

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
Petitioner,

v.

LONGHORN AUTOMOTIVE GROUP LLC,
Patent Owner.

IPR2025-01064
Patent 8,265,353 B2

Before GEORGE R. HOSKINS, ROBERT L. KINDER, and
STEVEN M. AMUNDSON, *Administrative Patent Judges*.

HOSKINS, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Petitioner Volkswagen Group of America, Inc. has filed a Petition (Paper 1, “Pet.”) pursuant to 35 U.S.C. §§ 311–319 to institute an *inter partes* review of U.S. Patent No. 8,265,353 B2 (Ex. 1001, “the ’353 patent”), claims 1–18.

Patent Owner Longhorn Automotive Group LLC requested then-Acting Director Stewart to exercise her discretion to deny institution, which was opposed by Petitioner. *See* Papers 6 and 8. Patent Owner’s request was denied, and the Petition was referred to the Board. *See* Paper 9.

Therefore, we now consider the Petition and Patent Owner’s Preliminary Response (Paper 7, “Prelim. Resp.”). For reasons provided below, we determine on behalf of the Director (*see* 37 C.F.R. § 42.4(a)) that the information presented in the record demonstrates a reasonable likelihood that Petitioner would prevail with respect to at least one challenged claim. *See* 35 U.S.C. § 314(a) (2024). Therefore, we grant institution of the petitioned *inter partes* review.

II. BACKGROUND

A. *Real Parties-in-Interest and Related Proceedings*

Petitioner identifies itself (Volkswagen Group of America, Inc.), Volkswagen AG, and Audi AG as its real parties-in-interest. *See* Pet. 151. Patent Owner identifies itself (Longhorn Automotive Group LLC) as its sole real party-in-interest. *See* Paper 4, 2.

The parties identify several U.S. District Court litigations as related matters. *See* Pet. 151; Paper 4, 2–3.

B. The '353 Patent Specification

The '353 patent is directed to methods for generating images of objects inside living beings, such as a human patient's internal organs. Ex. 1001, 1:5–9, 1:21–32, 2:42–44.

The '353 patent particularly concerns synchronizing two such imaging techniques. *See id.* at code (57). The first technique may be an attenuative radiation imaging method, such as computed tomography (CT) which utilizes X-rays to generate anatomical information concerning the composition and contours of a patient's organs. *See id.* at code (57), 1:8–35, 7:54–56. The second technique may be an emissive radiation imaging method, such as positron emission tomography (PET) which utilizes gamma rays to generate functional information such as metabolic activity within a patient's body. *See id.* at code (57), 1:8–35, 2:47–52, 5:34, 7:54–58, p. 10 (Cert. of Correction re 7:58); Ex. 1005 ¶ 48; Ex. 1006, 1:13–23.

One technical challenge in both CT and PET imaging is compensating for image blurs caused by movement of the patient (e.g. breathing movements) and/or the patient's organs (e.g. heart beating) during the image acquisition process. *See* Ex. 1001, code (57), 1:36–2:3. This technical challenge is more acute in emissive imaging than in attenuative imaging. *See id.* at 1:61–2:3.

The '353 patent provides methods of compensating for patient movement during an emissive imaging process, utilizing movement displacement fields obtained during an attenuative imaging process. *See id.* at code (57), 2:4–25, 2:53–56 (Fig. 1). This may involve, for example, “synchroniz[ing] measurements made using the two techniques on a common time base” such as the patient's breathing cycle, by utilizing a

motion sensor such as a breathing sensor during both imaging processes. *Id.* at 1:5–7, 2:24–25, 2:57–3:20 (Figs. 1 and 2). The movement displacement fields are applied to both imaging data sets to reconstruct a composite image, combining anatomical and functional data. *See id.* at 4:45–5:23, 7:24–48.

C. The '353 Patent Claims

The '353 patent includes eighteen claims. *See* Ex. 1001, 8:1–10:28. Claims 1 and 12 are the independent claims. *See id.*

Claim 1 recites:

1. A method of forming an image of a mobile object, comprising:
obtaining a plurality of first images of the mobile object using a first imaging technique while obtaining a plurality of first measurements corresponding to movements of the mobile object using a first sensor system, the first sensor system being independent from the first imaging technique;
associating the plurality of first images with first movement states of the mobile object, the first movement states being determined by the first measurements;
obtaining a plurality of second images of the mobile object using a second imaging technique while obtaining a plurality of second measurements corresponding to movements of the mobile object using a second sensor system, the second sensor system being independent from the second imaging technique;
associating the plurality of second images with second movement states of the mobile object using the first measurements; and
forming an image of the mobile object based on said plurality of first images, said associated plurality of first measurements, and said first movement states and on said

plurality of second images, said associated plurality of second measurements, and said second movement states, wherein the first imaging technique is different from the second imaging technique.

Ex. 1001, 8:2–28; *id.* at p. 11 (Cert. of Correction).

Claim 12 recites “[a]n apparatus to form an image of a mobile object, comprising” “means for” performing essentially the same steps recited in claim 1. *See id.* at 9:1–10:2. However, there is at least one difference in the steps, as noted by Petitioner. Where claim 1 recites “associating the plurality of second images with second movement states of the mobile object using the *first* measurements,” claim 12 recites “means for associating the plurality of second images with second movement states of the mobile object, the second movement states being determined by the *second* measurements.” *Id.* at 8:18–20, 9:21–24 (emphases added); *see* Pet. 137 & n.3 (claim 1), 148 (claim 12); Ex. 1003 ¶¶ 219, 323.

D. Asserted Prior Art

Petitioner relies on the following three references as prior art against the ’353 patent. *See* Pet. 1–2.

Name	Reference	Exhibit No.
Weese	US 2005/0226527 A1	1005
Muehllehner	US 5,744,802	1006
Wainer	US 5,871,013	1007

Patent Owner does not dispute at this time that these references are prior art against the ’353 patent. *See* Prelim. Resp. *generally*.

E. Asserted Grounds

Petitioner asserts the following four grounds of unpatentability. *See* Pet. 2.

35 U.S.C. §	Reference(s)	Claims Challenged
103(a) ¹	Weese	1–18
103(a)	Weese, Muchllehner	1–18
103(a)	Weese, Wainer	1–18
103(a)	Wainer	1–18

F. Testimonial Evidence

Petitioner relies on the proffered expert witness testimony of Todd Peterson, Ph.D. (Exhibit 1003). Patent Owner does not rely on proffered expert witness testimony at this time.

III. PETITIONER’S GROUNDS OF UNPATENTABILITY

A. Legal Standards — Petitioner’s Burden

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the

¹ Amendments to 35 U.S.C. § 103 enacted by the Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”) took effect in March 2013. The ’353 patent issued from an application filed in September 2004. *See* Ex. 1001, code (22). Thus, we apply the pre-AIA version of § 103.

grounds for the challenge to each claim”)). This burden of persuasion never shifts to the patent owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

B. Legal Standards — Obviousness

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness, if made available in the record, which has not happened here. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

C. Level of Ordinary Skill in the Art

Petitioner contends a person having ordinary skill in the art pertaining to the ’353 patent “would have possessed at least a four-year degree in physics, biophysics, medical physics, or a related field, and two years of experience in developing and/or applying computed tomography methods,” wherein “[a]dditional education and professional experience are interchangeable.” Pet. 1; Ex. 1003 ¶¶ 54–55.

“Patent Owner utilizes Petitioner’s proposed level of skill in the art.” Prelim. Resp. 2.

For purposes of this Decision, we adopt Petitioner’s formulation of ordinary skill in the art, as it appears to be consistent with the ’353 patent and the asserted prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

D. Claim Construction

We interpret the ’353 patent claims “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b) (2025). This “includ[es] construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *Id.*

Petitioner construes the “means for” clauses in claim 12, and other “means for” clauses in claims depending from claim 12, per 35 U.S.C. § 112 ¶ 6.² *See* Pet. 9–17; Ex. 1003 ¶¶ 62–135; 37 C.F.R. § 42.104(b)(3) (“Where the claim to be construed contains a means-plus-function . . . limitation as permitted under 35 U.S.C. 112(f), the construction of the claim must identify the specific portions of the specification that describe the structure, material, or acts corresponding to each claimed function[.]”). Petitioner does not proffer any other claim constructions. *See* Pet. 9–17.

Patent Owner asserts “claim construction is not required to resolve any issues” raised by the Preliminary Response. Prelim. Resp. 2.

² Amendments to 35 U.S.C. § 112 enacted by the AIA apply only to patent applications filed on or after September 16, 2012. *See* AIA §§ 4(c) & 4(e), 125 Stat. 296–97. The ’353 patent issued from an application filed in 2004. *See* Ex. 1001, code (22). Therefore, we apply the pre-AIA version of § 112.

We discuss the scope of the claim term “obtaining” in Section III.E.2(d) below when comparing claim 1 with Weese, and the claim term “imaging technique” in Section III.H.1 below when comparing claim 1 with Wainer.

Otherwise, based on the arguments and evidence presented at this time, we determine no explicit construction is needed to resolve the parties’ controversy. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

E. Ground One — Obviousness over Weese

In Ground One, Petitioner asserts claims 1–18 of the ’353 patent are unpatentable as having been obvious over Weese. *See* Pet. 2, 17–22, 26–101. Patent Owner disagrees. *See* Prelim. Resp. 1–2, 6–7.

We summarize Weese, then we consider the parties’ competing contentions. We conclude the record demonstrates a reasonable likelihood that Petitioner would prevail with respect to at least claim 1. Therefore, we grant the petitioned *inter partes* review.

1. Overview of Weese

Weese is directed to methods for correcting motion artifacts in tomographic images, including combined CT-PET images generated by medical imaging systems. *See* Ex. 1005, codes (54) and (57), ¶¶ 1–4, 45, 47.

(a) *Weese's Imaging System*

Figure 6 of Weese shows a combined CT-PET imaging system (see Ex. 1005 ¶¶ 45, 53), and is reproduced below with our color annotations added.

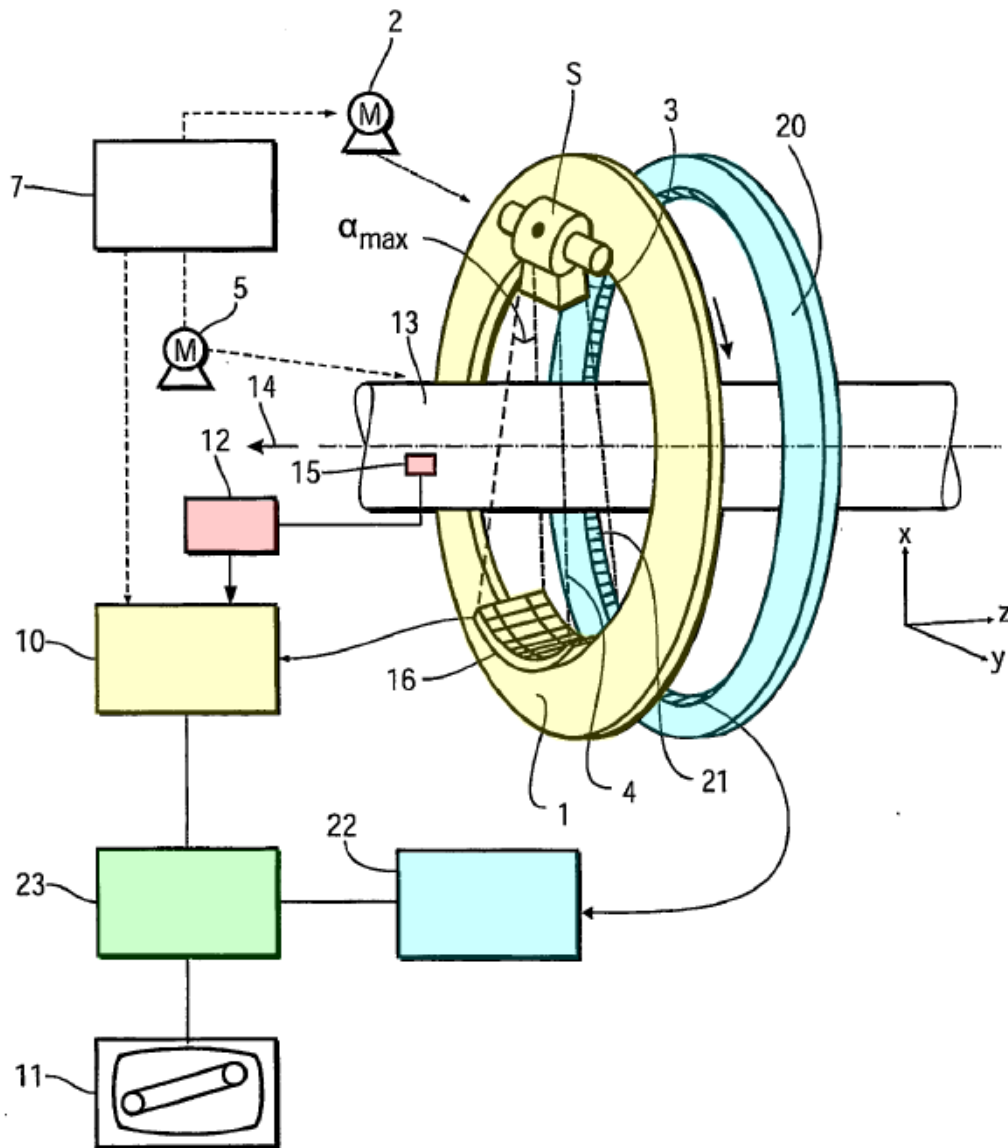


FIG.6

Weese, Figure 6 (Annotated in Color).

Figure 6 illustrates a computed tomography apparatus capable of generating CT and PET images. *See id.*

CT imaging data is generated by control unit 7 simultaneously operating motor 2 to rotate gantry 1 (yellow) and motor 5 to translate a table bearing the imaged patient within examination zone 13. *See id.* ¶¶ 54–56. X-ray source S (yellow) and two-dimensional X-ray detector unit 16 (yellow) are mounted on gantry 1 to record X-ray imaging data of the patient during the combined “helical path” movement. *Id.* At the same time, motion acquisition unit 12 (red) utilizes motion sensor 15 (red) arranged on the patient to detect the patient’s respiratory motion. *See id.* ¶¶ 57, 63–66. CT reconstruction unit 10 (yellow) reconstructs the recorded data to generate volume images of the patient. *See id.* ¶¶ 52–57.

PET imaging data is generated by PET acquisition unit 20 (blue) utilizing sensors 21 (blue) to record gamma ray radiation emitted from a preparation injected into the imaged patient. *See id.* ¶¶ 48, 58–59. PET evaluation unit 22 reconstructs the recorded data to generate PET volume images of the patient. *See id.* ¶¶ 48, 58.

Data processing unit 23 (green) combines the CT and PET images, and utilizes the motion data captured by motion acquisition unit 12 to reduce motion artifacts in the combined images. *See id.* ¶¶ 49–51, 60, 63–66.

(b) Weese’s Imaging Methods

Figure 1 of Weese illustrates an exemplary image processing method (*see* Ex. 1005 ¶¶ 40, 47), and is reproduced below with our color annotations added.

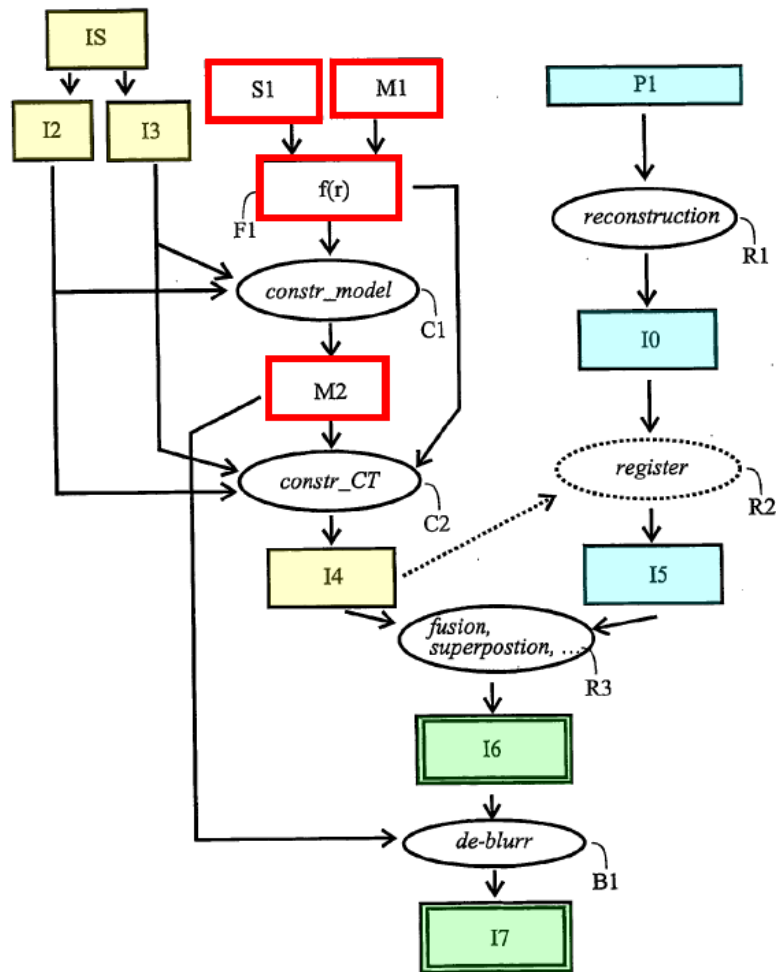


FIG.1

Weese, Figure 1 (Annotated in Color).

Figure 1 illustrates a sequence of CT images IS (yellow), from which instantaneous CT image I2 (yellow, the patient's inhaled state) and instantaneous CT image I3 (yellow, the patient's exhaled state) are extracted. *See id.* ¶¶ 10, 52, 57, 62. Motion model M2 (red) of the patient's respiratory cycle is formed utilizing: data from motion sensor S1 (red) arranged on the patient; instantaneous CT images I2 and I3; and state of motion function F1, which in Figure 1 is a frequency function $f(r)$ (red) of the human respiratory motion. *See id.* ¶¶ 12, 31, 57, 63–66.

PET projections P1 (blue) are utilized to generate reconstructed PET image I0 (blue), which contains motion artifacts. *See id.* ¶¶ 48–51. CT image I4 (yellow) also is formed, “represent[ing] a superposition of all states of motion weighted by the relevant duration of stay” thereby “exhibit[ing] substantially the same motion artifact as the image I0.” *Id.* ¶¶ 68–71. If necessary, PET image I0 can be registered to the same coordinate system as CT images I2, I3, and I4, resulting in registered PET image I5 (blue). *See id.* ¶¶ 72–75.

CT image I4 and PET image I5 then are combined to form CT-PET image I6 (green). *See id.* ¶¶ 75–76. Further, “it may be useful for a user of the system to limit the image I6 to given information or to highlight given information in particular,” for example by “focusing the image I6 which contains artifacts and in which only one state of motion of the [respiratory] motion is represented” to generate de-blurred CT-PET image I7 (green). *Id.* ¶ 77, Fig. 1.

Figure 3 of Weese illustrates “a further possibility for enhancing the information contents of an image by means of the motion model.” *Id.* ¶ 81.

2. Claim 1

Petitioner provides arguments and evidence contending claim 1 is unpatentable as having been obvious over Weese, including supporting testimony from Dr. Peterson. *See* Pet. 17–22, 26–83; Ex. 1003 ¶¶ 138–149, 159–257. Patent Owner opposes. *See* Prelim. Resp. 1–2, 6–7. We conclude Petitioner has demonstrated a reasonable likelihood of prevailing on its assertions, as follows.

(a) The Claim Preamble

The preamble of claim 1 recites “[a] method of forming an image of a mobile object.” Ex. 1001, 8:2–3. Petitioner assumes the preamble is limiting, and contends Weese discloses a method of forming an image of a mobile object. *See* Pet. 29–33 (citing Ex. 1005, code (57), Figs. 1–6, ¶¶ 1–18, 47–84); Ex. 1003 ¶¶ 174–178. We conclude this contention, which Patent Owner does not oppose at this time, is supported sufficiently by the cited disclosures in Weese and Dr. Peterson’s testimony to justify institution of review. In particular, Weese describes methods for correcting motion artifacts in combined CT-PET images of a moving object such as a human patient’s internal organs. *See* Ex. 1005, codes (54) and (57), ¶¶ 1–2, 47–52.

(b) Obtaining First Images with First Movement Measurements

The first step of claim 1 is “obtaining a plurality of first images of the mobile object using a first imaging technique while obtaining a plurality of first measurements corresponding to movements of the mobile object using a first sensor system, the first sensor system being independent from the first imaging technique.” Ex. 1001, 8:4–9.

Petitioner contends Weese discloses and renders obvious this step. *See* Pet. 33–47 (citing Ex. 1005, Figs. 1–6, ¶¶ 2–3, 31, 52–84; Ex. 1008, 735); Ex. 1003 ¶¶ 179–193. We conclude this contention, which Patent Owner does not oppose at this time, is supported sufficiently by the cited disclosures in Weese and Dr. Peterson’s testimony to justify institution of review.

In particular, Weese describes obtaining a plurality of first images of the patient’s internal organs (i.e., CT images IS, I2, and I3) using a first

imaging technique (i.e., CT). *See* Ex. 1005, Figs. 1 and 6, ¶¶ 47, 52–56, 62. Further, CT images IS, I2, and I3 are obtained while also obtaining first movement measurements of the patient’s internal organs using a first sensor system (i.e., motion acquisition unit 12 and motion sensor 15 / S1) which is independent from the CT imaging technique. *See id.* at Figs. 1 and 6, ¶¶ 57, 62–66.

(c) *Associating First Images with First Movement States Determined by First Movement Measurements*

The second step of claim 1 is “associating the plurality of first images with first movement states of the mobile object, the first movement states being determined by the first measurements.” Ex. 1001, 8:10–11, p. 11 (Cert. of Correction).

Petitioner contends Weese discloses this step. *See* Pet. 47–52 (citing Ex. 1005, Figs. 1–3 and 6, ¶¶ 10, 53–79); Ex. 1003 ¶¶ 194–196. We conclude this contention, which Patent Owner does not oppose at this time, is supported sufficiently by the cited disclosures in Weese and Dr. Peterson’s testimony to justify institution of review.

In particular, Weese describes associating CT images IS, I2, and I3 with the patient’s respiratory motion, wherein CT image I2 is at the patient’s inhaled state and CT image I3 is at the patient’s exhaled state. *See* Ex. 1005, Figs. 1 and 4, ¶¶ 10, 12, 57, 62–66. Further, Weese forms object motion model M2 from CT images I2 and I3 utilizing state of motion function F1 which represents the frequency of human respiratory motion. *See id.* ¶¶ 63–66.

(d) Obtaining Second Images with Second Movement Measurements

The third step of claim 1 is “obtaining a plurality of second images of the mobile object using a second imaging technique while obtaining a plurality of second measurements corresponding to movements of the mobile object using a second sensor system, the second sensor system being independent from the second imaging technique.” Ex. 1001, 8:12–17.

Patent Owner opposes Petitioner’s analysis regarding the third step, as follows.

(i) Petitioner’s Contentions

Petitioner contends Weese discloses and renders obvious the third step of claim 1. *See* Pet. 52–66; Ex. 1003 ¶¶ 197–218.

Petitioner argues Weese discloses obtaining a plurality of second images of the patient’s internal organs (i.e., PET images I0 and I10 reconstructed from PET projections P1) using a second imaging technique (i.e., PET). *See* Pet. 52–56 (citing Ex. 1005, Figs. 1–3, ¶¶ 47–84); Ex. 1003 ¶¶ 197–211. Petitioner asserts PET images I0 and I10 “disclose and render obvious a ‘plurality of second images’ in two ways.” Pet. 56; Ex. 1003 ¶ 199. First, Petitioner argues PET images I0 and I10 each may “be a slice-by-slice ‘volume image’” wherein the collection of slice images corresponds to the plurality of second images in claim 1. Pet. 56–57 (section heading modified) (citing Ex. 1005, Fig. 6, ¶¶ 2, 26, 47–58, 61, 84; Ex. 1006, code (57), Figs. 1, 2, 2a, and 11–13, 1:65–2:14, 3:27–58, 12:48–60, 13:18–38; Ex. 1007, 6:53–60; Ex. 1019, code (57), Fig. 2, 2:18–33, 5:61–6:4, 6:11–25, 10:60–62, 16:62–67); Ex. 1003 ¶¶ 199–207. Second, Petitioner argues PET images I0 and I10 “are ‘superposed’ PET

images encompassing ‘several states of motion,’ which discloses and renders obvious ‘second images.’” Pet. 58 (citing Ex. 1005, Figs. 1–3, ¶¶ 4–8, 22, 37, 47–52, 70, 83; Ex. 1001, Fig. 1, 2:53–3:48; Ex. 1020³ ¶ 109); Ex. 1003 ¶¶ 208–211.

Petitioner further argues Weese discloses and renders obvious obtaining PET images I0 and I10 while also obtaining second movement measurements of the patient’s internal organs using a second sensor system (i.e., motion acquisition unit 12 and motion sensor 15 / S1) which is independent from the PET imaging technique. *See* Pet. 58–66 (citing Ex. 1005, Figs. 1–3, ¶¶ 65–83); Ex. 1003 ¶¶ 212–218. Petitioner asserts in support that “S1 data contributes to M2, which desirably facilitates image comparison [between CT and PET images] at common motion states.” Pet. 58–62 (citing Ex. 1005, Figs. 1–3, ¶¶ 31, 57–83; Ex. 1008, 735; Ex. 1009, 1609–10; Ex. 1010); Ex. 1003 ¶¶ 214–216.

(ii) Patent Owner’s Opposition

Patent Owner contends “Petitioner fails to adequately explain or identify any ‘second images’ in Weese.” Prelim. Resp. 6.

First, Patent Owner argues “Petitioner concedes that Weese’s ‘P1’ are ‘projections’ which are raw collected sensor data” and “Petitioner does not articulate how the ‘P1’ raw data itself constitutes a ‘second image[.]’” *Id.* at 1. Patent Owner asserts PET projections P1 cannot satisfy the “second images” of claim 1 because projections are “raw collected sensor data” not

³ The Petition here refers to Exhibit 1017 but the cited quotation comes from Exhibit 1020.

“images,” and “Petitioner does not articulate any explanation for why raw projection data meets the ‘second images.’” *Id.* at 6–7.

Second, Patent Owner argues “[t]o the extent Petitioner pivots to rely on Weese’s processed and reconstructed ‘I0’ and ‘I10’ elements” as the “second images” of claim 1, Petitioner fails to adequately explain how such constructions are ‘obtained’ as required by” claim 1. *Id.* at 1–2, 7. Patent Owner asserts Petitioner “conced[es] that Weese’s ‘I0’ and ‘I10’ need to be created or formed through a reconstruction process” and “Petitioner does not allege that ‘I0’ and ‘I10’ are obtained in any way.” *Id.* at 7 (citing Pet. 56).

(iii) *Analysis*

Based on the present record, we determine Petitioner’s contentions regarding the third step of claim 1 are supported sufficiently by the cited disclosures in Weese and Dr. Peterson’s testimony to justify institution of review. In particular, Weese describes obtaining a plurality of second images of the patient’s internal organs (i.e., PET image I0 in Fig. 1, and PET image I10 in Fig. 3) using a second imaging technique (i.e., PET). *See* Ex. 1005, Figs. 1, 3, and 6, ¶¶ 47–49, 58–59, 72. In particular, PET image I0 in Figure 1 may be a reconstructed “volume image[]” composed of a plurality of “quasi two-dimensional” “slice images” that, when combined, represent a three-dimensional region inside the patient. *Id.* ¶¶ 48, 58, 61; *see also* Pet. 56–57. PET image I10 in Figure 3 may be a similarly reconstructed volume image composed of a plurality of slice images.⁴ *See*

⁴ We do not rely here on Petitioner’s alternative theory that Weese discloses a “plurality” of second images because PET images I0 and I10 are “superposed” images encompassing “several states of motion.” Pet. 58.

Ex. 1005 ¶¶ 61, 83–84. Patent Owner’s sole opposition to Petitioner’s assertions in this regard are limited to whether Weese “obtain[s]” PET images I0 and I10 as recited in claim 1, which we address below.

Also, it appears that PET images I0 and I10 are obtained while also obtaining second movement measurements of the patient’s internal organs using a second sensor system (i.e., motion acquisition unit 12 and motion sensor 15 / S1) which is independent from the PET imaging technique. *See* Ex. 1005, Figs. 1 and 6, ¶ 65 (“[T]he respiratory motion is determined during the acquisition of the PET projections P1 by means of a respiratory motion sensor provided on the patient and therefrom the frequency function $f(r)$ or, more generally, a state of motion function F1 is derived for the construction of the motion model M2.”). Furthermore, Weese describes how frequency function $f(r)$ is utilized to facilitate image comparison between CT and PET images at common motion states. *See id.* ¶¶ 31, 49–51, 70–71, 75–77, 79–80, 83; *see also* Ex. 1003 ¶¶ 214–216 (Dr. Peterson’s supporting testimony). Patent Owner’s sole opposition to Petitioner’s assertions in this regard are limited to whether Weese “obtain[s]” PET images I0 and I10 as recited in claim 1, which we address below.

Patent Owner’s two opposing arguments are unavailing, based on the present preliminary record. First, Petitioner relies on reconstructed PET images I0 and I10 as satisfying the “plurality of second images” recited in claim 1, not PET projections P1 from which PET images I0 and I10 are derived. *See, e.g.,* Pet. 56, 58 (“I0 and I10 disclose and render obvious a ‘plurality of second images’ in two ways” — “I0 and I10 may be ‘volume images’ formed using ‘known’ techniques,” and “I0 and I10 are ‘superposed’ PET images encompassing ‘several states of motion,’ which

discloses and renders obvious ‘second images.’”). Thus, the issue of whether PET projections P1 are “images” per claim 1 does not materially address Petitioner’s challenge.

Second, we determine Petitioner adequately explains how reconstructed PET images I0 and I10 are “obtained” per claim 1 to justify institution. That is, they are obtained by reconstructing PET projections P1 into images using known methods. *See* Ex. 1005 ¶¶ 48–49, 58, 83; Pet. 56 (“Weese collects and reconstructs PET projections P1 to create I0 or I10.”). Patent Owner does not explain, and we do not discern, any reason why the recitation of “obtaining” an image per claim 1 might exclude the PET image reconstruction process identified by Weese.

Accordingly, on this record, we conclude Petitioner shows sufficiently for purposes of trial institution that Weese discloses or renders obvious the third step of claim 1.

(e) Associating Second Images with Second Movement States Using the First Movement Measurements

The fourth step of claim 1 is “associating the plurality of second images with second movement states of the mobile object using the first measurements.” Ex. 1001, 8:18–20.

Petitioner contends “Weese discloses and renders obvious [this step].” Pet. 66; *see id.* at 66–78 (citing Ex. 1005, code (57), Figs. 1–6, ¶¶ 5–84, claims 1 and 5); Ex. 1003 ¶¶ 219–245. We conclude this contention, which Patent Owner does not oppose at this time, is supported sufficiently by the cited disclosures in Weese and Dr. Peterson’s testimony to justify institution of review.

In particular, Weese describes associating PET image I0 with the patient's respiratory motion, as embodied by Weese's object motion model M2 which is formed utilizing CT images I2 and I3 as discussed in Section III.E.2(c) above, in order to create a new PET image I5 and a combined CT-PET image I6. *See* Ex. 1005, Fig. 1, ¶¶ 47–51, 57–58, 60–66, 68–77; Pet. 72–73. Weese also describes associating PET image I10 with the same object motion model M2, because “M2 forms I4, and I4 reconstructs projections P1 to create PET image I10, thereby associating M2's motion states with I10.” Pet. 77; *see* Ex. 1005, Fig. 3, ¶ 83.

(f) Forming an Image of the Mobile Object

The fifth step of claim 1 is “forming an image of the mobile object based on said plurality of first images, said associated plurality of first measurements, and said first movement states and on said plurality of second images, said associated plurality of second measurements, and said second movement states.” Ex. 1001, 8:21–26, p. 11 (Cert. of Correction).

Petitioner contends “Weese discloses and renders obvious [this step] **thirteen** ways by forming ‘image[s] of the mobile object.’” Pet. 78; *see id.* at 78–83 (citing Ex. 1005, Figs. 1–3, ¶¶ 47–84); Ex. 1003 ¶¶ 246–255.

Patent Owner asserts “Petitioner does not map Weese's ‘I0’ and ‘I10’ elements to” this step of claim 1. Prelim. Resp. 7. We disagree concerning Weese's PET image I0, because Petitioner explains how PET image I0 is utilized to form combined CT-PET images I6 and I7 of the patient's internal organs. *See* Pet. 78–79; *see also* Ex. 1005 ¶¶ 75–76, Fig. 1 (process flow leads from I0 to I6 and I7). Thus, Petitioner's reliance on Weese's PET image I0 is sufficient to justify institution of review. *See also supra*

Section III.E.2(d)(iii) (discussing how PET image I10 may be composed of a plurality of images).

However, Petitioner's reliance on Weese's PET image I10 is more suspect, because it does not appear that PET image I10 is utilized to form any other images. *See* Ex. 1005 ¶ 83, Fig. 3 (process flow concludes with I10).

We further conclude Petitioner's remaining contentions addressing this step of claim 1, which are not opposed by Patent Owner at this time, are supported sufficiently by the cited disclosures in Weese and Dr. Peterson's testimony to justify institution of review.

(g) First and Second Imaging Techniques Are Different

The final limitation of claim 1 recites "wherein the first imaging technique is different from the second imaging technique." Ex. 1001, 8:27–28. We agree with Petitioner's corresponding contention that Weese's CT and PET imaging techniques are different, which Patent Owner does not dispute at this time. *See* Pet. 83; Ex. 1003 ¶¶ 256–257.

(h) Conclusion as to Claim 1

We conclude Petitioner has demonstrated a reasonable likelihood of prevailing on its assertion that claim 1 is unpatentable as having been obvious over Weese.

3. Claims 2–18

Petitioner provides arguments and evidence contending claims 2–18 are unpatentable as having been obvious over Weese, including supporting testimony from Dr. Peterson. *See* Pet. 17–22, 83–101; Ex. 1003 ¶¶ 138–149,

258–348. Patent Owner opposes, relying on arguments discussed above in connection with claim 1. *See* Prelim. Resp. 1–2, 6–7.

“When instituting *inter partes* review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim.” 37 C.F.R. § 42.108(a). Thus, pursuant to USPTO rules and policy implementing *SAS Institute Inc. v. Iancu*, 584 U.S. 357 (2018), we “either (1) institute as to all claims challenged in the petition and on all grounds in the petition, or (2) institute on no claims and deny institution.” Patent Trial and Appeal Board Consolidated Trial Practice Guide (Nov. 2019) (“CTPG”), 5–6, 64.⁵ We “will not institute on fewer than all claims or all challenges in a petition.” *Id.* at 5, 64; *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1359–60 (Fed. Cir. 2018) (stating a decision to institute is “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”).

Thus, because we have decided to grant institution on claim 1, we do the same for claims 2–18. *See supra* Section III.E.2; 37 C.F.R. § 42.108(a); CTPG 5–6, 64. Further, Patent Owner does not address these claims apart from arguments we have considered above in connection with claim 1, so there is nothing further for us to address with respect to these claims at this time. *See* CTPG 5–6, 64.

4. Conclusion as to Ground One

We conclude the record demonstrates a reasonable likelihood that Petitioner would prevail with respect to challenging claim 1 as having been

⁵ Available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

obvious over Weese, so we grant institution of review on Petitioner's Ground One.

F. Ground Two — Obviousness over Weese and Muehllehner

In Ground Two, Petitioner asserts claims 1–18 of the '353 patent are unpatentable as having been obvious over Weese and Muehllehner. *See* Pet. 2, 17–24, 101–05. Patent Owner disagrees, relying on arguments concerning Weese discussed above in connection with claim 1. *See* Prelim. Resp. 1–2, 6–7.

As discussed above, because we have decided to grant institution on Ground One, we do the same for Ground Two. *See supra* Section III.E.3; 37 C.F.R. § 42.108(a); CTPG 5–6, 64. Further, Patent Owner does not address Ground Two separately from Ground One, so there is nothing further for us to address with respect to Ground Two at this time. *See* CTPG 5–6, 64.

G. Ground Three — Obviousness over Weese and Wainer

In Ground Three, Petitioner asserts claims 1–18 of the '353 patent are unpatentable as having been obvious over Weese and Wainer. *See* Pet. 2, 17–22, 25–26, 105–32. Patent Owner disagrees, relying on arguments concerning Weese discussed above in connection with claim 1. *See* Prelim. Resp. 1–2, 6–7.

As discussed above, because we have decided to grant institution on Ground One, we do the same for Ground Three. *See supra* Section III.E.3; 37 C.F.R. § 42.108(a); CTPG 5–6, 64. Further, Patent Owner does not address Ground Three separately from Ground One, so there is nothing

further for us to address with respect to Ground Three at this time. *See* CTPG 5–6, 64.

H. Ground Four — Obviousness over Wainer

In Ground Four, Petitioner asserts claims 1–18 of the ’353 patent are unpatentable as having been obvious over Wainer. *See* Pet. 1–2, 25–26, 132–50. Patent Owner disagrees. *See* Prelim. Resp. 1–2, 7–10.

As discussed above, because we have decided to grant institution on Ground One, we do the same for Ground Four. *See supra* Section III.E.3; 37 C.F.R. § 42.108(a); CTPG 5–6, 64. Nonetheless, we will address Patent Owner’s arguments concerning Ground Four separately from Ground One, to provide guidance to the parties for the upcoming trial. *See* CTPG 6, 64.

1. Claim 1

Petitioner maps the “first images” obtained by “a first imaging technique” in claim 1 to Wainer’s “structural images (e.g., CT or SPTCT)” comprising “a plurality of slices.” Pet. 133–34 (citing Ex. 1007, code (57), Figs. 2A and 6, 2:29–3:60, 4:34–61, 6:53–7:31, 8:38–9:20); Ex. 1003 ¶¶ 518–530. Petitioner maps the “second images” obtained by “a second imaging technique” in claim 1 to Wainer’s “functional 2D slice images (e.g., STET, SPECT).” Pet. 135–36 (citing Ex. 1007, code (57), Figs. 4A and 6, 2:29–3:60, 4:34–61, 6:53–7:42, 8:38–9:20); Ex. 1003 ¶¶ 534–545.

Petitioner asserts Weese’s first and second imaging techniques are “different” per claim 1 because “[s]tructural imaging (CT, SPTCT), is a first technique, while functional imaging (STET, SPECT) is a second, different technique.” Pet. 141 (citing Pet. 110–13 (§§ X.B.2–4), 113–115 (§§ X.B.6–8); Ex. 1003 ¶ 563.

Patent Owner firstly opposes Petitioner's contention that Wainer discloses a CT imaging technique as the first imaging technique of claim 1, because "Wainer does not actually disclose obtaining CT images using Wainer's system." Prelim Resp. 2, 8, 9. According to Patent Owner, "Wainer discloses a single SPECT system" and "does not disclose that a SPECT system also performs CT imaging." *Id.* at 9 (citing Ex. 1007, 4:30–32). Patent Owner asserts "SPECT systems are completely different from CT systems" and "Petitioner does not identify any combined system for performing multiple types of imaging techniques, including SPECT and CT imaging, because such a combined system does not exist in the prior art of record." *Id.* at 9–10.

We agree with Patent Owner to the extent that Wainer does not disclose a CT imaging system *per se*, and Wainer does not discuss any methods of generating CT images *per se*. Wainer instead focuses on nuclear medicine imaging techniques. *See, e.g.*, Ex. 1007, code (54), 1:10–14. In particular, Wainer utilizes SPECT (Single Photon Emission Computerized Tomography) to generate functional information concerning the patient's internal organs. *See id.* at 1:17–27, 1:57–2:21, 6:19–31. Wainer utilizes SPTCT (Single Photon Transmission Computerized Tomography) to generate structural information concerning the patient's internal organs. *See id.* at 1:39–40, 5:18–24 (Fig. 2A). Wainer also discusses how STET (Simultaneous Transmission and Emission Tomography) imaging systems use "SPECT and SPTCT simultaneously." *Id.* at 1:57–59, 4:62–5:24 (Figs. 1, 2A, 2B, and 2C). Based on the present record, we conclude none of SPECT, SPTCT, and STET is a CT-based imaging system.

At the same time, however, Wainer discloses “*a method for registering a STET image and a structural diagnostic image (such as an MRI, ultrasound or X-ray CT image)* [which] uses the SPTCT data in order to identify structure in the patient’s body” for the STET-CT registration. *Id.* at 2:39–53 (emphasis added), 6:10–18 (Figs. 2B and 3), 7:10–19, 7:39–41 (Fig. 4B). Wainer further discusses how this STET-CT registration can utilize “gated” STET and CT images that are synchronized to the patient’s cardiac or respiratory rhythm, which advantageously simplifies the registration and allows for motion correction. *Id.* at 3:34–60, 4:56–61, 8:38–59. These disclosures sufficiently support Petitioner’s reliance on Wainer to justify institution of review.

In particular, although claim 1 recites a method of forming an image, the first image generation step is recited broadly as “*obtaining a plurality of first images of the mobile object using a first imaging technique while obtaining a plurality of first measurements corresponding to movements of the mobile object using a first sensor system.*” Ex. 1001, 8:2–9 (emphases added). Based on the present record, we conclude a person of ordinary skill in the art would have understood that the X-ray CT images expressly described in Wainer as discussed above are obtained utilizing a CT imaging technique per the first image generation step of claim 1. Further, the CT imaging technique would have included obtaining first movement measurements using a first sensor system per claim 1, in order to perform the gated STET-CT image registration expressly described in Wainer as discussed above. *See, e.g.*, Ex. 1007, 3:40–45, 8:38–43 (CT imaging acquisition is gated to body rhythms and motions “in the same manner” as a STET imaging acquisition); *id.* at Fig. 6, 8:60–9:23 (STET imaging

system 21 includes position sensor 31 and cardiac sensor 36 to perform respiratory or cardiac gating); Ex. 1003 ¶¶ 523–530.

Patent Owner secondly opposes Petitioner’s alternative combination of Wainer’s SPTCT images as the “first imaging technique” in claim 1 with Wainer’s STET or SPECT images as the “second imaging technique” in claim 1 which must be “different from” the first imaging technique. *See* Prelim. Resp. 2, 7–10. Patent Owner asserts Wainer provides a “single-system single-imaging technique for STET, SPECT, and SPTCT images [which] are the exact same, not *different*, as required by” claim 1. *Id.* at 2, 7–8. According to Patent Owner: “Wainer expressly discloses that STET, SPECT and SPTCT are all proposed images using *the same imaging technique*” and the same STET camera assembly. *Id.* at 8–9 (citing Ex. 1007, 1:57–61, 2:30–37, 4:30–32). For example, Patent Owner notes Wainer incorporates U.S. Patent. No. 5,210,421 (“the ’421 patent”)⁶ by reference, and Wainer states “FIG. 1 in [the ’421 patent] shows a typical STET camera assembly which is used for acquiring STET images.” Ex. 1007, 1:57–61, 4:30–55; *see* Prelim. Resp. 8–9. Patent Owner asserts “review of the [’421 patent] shows only a single SPECT system using one single imaging technique.” Prelim. Resp. 9.

Resolution of this particular dispute appears to turn on claim construction of the term “imaging technique” in claim 1. That is, Petitioner’s implicit view is that Wainer’s SPTCT images are *structural* images whereas Wainer’s SPECT and STET images are *functional* images, so they are different “imaging techniques.” *See* Pet. 133, 135, 141. Patent

⁶ The ’421 patent has not been entered into the record of this proceeding.

Owner's implicit view is that Wainer's SPTCT, SPECT, and STET images are the same "imaging technique" because they each are generated by creating gamma ray radiation (either internally within the patient or externally outside the patient) and collecting the gamma ray radiation utilizing the same detector. *See* Ex. 1007, 1:10–2:38, 4:23–55, 5:43–6:37, 8:60–9:6 (Fig. 6); Prelim. Resp. 2, 7–10.

On the present record, Patent Owner has not fully developed its position, including explaining why its implicit claim construction should be adopted. If Patent Owner elects to maintain this as an active issue during the trial instituted by this Decision, we encourage the parties to support their respective views with additional claim construction arguments and evidence concerning the claim term "imaging technique."

2. *Claims 2–18*

Petitioner provides arguments and evidence contending claims 2–18 are unpatentable as having been obvious over Wainer, including supporting testimony from Dr. Peterson. *See* Pet. 25–26, 142–50; Ex. 1003 ¶¶ 154–158, 564–641. Patent Owner opposes, relying on arguments discussed above in connection with claim 1. *See* Prelim. Resp. 1–2, 7–10.

As discussed above, because we have decided to grant institution on Ground One, we do the same for Ground Four. *See supra* Section III.E.3; 37 C.F.R. § 42.108(a); CTPG 5–6, 64. Further, Patent Owner does not address claims 2–18 in Ground Four separately from claim 1, so there is nothing further for us to address with respect to Ground Four at this time. *See* CTPG 5–6, 64.

IV. CONCLUSION

For the reasons provided above, we determine the information presented in the record demonstrates a reasonable likelihood that Petitioner would prevail with respect to at least one claim of the '353 patent challenged in the Petition. Therefore, we institute an *inter partes* review of all challenged claims 1–18 on all grounds presented in the Petition. *See* 35 U.S.C. § 314(a); 37 C.F.R. § 42.108(a).

At this preliminary stage, the Board has not made a final determination with respect to the patentability of the challenged claims or any underlying factual or legal issue. The Board's final determination will be based on the record as developed during the *inter partes* review. Any arguments not raised by Patent Owner in a timely filed response may be deemed waived.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review is instituted for claims 1–18 of the '353 patent on all grounds presented in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which commences on the entry date of this decision.

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