, enable the respective left and right display devices 121L and 121R [e.g., goggles] to display at least selected portions of the respective left and right panoramic images 31L and 31R, so that they may be viewed by the viewer. *The display control module enables the left and right panoramic images [to] be aligned so as to display images relating to the same portion of the panorama at the same relative position in the viewer’s field of vision.* . . . The viewer can use the pointing stick 124 to control the display control module to adjust the particular portion of the scene that is directly in front of the viewer’s eyes, which is similar to controlling the angular position of an observer in viewing the scene as described in connection with Fig. 1A.

⁴ These mechanisms also generally may involve filters, polarization, or other “stereo separation” viewing mechanisms, which isolate left and right strips each to be viewed by one eye only, mechanisms that were well-known at the time of the invention. *See* Ex. 1001, col. 12, l. 65–col. 13, l. 7 (describing devices or methods “appreciated by those skilled in the art”).

Id. at col. 11, l. 60–col. 12, l. 8 (emphasis added).

As the passage confirms, a stereoscopic display mechanism enables alignment of the two images. In contrast to the claims at issue here, claim 32, for example, recites “[a] *system for displaying* a stereo panoramic image to a viewer . . . *to facilitate stereoscopic viewing of the panoramic image.*” *Id.* at col. 17, ll. 37–49. Similarly, claim 1 of patent U.S. Patent No. 7,477,284 B2, which is related to the ’003 Patent by virtue of common provisional applications according to the face of both patents, and which is challenged in *Sony Corp. v. Yissum Research Co. of the Hebrew University of Jerusalem*, Case IPR2013-00219 (PTAB Mar. 29, 2013), specifically recites “*a display that receives a plurality of the mosaics and displays them so as to provide a sense of depth of the scene.*” *See* IPR2013-00219, Ex. 1001, col. 14, ll. 12–13 (emphases added). These claims, although not at issue here, inform and corroborate our understanding of the ’003 Patent disclosure and corresponding claim construction that an unclaimed display or other mechanism processes (e.g., aligns) the images (provided by the “mosaic image generator module”) to “provide a sense of depth of the scene,” *see id.* The record shows that a “mosaic image generator module,” as set forth in claim 1, provides an image pair, which thereafter provides stereoscopic information, as an intended use by a human, computer, or robot.

In other words, according to claim 1, the claimed mosaic image generator “*construct[s] two panoramic mosaic images.*”⁵ Those images “compris[e] the stereoscopic panoramic mosaic image pair *providing a stereoscopic image of the scene as recorded over the path.*” Therefore, the image pair “provide[s] . . . a stereoscopic image,” in the context of the pair having the necessary structural

⁵ Claim 34, at issue here, but not argued separately by Patent Owner in the Response or otherwise, recites a corresponding “mosaic image generation step.”

features to provide stereoscopic information. These necessary structural features arise from how the image pair was formed, i.e., by recording the same point or portion of a scene from different angles, according to the ordinary meaning of the term, the '003 Patent Specification, and similar evidence of record. In other words, because an image display provides depth perception and the recited mosaic image generator module does not, the phrase, “providing a stereoscopic image,” as recited in claim 1, means providing an image pair with certain properties, so that the pair provides depth information.

Therefore, if the image pair is aligned (or processed similarly), by a display or similar apparatus, the aligned pair provides depth perception to a human. We agree with the parties that “a perception of depth is the visual perception of differential distances among objects in a person’s line of sight.” Ex. 2010 ¶ 19; Ex. 1044 ¶ 15; *accord* Prelim. Resp. 15. Alternatively, or in addition, the depth information included in the recited “stereoscopic image” may be provided to a robot or a computer, which may process the information to arrive at distance or height calculations used by the robot or computer, as discussed above and further below in connection with the asserted application of the prior art.

In our Institution Decision, we also noted that the '003 Patent allows for “operator input” and “any conventional technique” to create the images. *See* Dec. on Inst. 20 (discussing Ex. 1001, col. 6, ll. 40–41, col. 8, l. 22). We determined that this shows that “claim 1 does not preclude . . . further processing or adjustments.” *Id.* The parties have not disputed this determination with persuasive evidence or rationale.⁶ The '003 Patent also describes other processing, such as

⁶ Patent Owner did not maintain its related arguments specifically based on the prosecution history of the '003 Patent. *See* Prelim. Resp. 23; Dec. on Inst. 19–22 (determining that the prosecution history did not limit the claims in the manner

“geometrical transformation,” which may be required during display processing, for example, when the recording surface geometry differs from the display surface geometry (i.e., flat versus cylindrical). Ex. 1001, col. 11, ll. 9–14.

Patent Owner also argues that a preliminary construction of “stereoscopic image,” outlined in our Institution Decision, requires the stereoscopic images to be “recorded from slightly displaced images, which provide a perception of depth.” See PO Resp. 43 (discussing Dec. on Inst. 7–8). According to Patent Owner, this selected displacement (or baseline) distance, between the recording positions of the two views of the same scene or object, must “approximat[e] the distance between a human’s eyes.” *Id.* According to Dr. Darrell, this argued baseline distance otherwise is known as the human inter-ocular distance (about 65 millimeters on average). See Ex. 1044 ¶¶ 6–7.

This “slightly displaced” baseline derives in part from prior input by the parties, and is based on a description of a prior art embodiment in the ’003 Patent, and also on the definition of a “stereoscope.” See Pet. 3–5, 7–8; Ex. 3002; Ex. 1001, col. 1, ll. 36–39. Nevertheless, the claims are not limited to a disclosed description of a prior art embodiment or to image production by a prior art stereoscope. At the preliminary stage of this proceeding, we did not have before us the current agreement between the parties that a “stereoscopic image” carries the broad ordinary meaning specified above. We also did not have an apparent reason to define the breadth of “slightly displaced.” In any case, we did not specify then that the “selected displacement,” as recited in claim 1, would be limited to the human inter-ocular distance.

Claim 1 specifically recites “respective images displaced from one another by at least one selected displacement.” It does not recite, however, that a

argued—with respect to further processing).

stereoscopic image must be made by recording two images from “slightly displaced” camera positions. Petitioner persuasively argues that skilled artisans would have understood that even if “slightly displaced” is implied in producing a stereoscopic image, that displacement is relative to the distance of the objects to be recorded. Pet. Reply 2–5. For example, relying on the ’003 Patent, Dr. Essa’s deposition, and Dr. Darrell’s second declaration, Petitioner quotes the ’003 Patent and shows that that the viewing circle for recording purposes may approximate the distance between a person’s eyes; however, “the diameter of the viewing circle can be enlarged or reduced for exaggerated or reduced stereo.” See Pet. Reply 3 (quoting Ex. 1001, col. 7, ll. 21–26; citing Ex. 1043, 79:6–15, Ex. 1044 ¶ 16).

Dr. Darrell similarly relies on descriptions in the ’003 Patent, which include computer graphics techniques, reduced stereo, and exaggerated stereo, to show that the disclosed techniques involve different baseline distances. Ex. 1044 ¶¶ 8–10. Dr. Darrell also points to a related Yissum patent, which has common inventors with the ’003 Patent, and which describes using aids such as binoculars, which effectively increase the baseline. See Ex. 1044 ¶¶ 10–14. Dr. Darrell establishes that skilled artisans would have known that “slightly displaced,” as described in the ’003 Patent, does not limit a recording baseline to the distance between a human’s eyes:

A person of ordinary skill in the art as of 1998 would *not* have understood the reference to “slightly displaced positions” to mean that the separation of the recording positions is limited only to the human inter-ocular distance. As discussed above, such a person would have known that the amount of disparity present in a pair of images, which affects whether depth is perceived when appropriately viewing the images (*e.g.*, an anaglyph), depends on both the baseline and the distance to points or objects in the scene.

Ex. 1044 ¶ 18.

In forming his opinion, Dr. Darrell also relies on a stereoscopic image created by another of Petitioner's declarants, a photographer, Mr. Leonard Barton. Ex. 1044 ¶ 16. To create the image, Mr. Barton explains how he captured distant objects by taking pictures at recording positions separated by 100 feet. Ex. 2019 ¶ 5. Therefore, Mr. Barton corroborates Dr. Darrell's testimony. *See* Ex. 2019 ¶ 5; Ex. 2020, 15:9–23 (Patent Owner's deposition of Mr. Barton).

Dr. Darrell also establishes that skilled artisans knew how to align images for viewing. Ex. 1044 ¶ 26. Patent Owner does not challenge Mr. Barton's testimony and does not refute Dr. Darrell's testimony persuasively. During cross-examination, Dr. Essa, Patent Owner's declarant, qualified his declaration testimony that stereoscopic images must be produced by capturing images at the human inter-ocular distance. *Compare* Ex. 2010 ¶ 26 (testifying that images must be "generated from the perspective of human eyes" for possible stereographic fusion), *with* Ex. 1043, 59:23–60:17 (implying the opposite, i.e., answering "[w]hen presented properly," to a question about whether an image "provide[s] a perception of depth" when "a single stereo camera . . . has a baseline wider than the approximate distance between human eyes"); 30:1–33:1 (generally agreeing that the amount of disparity (i.e., depth perception) varies with baseline and distance to objects recorded).

As discussed above, according to the '003 Patent, "the invention may find utility in connection with robotics and computer video games." Ex. 1001, col. 14, ll. 19–20. This use in robots or computers, the varying recording distances, and the broad claim terms "stereoscopic image" and "selected displacement," imply that the argued recording distance may or may not correspond to the human inter-ocular distance. In other words, the recited "selected displacement" indicates "selected" is broader than any implied limitation of "slightly displaced." Even

“slightly displaced” is relative to the distances of objects to be recorded, and claim 1 does not preclude a relative displacement as a “selected” displacement.

Moreover, Dr. Essa’s agreement that “the term ‘stereoscopic image’ is a broad term, which generally refers to a pair of images that view a scene from two different viewpoints” (Ex. 2010 ¶ 55), generally fails to limit the distance between the two image capture points to the human-ocular baseline distance. The ordinary definition that a stereoscope involves “the same scene taken from slightly different *angles*” further implies that the distance is relative. Ex. 3002 (emphasis added). Dr. Darrell testifies, via the aid of a diagram, that the angle subtended by the two recording positions and the recorded object is important for perceiving depth, i.e., an “[e]quivalent angle[]” requires the baseline to vary with object distance to obtain the “[s]ame [d]isparity” of human depth perception. *See* Ex. 1044 ¶ 14.

Based on the foregoing discussion, “the stereoscopic panoramic mosaic image pair providing a stereoscopic image of the scene as recorded over the path,” requires at least a pair of mosaic image strips to be recorded from different recording perspectives of a scene, with multiple pairs forming a panoramic mosaic. The pair of image strips must have the physical structure to provide depth information, either as a perception of depth if aligned or similarly processed and viewed with an appropriate display mechanism, or as distance or height information after possible processing in a computer or robot.

B. Asserted Grounds of Unpatentability

1. Introduction

Petitioner asserts that Kawakita or Ishiguro anticipates claims 1, 2, 4, 5, and 34, that Asahi anticipates claims 1–5, 22, and 34, and that Kawakita or Ishiguro renders claim 22 obvious. To support these asserted grounds of unpatentability in its Petitions, Petitioner provides detailed explanations, and the declaration of Dr.

Darrell, to show how each reference discloses each claim limitation. *See* Pet. 16–36, 47–60; IPR2013-00326, Paper 1, 18–35, 45–56; Ex. 1010 ¶¶ 10–11.

Relying partially on the declaration of Dr. Essa, Patent Owner counters that none of Kawakita, Ishiguro, and Asahi discloses all of the limitations of claim 1 and that “[c]laim 1 is representative” of the claims in the trial. *See* PO Resp. 8, 21, 32; Ex. 2010. Claims 2–5 and 22 depend from claim 1, and claim 34 is similar in scope to claim 1.

Upon consideration of the parties’ contentions and supporting evidence, we determine that Petitioner has demonstrated by a preponderance of evidence that the claims are unpatentable based on the foregoing grounds. In our analysis below, we focus on Patent Owner’s arguments presented in the Patent Owner Response, which dispute certain limitations recited in claim 1. *See Office Patent Trial Practice Guide*, 77 Fed. Reg. at 48,766 (“The [Patent Owner] [R]esponse should identify all the involved claims that are believed to be patentable and state the basis for that belief.”).

2. Kawakita
Anticipation—Claims 1, 2, 4, 5, and 34
Obviousness—Claim 22

As discussed in the Introduction, the Petitions detail how Kawakita anticipates claims 1, 2, 4, 5, and 34, and renders obvious claim 22. In response, Patent Owner asserts that “[c]laim 1 is representative” of the claims challenged based on Kawakita. *See* PO Resp. 8. Patent Owner’s Response does not contend that the challenged claims are patentably distinct from claim 1.

Figure 5 of Kawakita follows:



Fig. 5: Panoramic Images of an Elevator Hallway

Figure 5 of Kawakita depicts “left and right panoramic images created from images taken of an elevator hallway,” with the upper and lower rows of mosaic slits respectively representing the left and right eye panoramic images. Ex. 1003, 16.

Kawakita states that “[a]s a result of stereoscopic viewing with alignment control of the panoramic images using the calculated depth parallax angles with 10 research personnel, there were no noticeable double images in the objects attended to, and the sense of depth was faithfully reproduced.” *Id.* at 18.

Kawakita’s system is similar to the system described in the ’003 Patent. For example, Kawakita describes the “Generation of Panoramic Stereo Images.” *See* Ex. 1003, Title. In addition, Kawakita discloses a rotating camera in which “the left and right camera positions correspond to the left and right eye positions when viewing a panoramic image stereoscopically.” Ex. 1003, 15.

Further, in Kawakita, “[a]ll of the slit images excised from the frame images are continuously composited in sequence.” *Id.* at 16. Petitioner generally contends, and Patent Owner does not dispute, that Kawakita’s digital camera reasonably discloses both claimed modules. Kawakita’s camera generates these left and right “slit images,” corresponding to the claimed strip generator module, and thereafter, Kawakita’s system continuously mosaics or joins those images in

sequence, corresponding to the claimed mosaic image generator module. *See* Pet. 18–19 (citing Ex. 1003).

Patent Owner argues that Kawakita does not disclose “a stereoscopic panoramic mosaic image pair” as recited in the challenged claims:

Thus, because Kawakita does not teach a *stereoscopic panoramic mosaic image pair* that provides a perception of depth, as recited in the claim, Petitioner has failed to establish by a preponderance of the evidence that Claims 1, 2, 4, 5, and 34 are unpatentable over Kawakita under §102 and that Claim 22 is unpatentable over Kawakita under 35 U.S.C. §103.

PO Resp. 20.

Contrary to Patent Owner’s argument, Kawakita describes, in a section titled, “Stereoscopic Viewing Using Depth Parallax Angle” the following:

When the left and right panoramic *images obtained using the foregoing procedure* are viewed *binocular stereoscopically*, a *stereoscopic view is possible that faithfully reproduces the positional relationships, if the image was captured from a sufficient distance*. However, *if the camera was placed at a comparatively close distance, or if the distance from the camera to the objects varies greatly, the positions* representing the left and right panoramic images *must be adjusted*.

Ex. 1003, 16–17 (emphases to paragraph added).

As the quoted text shows in context, at “sufficient” camera distances, “a stereoscopic view is possible that faithfully reproduces the positional relationships” without further adjustments. *See id.* at 16. Kawakita’s system requires an adjustment if the camera is too “close” to, or if its distance “varies greatly” from, objects to be recorded. *Id.* Kawakita summarizes that “it is possible to generate panoramic images with a sense of realism and view them stereoscopically with few limitations during image capture and without using special equipment.” *Id.* at 18–19. Dr. Darrell, Petitioner’s declarant, corroborates this understanding: “Kawakita

discloses a technique to generate stereoscopic panoramic images by excising slit images from images captured by a rotating camera and mosaicing the respective slit images together.” Ex. 1010 ¶ 10.

In summary, Kawakita’s system reproduces a perception of depth for most “positional relationships,” without processing. For two listed exceptions, Kawakita requires further processing to create stereoscopic depth perception. Claim 1 does not preclude operator input or further processing of the pair of mosaic image strips, including alignment thereof, for example, as discussed in the foregoing Claim Construction section. *See supra* 12–16. Therefore, Kawakita’s system discloses the disputed elements of the challenged claims for two independent reasons: 1) Kawakita provides depth perception for most positional relationships between recorded objects, and 2) the ’003 Patent does not preclude adjustments for Kawakita’s two listed exceptions (that is, when distances between the camera and objects vary greatly, and when the camera is too close to objects).

Patent Owner’s argument and evidence do not demonstrate otherwise. Patent Owner admits that, in what Patent Owner refers to as a “[first] scenario,” “Kawakita briefly notes that a stereoscopic view is possible if the image was captured from a sufficient distance and if the distances from the camera to the objects do not vary greatly.” PO Resp. 9. Nevertheless, Patent Owner maintains that in Kawakita, when the object distances do not vary greatly, they must be “roughly at the same distance” in this first scenario defined by Patent Owner, and therefore, notwithstanding Kawakita’s disclosure, “there will not be a perception of depth” (*id.* at 13). Under this first scenario, Patent Owner’s argument incorrectly reduces “distance . . . does not vary greatly” (*id.* at 12) to “distance . . . is roughly the same” (*id.* at 13).

In all other situations, in what Patent Owner refers to as “Kawakita’s second scenario,” “when the objects in the image are at different distances,” Patent Owner maintains that Kawakita’s system must make adjustments. *Id.* at 14. According to Patent Owner, these adjustments under the second scenario fail to satisfy claim 1, because Kawakita only aligns “part of the image,” with other object images overlapping, thereby rendering the whole scene only “partially viewable (not panoramic).” *Id.* at 16.

Contrary to Patent Owner’s arguments, as we find above, and as Petitioner contends, Kawakita discloses obtaining a perception of depth, by making adjustments when object to camera distances vary greatly, and without making adjustments when those distances do not vary greatly (assuming the camera is not too close to the objects). *See* Pet. Reply 5–9 (addressing Patent Owner’s two scenarios). Patent Owner’s arguments and evidence do not show that Kawakita’s system reduces to the alleged two mutually exclusive scenarios defined by Patent Owner.

Patent Owner cites its declarant, Dr. Essa, and the deposition testimony of Petitioner’s declarant, Dr. Darrell, in an attempt to support its characterization of Kawakita. *See* PO Resp. 13 (citing Ex. 2010 ¶¶ 27, 33–35; Ex. 2008, 32:16–23). Nevertheless, at the cited portions, and elsewhere, Dr. Essa and Dr. Darrell mainly confirm that if objects are at the same distance from the camera, they will appear to be at the same distance from the camera. This fails to show that Kawakita does not disclose a system that provides depth perception. The proposal by Patent Owner of mutually exclusive first and second scenarios overlooks the natural combination of different distances, implicit in the objects recorded, as disclosed by Kawakita. Contrary to Patent Owner’s argument, a given scene may have objects that are close together separated by other objects that are not close together, and still other

objects that are further apart. *See, e.g.*, Ex. 1003, Fig. 4 (rotating camera system for omnidirectional stereo—not limited to any certain depth of objects), Fig. 5 (example images of objects from first and right slits).

As an example, Dr. Essa declares that “if all objects in the scene are roughly at the same distance in a scene, a person would not be able to distinguish if the objects are near or far with respect to each other.” Ex. 2010 ¶ 27. This fails to show a lack of a perception of depth, as Kawakita discloses, for object distances that vary or vary greatly. As another example, Patent Owner relies on Dr. Darrell’s and Dr. Essa’s testimony and concludes that their testimony supports the proposition that “if all objects are roughly at the same distance in a scene, one would see the objects as being at infinity or close, in ‘whatever depth it was.’” *See* PO Resp. 4–5 (quoting Ex. 2008, 47:9–21; citing Ex. 2010 ¶ 27). Even under this unrealistic hypothetical situation in which all objects are at the same distance, Dr. Darrell indicated that a perception of “whatever depth it was” constitutes a “degenerate sense of depth.” *See also* Ex. 2008, 47:15–24 (Dr. Darrell qualifying his answer by adding that the question does not “include[] the notion that there has to be some depth distances in the scene.”). Patent Owner’s selective reliance on certain testimony does not show a lack of depth perception in Kawakita’s system.

Patent Owner does not direct attention to testimony that shows that Kawakita’s system fails to provide depth perception between objects at different distances from the camera. Kawakita summarizes that “it is possible to generate panoramic images with a sense of realism and view them stereoscopically with few limitations during image capture and without using special equipment.” Ex. 1003, 18–19.

Dr. Essa concedes that, in Kawakita, when there is some variance in distance between objects, “[a] scene could be captured that would result in the viewing

experience that is desired.” *See* Ex. 1043, 154:15–17. Moreover, Patent Owner does not direct us to portions of Dr. Essa’s testimony that outweigh the teachings in Kawakita relevant to the claims at issue here, in light of Dr. Darrell’s testimony about Kawakita. Ex. 1044 ¶¶ 19–23. In simple terms, Kawakita discloses a system that provides “panoramic images with few restrictions . . . and capable of being viewed in binocular stereo,” as encompassed by claim 1. Ex. 1003, 14. Dr. Darrell declares that “Prof. Essa ignores an entire class of scenes where Kawakita indicates that parallax adjustment is not required—scenes where the distances to objects varies, but do not vary greatly.” Ex. 1044 ¶ 21.

As Petitioner also points out, Dr. Essa’s opinion about Kawakita is based on an unsupported assertion that Kawakita discloses uneven slit widths during image capture. *See* Pet. Reply 6–7 (discussing “optical flow,” uneven slit widths, and required adjustments under Patent Owner’s second scenario); Ex. 2010 ¶ 32–36 (similar). Later, however, during his deposition, Dr. Essa concedes that Kawakita discloses using a constant slit width “sw.” *See* Pet. Reply 6–7 (discussing Ex. 1043, 140:16–20; Ex. 1003, 16; Ex. 2010 ¶ 32; Ex. 1044 ¶ 19). Dr. Darrell points to Dr. Essa’s “incorrect premise” about slit width “sw” (Ex. 1044 ¶ 20), and persuasively explains how that premise undermines Patent Owner’s position regarding the two scenarios discussed above. *See* Ex. 1044 ¶¶ 19–23 (explaining that Kawakita’s constant slit widths “sw” show that Kawakita’s method does not require adjustment for all instances, contrary to Dr. Essa’s testimony).

In any event, Patent Owner and Petitioner agree that, if the object distances vary greatly, Kawakita discloses adjusting the scene to provide a perception of depth, but Patent Owner qualifies this agreement. *See* PO Resp. 14–15; Pet. Reply 6–7. That is, Patent Owner maintains that “only part of the image (the sight line looked at by the viewer) is adjusted.” PO Resp. 15. According to Patent Owner,

Kawakita does not disclose “the claimed *stereoscopic panoramic mosaic image pair* because they are only partially viewable (not panoramic).” *Id.* at 16. In support of the argument, Patent Owner notes that claim 1 further requires “a perception of depth of *the scene as recorded over the path.*” *Id.*

Claim 1 recites a “panoramic mosaic image pair providing a stereoscopic image of the scene as recorded over the path.” That phrase requires the image pair to provide a stereoscopic image as “recorded,” but, for reasons discussed in the Claim Construction section, claim 1 does not require depth perception from the image strips until the image actually is viewed. *See* Pet. Reply 7. Claim 1 also does not require viewing, much less viewing each and every sight-line of a panoramic scene simultaneously (which would not be humanly possible for large angles, e.g., over 180 degrees). On the other hand, if viewing occurs, under the narrower claim construction, the stereoscopic image scene that is viewed must be capable of being processed (e.g., aligned) to provide a perception of depth.

Claim 1 does not define the size of the scene to be viewed. According to claim 1, a panoramic scene requires a “series of image strips [mosaiced] together thereby to construct two panoramic mosaic images.” Claim 1 does not specify a lower limit for a viewing angle, such as a viewing angle subtended within a single sight-line in Kawakita. Moreover, each sight-line, including adjacent sight-lines, according to the findings regarding Kawakita as discussed, need not be adjusted necessarily, depending on the object distances in that sight-line, in order to provide a perception of depth along different sight-lines.

The '003 Patent specifically notes that “[p]anoramic images are images of a scene having a wide field of view, *up to a full 360°.*” Ex. 1001, col. 1, ll. 21–22 (emphasis added). Further, as discussed in the Claim Construction section, claim 1 does not preclude further processing to provide a perception of depth, including

operator input, which could be ongoing, i.e., as viewing of the scene occurs. Still further, as also discussed in the Claim Construction section, the '003 Patent describes how a viewer rotates and selects scenes according to the “viewer’s field of vision. . . . The viewer can use the pointing stick 124 to control the display control module to adjust the particular portion of the scene that is directly in front of the viewer’s eyes.” Ex. 1001, col. 12, ll. 2–6. The parties agree that Kawakita provides depth perception upon each perceived sight-line, and further agree that depth perception only requires that “one object in an image will be perceived as being closer to the person viewing the image, as compared to another object in the image.” PO Resp. 5; Pet. Reply 8.

For these reasons, even if Kawakita’s system only processes and provides adjustments for one sight-line view at a time, for example, as a viewer turns to view different portions of the panoramic scene, claim 1 does not preclude that ongoing adjustment. Stated differently, claim 1 does not have an implicit or explicit temporal or size requirement for viewing a panoramic mosaic image pair.

In addition, as explained in our Institution Decision, Kawakita contemplates ongoing dynamic adjustment. Dec. on Inst. 22. Kawakita states that “we believe it is possible to *automatically* drive the depth parallax angle using the relationship between the size of the flow vector” Ex. 1003, 19 (emphasis added). “By recording this depth parallax angle . . . alignment of the left and right panoramic images can be *dynamically controlled*, making stereoscopic viewing of the panoramic image possible.” *Id.* at 18 (emphasis added). *See* Dec. on Inst. 22 (quoting Kawakita).

With or without adjustment, Patent Owner’s arguments reduce to the assertion that Kawakita’s system does not provide depth perception because the perception is not perfect for every object in a scene. As Petitioner explains, Dr.

Darrell consistently testifies that Kawakita's system provides a perception of depth because depth perception simply does not require perfection. Pet. Reply 9–10 (citing Ex. 2008, 57:17–60.5; Ex. 1044 ¶¶ 22, 23).⁷

To emphasize this point, Petitioner points to another stereoscopic image, Patent Owner's Exhibit 2007, a stereographic image of a lion statue. Both parties agree that Exhibit 2007 shows a lion statue that provides a perception of depth along at least one line of sight. *See* Pet. Reply 8 (citing Ex. 2007 (flag pole in lion statue imparts double image); Ex. 1043, 106:3–107:7; Ex. 2010 ¶¶ 24, 25 (Dr. Essa relying on Ex. 2007 as showing depth perception, because “the stereoscopic image pair . . . can be stereoscopically fused.”)). Dr. Darrell points out that, even though both parties agree that Exhibit 2007 shows an example that provides stereographic depth perception, the image in that exhibit includes objects at certain sight-lines that cannot be fused, appearing as double images and obscuring depth perception for those objects. *See* Ex. 1044 ¶ 23. In general, the record shows that “[o]ne may perceive stereoscopic depth from an image pair, even if stereo fusion is not possible as to all objects along all lines of sight in the image.” *Id.* Moreover, as the record shows, in most situations, Kawakita's system provides faithful or

⁷ Patent Owner also argues that another translation of Kawakita, Exhibit 2013, contradicts Kawakita, Exhibit 1003. *See* Paper 43, 5–7. Patent Owner reasons that Exhibit 2013 does not use the term “faithful” to describe the image reproduction and Dr. Darrell relies on that term. *See id.* Petitioner and Dr. Darrell maintain persuasively that Exhibit 2013 does not differ materially from or contradict the thrust of Exhibit 1003. The latter employs similar words such as “normal” and “proper[]” image reproduction to describe the same “faithful” effect in terms of adjustment or otherwise. *See* Paper 47, 4 (citing Ex. 2013, 5, 6, 8; Ex. 2014, 139:19–140:3, 140:22–141:11, 142:5–21). Patent Owner does not move to exclude as unreliable Exhibit 1003, which is certified “under penalty of perjury that the foregoing [translation of Kawakita] is true and correct.” Ex. 1003, 1 (cover page signed by Christopher Girsch, Park IP Translations). Patent Owner also did not seek to cross-examine Mr. Girsch.

normal stereographic depth perception without any adjustments. *See supra* 21–24.

Based on the foregoing discussion, we determine that Kawakita’s system provides a “stereoscopic image of the scene as recorded over the path,” as recited in claim 1. Accordingly, we determine that Petitioner shows by a preponderance of evidence that Kawakita anticipates claim 1 and similar claim 34. As outlined above, Patent Owner relies on representative claim 1, and does not present separate arguments to distinguish claims 2, 4, 5, 22, or 34 over Kawakita. Upon consideration of Petitioner’s showing as to the challenged claims (Pet. 16–22, 47–49, 52–54, 56, 57–59; IPR2013-00326, Paper 1, 6, 7, 18–22, 45, 47–55), and considering the record evidence and arguments by the parties, we determine that Petitioner establishes by a preponderance of the evidence that Kawakita anticipates claims 1, 2, 4, 5, and 34, and renders obvious claim 22.

3. Asahi
Anticipation—Claims 1–5, 22, and 34

As discussed in the Introduction, the Petitions detail how Asahi anticipates claims 1–5, 22, and 34. In response, Patent Owner asserts that “[c]laim 1 is representative” of the claims challenged based on Asahi. *See* PO Resp. 32. Patent Owner’s Response does not contend that the challenged claims are patentably distinct from claim 1.

Asahi’s method “relates to a method and a device for three-dimensional data extraction, and to a stereo image formation device; more specifically, it relates to a method and a device for extracting three-dimensional data from video images, and to a stereo image formation device that forms stereo images from video images.” Ex. 1006 ¶ 1. The method takes video images of a target region using an aircraft. *Id.* ¶¶ 1, 35, 36. The method creates continuous “mosaic images” from forward, middle, and rear lines of fields in video frames, which respectively form “the forward view image,” “the nadir view image,” and “the rearward view image.” *Id.*

¶ 35. Changes in variable factors of flying speed, flight path deviations, altitude, pitch, roll, and yaw, require a vertical parallax removal process to calculate a parallax difference, create the mosaic images, calculate height, and create 3D topographical maps by using the stereo mosaic images. *See id.* ¶¶ 1, 3, 7, 11, 29, 36, 55–57, 61, 63, 70, claims 1, 11. In other words, to create 3-D maps, as an intermediate step, Asahi creates “stereo images” to calculate heights as a step in the process. *See id.* ¶ 29; *see also* Ex. 2014, 87:3–21, 92–100:8 (Dr. Darrell describing Asahi’s system and testifying that Asahi’s system uses “two stereo images” to calculate three-dimensional height data to form maps).

Asahi also states that “stereoscopic viewing is possible using this forward view image, this nadir view image, and this rearward view image.” Ex. 1006 ¶ 35. Petitioner relies, among other things, on workstation 76 in Asahi (*see* Fig. 3), as disclosing the recited mosaic image generator module. Pet. 33. Asahi states that the workstation “can obtain image data . . . after going through the various processing . . . [to generate] continuous mosaic image formation.” Ex. 1006 ¶ 28.

Patent Owner argues that Asahi does not disclose or suggest images of a scene recorded from a “slightly displaced” position, according to a construction in the Institution Decision, which states that “[s]tereoscopic images comprise two images recorded of a scene recorded from *slightly displaced* positions.” PO Resp. 43 (discussing Institution Decision). Patent Owner points out that Asahi’s system calculates height information using aircraft that record images at horizontal separation distances of tens or hundreds of meters. *See* PO Resp. 44. Therefore, according to Patent Owner, Asahi does not disclose “slightly displaced images.” PO Resp. 43. Patent Owner maintains that these large recording separation distances show that Asahi’s system cannot “provid[e] a perception of depth,” as claim 1 requires. *Id.* (citing Ex. 2010 ¶ 63).

According to the Claim Construction section, claim 1 does not quantify “slightly displaced” and only requires a selected displacement. To the extent a “stereoscopic image” in claim 1 implicitly requires image pair recordings at “slightly displaced” recording positions, the term is relative to a displacement that ultimately creates a stereoscopic image. As also discussed in the Claim Construction section, Petitioner shows persuasively that the distance is not limited to “the human inter-ocular baseline,” at least based on the ’003 Patent disclosure regarding “exaggerated stereo,” based on Dr. Essa’s testimony on that disclosure, based on testimony by Dr. Darrell, and similar evidence, including the ordinary meaning of stereoscopic images as being recorded from different angles. *See* Pet. Reply 2–3 (citing Ex. 1001, col. 7, ll. 24–26; Ex. 1043, 79:6–15; Ex. 1044 ¶¶ 8–14, 16 (discussing the stereographic image pair recorded 100 feet apart)); Ex. 3002.⁸

Also, as discussed above, the ’003 Patent informs that “the invention may find utility in connection with robotics and computer video games.” Ex. 1001, col. 14, ll. 18–20. This disclosed utility further implies that the challenged claims do not require images recorded at a human inter-ocular baseline distance.

Patent Owner acknowledges that the term “stereoscopic image” carries broad and well-known meanings:

To a person of ordinary skill in the art, the term “stereoscopic image” is not by itself limited to an image that provides a perception

⁸ We exclude, and do not rely upon, a portion of paragraph 16 of Exhibit 1044, pursuant to Patent Owner’s Motion to Exclude, as discussed in Section C(2)(ii) below. The date of publication for the image and text relied upon (and not excluded) in the paragraph is after the date of invention, but Petitioner relies on it to lend context to “exaggerated” stereo and to bolster the testimony by Dr. Darrell that baseline distances were possible at distances larger than the human inter-ocular baseline. *See* Pet. Reply 2–3.

of depth to a person. Instead, the term “stereoscopic image” is a broad term that includes images that are used by computers or machines to measure distance to an object.

PO Resp. 4.

Patent Owner’s declarant, Dr. Essa, testifies that “[i]n the context of Asahi, a person of ordinary skill in the art would understand the term ‘stereoscopic viewing’ solely to refer to an image for *computer vision* which is used to calculate the height of points in the scene.” Ex. 2010 ¶ 56 (emphasis added); *accord* PO Resp. 40 (arguing that Asahi’s stereoscopic images produce computer vision). Under the broader claim construction, because the “stereoscopic image” in claim 1 does not require human depth perception, Asahi’s “computer vision” technique anticipates the challenged claims.

Turning to Patent Owner’s narrower claim construction, which requires human depth perception, Dr. Essa contends that Asahi’s method does not record images from “slightly displaced images,” and the method results in image defects, precluding image fusion or human depth perception. Ex. 2010 ¶¶ 63–65. Contrary to the first contention, assuming “slightly displaced images” are an implicit claim requirement, Asahi’s method satisfies the requirement, because such displacement is relative to the distance to objects being captured. *See supra* 15–19 (Claim Construction) and further discussion *infra*. Dr. Essa’s testimony does not account for the totality of the record, which includes the ’003 Patent, Dr. Darrell’s testimony (Ex. 1044 ¶¶ 6–16), and Mr. Barton’s testimony (Ex. 2019), all of which demonstrate that stereo images provide depth information even if the image pair is recorded at relatively large baseline distances.

On a fundamental level, Petitioner shows that the ordinary meaning of “viewing,” and in the context of Asahi, does not mean “calculating,” contrary to Patent Owner’s contentions. *See* Pet. Reply 13–14; Ex. 1044 ¶ 27; PO Resp. 36–

37. Essentially, Asahi discloses calculating height and viewing, thereby distinguishing the two. *See* Pet. Reply 13–14; Ex. 1044 ¶ 27. Dr. Darrell also explains that other references of record, including Kawakita, employ the terms “stereoscopic viewing” and “stereo viewing,” in the sense of “human viewing of a display.” Ex. 1044 ¶ 28; Ex. 1006 ¶¶ 35, 55, 56.

Dr. Darrell concludes that “Asahi’s [images] . . . could be viewed using an appropriate display and provide a perception of depth.” Ex. 1044 ¶ 27. During cross-examination, Dr. Darrell re-iterated this position, and testified that, in Asahi’s system, “stereoscopic images that can be viewed are created” (Ex. 2014, 87:17–18), and responded “yes” to the following question: “Is it your opinion . . . that the stereo images . . . in Asahi are capable of being viewed so as to produce a depth - - or perception of depth in a human” (*id.* at 100:5–9).

In further response to Dr. Essa’s assertions about image defects in Asahi, Dr. Darrell explains that Asahi uses vertical parallax adjustment to calculate height, and that stereo viewing does not require that adjustment. Ex. 1044 ¶ 27. Dr. Darrell explains that Asahi removes defects as part of the vertical parallax removal process involved in height calculations, such as those depicted in the letter “F” of Figure 11. *Id.* ¶ 30. Therefore, although Dr. Essa relies on these defects to show that Asahi’s images do not provide depth perception (Ex. 2010 ¶ 61), according to Dr. Darrell, those defects typically do not occur in stereoscopic images produced for viewing (Ex. 1044 ¶30). Even if some defects were produced (when speed or camera orientation was not constant), the defects would “not be so severe in every case as to preclude depth from being perceived upon viewing an appropriate display of a pair of the mosaics.” *Id.*

In other words, according to Dr. Darrell, any defects, if they occur, appear to be related to viewing quality and would not be so severe in all cases. Dr. Essa’s

testimony corroborates this testimony by noting that any defects are from “flight turbulence/deviation, imaging limitations, and instrumentation inaccuracy, etc.” Ex. 2010 ¶ 61. This implies that when no flight “deviations” occur, for example, for straight flight paths and constant speeds, Asahi’s system would provide stereoscopic images that permit human depth perception. Moreover, Asahi is consistent with Dr. Darrell’s testimony, disclosing that viewing is possible for constant speeds and camera orientations. *See* Ex. 1006 ¶¶ 35–36.

Dr. Darrell’s testimony, which Asahi corroborates, shows that Asahi’s pair of mosaic stereo images would provide a perception of depth, if viewed by a human, by employing well-known display methods at the time of the invention. Dr. Darrell’s cross-examination testimony clarifies this, by noting that horizontal adjustment, to provide human viewing, is implicit in Asahi, and Asahi’s system also provides computer viewing. *See* Ex. 1044 ¶ 31; Ex. 2014, 95:1–13; 100:5–9; 104:1–23; 105:12–22.

Dr. Essa agrees that Asahi provides computer viewing, and does not explicitly contradict the finding that displaying Asahi’s images, using implicit adjustment (horizontal alignment) procedures, would provide a perception of depth. For example, Dr. Essa maintains that “Asahi does not disclose a display that receives mosaic images and displays the images.” Ex. 2010 ¶ 56. The challenged claims do not require images to be displayed even under Patent Owner’s narrower claim construction. Apart from his assertion about defects in Asahi (*see* Ex. 2010 ¶¶ 61–62), which amount to an assertion based on a degree of perception according to the discussion above, a careful reading of Dr. Essa’s declaration reveals that Dr. Essa does not rebut Dr. Darrell’s testimony that Asahi’s system would provide human depth perception after a horizontal alignment or adjustment process. *See* Ex. 2010 ¶¶ 56–66. Moreover, Asahi specifically

discloses “a stereo image formation device that forms stereo images from video images.” Ex. 1006 ¶ 1.⁹

Patent Owner raises another argument in its Motion for Observation, calling attention to Dr. Darrell’s testimony related to an alleged required overlap of lines in frames of Asahi and other observations. *See* Paper 37, 6–9. These arguments fail to rebut the above findings. The arguments about the overlap only pertain to the narrower claim construction. Regarding that construction, Patent Owner contends that Dr. Darrell testified that 99 percent overlap of lines in successive frames is required to obtain a perception of depth, and Asahi only discloses a 60

⁹ Patent Owner also argues that another translation of Asahi, Exhibit 2012, submitted by Patent Owner, contradicts paragraph 35 of Asahi, Exhibit 1006. *See* Paper 43, 8–9. Patent Owner reasons that Exhibit 2012 uses the term “3D image” and does not use the term “stereoscopic viewing,” which Asahi uses in paragraph 35, Exhibit 1006. *See id.* Petitioner maintains that Exhibit 2012 does not differ materially or contradict the thrust of Asahi, Exhibit 1006. *See* Paper 47, 1–2. The record supports Petitioner. For example, Patent Owner does not challenge the related statement in paragraph one, wherein Asahi states that “the present invention relates to . . . *extracting three-dimensional data from video images, and to a stereo image formation device that forms stereo images from video images.*” Ex. 1006 ¶ 1 (emphasis added). Paragraph one of Exhibit 2012 similarly refers to “an apparatus for extracting 3D data from a video image and *a stereo-image creation apparatus for creating a stereo image from a video image.*”

The record also shows that even if paragraph 35 refers to a 3-D image as a map instead of a stereoscopic mosaic image, that map image derives from two stereoscopic images, which provide computer vision, and at the least, are capable of being viewed by a human if horizontally aligned. *See e.g.*, Ex. 2014, 87:3–16 (describing Asahi). Moreover, Dr. Darrell testified, during cross-examination about Exhibit 2012, that, in context, “this is a stereoscopic 3D image. So it wouldn’t change my opinion.” *Id.* at 128:1–2. Finally, Patent Owner did not move to dismiss as unreliable, Exhibit 1006, which is certified as “an accurate and faithful rendition of the original text” under penalty of perjury. Ex. 1006, 1 (signed by Martin Cross, Patent Translations Inc.). Patent Owner also did not seek to cross-examine Mr. Cross.

percent overlap. *See id.* at 6. Petitioner responds that Patent Owner takes Asahi out of context, because Asahi does not describe using only 60 percent overlap to create images. *See* Paper 45, 7–8. Petitioner points out that Dr. Darrell testified that the “frame rate would be high enough so that you didn’t miss parts of the scene.” *Id.* at 8 (citing Ex. 2014, 108:9–16). Lending context, on the cited deposition page, Dr. Darrell responded “I think so” to a question about whether the frame overlap would be “substantial.” Patent Owner’s observations do not undermine the findings discussed above, including that Dr. Darrell testified that Asahi’s system is capable of producing stereographic images.

In summary, under the narrower claim construction, Asahi discloses stereographic image viewing or that the images are capable of human viewing by further processing, which the claims do not preclude. Under the broader claim construction, the claims do not require human depth perception, and embrace Asahi’s computer depth information, which constitute stereographic images for calculating height, thereby satisfying the challenged claim 1.

Based on the foregoing discussion, we determine that Petitioner shows by a preponderance of evidence that Asahi anticipates claim 1 and similar claim 34. As discussed above, Patent Owner’s arguments are directed to illustrative claim 1, which is similar in scope to claim 34, and Patent Owner does not contest the specific limitations in challenged claims 2–5, 22, and 34 with separate arguments. Upon consideration of Petitioner’s showing as to the dependent claims (Pet. 8–10, 30–36, 47–48, 50–60; IPR2013-00326, Paper 1, 9, 10, 21–35, 46–48, 50–55), and considering the record evidence and arguments by the parties, we determine that Petitioner establishes by a preponderance of the evidence that Asahi anticipates 1–5, 22, and 34.

4. Ishiguro
Anticipation—Claims 1, 2, 4, 5, and 34
Obviousness—Claim 22

As discussed in the Introduction, the Petitions detail how Ishiguro anticipates claims 1, 2, 4, 5, and 34 and renders obvious claim 22. In response, Patent Owner asserts that “[c]laim 1 is representative” of the claims challenged based on Ishiguro. PO Resp. 21. Patent Owner does not contend that the claims 2, 4, 5, and 22 are patentably distinct from claim 1.

In our Institution Decision, we preliminarily found that “Ishiguro discloses an ‘[o]mnidirectional stereo method,’ Ex. 1004, 49, to create ‘[t]wo omnidirectional views for stereo method,’ *id.* at Fig. 5, having a ‘panoramic representation’ *id.* at 47,” of a scene. Dec. on Inst. 23 (quoting Ishiguro). “Similar to the method described in the ’003 Patent, Ishiguro’s system uses a rotating camera over a series of positions to capture images through slits. [Ex. 1004,] 51, 53, Figs. 4, 5, and 6.” Dec. on Inst. 23 (citing Ishiguro). Patent Owner does not challenge these findings.

Rather, Patent Owner argues that the method described in Ishiguro allows a robot to “calculate[e] depth (or range),” but Ishiguro does not disclose “the claimed *stereoscopic . . . image pair* that provides a perception of depth.” PO Resp. 26. Patent Owner also argues that Ishiguro’s Figure 5 shows “significant disparity between the alignments of objects in image (a) from the left slit and the objects in image (b) from the right slit.” PO Resp. 29. According to Patent Owner and Dr. Essa, this disparity precludes a perception of depth. *Id.* at 29–30 (citing Ex. 2010 ¶ 46). Dr. Essa explains that Figure 5 does not produce depth perception because “the images must be *specifically* generated and aligned horizontally for human viewing – these are different/additional steps which Ishiguro does not perform and indeed has no reason to perform.” Ex. 2010 ¶ 46.

Neither party disputes that Ishiguro discloses stereographic images for robotic vision. For that reason, under the broadest reasonable claim construction, Ishiguro anticipates claim 1. As discussed in the Claim Construction section, the '003 Patent discloses computer or robotic utility based on the stored stereographic images on any type of media. *See* Ex. 1001, col. 6, ll. 52, 51–55 (describing “images . . . formed or stored in any convenient medium”); col. 14, ll. 19–21 (“[T]he invention may find utility in connection with robotics and computer video games.”).

The '003 Patent implies that the same stereographic images used for computers or robots also provide depth perception to a human using ordinary display techniques (for example, alignment processing). *See id.* Even under Patent Owner’s narrower claim construction, the challenged claims do not require viewing of the stereographic image pair, but require the pair to be *capable* of being aligned to provide a perception of depth.

Ishiguro’s Figure 5 describes and depicts “[t]wo omnidirectional views for *stereo method*.” Ex. 1004, 50 (emphasis added). Ishiguro refers to “*stereovision* using a pair of two omnidirectional images,” *id.* at 48 (emphasis added), and to an “[i]maging method” in Figure 1, which employs a rotating camera, *id.* (emphasis added). The term “stereovision” means “[v]isual perception of or exhibition in three dimensions.” THE AMERICAN HERITAGE DICTIONARY OF THE ENGLISH LANGUAGE 1264 (1976) (Ex. 3002). In other words, Ishiguro, similar to the '003 Patent, implies that its stereographic images, used by a robot, also would be capable of providing depth perception to a human.

Challenging Ishiguro’s disclosure as it applies to the narrower claim construction requiring human depth perception, Patent Owner contends that Ishiguro does not “either expressly or inherently” teach “making any modification

or adjustment to the images of Fig. 5, such that they are suitable for human viewing.” PO Resp. 31. Patent Owner and Dr. Essa contend that the left and right images have a “significant disparity,” precluding human depth perception, because the images were made for a robot. PO Resp. 29 (quoting Ex. 2010 ¶ 46).

Patent Owner also filed a Motion for Observation, calling attention to Dr. Darrell’s testimony about Figure 5 of Ishiguro. Paper 37, 3–6. Patent Owner contends that Dr. Darrell’s cross-examination testimony sheds doubt on his declaration testimony that skilled artisans would have known how to align the objects in Figure 5 of Ishiguro to create human depth perception. In other words, Patent Owner’s challenge relates to whether Ishiguro’s disclosure implicitly teaches that the images are capable of human depth perception after processing that the claims do not preclude. *Cf. Paulsen*, 30 F.3d at 1480 (references must be read in light of the knowledge of a skilled artisan). Patent Owner focuses on the lack of a conclusive experiment by Dr. Darrell to prove that Figure 5 shows depth, and Dr. Darrell’s testimony that he performed a “thought experiment[]” about Figure 5. *See* Paper 37, 4.

As Petitioner explains, Dr. Darrell need not provide an experiment to prove his consistent point about a “basic principle that for a given baseline, disparity varies with object distance,” that skilled artisans knew how to align images for stereography, and that objects in Figure 5 could have been moved farther away, without any alignment, to create a stereoscopic image using Ishiguro’s system. *See* Pet. Reply 12 (citing Ex. 1044 ¶ 26); *accord* Paper 45, 5–7 (Petitioner responding to the Motion for Observation and persuasively characterizing Dr. Darrell’s cross-examination testimony as consistent with his second declaration and citing Ex. 2014, 115:9–21, 111:3–9; Ex. 1044 ¶¶ 22, 23, 26); *see also* Ex. 1044, ¶¶ 6–14, 24–26 (discussing alignment in various contexts).

For example, according to Dr. Darrell, a person of ordinary skill in the art at the time of the invention “would [have] underst[oo]d that the left and right eye images must be horizontally aligned and would [have] underst[oo]d how to align the images,” as evidenced by “the numerous anaglyph images that were available at the time.” Ex. 1044 ¶ 26. The ’003 Patent, and other evidence of record, corroborates Dr. Darrell, who relies partly on the record and his knowledge, all showing that alignment of images to create stereographic depth was well-known, (and, therefore, implied in Ishiguro as a step that the claims do not preclude). *See* Ex. 1001, col. 1, ll. 39–43 (describing known arrangements in non-panoramic stereography); Ex. 1003, 18 (Kawakita disclosing mosaic “alignment of the left and right panoramic images”); note 4 (describing known display devices as disclosed in the ’003 Patent); Ex. 1044 ¶¶ 6–14 (Dr. Darrell discussing the ’003 Patent, related references, and knowledge by ordinary skill level in the art); *id.* ¶¶ 18–23 (discussing Kawakita’s disclosure of alignment).

The weight of evidence shows that horizontal alignment techniques were well-known at the time of the invention. As Petitioner points out, “[Dr.] Essa, when asked, offered no contrary opinion.” Paper 45, 7 (citing Ex. 1043, 167:2–9); *see also* 171:12, 170:4–171:16 (Dr. Essa testifying “I can’t be sure” when asked, after several iterations of the question, whether a skilled artisan in 1998 would know how to perform alignment). Therefore, Patent Owner’s contentions and evidence are insufficient to rebut Petitioner’s showing that horizontal alignment techniques were well-known, and that Ishiguro’s system teaches the creation of images that are capable of being aligned for human depth perception. Regarding the former point, Dr. Darrell testifies that “[a] person of ordinary skill in the art as of 1998 would understand that the left and right images must be horizontally aligned and would understand how to align the images.” *Id.* ¶ 26. Regarding the

latter point, Dr. Darrell testifies that, “even if humans are unable to stereoscopically fuse the images in Figure 5 because the disparities are too large [as Dr. Essa contends], the system disclosed by Ishiguro is capable of creating stereoscopic image pairs for human viewing.” Ex. 1044 ¶ 25. Dr. Darrell explains that using the “same system to image scenes where objects were further away would result in images with disparities well within the range of human viewing.” *Id.*

In other words, even assuming that the narrower claim construction applies, according to Dr. Darrell and the record evidence: 1) Skilled artisans could have made horizontal alignment adjustments to mosaic image pairs produced by Ishiguro’s system (adjustments the claims do not preclude or require); and 2) Ishiguro’s system would provide depth perception without any adjustments for some contemplated scenes, because Ishiguro’s system necessarily would portray depth for objects further away than those depicted in Figure 5. In essence, Patent Owner’s “argument . . . fails to recognize that prior art references must be ‘considered together with the knowledge of one of ordinary skill in the pertinent art.’” *Paulsen*, 30 F.3d at 1480 (quoting *In re Samour*, 571 F.2d 559, 562 (CCPA 1978)).

Based on the foregoing discussion, we determine that Petitioner shows by a preponderance of evidence that Ishiguro anticipates claim 1. Patent Owner does not present separate arguments to distinguish claims 2, 4, 5, 22, and 34 over Ishiguro. In other words, Patent Owner’s arguments are directed to representative claim 1, which is similar in scope to claim 34, and Patent Owner does not contest the specific limitations in the other challenged claims with separate arguments. *See* Prelim. Resp. 27–32; PO Resp. 25, 32. Upon consideration of Petitioner’s showing as to each of the challenged claims (Pet. 23–30; 47, 49–54, 56–59;

IPR2013-00326, Paper 1, 8–9, 23–28, 45, 46, 48, 50, 51, 53, 55), and considering the record evidence and arguments by the parties, we determine that Petitioner establishes by a preponderance of the evidence that Ishiguro anticipates claims 1, 2, 4, 5, and 34 and renders obvious claim 22.

C. Motions to Exclude Evidence

1. Petitioner’s Motion to Exclude Evidence

Petitioner moves to exclude Exhibits 2012 and 2013 filed by Patent Owner. Paper 40. As discussed above (notes 7 and 9), Exhibits 2012 and 2013 respectively correspond to “other translations” of Asahi, Exhibit 1006, and Kawakita, Exhibit 1003, which, according to Petitioner, were submitted to Patent Owner’s exclusive licensee, a real-party-in interest in these proceedings, during an ITC Investigation. Paper 40, 3.¹⁰ Petitioner challenges these translations for lack of relevancy and as beyond the scope of Dr. Darrell’s testimony. Paper 40. As to the former, Petitioner asserts that Exhibits 2012 and 2013 are not relevant to show the accuracy of the translations filed by Petitioner in this proceeding, Exhibits 1003 and 1006, because Patent Owner did not challenge the accuracy of those translations or seek to cross-examine the translators.

Patent Owner provided Exhibits 2012 and 2013 to show inconsistencies in Exhibits 1006 and 1003, asserting relevancy, and asserting that they are within the scope of Dr. Darrell’s testimony, because Dr. Darrell relies on Exhibits 1003 and 1006. *See* Paper 43, 2, 7–9. We address these alleged inconsistencies above. *See*

¹⁰ Petitioner explains that, in this proceeding, it provided a certified translation of Asahi (Ex. 1006) rather than relying on the uncertified translation (Ex. 2012). Paper 47, 5. Petitioner also explains that it provided a certified translation of “the entire conference booklet” that contains Kawakita (Ex. 1003), rather than relying on Exhibit 2013, because whether the former constitutes a “printed publication” was a potential issue in this proceeding. *See id.*

notes 7 and 9 (finding immaterial differences). The alleged inconsistencies respond to Dr. Darrell's testimony about the references. Based on the foregoing, Petitioner's motion is *denied*.

2. Patent Owner's Motion to Exclude Evidence

Patent Owner moves to exclude a Wikipedia article entitled "Stereoscopy" (Ex. 1040), certain passages of Dr. Essa's deposition (Ex. 1043, 52:8–72:11), certain paragraphs of Dr. Darrell's second declaration (Ex. 1044 ¶¶ 15–16, 27–28), and certain passages of Petitioner's Reply (Paper 31, 2, 12–15). *See* Paper 38, 5–10 (Patent Owner's Motion to Exclude). Patent Owner moves to exclude the Wikipedia article (Ex. 1040) based on the assertion that it lacks authentication, constitutes hearsay (Paper 38, 3–5), presents evidence that "is not responsive to arguments raised for the first time in Patent Owner's Response," and is untimely (*id.* at 6 (citing 37 C.F.R. §§ 42.23(b), 42.123)).

Patent Owner moves to exclude paragraphs 15 and 16 of Dr. Darrell's second declaration and page 2 of Petitioner's Reply because "relying on the untimely [Wikipedia evidence] should be stricken from the record" (Paper 38, 7), and also, any reliance on "the unauthenticated hearsay [Wikipedia] evidence should be stricken from the record" (*id.* at 5). Similarly, Patent Owner challenges the identified passages of Dr. Essa's deposition based on the assertion that the cross-examination relies on the inadmissible Wikipedia article, which is "beyond the scope [of direct] and lacking authentication." *Id.* at 7.

Patent Owner also moves to exclude paragraphs 27 and 28 of Dr. Darrell's second declaration, which refer to aspects of Asahi, and pages 12–15 of Petitioner's Reply, which relies on that testimony, based on the assertion that the testimony "is not responsive to issues raised for the first time by Patent Owner." *See* Paper 38, 8.

i) Cross-Examination, Exhibit 1043 (Dr. Essa's Deposition), and Exhibit 1040 (the Wikipedia Article).

The challenged Wikipedia article, "Stereoscopy" (Ex. 1040), contains 19 web pages of information about stereoscopy. The Wikipedia article pages relevant to this proceeding—those upon which Petitioner primarily relies for cross-examination of Dr. Essa (and relies upon as direct testimony as discussed below)—involve pages 11–13. *See* Ex. 1044 ¶ 16 (citing Ex. 1040, 11–13); Ex. 1043, 52:8–72:11 (passages related to the Wikipedia article, Ex. 1040).¹¹

Patent Owner seeks to exclude Dr. Essa's deposition passages spanning from page 58, line 8, to page 72, line 11, on the assertion that Dr. Essa's cross-examination improperly refers to contents in the challenged Wikipedia article. Paper 38, 7. Patent Owner asserts that the lack of authentication of the Wikipedia article renders cross-examination about it inadmissible, and also, that, because the passages "relate to the Wikipedia entry [, Ex. 1040, they] . . . fall outside the scope of [Dr. Essa's] direct testimony." *Id.*

Although a large portion of the challenged deposition pages (Ex. 1043, 52:8–72:11) pertains to cross-examination based on certain portions of the Wikipedia article, several of the pages pertain to cross-examination based on passages in the '003 Patent or other evidence. For example, the section from page 65, line 2, to page 69, line 17, of the deposition, pertains to cross-examination about "exaggerated" and "normal" stereo as described in the '003 Patent and

¹¹ Before Petitioner filed the Wikipedia article as Exhibit 1040 or used it during cross-examination of Dr. Essa, Patent Owner and Patent Owner's declarant, Dr. Essa, cited it, albeit not directly, but as a link that appears in another web-based citation upon which Dr. Essa directly relies. *See* Ex. 2010 ¶ 27 (Dr. Essa's declaration citing Ex. 2003, a webpage entitled "stereoscopy (stereoscopic imaging)," which, in turn, provides a link to the challenged "Stereoscopy" Wikipedia article cited by Petitioner, Ex. 1040).

related evidence. The thrust of the cross-examination concerns the “exaggerated” stereo concept as described in the ’003 Patent—baselines larger than the human inter-ocular baseline. *See* Ex. 1043, 52:8–72:11. Also, without using the Wikipedia article in particular, but using general questioning, Dr. Essa affirmed the underlying thrust of Petitioner’s question, by answering “[w]hen presented properly” to Petitioner’s question: “[D]o I understand correctly that - - that one can use a imaging system like two stereo cameras or a single stereo camera that has a baseline wider than the approximate distance between human eyes” to “provide a perception of depth?” *See* Ex. 1043, 59:23–60:8; *accord id.* at 60:9–17 (similar colloquy).

Therefore, based on Patent Owner’s contentions in its motion, we deny the motion to the extent it pertains to excluding the portions of Dr. Essa’s deposition that do not involve, specifically, the Wikipedia article as a basis for impeachment. Patent Owner has not carried the burden on its motion, at least as to the challenged deposition pages that do not involve the Wikipedia article. On the other hand, to simplify issues, and based on Patent Owner’s arguments, which rely on the Wikipedia article, we do not consider the portions of the deposition that relate to cross-examination of Dr. Essa based on that article: Exhibit 1043, 52:8–59:22, 60:18–65:1, and 69:18–72:11.

Questioning outside of the non-considered portions shows that Dr. Essa did not dispute clearly Petitioner’s contention that a stereoscopic perception of depth may be provided using relative baselines—i.e., when images are recorded at distances that are wider than the distance between human eyes. *See* citations in next paragraph. In contrast, prior to cross-examination, Dr. Essa’s direct testimony indicates that two conditions must be met for proper depth perception: 1) recording images at the human inter-ocular distance and 2) horizontally aligning them. *See*

Ex. 2010 ¶ 26. Dr. Essa does not testify clearly whether or not the latter alignment can cure the former recording distance.

Accordingly, contrary to Patent Owner’s argument challenging the deposition as non-responsive, the cross-examination in the challenged section falls within the scope of Dr. Essa’s declaration testimony.¹² It was proper for Petitioner to clarify or challenge Dr. Essa’s position regarding the human inter-ocular baseline. *Compare* Ex. 2010 ¶ 26 (testifying that “if the red/cyan images are not generated from the perspective of human eyes *and* properly aligned horizontally” that “double (overlap) images would appear and make stereoscopic fusion impossible”) (emphasis added), *with* Ex. 1043, 59:23–60:8 (quoted above, answering “[w]hen presented properly,” to a question about whether an image “provide[s] a perception of depth” when “a single stereo camera . . . has a baseline wider than the approximate distance between human eyes”); *see also id.* at 30:1–33:1 (agreeing that the amount of disparity (i.e., depth perception) generally varies with baseline distance) (deposition section not challenged), 69:2–17 (agreeing, based on the ’003 Patent, that “enlarging the viewing circle means increasing the baseline to something larger than the approximate distance between human eyes”).

Based on the foregoing discussion, Patent Owner has not satisfied its burden on its Motion to Exclude the particular cross-examination testimony of Dr. Essa at the following passages of the deposition: Exhibit 1043: 59:23–60:17; 65:2–69:17. We do not rely on the following passages that relate to cross-examination of Dr. Essa based on the Wikipedia article: Exhibit 1043, 52:8–59:22, 60:18–65:1, and 69:18–72:11. Similarly, we do not rely on any portion of the Wikipedia article,

¹² As outlined above, Patent Owner’s non-responsiveness argument also appears to be directed to cross-examination based on the Wikipedia article. Nevertheless, the non-responsiveness argument is intertwined with the related (unchallenged) evidence employed for cross-examination.

Exhibit 1040, for purposes of the cross-examination (Ex. 1043). (We do, however, consider, to a minor extent, one section of the Wikipedia article (Ex. 1040, 13, section titled “A practical example”), as direct evidence, as discussed below.)

Therefore, we deny Patent Owner’s Motion to Exclude Exhibit 1043 at the following passages: 59:23–60:17; 65:2–69:17. We dismiss as moot Patent Owner’s Motion to Exclude Exhibit 1043 at the following passages: 52:8–59:22; 60:18–65:1; 69:18–72:11. We dismiss as moot Patent Owner’s Motion to Exclude Exhibit 1040 for purposes of cross-examination.

ii) Direct Evidence, Exhibits 1040 and 1044, Petitioner’s Reply

As discussed at the outset of this section, in addition to moving to exclude the entirety of the Wikipedia article (Ex. 1040), Patent Owner seeks to exclude paragraphs 15, 16, 27, and 28 of Dr. Darrell’s second declaration (Ex. 1044), and pages 2 and 12–15 of Petitioner’s Reply (Paper 31). *See* Paper 38, 5–8. In addition to the authentication challenge to Exhibit 1040, Patent Owner challenges it as hearsay and as non-responsive to Patent Owner’s Response. *See* Paper 38, 5–7. Patent Owner challenges page 2 of Petitioner’s Reply and paragraphs 15 and 16 of Dr. Darrell’s second declaration (Ex. 1044), because they rely on the allegedly non-responsive, unauthenticated, hearsay in the Wikipedia article (Ex. 1040). *See id.*

Although Petitioner first served the Wikipedia article at Dr. Essa’s deposition (*see* note 11), Petitioner also filed it with the Reply, as Exhibit 1040, along with Dr. Darrell’s second declaration (Ex. 1044), which relies on it, and Mr. Barton’s declaration (Ex. 2019), which supports it. *See* Paper 44, 7 (noting that Exhibit 1040 is “reproduced with Sony’s Reply” and arguing that Mr. Barton’s declaration is timely under 37 C.F.R. § 42.64(b)(2) as supplemental evidence and cures hearsay objections to Exhibit 1040). Two challenged paragraphs of Dr.

Darrell's second declaration (Ex. 1044 ¶¶ 15, 16) refer to pages 11–13 of Exhibit 1040, the Wikipedia article. Patent Owner objects to Exhibit 1040 as constituting untimely supplemental evidence and unauthenticated hearsay. *See* Ex. 2017 ¶¶ 2–4. For reasons explained below, Mr. Barton's declaration (Ex. 2019) and other authenticating evidence, cures Patent Owner's hearsay and authentication objections to a specific section of page 13, to paragraph 15 and a portion of paragraph 16 of Exhibit 1044, and to the Reply. *See* Paper 44, 7.¹³

Page 13 of the Wikipedia article (Ex. 1040), specifically the section titled “A practical example,” and Mr. Barton (Ex. 2019, Ex. 2020), primarily corroborate and bolster, with a specific example of a mountain scene recorded at large baseline distances, Dr. Darrell's testimony (relative and large baseline distances possible), Asahi's disclosure (stereoscopic images obtained from a large baseline), and the '003 Patent disclosure (exaggerated stereographic baselines). Patent Owner does not seek to exclude Dr. Darrell's testimony in paragraphs 6–14, 18, and 29 of Exhibit 1044 that discuss the concept of wide and relative recording baselines. Essentially, in the unchallenged paragraphs of his second declaration, Dr. Darrell describes, in sufficient detail, how skilled artisans would have understood that the baseline distance between recording positions for stereographic images is relative and not limited to the human inter-ocular distance, and that horizontal alignment techniques were known for accommodating different recording distances. *See* Ex. 1044 ¶¶ 6–14, 29.

¹³ Based on the arguments presented, we deem a portion of the authentication challenge by Patent Owner and response by Petitioner to be part and parcel of the hearsay challenge and response. *See U.S. v. Jackson*, 208 F.3d 633, 638 (7th Cir. 2000) (citing Fed. R. Evid. 901, implying that authentication may require that the proponent shows who posted website information if “offered to prove the truth of the matter asserted”).

Patent Owner does not specify the portions of paragraphs 15 and 16 that constitute unauthenticated evidence and hearsay. Apart from the aspect of authentication that involves personal knowledge of the truth of the matter asserted (*see* note 13), paragraph 15 of Exhibit 1044 helps to authenticate the Wikipedia article, referenced as a link within Patent Owner's Exhibit 2003, as the same disclosure as Petitioner's Exhibit 1040. Mr. Sander, Petitioner's declarant (Ex. 2018) further helps to authenticate this document, by testifying that Dr. Essa discussed the Wikipedia article at his deposition, and testifying that it is substantively the same as Exhibit 1040. Ex. 2018; *see also* Paper 44, 3–4 (discussing Exs. 1043, 1044, 2003, 2018). Patent Owner has not carried the burden on its motion to exclude the references to the Wikipedia article in paragraph 15. That paragraph does not contain substantive matter and merely introduces the later substantive discussion about baseline distances and the Wikipedia mountain scene (“A practical example”) that occurs in paragraph 16.

Challenged paragraph 16 of Dr. Darrell's second declaration also includes passages that cite pages 11 and 12 of the Wikipedia article (Ex. 1040). We exclude those passages and pages as hearsay because Mr. Barton does not address them—he does not cure the hearsay and authentication objections of those pages.

On the other hand, Mr. Barton's declaration and other evidence overcomes Patent Owner's objection to the remaining portions of paragraph 16. Mr. Barton testifies that, in 2004, he captured a pair of images to create the stereographic mountain scene image in the section titled “A practical example” in the Wikipedia article (Ex. 1040)—the subject of the hearsay objection and the primary subject of paragraph 16 of Dr. Darrell's second declaration. *See* Ex. 2019 ¶¶ 3–8; Ex. 1044 ¶ 16; *see also* Paper 44, 6–8 (discussing Exs. 2019 and 1044). Patent Owner cross-examined Mr. Barton and does not challenge his declaration. *See* Ex. 2020, 15:9–

23, 19:15–18. Mr. Barton also declares that he edited hundreds of Wikipedia articles and contributed over 200 photographs to Wikipedia, including several stereoscopic images. Ex. 2019 ¶ 3. Mr. Barton testifies that he created the “red/cyan stereoscopic anaglyph image,” a mountain scene from Dinosaur Hill Park, which is displayed and discussed in the Wikipedia article (Ex. 1040), by recording images at separated camera positions of 100 feet, and then uploading the image into the Wikipedia “Stereoscopy” article. *See* Ex. 2019 ¶¶ 4–8. He essentially confirms his declaration testimony during his deposition. *See* Ex. 2020, 13:3–18:16, 19:15–18; Paper 44, 6–7 (discussing Ex. 2019 ¶ 5; Ex. 2020, 5:9–23, 19:15–18; Pet. Reply 2).

The record shows that the mountain scene captured by Mr. Barton appears in the “A practical example” section of Exhibit 1040, which also includes text about the mountain scene. *Compare* Ex. 1040, 13, *with* Ex. 2019 ¶¶ 4–8, Ex. 1044 ¶ 16 and Pet. Reply 2. Patent Owner acknowledges that Mr. Barton testified during his cross-examination about that specific section of the Wikipedia article, including the text. *See* Paper 38, 5 (stating that Mr. Barton did not write the Wikipedia article “not including the text of the ‘Practical Example’ section on page 13”).

Patent Owner’s hearsay objection focuses on statements in the Wikipedia article and Petitioner’s Reply at page 2 that the images used to create the mountain scene from Dinosaur Hill Park were captured at distances of “100 feet” to produce a stereoscopic image. *See* Ex. 2017 ¶ 3 (asserting Wikipedia has been held to be unreliable (citation omitted)). According to Patent Owner, that statement (about the distance of 100 feet) constitutes “the out-of-court statement offered to prove the truth of the matter asserted.” *See id.*; Paper 44, 6–7 (Petitioner’s Opposition discussing the objection set forth in Ex. 2017 ¶ 3). Patent Owner correctly characterizes the statement in Exhibit 1040 as hearsay. Nonetheless, based on the

foregoing discussion, we find that Mr. Barton's declaration, availability for cross-examination, and the cross-examination testimony, cured the objections. Mr. Barton specifically testified about the 100 feet distance in his declaration and during cross-examination, as noted above.¹⁴ Mr. Barton's declaration testimony is not hearsay in this proceeding, and is reliable. In any event, Mr. Barton's testimony, Dr. Darrell's testimony, and Mr. Sander's testimony, responsively cure the authentication and hearsay objections related to the direct evidence of "A practical example" as part of Petitioner's Reply.¹⁵

Despite curing the "A practical example" section of Exhibit 1040 and related portions of paragraph 16, Exhibit 1044, the first two sentences of that paragraph

¹⁴ Mr. Barton's unchallenged declaration testimony proves the truth of the matter asserted about the "100ft" baseline recordings and other matters regarding the mountain scene in "A practical example." See Ex. 2019 ¶ 5. Mr. Barton's declaration, Dr. Essa's declaration (relying on Exhibit 2003, which provides a link to the Wikipedia article), and Dr. Darrell's declaration, show that the "A practical example" section of Exhibit 1040 constitutes an exception to hearsay in this proceeding under Fed. R. Evid. 803 (18) *Statements in Learned Treatises, Periodicals, or Pamphlets*:

A statement contained in a treatise, periodical, or pamphlet if:

(A) the statement is called to the attention of an expert witness on cross-examination or relied on by the expert on direct examination [Dr. Darrell and Mr. Barton]; and

(B) the publication is established as a reliable authority by the expert's admission or testimony, by another expert's testimony [Dr. Darrell adopts it, Mr. Barton verifies it, and Dr. Essa indirectly cites it], or by judicial notice. If admitted, the statement may be read into evidence but not received as an exhibit.

¹⁵ Patent Owner does not dispute that Mr. Barton, Mr. Sanders, and Dr. Darrell authenticated Exhibit 1040 to the extent of showing that Exhibit 2003 cites a hyperlink to the Wikipedia article. See Paper 46, 3 (challenging the authentication based on a lack of a showing of "a person with knowledge"); see also note 13 (discussing related aspects of authentication and hearsay).

discuss other material in Exhibit 1040 (i.e., pages 11 and 12), which constitutes hearsay that Mr. Barton does not address, as indicated above. Although Petitioner asserts that Patent Owner's specific hearsay objection focused on one statement (100 feet), Patent Owner also generally asserts in its Reply to Petitioner's Opposition that "Mr. Barton admitted on cross-examination that he did not write a majority of the text relied upon by Petitioner and Mr. Darrell" (Paper 46, 2), and that Dr. Darrell and Mr. Sanders did not have personal knowledge of the material in the Wikipedia article, and, therefore, could not have authenticated it (*id.* at 3). On the other hand, as noted above, Patent Owner acknowledges that Mr. Barton testified that he wrote the portions of the Wikipedia article that relate to the mountain scene viewed from Dinosaur Hill Park, which is the subject of the section titled "A practical example." *See also* Ex. 2020, 20:16–24; 22:10–19 (Mr. Barton testifying about portions he wrote). Therefore, the sentences in paragraph 16 in Exhibit 1044 that refer to the portions of the Wikipedia article that do not pertain to "A practical example," and all portions of Exhibit 1040 except "A practical example," are excluded as unreliable hearsay or lacking authentication. The "A practical example" section of Exhibit 1040 and the latter sentences in paragraph 16 of Exhibit 1044 that rely on it are not excluded.

Accordingly, we consider a rewritten version of paragraph 16 of Exhibit 1044 with the first two sentences excluded, as follows:

An anaglyph in the article (see below), depicts a mountain scene, the left and right images of which were captured by "a single camera [that] was walked about one hundred feet (30 m) between pictures." (*Id.* at 13). The method of using wider than human inter-ocular baselines to record scenes with distant objects was well-known to those of ordinary skill in the art as of 1998.



"Long base line image showing prominent foothill ridges."
See Wikipedia, Stereoscopy, Sony-1040 at 13.

The passage and image above represent a version of paragraph 16 of Exhibit 1044 that remains under consideration after we exclude unreliable portions thereof.

In summary, by providing Mr. Sander's and Mr. Barton's declarations, and by providing both declarants for cross-examination, Petitioner cured the authentication and hearsay objections to the above-specified portions of the Wikipedia article, Dr. Darrell's second declaration, and the Reply. Patent Owner does not object to Mr. Barton's declaration or to portions of Dr. Darrell's second declaration that establish the substance of the sought-after evidence to be excluded: the evidence of record that recording baseline distances are relative to the distance to the objects to be recorded, and may be larger than the human inter-ocular distance. The thrust of the authentication and hearsay objections relate to the truth about making stereographic images using the specific base-line image capturing distance of 100 feet. This particular testimony bolsters other evidence of record, and while not necessary to the ultimate conclusion of anticipation or obviousness, serves as a worthy example to facilitate the discussion of relative baselines.

Patent Owner's contentions that the relied-upon portions of the Wikipedia article, and the corresponding portions of Dr. Darrell's second declaration and the Reply, are not responsive to arguments raised by Patent Owner's Response, and are beyond the scope of Dr. Essa's declaration, are improper, and in any event, not persuasive. *See* Paper 38, 6. A motion to exclude is not a mechanism to argue that a reply contains new arguments or relies on evidence necessary to make out a

prima facie case. A motion to exclude, for instance, must state why the evidence is inadmissible (e.g., based on relevance or hearsay), identify the corresponding objection in the record, and explain the objection. *See* 37 C.F.R. § 42.64(c); *Office Patent Trial Practice Guide*, 77 Fed. Reg. at 48,767. Whether a reply contains arguments or evidence that are outside the scope of a proper reply under 37 C.F.R. § 42.23(b) is left to our determination. Therefore, Patent Owner's argument that certain evidence and arguments in the Reply are not responsive to arguments raised by the Patent Owner in the Patent Owner Response is improper. In any event, we are not persuaded by the arguments for the following reasons.

In opposition, Petitioner maintains that the proffered evidence responds to Dr. Essa's testimony (Ex. 2010 ¶¶ 28, 59) and similar contentions by Patent Owner that depth perception requires images to be generated at human inter-ocular baselines. *See* Paper 44, 9–12; *see also* Ex. 2010 ¶¶ 63–66 (similar testimony by Dr. Essa related to Asahi). Petitioner particularly explains that “Petitioner could not have reasonably expected [Dr.] Essa to testify that only stereoscopic images recorded from positions separated by a single distance, the human inter-ocular baseline could provide a sense of depth.” Paper 44, 9. Despite Patent Owner's argument to the contrary, as discussed in connection with Dr. Essa's deposition testimony and otherwise, the record shows that Petitioner properly replied to the Patent Owner Response and Dr. Essa's declaration. Petitioner's Reply, Exhibit 1040 at page 13 (“A practical example”), and Exhibit 1044, also respond properly and similarly to Patent Owner's argument that “slightly displaced” precludes relative displacement, including large relative baselines and the displacement discussed above in connection with Asahi. *See* PO Resp. 43–45 (citing Dr. Essa's declaration, Ex. 2010).

Under these circumstances, Petitioner's rationale for relying on "A practical example" at page 13 of Exhibit 1040 is proper and falls under the ambit of 37 C.F.R. § 42.23 (b) ("reply may only respond to arguments raised in the corresponding opposition or patent owner response"). In summary, Patent Owner argued about the human inter-ocular distance, relative baseline widths, slightly displaced recording positions, and calculating height in Asahi. Petitioner responded in its Reply with rebuttal evidence by Dr. Darrell and Mr. Barton.

Patent Owner's similar arguments concerning Asahi, alleging that Dr. Darrell's testimony (Ex. 1044 ¶¶ 27–28) about "stereoscopic viewing," and the related portions of Petitioner's Reply (Paper 31, 12–15) that rely upon it, do not properly respond to Patent Owner's Response, are not persuasive to carry the burden of exclusion in its motion. *See* Paper 38, 9–11. For similar reasons discussed above, the record shows that Patent Owner submitted evidence and argued in its Patent Owner Response that "stereoscopic viewing," as the term is used in Asahi, only means calculating height or depth, and does not mean providing a stereoscopic image, according to the '003 Patent, partly because the aircraft recording system does not record images at inter-ocular baseline distances. *See* PO Resp. 36–45; Ex. 2010 ¶¶ 55, 64; Paper 44, 10–12 (explaining how the evidence responds to Patent Owner's arguments about Asahi). Therefore, Petitioner's Reply and corresponding evidence properly fall within the scope of, and respond properly to, Patent Owner's Response (including Dr. Essa's declaration).

Based on the foregoing discussion, Patent Owner has not carried the burden in its motion to exclude, as hearsay, and as not authenticated, paragraph 15 and all portions, except for the first two sentences, of paragraph 16 of Exhibit 1044. Patent Owner has not carried the burden in its motion to exclude the portion of

Exhibit 1040 titled “A practical example” at page 13, or the pages challenged in Petitioner’s Reply.

Therefore, we deny the Motion to Exclude the following: paragraph 15 and the latter portions of paragraph 16 of Exhibit 1044, the portion of Exhibit 1040 titled “A practical example” at page 13, and any portion of Petitioner’s Reply.

We grant the Motion to Exclude all other portions of Exhibit 1040 and the first two sentences of paragraph 16 of Exhibit 1044.

III. CONCLUSION

Based on the foregoing discussion, we conclude that Petitioner has demonstrated by a preponderance of the evidence that claims 1–5, 22, and 34 are unpatentable as follows: a) anticipation of claims 1, 2, 4, 5, and 34 by Kawakita; b) anticipation of claims 1–5, 22, and 34 by Asahi; c) anticipation of claims 1, 2, 4, 5, and 34 by Ishiguro; d) obviousness of claim 22 over Kawakita; and e) obviousness of claim 22 over Ishiguro.

IV. ORDER

In consideration of the foregoing, it is

ORDERED that Petitioner has shown by a preponderance of the evidence that claims 1–5, 22, and 34 of U.S. Patent No. 6,665,003 are unpatentable;

FURTHER ORDERED that Patent Owner’s Motion to Exclude Evidence is *granted-in-part* with respect to the use of Exhibit 1040 as direct evidence, except for the portion titled “A practical example” at page 13, and *granted-in part* as to the first two sentences of paragraph 16 of Exhibit 1044, and otherwise is *dismissed-in-part* as moot or *denied-in-part*, as specified *supra* in Section II.C.2.;

FURTHER ORDERED that Petitioner’s Motion to Exclude Evidence is *denied*; and

FURTHER ORDERED that, because this is a final decision, parties to the

IPR2013-00218
Patent 6,665,003 B1

proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

FOR PETITIONER:

Walter Hanley
Michelle Carniaux
Michael E. Sander
Kenyon & Kenyon, LLP
Sony-HumanEyes@kenyon.com
whanley@kenyon.com
mccarniaux@kenyon.com
msander@kenyon.com

FOR PATENT OWNER:

David L. McCombs
David O'Dell
Gregory Huh
Haynes and Boone, LLP
david.mcombs.ipr@haynesboone.com
david.odell.ipr@haynesboone.com
gregory.huh.ipr@haynesboone.com

Robert Gerrity
William Nelson
Tensegrity Law Group, LLP
robert.gerrity@tensegritylawgroup.com
william.nelson@tensegritylawgroup.com