

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TETRA TECH CANADA INC.,
Petitioner,

v.

GEORGETOWN RAIL EQUIPMENT COMPANY,
Patent Owner.

IPR2019-01409
Patent 8,209,145 B2

Before HUBERT C. LORIN, JENNIFER S. BISK, and
KRISTINA M. KALAN, *Administrative Patent Judges*.

LORIN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

This is a Final Written Decision in an *inter partes* review challenging the patentability of claims 1–12 of U.S. Patent No. 8,209,145 B2 (Ex. 1001, “the ’145 patent”). We have jurisdiction under 35 U.S.C. § 6.

Petitioner has the burden of proving unpatentability of a claim by a preponderance of the evidence. 35 U.S.C. § 316(e). Having reviewed the arguments of the parties and the supporting evidence, we find that Petitioner has demonstrated by a preponderance of the evidence that claims 1–12 are unpatentable.

A. Background

Tetra Tech Canada Inc. (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1–12 of the ’145 patent. Paper 1 (“Pet.”). Georgetown Rail Equipment Company (“Patent Owner”) did not file a Preliminary Response to the Petition.

On February 5, 2020, we instituted an *inter partes* review, pursuant to 35 U.S.C. § 314(a). Specifically, we instituted an *inter partes* review of claims 1–12 on all asserted grounds of unpatentability. Paper 6 (“DI”).

After institution, Patent Owner filed a Patent Owner Response (Paper 8, “PO Resp.”); Petitioner filed a Reply (Paper 9, “Pet. Reply”); and Patent Owner filed a Sur-reply (Paper 11, “PO Sur-reply”).

On November 4, 2020, the parties presented arguments at oral hearing, the transcript of which is of record. Paper 14 (“Tr.”).

B. Related Proceedings

Petitioner indicates that it “is unaware of any related matters involving the ’145 patent.” Pet. 2. Petitioner identifies various proceedings involving patents related to the ’145 patent, including three *inter partes* review

proceedings (IPR2019-00619, IPR2019-00620, and IPR2019-00662)¹ and co-pending litigation captioned Georgetown Rail Equipment Company v. Tetra Tech Canada Inc. (E.D. Tex.) (Tyler) (6:18-cv-377). *Id.* at 3. After filing the petition in this case, Petitioner filed a petition for *inter partes* review of related Patent No. 8,081,320 B2. *See* IPR2019-01581, Paper 1.² Petitioner also notifies us of proceedings in Canada involving Canadian national stage entries of patents related to the '145 patent. Pet. 4.

C. The '145 patent (Ex. 1001)

1. Disclosure

The '145 patent, titled “Methods for GPS to Milepost Mapping,” “relates generally to methods for determining the location of various features along a railroad track, and, more particularly to [a] method for increasing the accuracy of GPS to milepost mapping.” Ex. 1001, code (54), 1:32–35.

The '145 patent describes an imaging system that captures features of a rail system and increases the accuracy of interpolation of mileposts in the rail system. *Id.* at 1:57–62. “Based upon this image data and data provided in the track chart, reference points are selected along the track, and their location is verified using GPS data” and “the milepost location of various points between the reference points are determined using mathematical interpolation.” *Id.* at 1:62–67.

Figures 1 and 2 of the '145 patent, reproduced below, illustrate “inspection system 30.” *Id.* at 2:19–23.

¹ Trial was instituted in each of these proceedings. *See* IPR2019-00619, Paper 12; IPR2019-00620, Paper 8; IPR2019-00662, Paper 13.

² Trial was instituted. *See* IPR2019-01581. Paper 6.

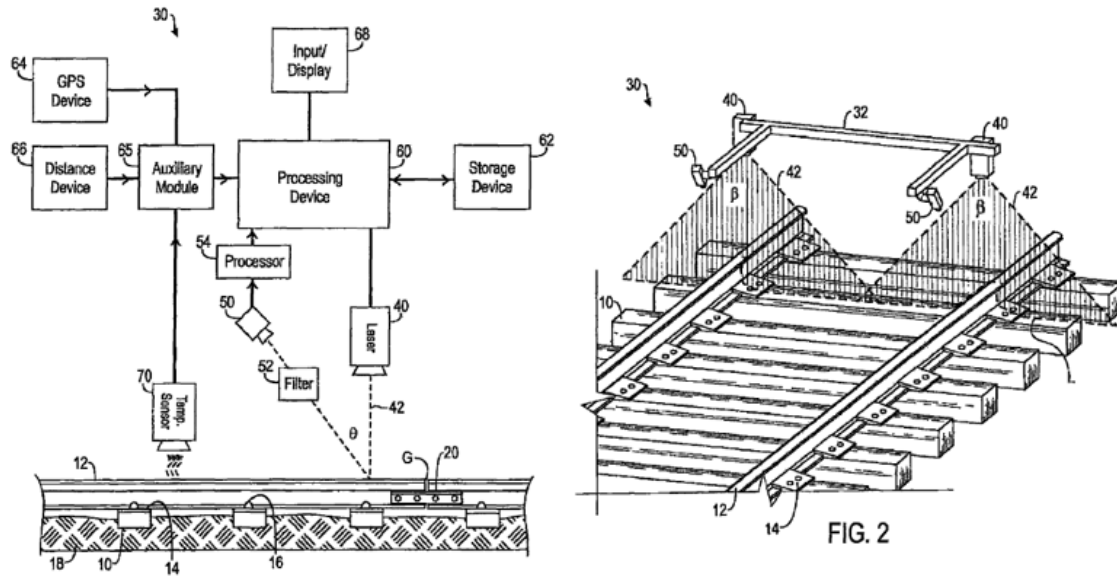


FIG. 1

Figures 1 and 2 (above) show a system for inspecting railroad track. *Id.* at 3:15–17.

As shown in both figures, “[t]he track bed includes crossties 10, rails 12, tie plates 14, spikes 16, and ballast 18.” *Id.* at 3:36–37.

“[I]nspection system 30 includes a light generator such as a laser 40” (*id.* at 3:22–23) which “projects a beam 42 of laser light at the track bed” (*id.* at 3:37–38).

As shown in Figure 2, “beam 42 produces a projected line L.” *Id.* at 3:38–39. Projected line L “follows the contours of the surfaces and components of the track bed” (*id.* at 3:39–40) and, further, projected line L “is substantially straight and extends substantially across the track bed” (*id.* at 4:11–12). “The light receiver, camera 50, captures an image of the line L of laser light 42 projected on the track bed. The camera 50 sends the captured image to the processing device 60 for processing and analysis.” *Id.* at 3:41–44.

Figure 3, reproduced below, illustrates “[a]n example image or frame showing the projected line L of the track bed.” *Id.* at 5:30–31.

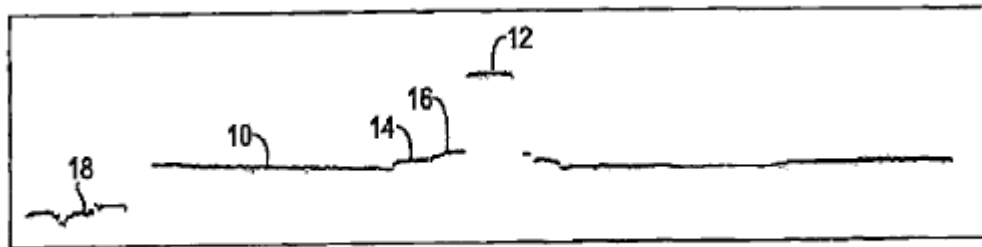


FIG. 3

Fig. 3 illustrates an image or frame projecting across line L of Fig. 1.

The description associated with Figure 3 (above) is as follows:

The image data or frame includes a plurality of pixels given X-Y coordinates and shows a contour of the track bed captured by the cameras 50. Due to filtering and other image processing techniques known in the art, the image includes two pixel values, where the dark pixels represent the contour of the track bed. Every pixel of a given image data is given the same Z-coordinate, which represents the particular position along the length of the track at which the image data was captured. In this manner, a plurality of captured images produce a three-dimensional scan of the track bed in which each image of the scan has X-Y coordinates showing the contour of the track bed and has a Z-coordinate representing the particular position of the contour along the length of rail.

Id. at 5:31–44.

The '145 patent also describes methods of identifying the location of track features. *Id.* at 13:48–50. As shown in Figure 1, inspection system 30 includes Global Position System (GPS) receiver 64. *Id.* at 5:66–67. In one embodiment of the '145 patent, “the system records a unique global position satellite (GPS) location for each rail feature it records.” *Id.* at 13:57–59. “Milepost identification is achieved via a lookup table, provided by each customer that provides a milepost location marker and its corresponding

GPS location” (*id.* at 13:59–62) and locations “of rail features that lie between these milepost mappings are derived through mathematical interpolation using a method of encoder odometer marks that calculate the distance traveled” (*id.* at 13:62–65).

Figure 19 of the ’145 patent, reproduced below, depicts a flowchart of a method of determining the location of features between references points. *Id.* at 14:20–15:25.

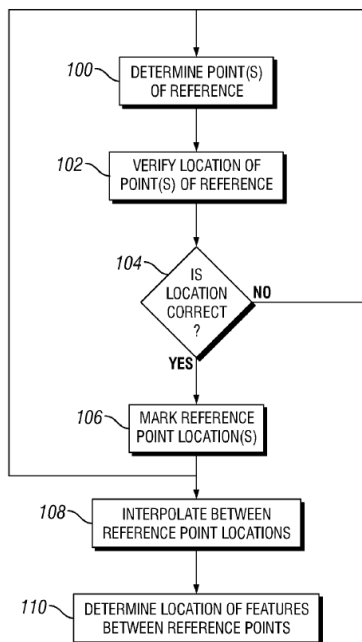


FIG. 19

Figure 19 depicts a flowchart of a method of determining the location of features between references points.

As shown in Figure 19, “[a]t step 100, a point of reference is determined.” *Id.* at 14:21–22. By way of example, the ’145 patent explains that “a customer track chart . . . may be utilized to determine which landmarks along a railroad track can be used as points of reference.” *Id.* at 14:23–25. Next, “at step 102, the GPS location of the selected point of

reference is verified.” *Id.* at 14:27–28. The ’145 patent explains that verification

is accomplished by comparing camera imaging data of the reference point, such as described herein, to satellite GPS images of GPS signatures of the same reference point. Since each camera image has a unique GPS location signature assigned to it, the camera's image, along with the image's GPS location signature, is then compared to a satellite image of the same GPS location to verify the location of the selected point of reference.

Id. at 14:29–36. Then, “at step 104, it is determined whether the GPS signatures and camera images are the same.” *Id.* at 14:37–38. The ’145 patent explains that:

If the Satellite image shows the railroad feature that the camera image also shows at the exact same GPS location, then the two are the same point. If the two points are not the same, another point of reference is selected and the process begins again at step 100. However, if the two points are the same, the reference point location is marked and recorded at step 106. Here, the exact feature. Such as a crosstie, for example, is marked in the customer deliverable report with the milepost as described in the customer provided track chart. Thereafter, as many reference points as desired may be determined and marked.

Id. at 14:38–48. Next, mathematical interpretation is performed at step 108, which is described as follows:

In order to perform the interpolation of step 108, using the customer deliverable report and the customer Track Charts, the distance (in feet) traveled between two reference points is first determined at step 1. Each crosstie has a distance measure as determined from the vehicle encoder from the beginning of the scan to each crosstie. Next, at step 2, determine the distance between the two reference points (in miles) as stated by the customer track chart. Next, at step 3, divide step 1 by step 2 to determine the ratio of feet per mile. Thereafter, at step 4, note the milepost of the two reference points in the report file as determined from the customer's Track Chart. At step 5, the

following interpolation formula is applied to the location of each individual crosstie between the two reference points: (Previous crosstie MilePost)+(distance between current & previous crosstie÷(ratio of feet per mile as determined from step 3×12 in per foot)).

Example: if 1st reference point is at MilePost 100.25 and the 2nd reference point is at Milepost 100.78, and the distance between them as determined by the vehicle encoder is 2809 feet, then the ratio for step 3 is 2809 ft/0.53 mile=5300 ft/mile.

A further Example: In step 5 above, the formula would look like this if the distance between current & previous crosstie happened to be 22.48 inches as determined by vehicle encoder:

$$100.25 \div (22.48 \text{ inches}(5300 \text{ ft/mile} \times 12 \text{ inchs/ft}))$$

Thereafter, at step 110 (of FIG. 19), the interpolation formula is applied to each successive crosstie to determine it's [sic] unique milepost value.

Id. at 14:63–15:25.

2. Claims

The '145 patent has 12 claims, all of which are challenged. Claims 1 and 7 are independent claims. Claims 2–6 depend from claim 1 and claims 8–12 depend from claim 7.

Independent claim 1, reproduced below, is illustrative.

1. A method for determining a location of features along a rail road track, the method comprising the steps of:

(a) determining at least two reference points, the reference points being features of the rail road track;

(b) verifying a GPS location of the reference points, the verification being accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points;

(c) marking the location of the reference points;

(d) performing mathematical interpolation for at least one feature between the reference points; and

(e) determining the location of the feature between the reference points.

Ex. 1001, 16:53–65.

Independent claim 7, reproduced below, is broader than claim 1 in that it does not specify the use of GPS and omits the third step recited in claim 1 (i.e., “marking the location of the reference points”).

7. A method for determining a location of features along a rail road track, the method comprising the steps of:

- (a) determining two reference points, the reference points being features of the rail road track;
- (b) verifying a location of the reference points;
- (c) performing mathematical interpolation for at least one feature between the reference points; and
- (d) determining the location of the feature between the reference points.

Id. at 17:18–18:2.

D. Asserted References

Petitioner relies on the following references:

Name	Reference	Ex. No.
Villar	U.S. Patent Application Publication No. 2006/0017911 A1 to Villar et al.	1005
Nejikovsky	U.S. Patent No. 7,755,660 to Nejikovsky et al.	1006
Schnieder	International Patent Pub. No. WO 01/66401 to Schnieder	1007
Dorum	U.S. Patent No. 6,873,998 to Dorum et al.	1008
Kennedy	R. Gordon Kennedy, “Problems of Cartographic Design in Geographic Information Systems for Transportation,” Cartographic Perspectives (July 20, 1999)	1009

Petitioner also relies on the Declaration of Nikos Papanikolopoulos, Ph.D. (Ex. 1004) as support for the various contentions. Patent Owner has not submitted any declarations.

E. Grounds Asserted

Petitioner contends that claims 1–12 of the ’145 patent are unpatentable under the following grounds:

Claim(s) Challenged	35 U.S.C.	Reference(s)/Basis
1–12	§ 103 ³	Villar, Dorum, Kennedy
7	§ 103	Schnieder, Dorum
8, 9	§ 103	Schnieder, Dorum, Kennedy

³ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Because the application from which the ’145 patent issued was filed before this date, the pre-AIA version of § 103 applies.

Claim(s) Challenged	35 U.S.C.	Reference(s)/Basis
1, 3–5	§ 103	Schnieder, Dorum, Nejikovsky
2, 6	§ 103	Schnieder, Dorum, Nejikovsky, Kennedy
10	§ 103	Schnieder, Dorum, Kennedy, Nejikovsky
11, 12	§ 103	Schnieder, Dorum, Nejikovsky

Pet. 7.

II. ANALYSIS

A. Principles of Law

1. Burden

“[T]he 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 grounds for the challenge to each claim”)). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

2. Obviousness

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented 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 that subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved based on 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 present. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

In analyzing the obviousness of a combination of prior art elements, it can be important to identify a reason that would have prompted one of skill in the art “to combine . . . known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418. A precise teaching directed to the specific subject matter of a challenged claim is not necessary to establish obviousness. *Id.* Rather, “any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.” *Id.* at 420. Accordingly, a party that petitions the Board for a determination of unpatentability based on obviousness must show that “a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016) (internal quotation marks and citations omitted). Under the proper inquiry, “obviousness cannot be avoided simply by a showing of some degree of unpredictability in the art so long as there was a reasonable probability of success.” *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1364 (Fed. Cir. 2007).

We analyze the instituted grounds of unpatentability in accordance with these principles.

B. Level of Ordinary Skill in the Art

In determining the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art;

prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (internal quotation marks and citation omitted).

Petitioner contends, *inter alia*, that

a person of ordinary skill in the art for the ’145 patent would have a bachelor’s degree in electrical engineering, computer engineering, mechanical engineering, computer science, physics, or a related field, and at least four years of experience (or the academic equivalent) in the field of computer or machine vision, including image-based localization and mapping.

Pet. 12 (citing Ex. 1004 ¶ 30).

Patent Owner states: “For purposes of this response, Patent Owner does not contest Petitioner’s asserted level of ordinary skill in the art. *See* Petition at 12.” PO Resp. 1.

Based on the positions of Petitioner and Patent Owner, we find agreement as to the level of skill of such ordinarily skilled artisans and, consistent therewith, we are persuaded that one of ordinary skill in the art at the time of the invention would have had a bachelor’s degree in electrical engineering, computer engineering, mechanical engineering, computer science, physics, or a related field, and at least four years of experience (or the academic equivalent) in the field of computer or machine vision, including image-based localization and mapping.

The level of ordinary skill in the art is also reflected by the references themselves. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (“[T]he absence of specific findings on the level of skill in the art does not give rise to reversible error ‘where the prior art itself reflects an appropriate level and a need for testimony is not shown.’”).

C. Claim Construction

For petitions filed on or after November 13, 2018 (as in this case), “[claims] of a patent . . . shall be construed using the same claim construction standard that would be used to construe the [claims] in a civil action under 35 U.S.C. § 282(b), including construing the [claims] in accordance with the ordinary and customary meaning of such claims as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 42 C.F.R. § 100(b) (2019).

Petitioner does not offer any constructions for any terms of the challenged claims, and indicates that “[t]he terms of claims 1–12 in the ’145 patent should be given their plain and ordinary meaning.” Pet. 13.

Patent Owner states: “For purposes of this response, Patent Owner agrees with the Petitioner that the ’145 patent terms should be given their plain and ordinary meaning. *See* Petition at 12-13.” PO Resp. 1.

We determine that it is not necessary to construe any other claim term expressly to resolve the parties’ disputes apart from those discussed in the body of the decision below, namely “determining a distance between two reference point in feet and miles” and “a ratio of feet per mile using the distance” (claim 2); “customer track chart” (claim 6); and “feature” (claim 7). *See* sections II.E.2.[a] and [b]; II.E.6.; and, II.F.1(c), respectively; *Vivid Techs., Inc.*, 200 F.3d at 803 (“Only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (applying *Vivid Techs.* in the context of an *inter partes* review).

D. Overview of the Prior Art References

1. Villar

Villar (Ex. 1005) describes a system and method for inspecting a railroad track. *Id.* ¶ 2.

Fig. 1, reproduced below, illustrates inspection system 30 that appears to be structurally identical to inspection system 30 shown in Figure 1 of the '145 patent (reproduced *supra* in section I.C.1.).⁴

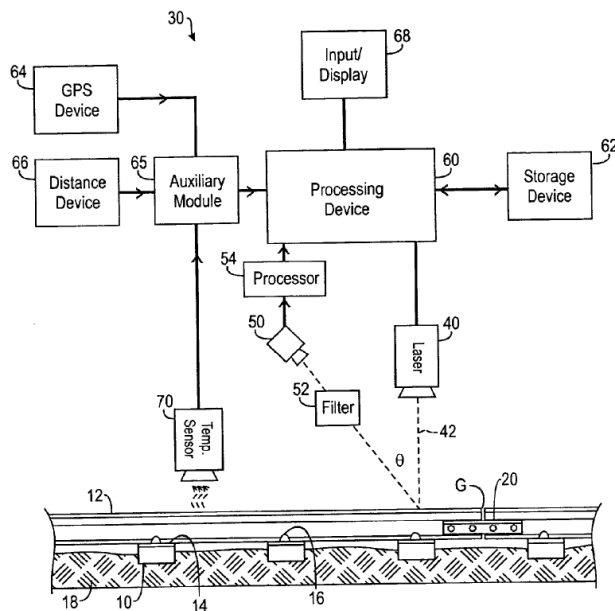


FIG. 1

Fig. 1 of Villar is a block diagram illustrating a railroad track inspection system.

⁴ This is due to the fact that Villar is a parent of the '145 patent. Villar (Christopher M. Villar, II, John Anthony Nagle, and Stephen C. Orrell) and the '145 patent (David Pagliuco, Christopher M. Villar, II, John Anthony Nagle, and Stephen C. Orrell) have overlapping named inventors. Although Villar and the '145 patent have similar specifications, the '145 patent specification describes interpolation techniques that are not described in Villar.

2. Dorum

Dorum (Ex. 1008) describes a reporting program and system for receiving error reports and updating a master copy of a geographic database based on an analysis of satellite images. *Id.* at 2:45–54.

Fig. 1, reproduced below, illustrates an error reporting system 102. *Id.* at 2:65–66.

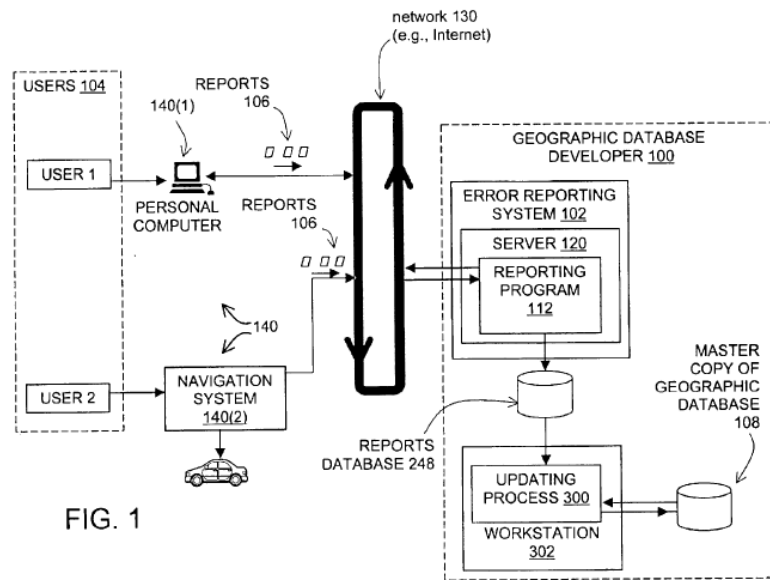


Fig. 1 of Dorum is a block diagram illustrating an error reporting system for updating a geographic database.

As shown in Figure 1 of Dorum, on-line error reporting program 112 is operated by geographic database developer 100. *Id.* at 3:21–22. End users 104 access on-line reporting program 112 to make reports about perceived errors or inaccuracies in the geographic data. *Id.* at 3:41–46. Reports are reviewed by a technician (i.e., a researcher) working for geographic database developer 100. *Id.* at 5:9–11.

Fig. 3, reproduced below, illustrates an example of a display screen 350 for use by a researcher reviewing an error report. *Id.* at 6:64–65.

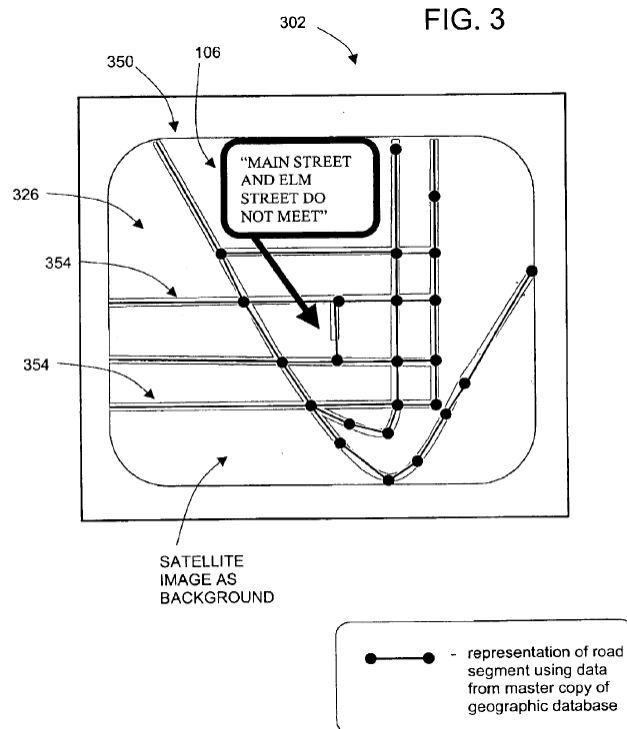


Fig. 3 of Dorum is an example of a display screen for use by a technician reviewing an error report.

Shown as a background on the display screen 350 is the satellite image 326. The satellite image 326 shows portions of several roads. Overlaid on the Satellite image 326 are representations of several road segments 354. The representations of road segments 354 are formed using the data 338 from the master copy of the geographic database.

To assist the researcher, the position of the reported error may be located at the center of the display screen 350. The position of the reported error may be highlighted or a square, circle, or other shape may be generated about the position of the reported error. Alternatively, the corresponding latitude and longitude may be displayed as the researcher moves a cursor over the image so that the researcher can find the position of the reported error.

Id. at 6:65–7:12.

3. *Kennedy*

Kennedy (Ex. 1009, 6–22) describes cartographic design in geographic information systems for transportation (GIS-T). *Id.* at 6. Kennedy explains that “[t]ransportation organizations need information about features and events that occur on the routes comprising the network,” and “[p]ositioning features on the links of a network is accomplished by reference to linear distance measures like highway mileposts, rather than by geographic coordinates.” *Id.* Kennedy further explains that “[t]he process of interpolating positions in a linear reference system is called *dynamic segmentation* in the GIS-T literature.” *Id.* at 7. Kennedy describes that “[j]unctions, bridges, tunnels and so forth are each assigned their own milepost value” (*Id.* at 11) and “[b]y using these reference points as well as physically posted milepost signs, any feature of interest can be assigned an interpolated or estimated milepost value.” *Id.* at 11–12.

a. Prior Art Status of Kennedy

Kennedy is applied as a prior art reference under Grounds I, III, V, and VI.

Ex. 1009 consists of several pages from an issue of the journal “Cartographic Perspectives”, preceded by a declaration from Rachel J. Watters. Ex. 1009, 3–22 (Exhibit A, Kennedy), 1–2.

The cover page of Kennedy states “Number 32, Winter 1999,” “cartographic perspectives,” and “journal of the North American Cartographic Information Society.” *Id.* at 3. The words are repeated on the next page and below them is an ISSN (“1048–9085”), a list of the names of six “Editor”s with their contact information, and below that, the words “Cartographic Perspectives Editorial Board” followed by the names of

various individuals. *Id.* at 4. The next page presents a table of contents of the issue. On this page, three “Featured Articles” are indicated as being “in this issue,” including the article “Problems of Cartographic Design in Geographic Information Systems for Transportation *R. Gordon Kennedy*” and, to the right, “44.” *Id.* at 5. Near the center at the top of this page there is a date stamp of “JUL 20 1999.” *Id.* The article begins on the next page, at the top of which it states “44 cartographic perspectives Number 32, Winter 1999” and below to the left the name “R. Gordon Kennedy” with his contact information. *Id.* at 6. The article begins on the right of this page with an “Introduction” and continues for the next 16 pages, in sequential order as indicated by the numerals “45” to “60” at the top of each the page. *Id.* at 6–22.

The declaration from Rachel J. Watters states that she is “a librarian, and the Director of Wisconsin TechSearch . . . an interlibrary loan department at the University of Wisconsin-Madison.” *Id.* at 1. She states that the declaration “relates to the dates or receipt and availability of [Kennedy]”. She states that “Exhibit A to the Declaration is [a] true and accurate copy of the title page with library date stamp of *Cartographic Perspectives* (1999), from the University of Wisconsin– Madison Library collection.” *Id.* She describes the standard operating procedures for materials at the University of Wisconsin-Madison Libraries and states that “[b]ased on the information in Exhibit A, it is clear that [Kennedy was] catalogued and available to library patrons within a few days or at most 2 to 3 weeks after July 20, 1999.” *Id.* at 2.

Patent Owner contends that “Petitioner fails to show that Kennedy . . . is prior art” because Petitioner has not satisfied its “burden to prove that [Kennedy] is a prior art printed publication.” PO Resp. 1.

“To prevail in a final written decision in an inter partes review, the petitioner bears the burden of establishing by a preponderance of the evidence that a particular document is a printed publication. *Nobel Biocare Servs.*, 903 F.3d at 1375 (citing *Medtronic*, 891 F.3d at 1380); *see also In re Wyer*, 655 F.2d at 227 (a party asserting a reference as a prior art printed publication should provide sufficient proof of accessibility).” *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039 (PTAB Dec. 20, 2019) (Paper 29) at 11.

i. Incorporation by Reference

First, Patent Owner contends that the Petition’s citation to the Declaration of Rachel J. Watters is an improper incorporation by reference and that “[t]he Board’s rules expressly prohibit incorporation by reference.” PO Resp. 3 (citing 37 C.F.R. § 42.6(a)(3)).

We do not agree that the Petition improperly incorporated by reference the Watters declaration. Instead, the Petition properly relies on the Watters Declaration to support its contention that Kennedy is a printed publication. *See* Pet. 5–6. Although the Petition’s discussion of the issue is succinct, we are not persuaded that any more was necessary. The Watters Declaration consists of 2 pages of straightforward testimony supporting Petitioner’s position that Kennedy was published in 2009 and, therefore, no further explanation was necessary prior to any dispute on this issue.

We note Patent Owner’s contention that “the standard of proof *at institution* is ‘qualitatively different,’ from the ‘preponderance of the evidence’ standard of proof required ‘to prevail at trial’ in an IPR.” PO Sur-reply 2, citing *Hulu*. But Patent Owner did not file a Preliminary Response or contest the prior art status of any reference at institution.

ii. Public Accessibility

Second, Patent Owner contends, the Watters Declaration insufficiently shows that Kennedy was publicly accessible.

Patent Owner argues that “[n]othing identified as ‘Exhibit A’ was submitted with the declaration.” PO Resp. 4.

We are unpersuaded. We agree with Petitioner that “‘Exhibit A’ clearly refers to the only document (Ex-1009, 3-22) that follows and is identified in Ms. Watters’ declaration. *Id.*, 1-2.” Pet. Reply 3 n.3. Ms. Watters testifies that

Exhibit A to this Declaration is true and accurate copy of the title page with library date stamp of *Cartographic Perspectives* (1999), from the University of Wisconsin-Madison Library collection. Exhibit A also includes an excerpt of pages 44 to 60 of that volume, showing the article entitled Problems of cartographic design in geographic information systems for transportation (1999).

Ex. 1009, 1–2. It is clear that, in referring to the title page having a library date stamp of *Cartographic Perspectives* (1999), from the University of Wisconsin-Madison Library collection, of “that volume,” Ms. Watters is referring to page 5 of the attached document where the data stamp of “Jul 20 1999” is clearly indicated. Ex. 1009, 5. The “excerpt of pages 44 to 60 of that volume” follow the title page. *Id.* at 6–22.

Patent Owner further argues that a POSITA would have been unable to locate Kennedy by exercising reasonable diligence. According to the Patent Owner, “[a]lthough the Kennedy article is a portion of a scientific journal (*Cartographic Perspectives* 1999), the Watters declaration does not indicate how a POSITA would be able to locate Kennedy by exercising reasonable diligence.” PO Resp. 3. According to Patent Owner, there is “no

evidence that Kennedy was cataloged or indexed in the library such that a POSITA, or other interested person, exercising reasonable diligence would have been able to locate that article in a search, such as by searching for key words in Kennedy’s title or content.” PO Sur-reply 4.

Petitioner disagrees, arguing *inter alia* that

GREX provides no evidence purporting to show that a library patron—including, e.g., a POSITA—would have been unable to locate Kennedy with a reasonable search of the University of Wisconsin-Madison Library records. *In fact, GREX concedes that Ms. Watters’ declaration “provides evidence that a person searching for the scientific journal could locate the journal.” Response, 4. There is no reason why “a person searching for the scientific journal”—yet not a POSITA—could not have located Kennedy by exercising reasonable diligence.*

Pet. Reply 2–4 (emphasis added)

We have reviewed the evidence and find that it weighs in favor of Petitioner’s position.

There is no dispute that a POSITA would have been able to locate “Cartographic Perspectives,” Number 32, Winter 1999, i.e., “volume,” which includes the Kennedy article “Problems of Cartographic Design in Geographic Information Systems for Transportation” by exercising reasonable diligence. *Cf. Telefonaktiebolaget LM Ericsson v. TCL Corporation*, 941 F.3d 1341, 1346 (Fed. Cir. 2019) (concerning the public availability of a journal in determining whether the journal constitutes a “printed publication”).

If one of ordinary skill in the art would have been able to locate “the volume” containing the Kennedy article upon exercising reasonable

diligence, then it is reasonable to believe that one of ordinary skill in the art would have been able to locate the Kennedy article within said journal upon exercising reasonable diligence.

As Patent Owner points out, “the ultimate question is whether the reference was available to the extent that persons interested and ordinarily skilled in the subject matter or art, exercising reasonable diligence, can locate it.” PO Sur-Reply 3 (quoting *Acceleration Bay*, 908 F.3d 765, 774 (Fed. Cir. 2018)). Patent Owner does not dispute that a POSITA would have been able to locate “the volume” (i.e., the journal “Cartographic Perspectives,” Number 32, Winter 1999) that includes said Kennedy article by exercising reasonable diligence. In fact, Patent Owner agrees that “[t]he declaration thus at most shows that a person searching for the scientific journal Cartographic Perspectives could locate *the journal* because it was indexed and cataloged.” PO Sur-reply 4 (emphasis added). If a person of ordinary skill in the art, exercising reasonable diligence, could locate the very volume containing the Kennedy article, then logically, that person, exercising reasonable diligence, could locate the Kennedy article.

In our view, Ms. Watters’s testimony credibly supports Petitioner’s assertion of the public accessibility of Kennedy as of the critical date. There is no dispute that a POSITA would have been able to locate “Cartographic Perspectives,” Number 32, Winter 1999, i.e., “volume,” which includes the Kennedy article “Problems of Cartographic Design in Geographic Information Systems for Transportation” by exercising reasonable diligence. Ms. Watters specifically refers to “an excerpt of pages 44 to 60 of that volume” (i.e., Kennedy). Her reference to those pages (i.e., Kennedy) persuades us that the July 20, 1999 date stamp on the title page of the “volume” demonstrates sufficiently that *all* of “Cartographic Perspectives,”

Number 32, Winter 1999, including pages 44–60 to Kennedy, was publicly accessible as of the critical date.

Furthermore, we observe that the page following the cover page states that “Cartographic Perspectives” is “published triannually”. Ex. 1009, 4. Also, it includes a list of editorial board members. And the cover indicates that this is the 32nd issue of the journal. Taken together, this evidence strongly suggests that it was published by an established publisher. “[W]hen there is an established publisher there is a presumption of public accessibility as of the publication date.” *VidStream LLC v. Twitter, Inc.*, 981 F.3d 1060, 1065 (Fed. Cir. 2020).

Accordingly, Petitioner has established that Kennedy is a printed publication by a preponderance of the evidence.

4. *Schnieder*

Schnieder (Ex. 1007) describes determining the position of a rail-bound vehicle, for instance a train. *Id.* at 1:11–13. Schnieder discloses that

By storing information in advance, such as position and features, about a number of topological irregularities in the track caused by rail components, such as switches, rail joints, and guide rails, along the possible routes of the vehicle and by identification of these rail components during travelling, the position can be determined with high accuracy and independently of signal systems adapted outside the vehicle.

Id. at 2:26–33.

Fig. 1, reproduced below, illustrates a block diagram of a rail-bound vehicle with a device to determine the position of the vehicle. *Id.* at 3:18–20.

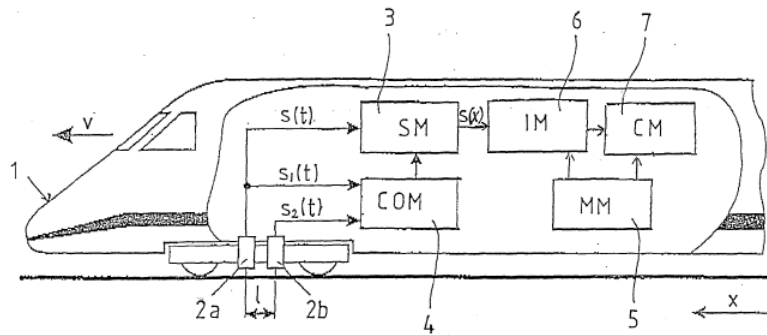


FIG 1

Fig. 1 of Schnieder is a block diagram of a rail-bound vehicle with a device to determine the position of the vehicle.

Fig. 1 shows the principle of how the position of a rail-bound vehicle 1 is determined according to the invention. In the vehicle, two sensors 2a, 2b are adapted at the distance I from each other in the direction of travel. For example, the sensors could be placed in the boogie. The sensors generate two signals $s_1(t)$ and $s_2(t)$ which are essentially similar, apart from a time shift T related to the velocity v of the vehicle and the distance I between the sensors according to the formula $T = I/v$. The signals generated by the sensors are dependent of track irregularities, for instance caused by rail components, such as switches, crossings, rail joints, and rail clamps, adapted in connection to or on the track.

Id. at 4:14–25.

To detect and identify rail components, one signal is sufficient, however, that signal has to be space-dependent, i.e., it must not depend upon the velocity of the vehicle. Since the signals $s_1(t)$ and $s_2(t)$ are time-dependent, at least one of the signals has to be converted to a velocity-independent representation. One of the signals is fed to a scaling means 3 where the signal is converted to be space-dependent $s(x)$. The scaling is performed according to the equation $x = v \cdot t$. To perform the scaling the velocity v of the vehicle has to be known. The velocity v is obtained from a correlator means 4. The signals $s_1(t)$ and $s_2(t)$ are fed to the correlator means 4 which calculates the time shift T between the signals and then, based upon the time period T, calculates the velocity v.

The use of only one sensor is possible, if the velocity of the vehicle is obtained in another manner. However, the more sensors used, the better the quality of the signal, which in turn gives a more robust detection method. To obtain a better identification signal, the signals from both sensors in fig. 1 could be merged, for instance by averaging. To further improve the quality of the signals, more than two sensors could be adapted closely after each other in the direction of travel, and the signals interleaved by any sensor fusion method.

To identify rail components in the signal $s(x)$, essential features are stored for identifying the rail components. These features are stored in a memory means 5. In the memory means 5 also a rail map of the railway net, containing information about actual routes of travel of the vehicle, is stored. In the rail map, which is a data base, information about the rail components and their position in the railway net is stored. For the detection and identification of rail components, which takes place in the identifying means 6, the scaled signal $s(x)$ is compared to the features stored in the memory means 5. For the comparison between the 5 stored features and the sensor signal, any cross-correlation method could advantageously be used. When a rail component is identified, the new position of the vehicle can be determined by means of the stored rail map. The positioning is effected in a calculating means 7.

This way, the exact position at each rail component can be determined. To obtain also a positioning between the rail components, the distance between the latest passed rail component and the vehicle is calculated by integrating the velocity of the vehicle. The velocity to be integrated can, for instance, be obtained from a conventional tachometer adapted on the wheels. Another way of obtaining a positioning between the rail components is to detect and count rail clamps. If the number of rail clamps and their position are stored, the position can be determined at each rail clamp.

Id. at 5:7–6:20.

5. Nejikovsky

Nejikovsky (Ex. 1006) describes a system for inspecting rail components of a railroad track, and a method for inspecting such rail components. *Id.* at 1:12–14.

Fig. 1, reproduced below, is a schematic illustration of a video inspection system that facilitates inspection of rail components while traveling on the railroad track. *Id.* at 5:33–36.

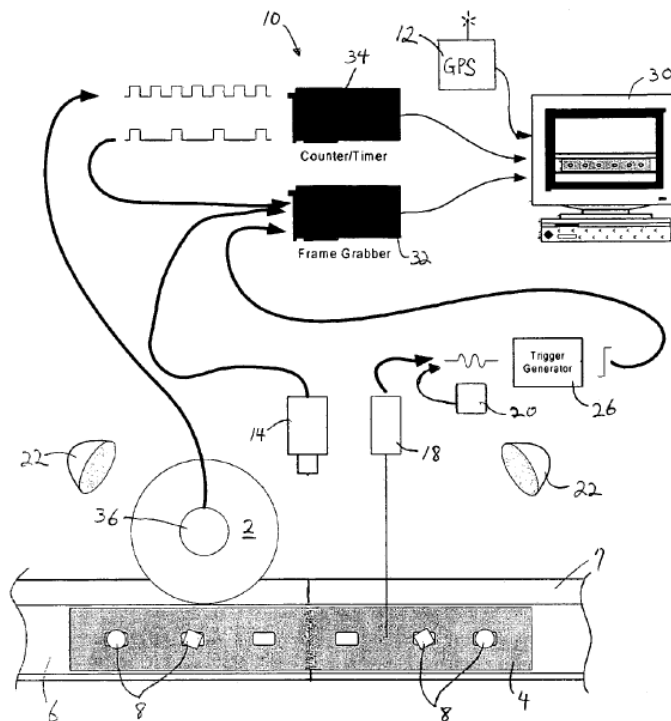


Figure 1

Fig. 1 of Nejikovsky is a schematic illustration of a video inspection system that facilitates inspection of rail components while traveling on the railroad track.

In the schematic example of FIG. 1, the inspected rail component is a joint bar 4 that secures the sides (i.e. webs) of two rails 6 and 7 of a railroad track together via fasteners 8. As can be appreciated, only one side of the railroad track is shown in FIG.1. As will be discussed below, the video inspection system 10 utilizes digital video, computer imaging, and illumination technologies to allow accurate, and efficient inspection of rail components, with reduced time and effort as compared to

conventional methods of inspection. It should be initially noted that whereas the present invention is described in detail below as inspecting joint bars 4 due to their importance in causing derailments, the present invention is not limited thereto, and may be utilized for inspection of any rail component that can appropriately be inspected using the video inspection system 10.

As shown in FIG. 1, the video inspection system 10 of the illustrated embodiment includes a high-resolution camera 14, a distance sensor 18 for detecting the presence of a rail component, an optional vibration sensor 20, and one or more light Sources 22. These components are located under a railcar or a vehicle such as a hi-railer that is adapted to travel on the rails 6 and 7 of the railroad track. It should be noted that FIG. 1 merely shows a schematic illustration of the video inspection system 10. Thus, the relative positioning of the various components of the video inspection system 10 is shown merely to facilitate understanding, and need not represent the actual relative positioning of these components.

In addition to the components that are located under the railcar or vehicle, the video inspection system 10 also includes a trigger generator 26, and a computer 30 with a camera interface device 32 and a counter/timer device 34. It should be noted that whereas in the schematic illustration of FIG. 1, the interface device 32 and counter/timer device 34 are shown as being separate from the computer 30, these devices are preferably housed in the computer 30 and connected to the bus of the computer 30. In addition, although the interface device 32 and the counter/timer device 34 are shown as being implemented as boards, these devices may be implemented differently in other embodiments. Furthermore, the interface device 32 and the counter/timer device 34 may be implemented as a single integrated board. However, these devices are discussed as being implemented separately herein to more clearly describe their respective functions.

The computer 30 of the illustrated embodiment has a processor and memory (not shown), for processing and storing data and instructions associated with the control and function of the interface device 32 and the counter/timer device 34, and to

further store the images of the rail components. In addition, the computer 30 is also preferably provided with digital image processing software and/or hardware that are adapted to process the images of the rail components that have been captured. The digital image processing software/hardware may be any appropriate Software/hardware that allows performance of image processing as described in further detail below. If implemented as software, the software can be stored in the memory as well.

Furthermore, the video inspection system 10 of the illustrated embodiment is also provided with an encoder 36 that is adapted to measure the rotation of a wheel 2 of the vehicle or railcar, the wheel riding on the rails 6 and 7 of the railroad track. Moreover, the video inspection system 10 shown also includes a Global Positioning System (GPS) receiver 12 that allows determination and monitoring of the position of the vehicle or railcar on which the video inspection system 10 is implemented. These components of the video inspection system 10 are provided on the vehicle or railcar that rides on the rails 6 and 7, and thus, can be utilized to inspect the rail components while traveling on the railroad track.

Id. at 5:41–6:43.

E. Ground I

Petitioner challenges claims 1–12 as obvious under 35 U.S.C. § 103 over Villar, Dorum, and Kennedy. Pet. 14–42.

1. Independent Claim 1

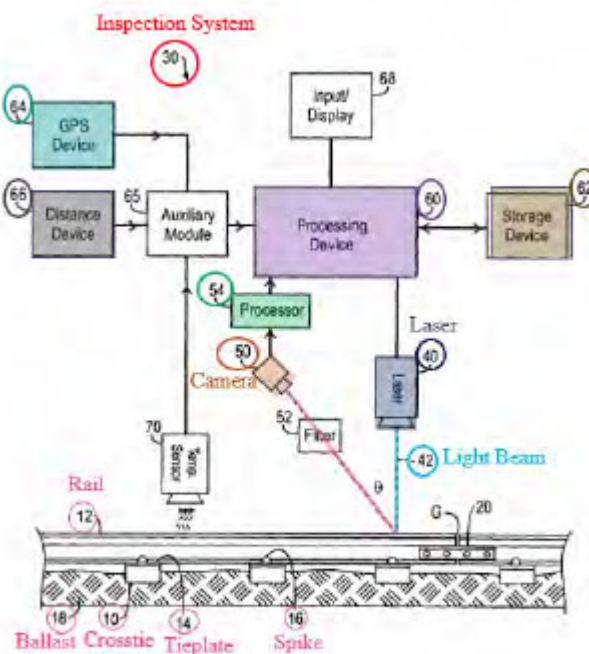
[preamble] “A method for determining a location of features along a rail road track”

According to Petitioner, “Villar [] discloses claim 1’s preamble.” Pet. 15. Regardless of whether the preamble is limiting, Petitioner has shown that Villar satisfies the recitation in the preamble.

Patent Owner has provided no argument challenging Petitioner’s contention. *See generally* PO Resp.

Petitioner provides an annotated version of Fig. 11 of Villar (Ex. 1005), reproduced below, and explains that it

discloses an inspection system 30 (red) for inspecting and imaging railroad track features, and, determining geographical locations of the inspected and imaged railroad track features. Villar, Abstract, [0024], [0025], [0035], [0037]-[0042]. As Villar's system 30 moves along the track, a camera 50 (orange) captures image data of various railroad features such as, e.g., crossties 10, rails 12, tie plates 14, spikes 16 (fuchsia). *Id.*, [0035], FIGS. 1-2. Concurrently, a GPS receiver 64 (aqua) and/or distance device 66 (e.g., an encoder or odometer sensor) (gray) obtains geographical location data of the imaged track features. *Id.*, [0037]-[0039].



Villar, FIG. 1 (annotated).

Villar explains that the captured image data and geographical location data are sent to a processing device 60 (purple), where they are linked together. *Id.*, [0025], [0037]. Geographical locations of the image data may also be directly recorded when the camera 50 captures the image data. *Id.*, [0037], [0038]. The processing device 60 includes a storage

device 62 (brown) that “effectively store[s] all the data obtained with the disclosed inspection system 30.” *Id.*, [0034].

Pet. 14–15.

The '145 Patent specification discloses a crosstie to exemplify a “feature.” *See* Ex. 1001, *e.g.*, 14:44–45 (“the exact feature, such as a crosstie”). Furthermore, consistent with Petitioner’s explanation (Pet. 14–15), Villar discloses an inspection system (i.e., system 30, indicated in red in Petitioner’s annotated Villar Fig. 1) that moves along rail road track (12) capturing image data (via camera 50) and location data (via GPS Device 64 or Distance Device 66) of, for example, *crossties* (10). *See* Ex. 1005, annotated Fig. 1 (above) and Fig. 2 (reproduced below).

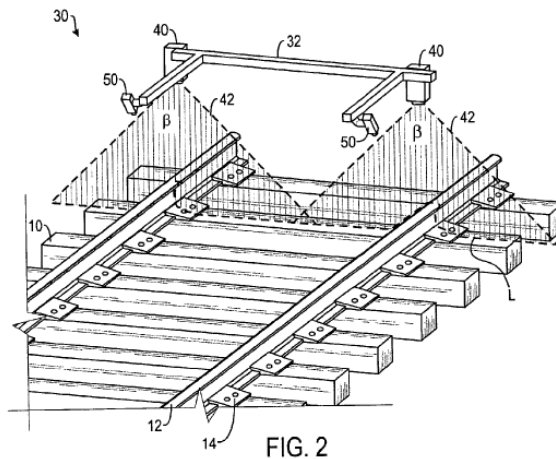


Fig. 2 illustrates an embodiment of the Villar “system for inspecting [a] railroad track” (Ex. 1005, ¶ 2).

Thus, consistent with Petitioner’s contention, Villar discloses a “method for determining a location of *features* [*e.g.*, crossties] along a rail road track” (claim 1 [preamble]) as claimed.

Accordingly, based on our review of the evidence of record, Petitioner has shown that Villar discloses “[a] method for determining a location of features along a rail road track” as recited in the preamble of claim 1.

“(a) determining at least two reference points, the reference points being features of the rail road track;”

According to Petitioner, “Villar [] discloses this limitation of claim 1.” Pet. 18.

Patent Owner has provided no argument challenging Petitioner’s contention. *See generally* PO Resp.

Petitioner first contends that the claim phrase “reference points” encompasses crossties. In support thereof, Petitioner directs us to the ‘145 patent, explaining that

[t]he ‘145 patent describes, for example, that “once all desired *points of reference* have been marked, mathematical interpolation is performed for the points/features between the *reference points*.” ‘145 patent, 14:49-51 (emphasis added). The ‘145 patent further explains that “[t]he *reference points* used to determine the location of the crossties in FIG. 20 are railroad crossings. However, any other railroad feature may also be used as a *point of reference*, such as, for example, crossties or spikes.” *Id.*, 15:34-38 (emphasis added).

Pet. 16–17.

We have reviewed the ‘145 patent. It identifies crossties as an example of a railroad feature that may be used as a “point of reference” (Ex. 1001, 15:37–38). Thus, Petitioner has shown that, in light of the ‘145 Patent specification, the claim phrase “reference points” encompasses crossties.

Petitioner next contends that “Villar refer[s] to ‘reference points such as . . . crossties 10,’ being located at a position [frame] Z1 along the track.”

Pet. 18 (quoting Ex. 1005 ¶ 50; referring to Fig. 7A, reproduced below). According to Petitioner, Villar determines the reference points (e.g., crossties) in a manner similar to that described in the ‘145 patent.

Like the ‘145 patent, as Villar’s system 30 moves along and inspects the railroad track, it determines and compiles geographical locations of the imaged railroad track features such as crossties 10, rails 12, tie plates 14, spikes 16. Villar, [0024], [0025], [0035], [0037]-[0042], FIG. 1. Villar’s system then uses the locations of the imaged track features to, e.g., “determine[] or detect[] locations along the track where defects occur or where allowable tolerances of the railroad track are not maintained ... so that appropriate repairs can be made or maintenance work can be scheduled.” *Id.*, [0042].

Id. at 17.

The record supports Petitioner’s contention.

Villar discloses capturing images along a railroad track and recording geographical locations for frames of the imaged data. Ex. 1005, *see e.g.*, ¶ 38:

When the image data from the cameras 50 is recorded, the geographical location of the frame can also be recorded. . . . [T]he disclosed inspection system 30 can use data from the GPS receiver 64 to trigger the cameras 50 to capture a still image of the track bed at about every 0.1-inches along the rail.

Villar uses the information to determine the location of a defect along the railroad track. *Id.* ¶ 42:

After the disclosed inspection system 30 completes a survey of railroad track, computer analysis of the image data is performed. . . . The computer analysis searches the image data and determines or detects locations along the track where defects occur or where allowable tolerances of the railroad track are not maintained. For a particular implementation, the computer analysis can be customized or changed. The geographic locations of defects or unallowable tolerances can be provided so

that appropriate repairs can be made or maintenance work can be scheduled.

In one disclosed technique for identifying defects, Villar includes reference points in frames of the imaged data and compares reference points in different frames to identify differences that may signify defects. *Id.* ¶ 50. By comparing the location of reference points in one frame (*e.g.*, Z1 in Fig. 7A, reproduced below) against their location in another frame (*e.g.*, Z2 in Fig. 7B, also reproduced below), defects may be detected. Villar explains in more detail:

FIG. 7A shows a frame F1 having rail 12 that is at a position Z1 along the track. The contour of the rail 12 lies within a region of interest R and at a level L along the Y-axis of the frame F1. The contour of rail 12 is above a reference level L2, which may be the height of a tie plate, a measurable distance LD. As would be apparent to one of ordinary skill in the art having benefit of this disclosure, reference L2 may be located at a number of reference points such as tie plates 14, spikes 16, or crossties 10, for example. FIG. 7B shows another frame F2 at another position Z2 along the track. At position Z2, the distance LD is less between the contour of the rail 12 and level L2 than at position Z1. Thus, frame F2 may indicate wear of the rail 12 at the position Z2 along the track.

Id. Figs. 7A and 7B are reproduced below:

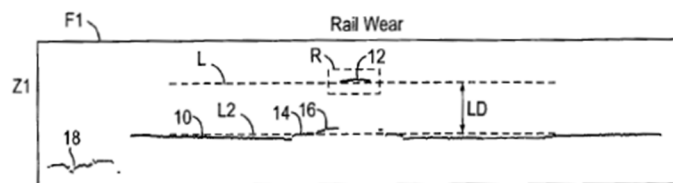


FIG. 7A

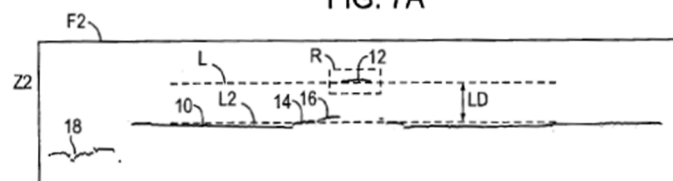


FIG. 7B

Figs. 7A and 7B “illustrate example frames of railroad track obtained with the [Villar] inspection system for determining wear of [a] rail.” Ex. 1005 ¶ 17.

Petitioner’s contention that “Villar refer[s] to ‘reference points such as . . . crossties 10,’ being located at a position [frame] Z1 along the track” (Pet. 18 (*quoting* Ex. 1005 ¶ 50)) is consistent with the technique illustrated in Figs. 7A and 7B. This is similar to the technique disclosed in the ’145 Patent. *See* Ex. 1001, *e.g.*, 823–38. As Dr. Papanikolopoulos explains, one of ordinary skill in the art would understand that Villar’s imaged track features are similar to the reference points of the ’145 patent, in which reference points or features (*e.g.*, imaged track features) are used to determine or assess, *e.g.*, an attribute or location of something else (*e.g.*, another feature along the track).

Ex–1004 ¶ 48.

Given that Petitioner has shown that, in light of the ’145 patent specification, crossties are “reference points,” and that Villar’s system determines reference points in a way similar to that disclosed in the ’145 patent, based on our review of the evidence, Petitioner has shown that Villar discloses “(a) determining at least two reference points, the reference points [*e.g.*, crossties] being features of the rail road track” as claimed.

“(b) verifying a GPS location of the reference points, the verification being accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points;”

The claimed method further requires “verifying a GPS location of the reference points” and that “the verification being accomplished by comparing imaging data of the reference points to satellite images of GPS

signatures of the reference points.” Claim 1. Petitioner contends that “Villar and Dorum [] render obvious this limitation of claim 1.” Pet. 22.

There is no dispute that (1) Villar discloses “a GPS location of the reference points.” Ex. 1005, e.g., ¶ 37 (the disclosed inspection system 30 may further include a Global Position System (GPS) receiver 64 for obtaining geographical locations of the inspection vehicle when inspecting the railroad track.”)

The dispute is over *verifying* said “GPS location of the reference points”; more particularly, “by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points.”

According to Petitioner, (2) Dorum discloses verifying by comparing imaging data to satellite images of GPS signatures.

Petitioner argues (3) that the combined disclosures of Villar and Dorum would lead one of ordinary skill in the art to “verify[]” as claimed.

Patent Owner disagrees. See, *inter alia*, PO Resp. 8:

As admitted by the Petitioner, Villar “does not verify the GPS location of imaged railroad track features by comparing imaging data of the railroad track features to satellite images of GPS signatures of the railroad track features,” as element [b] requires. Petition at 19. Petitioner relies on Dorum in a failed attempt to include the requirements of element [b]. *Id.* at 19-21.

(1) On whether Villar discloses “a GPS location of the reference points”

Patent Owner has provided no argument challenging Petitioner’s contention that Villar discloses “a GPS location of the reference points.”

Petitioner explains that “Villar’s system 30 moves along and captures images of various railroad track features, [and] a GPS receiver 64 and/or distance device 66 (e.g., an encoder or odometer sensor) *concurrently*

obtains geographical location data of the imaged features.” Pet. 18 (emphasis added).

Consistent with Petitioner’s explanation, and as illustrated on annotated Fig. 1 of Villar, reproduced above, Villar shows a GPS receiver (64) that records location data, i.e., the GPS location, for various railroad track features (e.g., crossties).

Accordingly, based on our review of the record, Petitioner has shown that (1) Villar discloses the claim limitation “a GPS location of the reference points [e.g., crossties].”

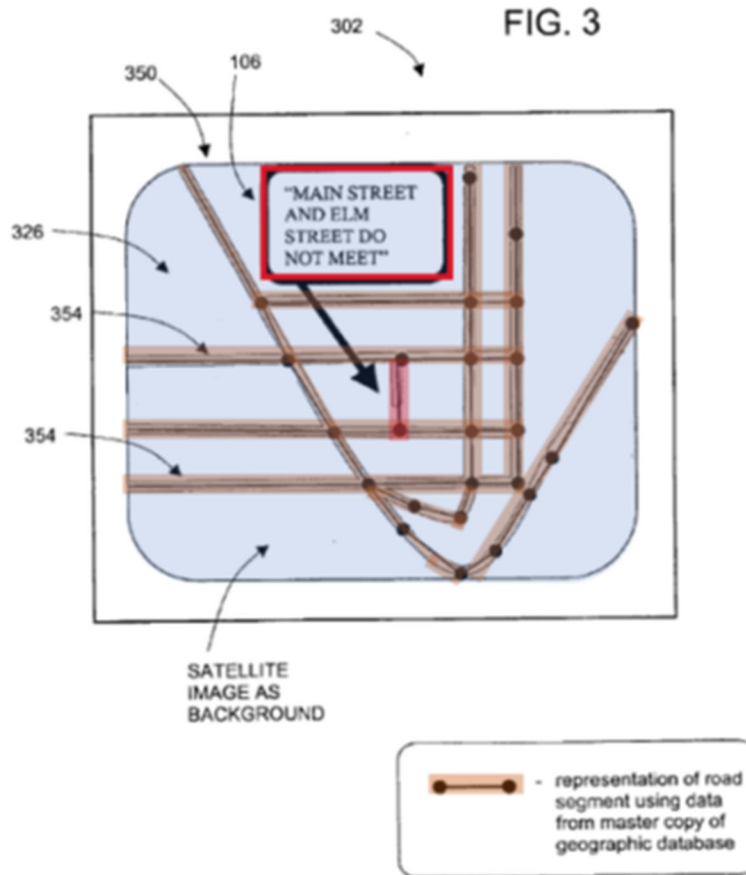
(2) On whether Dorum discloses verifying by comparing imaging data to satellite images of GPS signatures

Petitioner contends that

[v]erifying the GPS location of imaged railroad track features by comparing imaging data of the railroad track features to satellite images of GPS signatures of the railroad track features was well-known at the relevant time, as evidenced by, e.g., Dorum (Ex-1008). Ex-1004, ¶51.

Pet. 19.

To show that Dorum discloses said “verifying” limitation, Petitioner provides an annotated version of Fig. 3 of Dorum (Ex. 1008), reproduced below.



Petitioner's annotated version of Fig. 3 of Dorum (Ex. 1008).

Pet. 20. Petitioner explains:

Dorum discloses that, “[b]y overlaying the data 338 [orange] from the master copy of the database over the satellite image 326 [navy], the researcher can determine whether the data 338 from the master copy of the geographic database *correctly represent the actual geographic features.*” Dorum [Ex.1008], 6:57-61 (emphasis added); see also *id.*, 6:61-63 (further explaining that “[t]he information from the report can be used to identify the perceived error [e.g., red] and also to indicate what the end user perceived the error to be.”).

Id. at 19–20.

Accordingly, Petitioner's position is that Dorum discloses verifying imaging data by comparing imaging data [i.e. Dorum's data 338 [orange]] to satellite images of GPS signatures [i.e., Dorum's satellite image 326 [navy]].

Consistent with Petitioner’s position, Dorum discloses comparing imaging data to satellite images. Ex.1008, 6:57-61. By doing so, Dorum is able to verify that the imaging data accurately represents actual geographic features (*id.* at 6:61-63).

On whether Dorum compares imaging data to satellite images “of GPS signatures,” as the claim more specifically requires, Petitioner argues that Dorum’s satellite images necessarily include GPS signatures. *See* Pet. 20 (“Dorum further discloses using GPS data from satellites, which one of ordinary skill in the art would have understood to have uniquely associated GPS signatures. Ex-1004, ¶54.”)

Petitioner points out that the Specification of the ’145 patent does not define the term “GPS signatures” (Pet. 20). So, to support its argument, Petitioner relies on the declaration of Dr. Papanikolopoulos who testifies that “one of ordinary skill in the art would have understood this term [i.e., “GPS signatures”] to include unique GPS location information provided by a particular GPS device based on, for example, the device’s technical specification and positions.” Ex. 1004 ¶ 54, reproduced at Pet. 20.

Given Dorum’s disclosure of verifying image data by comparing imaging data to satellite images and Dr. Papanikolopoulos’s unrebutted testimony that one of ordinary skill in the art would have understood the claim phrase “GPS signatures” to include unique GPS location information provided by a particular GPS device associated with a satellite image, Petitioner’s argument that (2) Dorum discloses verifying by comparing imaging data to satellite images “of GPS signatures” is supported by the evidence.

For its part, Patent Owner argues that Dorum is non-analogous art.

“Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed and (2), if the reference is not within the field of the inventor’s endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.” *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004).

According to Patent Owner, Dorum is from a different field of endeavor because

Villar discloses a complex machine vision system that identifies defects in features along a railroad track. Ex-1005 at ¶¶[0002], [0008]. In stark contrast, Dorum is from a different field of endeavor because it discloses updating a geographic database and uses satellite imagery to determine various errors. Dorum indicates that various geographic features may be a type of error that Dorum’s system can confirm, including railroad tracks, railroad terminals, and train terminals. Dorum thus at most deals with determining a potential error in the database with the geographical location of a railroad track.

PO Resp. 5.

However, in applying the “field of endeavor” test, one looks to see whether Dorum is in the same field of endeavor as that of the ’145 patent, not whether there are significant differences between the Villar and Dorum systems as Patent Owner argues. *See In re Deminski*, 796 F.2d 436, 442 (Fed. Cir. 1986) (stating that in determining whether a reference is from analogous art, “[f]irst, we decide if the reference is within the field of *the inventor’s* endeavor”) (emphasis added).

Also, we observe, as Petitioner has (Pet. Reply 5), that Patent Owner indicates that Dorum “deals with determining a potential error in the database with the geographical location of a railroad track” (PO Resp. 5),

which would place Dorum in the same field of endeavor as that of the '145 patent; that is, “method[s] for determining a location of a features along a railroad track.’ Ex-1001 at 16:53-54, 17:19-20.” PO Sur-reply 6. Patent Owner argues, *inter alia*, that Dorum is more concerned with correcting errors in a geographic database than locating features on a railroad track. *Id.* (“Dorum is directed to ‘[a] reporting program and system for updating a master copy of a geographic database.’ Ex-1008 at Abstract.”) But, as Patent Owner acknowledges, “the location of a railroad track on the ground may be one of many features Dorum’s system may update.” *Id.*

Even if Dorum is in a different field of endeavor, Dorum may nevertheless be reasonably pertinent to the particular problem with which the invention is concerned. “A reference is reasonably pertinent if, even though it may be in a different field from that of the inventor’s endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to an inventor’s attention in considering his problem.” *In re Clay*, 966 F.2d 656, 659 (Fed. Cir. 1992).

In that regard, according to Patent Owner, Dorum “is not reasonably pertinent to the problem to be solved in the '145 patent” because

Dorum indicates that various geographic features on a database map may include errors that Dorum’s system can identify and confirm. *Id.* at 5:44-60. Dorum recites a litany of features that might appear on a map, including roads, road attributes, road traffic features, border crossings, marinas, lakes, rivers, parks, railroad tracks, railroad terminals, and train terminals. *Id.* As applied to railroad tracks or any other geographic feature, Dorum deals with determining a potential error in the database concerning the geographical location of a railroad track on a large-scale map. Dorum bears no relation to the '145 patent’s topic of milepost mapping along a railroad track, and increasing the accuracy of the location of features along the track. Ex-1001 at 1:32-35, 1:57-2:7. Dorum does not address mapping for trains

along a railroad track and thus addresses a distinct problem from the '145 patent.

PO Resp. 6. According to Patent Owner, “Dorum concerns only determining a potential error in a geographical database concerning the geographical location of the overall railroad track on a large-scale map or, in other words, the position of the entire track as it lays across the ground.” PO Sur-reply 7.

However, according to the '145 patent, “there is a need in the art for the present invention which provides an accurate and efficient method of determining the location of features along a rail road track.” Ex. 1001, 1:50–54; *see* Pet. Reply 5–6. “To increase the accuracy of the interpolation of mileposts, the present invention is provided.” Ex. 1001, 1:57–58.

Thus, the '145 patent is concerned with improving the accuracy of a determination of the location of a railroad feature, and not solely, as Patent Owner argues, to “‘increas[e] the accuracy of GPS to milepost mapping’.” PO Sur-reply 7 (quoting Ex-1001, 1:32-35).

Similarly, Dorum seeks to improve the accuracy of a determination of the location of a geographic feature. This is needed because “[f]or example, ... there may be errors associated with “the presence and locations of ... railroad tracks” (*id.* at 5:51–53). This is confirmed by Petitioner’s expert. Pet. Reply 6; Ex-1004, ¶56 (Dorum “specifically teaches that its system may be used to verify geographical locations of ‘railroad tracks’ and other similar transportation regions” and “target[s] the application of localization and mapping in the railroad industry”).

We find Dorum and the '145 patent have similar objectives—improving the accuracy of a location of geographical features, such as railroad tracks. We also credit Dr. Papanikolopoulos’s un-rebutted

testimony, which echoes that Dorum and the '145 patent are directed to similar problems. Ex-1004, ¶56. Thus, we determine that Dorum would have commended itself to patentee's attention.

Therefore, Dorum is reasonably pertinent to the particular problem with which the invention is concerned.

As such, Dorum is analogous art.

(3) On whether one of ordinary skill in the art would have been motivated to “verify[] a GPS location of the reference points, the verification being accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points”

Patent Owner argues that “Petitioner provides no adequate reason for combining Villar and Dorum to achieve a claimed element, much less element [b].” PO Resp. 8.

Part of the reason Petitioner gives for combining Villar and Dorum to achieve “verifying a GPS location of the reference points, the verification being accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points” is that “both Villar and Dorum’s systems target the application of localization and mapping in the railroad industry.” Pet. 21. “[O]ne of ordinary skill in the art would have been motivated to combine Villar with Dorum because they both deal with ‘railroad tracks’.” *Id.*

Patent Owner disagrees with this reason, finding it inadequate because, according to Patent Owner, Dorum does not “deal” with railroad tracks.

[W]hile the sole and detailed focus of Villar is identifying the details of railroad tracks down to very small details, Dorum in stark contrast does not really even “deal” with “railroad tracks.” Instead, the focus of Dorum is the location of a vast variety of

features on a geographic database that is, in effect, a large-scale electronic map.

Id. at 9.

A principal difficulty with Patent Owner's position is that Dorum specifically mentions "railroad tracks" (Ex. 1008, 5:53) as a subject of potential errors, the reporting of which "are suitable for confirmation by satellite imagery" (*id.* at 45) by Dorum's system. Pet. 19. This is supported by Dr. Papanikolopoulos's unrebutted testimony. *Id.* at 21; Ex. 1004 ¶ 56.

Notwithstanding Dorum specifically mentions "railroad tracks," Patent Owner asserts that Dorum's focus is different from that of Villar and therefore one of ordinary skill in the art would not look to Dorum in order to modify Villar and thereby reach the claimed verifying step.

Specifically, "the focus of Dorum is a large-scale geographic database, and all features that may appear on a geographic map, and not railroad tracks or all the small-scale features that a train may encounter along a railway." PO Resp. 9. "The disclosure in Villar focuses on the small-scale minutiae of railroad track features, such as crossties, tie plates and other fasteners, insulators, rail wear, rail gage, and ballast height. See, e.g., Ex-1005 at ¶[0008]." *Id.* at 10. Because of the different focuses, according to Patent Owner,

A POSITA looking to improve Villar's accuracy and reliability would not have looked to Dorum because Dorum's disclosure is extremely large scale. A POSITA would not have believed that a reference that fixes errors on such an outsized scale on an electronic map would be useful for fixing errors in the small components that form a railroad track.

Id. See also *id.* at 12 ("Verifying the geographical location of a railroad track, or a similar 'transportation region' [per Dorum], is very different than

verifying the geographical location of small-scale features, such as a crosstie, tie plate, or spike, along a railroad track” [per Villar]).

It is true that Dorum focuses on features on a geographic map while Villar focuses on smaller elements of a railroad track. But, if one of ordinary skill in the art would recognize that Dorum’s technique for verifying imaging data by comparing imaging data to satellite images of GPS signatures would improve the detection of errors when inspecting railroad track components, then it would have been obvious to apply Dorum’s verifying technique in Villar unless the actual application of said technique is beyond his or her skill. *KSR*, 550 U.S. at 416 (“[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.”).

In that regard, both Villar and Dorum identify problems associated with railroad tracks, albeit they do so in different contexts. Villar uses an inspection system designed to detect physical defects in railroads (Ex. 1005, *e.g.*, ¶ 23 (“railroad track”)) while Dorum uses satellite imagery to confirm geographic errors in, for example, railroad track reports (Ex. 1008, 5:53 (“railroad tracks”). Be that as it may, “[w]hen a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability.” *KSR*, 550 U.S. at 417.

Here, Villar records location data for railroad features via, for example, GPS receiver 64. Ex. 1005 ¶ 37 (element 64 in Petitioner’s annotated version of Villar Fig. 1 above).

Dorum provides a system for verifying geographical location data by comparing image data to satellite images.

Dorum provides an incentive to incorporate its verifying system into Villar because it ensures that the location data for railroad features that Villar records are accurate. As Dr. Papanikolopoulos explains, Dorum

provide[s] the predictable advantage of more accurate geographical location data of the railroad track features, leading to an increase in the reliability of the information stored in the database, as taught by Dorum. Dorum, Abstract, 2:43-54, 6:51-63, 7:20-38. Also, updating an existing geographic database, including verified locations of reference points, provides better accuracy (and fewer errors) in determining locations of unknown points, an important feature of localization and mapping systems, like Villar's.

Ex. 1004 ¶ 55; Pet. 21.

Combining Villar's system for recording GPS locations of reference points (e.g., crossties) along a railroad track with Dorum's system for verifying geographical locations yields, predictably, a system that records and verifies GPS locations of reference points. "The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR*, 550 U.S. at 416.

Patent Owner further argues that "even if there were an adequate reason to combine the references, element [b] still would not be achieved" because, *inter alia*, "Dorum never refers to 'GPS' or 'Global Positioning System.' See generally Ex-1008." PO Resp. 10. "Dorum does not [] verify the GPS location of imaged railroad track features by comparing imaging data of the 'railroad track' features to satellite images of GPS signatures of the 'railroad track' features, as element [b] requires." *Id.*

The difficulty with this argument is that, although the term “GPS is not expressly recited in Dorum, the evidence nevertheless supports the view that one of ordinary skill in the art would understand Dorum’s disclosure of “satellite imagery” to involve the use of GPS. Petitioner’s expert, Dr. Papanikolopoulos, testified to Dorum’s use of GPS. Pet. 20; Ex. 1004 ¶ 54 (“one of ordinary skill in the art would have understood this term [GPS signatures] to include unique GPS location information provided by a particular GPS device based on, for example, the device’s technical specification and positions”). This evidence has not been rebutted.

Accordingly, contrary to Patent Owner’s suggestion, the evidence supports viewing Dorum as involving the use of GPS.

We have reviewed the record and conclude, for the foregoing reasons, Petitioner has shown that claim step “(b) verifying a GPS location of the reference points, the verification being accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points” would have been obvious over the combined disclosures of Villar and Dorum to one of ordinary skill in the art at the time of the invention.

“(c) marking the location of the reference points;”

With regard to limitation [c], Petitioner’s states that “Villar [] discloses this limitation of claim 1.” Pet. 23.

In support thereof, Petitioner contends that Villar stores location data of reference points and in this way “marks” their location. Petitioner explains that

As discussed above, Villar’s inspection system 30 images railroad track features and obtains geographic location data of the imaged railroad track features, which it then stores, among other

data, in storage device 62. Villar, [0034] (storage device 62 “effectively store[s] all the data obtained with the disclosed inspection system 30.”), [0033], [0037], [0038]. According to Villar, the geographic locations of any “defects or unallowable tolerances” can then be provided (from the storage device 62) “so that appropriate repairs can be made or maintenance work can be scheduled.” *Id.*, [0042].

Pet. 22.

Patent Owner has provided no argument challenging Petitioner’s contention. *See generally* PO Resp.

Villar’s inspection system stores image data and geographical locations of imaged railroad track features (such as crossties) in “determin[ing] or detect[ing] locations along the track *where defects occur* or where allowable tolerances of the railroad track are not maintained ... so that appropriate repairs can be made or maintenance work can be scheduled.” *Id.* at 42 (emphasis added). In “storing . . . the various data obtained with the disclosed inspection system 30” (Ex. 1005 ¶ 33), Villar stores the location data *where defects occur*, in effect “marking” the locations in need of repair. As Dr. Papanikolopoulos explains,

In my opinion, one of ordinary skill in the art would thus understand that Villar’s storage device 62 marks the geographic location information of certain track features (i.e., ones GPS receiver 64. Villar, [0037]. Thus, in my opinion, implementing Villar’s system to verify the GPS locations of the imaged railroad track features by comparing image data of the imaged railroad track features to satellite images of GPS signatures of the railroad track features would simply provide Villar’s system with another well-known technique to ensure accurate location information of the imaged railroad track features.

Ex. 1004 ¶ 58.

In our view, based on our review of the record, Petitioner has shown that Villar discloses “(c) marking the location of the reference points” (claim 1).

Alternatively, Petitioner states that, “[t]o the extent claim 1[c] is interpreted to mean ‘marking [a verified] location of the reference points,’ based on the method step of claim 1[b], Villar and Dorum render obvious this limitation.” Pet. 23.

In that regard, as Petitioner states,

Dorum [] discloses updating a stored feature in the geographic database after comparison (i.e., verification) of an image of the feature with a satellite image of the feature. Dorum, 7:20-34 (“[B]ased on the satellite image 326 . . . , the researcher inputs a correction to the master copy of the geographic database,” and “[b]ased on the input from the researcher, the master copy of the geographic database 108 is *updated*.”) (emphasis added).

Pet. 23.

Patent Owner has provided no argument challenging Petitioner’s contention. *See generally* PO Resp.

Given that Petitioner has shown that (1) Villar discloses storing the location data where defects occur, in effect “marking” the locations in need of repair, and (2) the combined disclosures of Villar and Dorum render obvious “verifying a GPS location of [] reference points [such as crossties], the verification being accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points” (claim 1), it follows that the combined disclosures of Villar and Dorum would have led one of ordinary skill in the art to store the “verified” location data where defects occur, in effect “marking” the “verified” locations in need of repair. As Dr. Papanikolopoulos explains,

Villar instructs that the storage device 62 “effectively store[s] all the data obtained with the disclosed inspection system 30.” Villar, [0034]. Thus, in my opinion, implementing Villar’s system with the verified location of the railroad track features would simply be an extension of Villar’s own teachings.

Ex. 1004 ¶ 60.

Accordingly, based on our review of the record, Petitioner has shown that the combined disclosures of Villar and Dorum render obvious “(c) marking [a verified] location of the reference points” as claimed.

“(d) performing mathematical interpolation for at least one feature between the reference points;”

Petitioner states that “Villar and Kennedy render obvious this limitation of claim 1.” Pet. 29.

Petitioner contends that Villar “acknowledges the concept of interpolating between two features of a railroad track.” *Id.* at 25. Petitioner also contends that Kennedy “disclos[es] interpolation methods for determining locations of features between known reference points.” *Id.* at 26. Petitioner argues, *inter alia*, that “[i]t would have been obvious to one of ordinary skill in the art to have implemented Villar’s system to interpolate the location of a feature between the known location of railroad track features” given the benefits expressed in Kennedy for doing so. *Id.* at 26–27.

Patent Owner has provided no argument challenging Petitioner’s contention. *See generally* PO Resp.

Villar discloses that “the disclosed system could interpolate between any two captured frames to create a new third frame at any desired location along [a railroad] track.” Ex. 1005 ¶ 41. Given that the captured frames may include reference points (see frames Z1 and Z2 illustrated in Figs. 7A

and 7B reproduced above), in disclosing interpolating between any two captured frames to create a new third frame, Villar would appear to disclose “performing mathematical interpolation . . . between the reference points” (claim 1).

According to Kennedy, with the advent of state highway departments, Mileposts became the index for locating myriad highway attributes and events: construction projects, surface types, functional classification, signals, signs, bridges, roadside maintenance, and accident sites. A planner or engineer could create a project location map by interpolating the project's beginning and ending mileposts from reference mileposts shown on a base map.

Ex. 1009, 10. Kennedy discloses, *inter alia*, that, “[b]y using [] reference points as well as physically posted milepost signs, *any feature of interest* can be assigned an interpolated or estimated milepost value.” *Id.* at 11–12 (emphasis added).

Kennedy’s interpolating a *feature* between reference mileposts is applicable to the railroad industry. As Dr. Papanikolopoulos explains, “Kennedy expressly recognizes the benefits of performing interpolation with ‘railroads’ having ‘databases full of features indexed.’ Kennedy, 12 [‘Highway departments and railroads have databases full of features indexed this way.’].” Ex. 1004 ¶ 65.

Accordingly, based on our review of the record, Petitioner has shown that, given the benefits the railroad industry would obtain from performing an interpolation for a feature between reference points as Kennedy discloses, a person of skill in the art would have reason to modify Villar’s interpolation so as to interpolate for a *feature* along a railroad track, thereby “performing

mathematical interpolation for at least one feature between the reference points” as claimed.

For the foregoing reasons, based on our review of the record, Petitioner has shown that the combined disclosures of Villar and Kennedy render obvious “(d) performing mathematical interpolation for at least one feature between the reference points,” as claimed.

“(e) determining the location of the feature between the reference points.”

Petitioner states that “Villar and Kennedy render obvious this limitation of claim 1, and, along with Dorum render obvious claim 1.”
Pet. 30.

Patent Owner has provided no argument challenging Petitioner’s contention. *See generally* PO Resp.

Since “(d) performing mathematical interpolation for at least one feature between the reference points” necessarily “determin[es] the location of the feature between the reference points,” and Petitioner has shown that the combined disclosures of Villar and Kennedy render obvious said performing a mathematical interpolation, it follows that Petitioner has also shown that the combined disclosures of Villar, Kennedy, and Dorum render obvious “(e) determining the location of the feature between the reference points,” as claimed. We find a preponderance of the evidence supports Petitioner’s position that the combination of Villar, Dorum, and Kennedy discloses or suggests the subject matter of claim 1 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

2. *Claim 2*

“A method as defined in claim 1, wherein step (d) comprises the steps of:”

Claim 2 limits claim 1(d) such that it further comprises three steps; hereinafter referred to as steps [a], [b], and [c].

[a] “determining a distance between two reference points in feet and miles;”

With regard to step [a], Petitioner states that “Villar and Kennedy [] render obvious this limitation of claim 2.” Pet. 32.

Patent Owner disagrees. PO Resp. 12–16.

“determining a distance between two reference points”

“[D]etermining a distance between two reference points” is necessarily required in order to “perform[a] mathematical interpolation for at least one feature between the reference points” (claim 1(d)). In that regard, as we explained in Section II.E.1.d., based on our review of the record, Petitioner has shown that the combined disclosures of Villar and Kennedy render obvious “[claim 1](d) performing mathematical interpolation for at least one feature between the reference points,” as claimed. Patent Owner provided no argument challenging Petitioner’s contention as to claim 1(d). *See generally* PO Resp. Furthermore, as Dr. Papanikolopoulos explains, “one of ordinary skill in the art would have understood that interpolating the location of a feature relative to known reference points would include as a step the determination of the distance between the reference points.” Ex. 1004 ¶ 72. Pet. 30.

For these reasons, Petitioner has shown that the combined disclosures of Villar and Kennedy render obvious “determining a distance between two reference points.”

“in feet and miles”

The dispute centers on the phrase “in feet and miles.”

As discussed in detail below, Patent Owner contends that “in feet and miles” requires two separate determinations of a distance between two reference points; that is, one determination in feet and another determination in miles. Petitioner contends that a single determination of the distance satisfies the claim and that “in feet and miles” conveys alternative measurement units for expressing that single determination.

Consistent with the parties’ arguments, we analyze this issue in together with limitation [b], in the next section. As we explain below, we find that the evidence supports Petitioner’s construction.

[b] “determining a ratio of feet per mile using the distance between the two reference points;”

Step [b] calls for “determining a ratio of feet per mile using the distance,” referring to step [a], i.e., the distance “determin[ed] ... in feet and miles.” Thus, it is necessary for us to first analyze “in feet and miles” in the context of step [a] before addressing step [b]

In that regard, according to Petitioner, Villar and Kennedy disclose step [a].

[A]s Villar’s inspection vehicle moves along the track, the number of counted wheel revolutions from the first known reference point to the second known reference point will indicate the distance traveled by the vehicle between the first known reference point and the second known reference point. ...

Villar’s odometer [see element 66 in Petitioner’s annotated Fig. 1 reproduced above] can similarly obtain and use vehicle distance data to interpolate a location of a point or feature between two reference points based on the distance travelled by the vehicle. Ex-1004, ¶74. See also Villar, claim 13, [0045]

(disclosing a specific “algorithm for determining the distance between crossties of the railroad track bed. And because Villar’s crossties are expressly identified as reference points, Villar, [0050], this algorithm is used to determine the distance between two reference points (i.e., the crossties).), FIGS. 4A-C. Ex-1004, ¶74.”

Id. at 31. “Further, Kennedy expressly discloses ‘interpolat[ing] a position . . . based on the length of the line representing the route.’ Kennedy, 8.” *Id.*

According to Petitioner,

It also would have been obvious to represent the determined distance between the known reference points and the location of the feature along the track in feet and miles. Ex-1004, ¶75. Villar characterizes units of measurement both in terms of “feet” and “miles.” Villar, [0036]. Ex-1004, ¶75. And it was well-known that both encoders and odometers may provide the distance the vehicle has traveled in a number of different units of measurement, including feet and miles. Ex-1004, ¶75.

Id. at 32.

Petitioner relies on Dr. Papanikolopoulos for support, who explains:

Villar characterizes units of measurement both in terms of “feet” and “miles.” Villar, [0036]. And it was well-known that both encoders and odometers may provide the distance the vehicle has traveled in a number of units of measurement, including feet and miles. In my opinion, one of ordinary skill in the art at the relevant time would have found it obvious to represent the determined distance in several different units of measurement, including feet and/or miles, as well as to convert one unit of measurement to a different unit of measurement. Thus, for example, once the determined distance was known in terms of feet, it would have been obvious to convert the distance to miles, and vice versa. It is also well-known in the railroad industry to use feet and miles as measurement units to facilitate calculation of the corresponding milepost location of the feature along the railroad track.

Ex. 1004 ¶ 75; Pet. 32; *see also* Pet. Reply 13.

As for step [b], Petitioner argues that “it would have been obvious to represent the determined distance between the known reference points in the commonly used units of measurement, feet and miles.” *Id.* at 32–33.

“[T]aking the common knowledge into account that the ratio of feet/miles is 5,280/1, it would have been obvious to one of ordinary skill in the art to use the feet and miles of the determined distance between the two reference points to determine a ratio of feet per mile.” *Id.* at 33.

Petitioner relies on Dr. Papanikolopoulos for support, who explains:

it would have been obvious to represent the determined distance between the known reference points in the commonly used units of measurement, feet and miles. Using feet and miles of the determined distance to determine a ratio of feet per mile would also have been obvious to one of ordinary skill in the art, in my opinion. It is readily apparent and well-known to one of ordinary skill in the art that there are 5,280 feet in a mile, and that the ratio of feet per mile is 5,280/1 (or 1/5,280 in terms of miles per foot). Thus, regardless of the determined distance, the ratio of feet per mile would stay the same. Therefore, taking the common knowledge into account that the ratio of feet/miles is 5,280/1, it would have been obvious to one of ordinary skill in the art to use the feet and miles of the determined distance between the two reference points to determine a ratio of feet per mile.

Ex. 1004 ¶ 77. Pet. 33.

Accordingly, Petitioner construes step [a] as covering a single measurement of the distance “in feet and miles,” where “in feet and miles” characterizes units of measurement, and views step [b] as calling for said measurement to be expressed as “a ratio of feet per mile.” Given said construction, Petitioner finds that Villar and Kennedy disclose steps [a] and [b].

Patent Owner disagrees that step [a] is satisfied by a single measurement of the distance “in feet and miles” where “in feet and miles” characterizes units of measurement.

[T]he ordinary meaning of the distance in feet and the distance in miles cannot mean, as Petitioner asserts and relies upon to prove unpatentability, that, “once the determined distance was known in terms of feet, it would have been obvious to convert the distance to miles, and vice versa.” Petition at 32 [quoting Dr. Papanikolopoulos, Ex. 1009, ¶ 75]. Indeed, such an approach would, in effect, render element [b] moot because, as Petitioner recognizes “there are 5,280 feet in a mile.” Petitioner at 33. If element [b] were deemed to require only making the determination of the ordinary definitional relationship between feet and miles, then element [b] would be pointless.

Petitioner’s obviousness analysis fails to apply, or satisfy, the plain meaning of the claim language in its combination of Villar and Kennedy. Petitioner never even attempts to show that those references (or Dorum) disclose or suggest the features of claim 2 as described above. Instead, Petitioner expressly alleges “regardless of the determined distance, the ratio of feet per mile would stay the same.” Petition at 33. Thus, Petitioner has not provided a prima facie case of obviousness regarding claim 2.

PO Resp. 15–16.

In support of its construction of step [a] as requiring making two separate distance determinations, Patent Owner relies on intrinsic evidence; that is, the claim language and the specification. PO Resp. 12–16; PO Sur-reply 13–17. According to Patent Owner, given the intrinsic record, we should disregard Dr. Papanikolopoulos’ testimony in support of Petitioner’s construction.

Dr. Papanikolopoulos’ testimony is merely extrinsic evidence (and of lesser value) and, more importantly, it cannot be used, as Petitioner does here, to contradict the plain meaning of claim 2 evident from the intrinsic evidence. ... The meaning of claim 2

is evident from the intrinsic evidence in the claim language and specification and thus Dr. Papanikolopoulos' contrary meaning should be disregarded.

PO Sur-reply 17.

Claim Language

According to Patent Owner:

the plain meaning of element [a] requires determining a distance between two reference points in “feet and miles.” The conjunction “and” takes on importance, requiring that a separate determination must be made of the distance between the reference points in feet AND in miles. If the distance determined in one form could be mathematically derived from the other form, then there would be no need for determining the two distances separately.

PO Resp. 14.

According to Petitioner:

First, the plain language of claim 2 does not require GREX's construction. Instead, GREX drafted claim 2 broadly to only require “determining a distance between two reference points in feet and miles.” '145 patent, 17:1-2 (emphasis added). The claim does not require making two separate distance determinations between reference points (i.e., determining a first distance in feet and determining a second distance in miles), let alone using two different measurement means. Instead, the plain language of the claim only requires determining a distance (i.e., one distance) between two reference points in feet and mile measurement units.

GREX argues that “[t]he conjunction ‘and’ takes on importance, requiring that a separate determination must be made of the distance between the reference points in feet AND in miles.” Response, 14. But, the conjunction “and” is between the two units and thus only modifies that part of the claim limitation. Nothing in the plain language of the claim requires a more limited reading. GREX's further suggestion that, “[i]f the

distance determined in one form could be mathematically derived from the other form, then there would be no need for determining the two distances separately,” Response, 14, is also misplaced. Again, GREX could have attempted to draft claim 2 to align with its current interpretation, but instead drafted it broadly to only require “determining a distance between two reference points in feet and miles.” ’145 patent, 17:1-2 (emphasis added). Moreover, GREX’s argument ignores Dr. Papanikolopoulos’ unrebutted testimony explaining that a POSITA would have appreciated determining a distance between reference points in both feet and miles, to facilitate conversions between units and locating corresponding milepost locations along the railroad track. Petition, 32; Ex-1004, ¶75.

Pet. Reply 12–13.

Patent Owner responds:

Directly contrary to Petitioner’s argument, the Federal Circuit “has repeatedly emphasized that an indefinite article ‘a’ or ‘an’ ... carries the meaning of ‘one or more’ in open-ended claims containing the transitional phrase ‘comprising.’” *KCJ Corp. v. Kinetic Concepts, Inc.*, 223 F.3d 1351, 1356 (Fed. Cir. 2000). “Unless the claim is specific as to the number of elements, the article ‘a’ receives a singular interpretation only in the rare circumstances when the patentee evinces a clear intent to so limit the article.” *Id.* Thus, contrary to Petitioner’s argument, by using the phrase “a distance,” the claim language is not limited as a matter of law to determining “one distance.” Indeed, the use of the article ‘a’ here does not decide the issue because, on its own (without reference to other claim language or the specification), the article ‘a’ can mean determining one, two, three, or more distances.

Petitioner likewise provides no basis for limiting the ambit of the conjunction “and” (in the claim language “feet and miles”) to only the words “feet” and “miles” such that it does not apply to element 2[a]’s recitation “determining a distance between two reference points in feet and miles.” Indeed, read in full context, and bearing in mind the Federal Circuit’s mandate that “a” can mean more than one, a proper reading of element 2[a] is

“determining a distance between two reference points in feet” and “determining a distance between two reference points in miles” or, in other words, making two separate distance determinations.

Moreover, limiting the conjunction “and” makes no sense in the context of the rest of claim 2 or the specification’s disclosure. For example, element 2[b] confirms that the article “a” means determining more than one distance determination. Element 2[b] recites “determining a ratio of feet per mile using the distance between the two reference points.” To “determin[e] a ratio,” two measurements must be made because one measurement must be divided into the other. Petitioner’s proposed construction would in effect rewrite element claim 2[b] to recite “apply the known definitional ratio of feet per mile to the distance between the two reference points.”

PO Sur-reply 13–18.

We have reviewed the language of claim 2. We are unpersuaded that, based on its plain language, claim 2 is limited to requiring two separate distance determinations, one in feet and another in miles.

Patent Owner emphasizes the conjunction “and” and argues that it “*requir[es]* that a separate determination must be made of the distance between the reference points in feet AND in miles.” PO Resp. 14 (emphasis added).

However, Dr. Papanikolopoulos testifies that

one of ordinary skill in the art at the relevant time would have found it obvious to represent the determined distance in several different units of measurement, including feet and/or miles, as well as to convert one unit of measurement to a different unit of measurement. Thus, for example, once the determined distance was known in terms of feet, it would have been obvious to convert the distance to miles, and vice versa. It is also well-known in the railroad industry to use feet and miles as measurement units to facilitate calculation of the corresponding milepost location of the feature along the railroad track.

Ex. 1004 ¶ 75. Pet. 32.

Accordingly, there is evidence that one of ordinary skill in the art reading step [a] would not necessarily understand the language of claim 2 to *require* that separate determinations must be made of the distance between the reference points, one in feet and another in miles. Given Dr. Papanikolopoulos's testimony, one of ordinary skill in the art would not necessarily limit step [a] to requiring separate determinations. As Dr. Papanikolopoulos explains, it covers a "determined distance in [] different units of measurement, [] feet and/or miles." Ex. 1004 ¶ 75.

Patent Owner does not provide sufficient evidence that, in contrast to Dr. Papanikolopoulos's testimony, one of ordinary skill in the art would understand step [a] to be limited to two separate determinations.

It is notable that step [a] calls for "determining *a* distance."

Patent Owner correctly argues that "the use of the article 'a' here does not decide the issue because, on its own (without reference to other claim language or the specification), the article 'a' can mean determining one, two, three, or more distances." PO Sur-reply 13–18 (relying on *KCJ Corp. v. Kinetic Concepts, Inc.*, 223 F.3d 1351, 1356 (Fed. Cir. 2000)).

But if "a" can mean determining one distance, then a plain reading of step [a] does not undermine Petitioner's position that "[t]he claim does not *require* making two separate distance determinations." Pet. Reply 12 (emphasis added).

Patent Owner argues that step [b] "confirms that the article 'a' means determining more than one distance determination." PO Sur-reply 14–15. According to Patent Owner, step [b] recites "determining a ratio" and this requires "two measurements must be made because one measurement must be divided into the other." *Id.* at 15.

However, Dr. Papanikolopoulos testifies that

[i]t is readily apparent and well-known to one of ordinary skill in the art that there are 5,280 feet in a mile, and that the ratio of feet per mile is $5,280/1$ (or $1/5,280$ in terms of miles per foot). Thus, regardless of the determined distance, the ratio of feet per mile would stay the same.

Ex. 1004 ¶ 77. Pet. 33.

Accordingly, there is evidence that one of ordinary skill in the art reading step [b] would not necessarily understand it to require dividing two separate determinations of the distance, one in feet and another in miles. Given Dr. Papanikolopoulos's testimony, one of ordinary skill in the art would not necessarily limit the meaning of "ratio" to the quotient of one determination of the distance in feet divided by another separate determination in miles. As Dr. Papanikolopoulos explains, it can also mean expressing the single distance determined via step [a] "in feet per mile."

Patent Owner does not provide sufficient evidence that, in contrast to Dr. Papanikolopoulos's testimony, one of ordinary skill in the art would understand step [b] to be *limited* to determining a quotient of one determination of the distance in feet divided by another separate determination in miles.

For the foregoing reasons, based on our review of the record, we do not find that the language set forth in steps [a] and [b] limit claim 2 so as to require making two separate determinations of a distance between two reference points, one in feet and another in miles, and then calculating a quotient.

Specification

According to Patent Owner, the '145 patent supports reading steps [a] and [b] as requiring making two separate determinations of a distance, one in feet and another in miles, and calculating a quotient. PO Resp. 13–16 (citing Ex. 1001, 14:63–15:38).

There is no dispute that the '145 patent describes an embodiment where two separate determinations are made of the distance between reference points and a quotient is calculated. *See* Ex. 1001, 14:65–15:4:

the distance (in feet) traveled between two reference points is first determined at step 1. Each crosstie has a distance measure as determined from the vehicle encoder from the beginning of the scan to each crosstie. Next, at step 2, determine the distance between the two reference points (in miles) as stated by the customer track chart. Next, at step 3, divide step 1 by step 2 to determine the ratio of feet per mile.

But the claim is not limited to said embodiment. As Petitioner argues,

Although GREX refers to an “exemplary embodiment” from the specification, 14:63-15:38, describing determining two separate distance determinations using two different measurement means, it does not require GREX’s interpretation be read into the claim. Indeed, “it is improper to read limitations from a preferred embodiment described in the specification—even if it is the only embodiment—into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited.” *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 913 (Fed. Cir. 2004).

Pet. Reply 12–14.

Patent Owner disagrees:

the specification provides evidence of claim 2’s meaning. “[T]he specification ‘is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to

the meaning of a disputed term.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (Fed. Cir. 2005).

... In accord with controlling precedent, this disclosure [i.e., Ex-1001 at 14:63-15:38] is compelling evidence as to the meaning of claim 2. Notably, Petitioner cites no contrary evidence from the specification.

Petitioner next erroneously claims that the embodiment’s features should not be read into the claims. However, by ignoring the guidance provided by the disclosed embodiment (as Petitioner beseeches), Petitioner seeks to improperly apply an interpretation that expressly excludes a disclosed embodiment. As the Federal Circuit has held, it is a “well-established” principle “that a claim construction that excludes a preferred embodiment is ‘rarely, if ever, correct.’” *Dow Chemical Co. v. Sumitomo Chemical Co.*, 257 F.3d 1364, 1378 (Fed. Cir. 2001) (emphasis added).

PO Sur-reply 13–16.

The difficulty with Patent Owner’s argument is that Petitioner is not arguing for “an interpretation that expressly excludes a disclosed embodiment” (PO Sur-reply 16). Petitioner agrees that “GREX refers to an ‘exemplary embodiment’ from the specification, 14:63-15:38, describing determining two separate distance determinations using two different measurement means.” Pet. Reply 13. Petitioner’s position, supported by Dr. Papanikolopoulos’s testimony, is that “[t]he claim does not *require* making two separate distance determinations between reference points.” Pet. Reply 12 (emphasis added).

Patent Owner does not provide sufficient evidence that, in contrast to Dr. Papanikolopoulos’s testimony, one of ordinary skill in the art would understand steps [a] and [b] to be *limited* to making two separate determinations and then determining a quotient of one determination of the

distance in feet divided by another separate determination in miles, consistent with the embodiment described at 14:63-15:38 of the '145 patent.

For the foregoing reasons, based on our review of the record, we do not find that the specification supports limiting steps [a] and [b] so as to require making two separate determinations of a distance between two reference points, one in feet and another in miles, and then calculating a quotient.

We find the evidence weighs in favor of Petitioner's construction; that is, claim 2 covers a single determination of a distance "in feet and miles" expressed in "feet per mile."

Given said construction, Petitioner has shown that Villar and Kennedy render obvious steps [a] and [b] of claim 2.

[c] "determining a milepost value for the feature between the two reference points."

Petitioner states that "Villar and Kennedy [] render obvious this limitation of claim 2, and along with Dorum render obvious claim 2." Pet. 34.

Patent Owner has provided no argument challenging Petitioner's contention. *See generally* PO Resp.

As we indicated in our discussion of Kennedy in Section II.E.1.(d), Kennedy discloses, *inter alia*, that, "[b]y using [] reference points as well as physically posted milepost signs, any feature of interest can be assigned an interpolated or estimated milepost value." Ex. 1009, 11–12. Furthermore, according to Dr. Papanikolopoulos, "[u]sing milepost values to represent the location of a railroad feature in the railroad industry was well-known at the relevant time, as evidenced by, e.g., Kennedy." Ex. 1004 ¶ 79.

Accordingly, Petitioner has shown that the combined disclosures of Villar and Kennedy render obvious “determining a milepost value for the feature between the two reference points” as claimed.

We find a preponderance of the evidence supports Petitioner’s position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 2 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

3. *Claim 3*

“A method as defined in claim 1, wherein the features are at least one of a crosstie or rail base.”

Claim 3 further limits the “features” recited in claim 1 to at least “a crosstie or rail base.”

Petitioner states that “Villar, Dorum, and Kennedy [] render obvious claim 3.” Pet. 35.

Patent Owner relies on its position with respect to claim 1 and does not provide additional argument challenging Petitioner’s contention as to claim 3. PO Resp. 16.

We previously determined that the “’145 patent specification discloses a crosstie to exemplify a ‘feature’” and that “Villar discloses a “method for determining a location of *features* [e.g., crossties] along a rail road track” (claim 1 [preamble]) as claimed.” See Section II.E.1.[preamble]).

Accordingly, Petitioner has shown that Villar discloses “wherein the features are at least one of a crosstie or rail base” as claimed.

We find a preponderance of the evidence supports Petitioner’s position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 3 and a sufficient rationale for

combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

4. Claim 4

“A method as defined in claim 1, wherein the imaging data is received from a system for inspecting a rail road track, the system being mounted on a vehicle for movement along the rail road track.”

Claim 4 further limits the “imaging data” recited in claim 1 so that the imaging data is “received from a system for inspecting a rail road track” and limits the “system” to one “mounted on a vehicle for movement along the rail road track.”

Petitioner states that “Villar, Dorum, and Kennedy [] render obvious claim 4.” Pet. 36.

Patent Owner relies on its position with respect to claim 1 and does not provide additional argument challenging Petitioner’s contention as to claim 4. PO Resp. 16.

As shown in Petitioner’s annotated Fig. 1 (Section II.E.1.[preamble]), Villar’s system (30) for inspecting a rail road track includes camera (50) by which imaging data is received. Also, Villar discloses the system can be “mounted on an inspection vehicle (not shown) or other device moving along the track so as to maintain the inspection system 30 in the proper position.” Ex. 1005 ¶ 26.

Accordingly, Petitioner has shown that Villar discloses “the imaging data is received from a system for inspecting a rail road track, the system being mounted on a vehicle for movement along the rail road track,” as claimed.

We find a preponderance of the evidence supports Petitioner's position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 4 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

5. *Claim 5*

"A method as defined in claim 3, wherein an encoder is utilized to determine the distance between the two reference points in feet and miles."

Claim 5 adds to the method of claim 3 a step of "determining the distance between the two reference points in feet and miles" and employing "an encoder" to do so.

Petitioner states that "Villar and Kennedy render obvious this limitation of claim 5, and along with Dorum, render obvious claim 5." Pet. 36.

Patent Owner relies on its position with respect to claim 1 and does not provide additional argument challenging Petitioner's contention as to claim 5. PO Resp. 16.

We previously discussed the claim limitation "determining the distance between the two reference points in feet and miles." See Section II.E.2. And as discussed in Section II.E.1.[preamble], with reference to Petitioner's annotated Fig. 1, we determined that Villar discloses "encoder" (66) for determining distance.

Accordingly, Petitioner has shown that Villar discloses using an encoder to determine the distance between two reference points, and that the combination of Villar and Kennedy suggests "an encoder is utilized to

determine the distance between the two reference points *in feet and miles*” as claimed.

We find a preponderance of the evidence supports Petitioner’s position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 5 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

6. *Claim 6*

“A method as defined in claim 1, wherein a customer track chart is utilized to determine the reference points in step (a).”

Claim 6 calls for the use of a “customer track chart” in “determining at least two reference points . . . of the railroad track” (claim 1, step (a)).

Petitioner states that “Villar and Kennedy [] render obvious this additional limitation of claim 6, and along with Dorum render obvious claim 6.” Pet. 38.

In Section II.E.1.(a), we determined that Petitioner has shown that Villar discloses “(a) determining at least two reference points, the reference points being features of the rail road track” as claimed.

Here the question is whether the cited references show or would lead one of ordinary skill in the art to perform the determining step using a “customer track chart.”

Regarding the claim phrase “customer track chart,” Petitioner construes this term as providing information, including location, of railroad features. Petitioner states that “the ’145 patent explains that the ‘customer track chart’ gives detailed information, including location, about rail system features. ’145 patent, 14:6–9.” Pet. 37.

We have reviewed the '145 patent. It discloses that “[e]ach customer provides ‘Track Charts’ that give detailed information about their rail system features. One of these details is the location of each rail feature, measured to /100 of a mile.” Ex. 1001, 14:6–9.

Accordingly, in our view, the '145 Patent specification supports Petitioner’s position that a “customer track chart” gives detailed information, including location, of railroad features.

Petitioner relies on Kennedy as disclosing such a “customer track chart.”

Kennedy discloses a plot of features by “State Route and Milepost” based on “Tables of data indexed to a linear reference system by State Route and Milepost.” Ex. 1009, 8 (Figure 1). Kennedy also discloses “thousands of highway features indexed by route and milepost.” Ex. 1009, 8. As Dr. Papanikolopoulos explains,

Kennedy discloses using “[t]ables of data” with “thousands of highway features indexed by route and milepost” provided by, for example, a state transportation department. Kennedy, 7-8; see also, 8 (“Some of these are physical infrastructure features like highway ramps, signs, signals, bridges, pavement materials, lane widths, railway crossings and tunnels.”). One of ordinary skill in the art would have understood the “state transportation department” provided “[t]ables of data” about features along a route as corresponding to the claimed “customer track chart.”

Ex. 1004 ¶ 87; Pet. 37.

In disclosing using detailed information, including location, of railroad features, Kennedy appears to disclose the use of a “customer track chart” to determine reference points, within the meaning of “customer track chart.” According to Dr. Papanikolopoulos, “[i]ndeed, like Kennedy, the '145 patent explains that the ‘customer track chart’ gives detailed

information, including location, about rail system features. '145 patent, 14:6–9.” Ex. 1004 ¶ 87, *quoted* at Pet. 37.

Patent Owner disagrees that Kennedy’s “[t]ables of data” corresponds to the claimed “customer track chart.”

Kennedy’s “tables of data” of that sort do not provide any information, let alone detailed information, about rail system features like that in the exemplary track chart referenced in Figure 20 of the '145 patent, which has information for each “crosstie,” including its longitude, latitude, milepost number, tie to tie distance, and points of reference along the track. See Ex-1001 at 15:24-38 & Fig. 20.

PO Resp. 17.

According to Petitioner:

That is incorrect. Kennedy discloses using “[t]ables of data” with “thousands of highway features indexed by route and milepost” and that “[s]ome of these are physical infrastructure features like highway ramps, signs, signals, bridges, pavement materials, lane widths, railway crossings and tunnels.” Petition, 37 (citing Kennedy, 7-8; Ex-1004, ¶87). Likewise, FIG. 20 of the '145 patent uses “railroad crossings” as an example of “reference points” which are indexed by “milepost.” '145 patent, 15:26-38.

Pet. Reply 15.

Patent Owner responds:

As GREX demonstrated, Kennedy does not disclose or suggest “a customer track chart.” Response at 28-29.

Petitioner does not prove otherwise; instead, Petitioner affirms that Kennedy’s tables of data include “thousands of highway features indexed by route and milepost.” Reply at 15 (emphasis added); see Petition at 37-38. Kennedy’s tables of data thus constitute “highway features” rather than “railroad” tracks, and thus are not a “track chart.” Although, as Petitioner emphasizes (Reply at 15), Kennedy’s “tables of data” include “railway crossings” “indexed by route and milepost,” (a feature

also included on Fig. 20's track chart in the '145 patent), Kennedy's disclosure does not even vaguely resemble a customer track chart as required by claim 6. Merely having one specific feature in common with a customer track chart—and only because roads and railroad tracks occasionally intersect—does not mean that Kennedy's "highway feature[]" chart discloses or suggests the use of such a railroad track chart.

PO Sur-reply 18.

Patent Owner argues that Kennedy's disclosure of "tables of data" that include, for example, "railway crossings" is insufficient to satisfy the claim 6 requirement of using a "customer track chart."

But claim 6 does not limit the "customer track chart" to one that provides information as Patent Owner argues. The claimed "customer track chart" is not required to be "like that in the exemplary track chart referenced in Figure 20 of the '145 patent, which has information for each 'crosstie,' including its longitude, latitude, milepost number, tie to tie distance, and points of reference along the track. *See* Ex-1001 at 15:24-38 & Fig. 20."

PO Resp. 17. As Petitioner points out, "The plain language of claim 6 simply requires that the customer track chart 'is utilized to determine the reference points in step (a).' There is no definition or disclaimer in the plain language of the claim or specification requiring the chart include specific types of information." Pet Reply 15.

Given the breadth of the claim phrase "customer track chart" and Dr. Papanikolopoulos's testimony that "[o]ne of ordinary skill in the art would have understood the "state transportation department" provided "[t]ables of data" about features along a route as corresponding to the claimed "customer track chart" (Ex. 1004 ¶ 87; Pet. 37), the evidence supports Petitioner's

position that Kennedy's "[t]ables of data" meets "customer track chart" as that phrase is used in claim 6.

Accordingly, the evidence supports Petitioner's position that Kennedy discloses a "customer track chart" as claimed.

We find a preponderance of the evidence supports Petitioner's position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 6 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

7. Independent Claim 7

a. The Effective Filing Date for the '145 Patent and Prior Art Status of Villar

The '145 patent issued on June 26, 2012, based on an application, 12/494,400 ("400 application"), filed on June 30, 2009. Ex. 1001, code (54). The '400 application was filed as a "continuation-in-part of [] application 12/489,570, . . . , which is a continuation-in-part of application [] 12/465,473, . . . which is a continuation-in-part of application [] 11/172,618 ["618 application"], filed on Jun. 30, 2005, now Pat. No. 7,616,329 ["329 patent")." *Id.* at (63). The '145 patent indicates that it claims "benefit of expired U.S. Provisional application Ser. No. 60/584,769 ["769 application]), . . . filed Jun. 30, 2004." *Id.* at 1:24–26.

Villar (Ex. 1005; i.e., US 2006/0017911, filed June 30, 2005) is the published application of the '618 application, now the '329 patent. Villar was published on June 26, 2006. Like the '145 patent, Villar indicates that it claims "priority to [the '769 application], . . . filed Jun. 30, 2004." *Id.* at ¶ 1.

Villar's prior art status as to the challenged claims depends on the effective filing date of the '145 patent. Petitioner argues that the '145 patent

has an effective filing date no earlier than June 30, 2009, the filing date of the underlying '400 application. See Pet. 5 n.5; further discussed at 10–11.

Patent Owner argues that the '145 patent (and claim 7 in particular) has an effective filing date of June 30, 2004, the filing date of the provisional '769 application. PO Resp. 17.

The '145 patent is entitled to the filing date of an earlier application if the “invention [is] disclosed in the manner provided by § 112(a) (other than the requirement to disclose the best mode).” 35 U.S.C. § 120.

Patent Owner argues that “the subject matter of claim 7 is supported by the disclosure in the earlier application filed on June 30, 2005 (later published as Villar), and thus claim 7 is entitled to that application’s earlier priority date of June 30, 2004.” PO Resp. 18. According to Patent Owner, Villar provides written descriptive support for all the limitations of claim 7. PO Resp. 20–24.

Petitioner argues that Villar does not provide written description support for claim 7 because:

Villar does not support at least claim 7’s steps of “[b)] verifying a location of reference points, [(c)] performing mathematical interpolation for at least one feature between the reference points, and [(d)] determining the location of the feature between the reference points.” Petition, 10-11. Instead, purported written description support for these features was first added on June 30, 2009. *Id.*, 11 (citing Ex-1002, 38-44, 61-62; Ex-1011, 1-8 (FIGS. 13-20), 23-36).

Pet. Reply 16. We address written description support for the three aspects of claim 7 identified by Petitioner below.

“(b) verifying a location of the reference points,”

Regarding “(b) verifying a location of the reference points,” Patent Owner states that Villar “discloses the content of element 7[b], which recites ‘verifying a location of the reference points.’” PO Resp. 21.

Petitioner disagrees, arguing that the ’145 patent explains “verifying” as authenticating a previously-determined location which, according to Petitioner, Villar does not disclose.

The ’145 patent explains that “verifying a location” means authenticating a previously-determined location. For example, in step 104, the ’145 patent determines whether a previously-determined location is correct based on the verification in step 102. *Id.*, 14:37-44; see also Ex-1004, ¶¶21-22. The ’145 patent also explains that the verification step “verifies that the GPS coordinate of the reference point is precise.” ’145 patent, 15:54-56 (emphasis added); *see also id.*, 14:27-28 (emphasis added) (“Once a point of reference has been identified, . . . the GPS location of the selected point of reference is verified.”), 14:29-36.

Villar does not disclose authenticating a previously-determined location. Instead, Villar merely discloses using “a GPS receiver 64” and “a distance device 66” to “determine” and “obtain” initial location data. Villar, ¶¶37-39; Response, 21- 22. Villar’s disclosure does not describe or even suggest using GPS receiver 64 or distance device 66 to “verify a location,” consistent with the use and description of this term as introduced in and claimed by the ’145 patent, 15:54-56, 14:27-44, FIG. 19; see also Ex-1004, ¶¶21-22.

Pet. Reply 17–18.

Patent Owner counters:

Villar’s disclosure is not so limited. Because Villar discloses using those two distinct methods of obtaining the location of the reference points in the same device (Ex-1005 at Fig. 1), use of

both in conjunction necessarily means that the location data from one can be verified by the location data from the other.

PO Sur-reply 19–20.

We agree with Petitioner that Villar nowhere suggests or discloses “verifying.” As Petitioner points out, Villar merely discloses using “a GPS receiver 64” and “a distance device 66” to “determine” and “obtain” initial location data. Villar, ¶¶37-39.” Pet Reply 17. Villar does not verify the location that is determined and obtained by these devices.

Patent Owner argues that, in “using ‘a GPS receiver 64’ and ‘a distance device 66’ to ‘determine’ and ‘obtain’ initial location data” “the location data from one *can be verified* by the location data from the other.” PO Sur-reply 19–20 (emphasis added). That one of ordinary skill in the art *could* have “verified” the location given said disclosure of determining and obtaining location data is, without more, insufficient to establish written descriptive support in Villar for the verifying step. This is so because “[e]ntitlement to a filing date does not extend to subject matter which is not disclosed, but would be obvious over what is expressly disclosed.” *In re Huston*, 308 F.3d 1267, 1277 (Fed. Cir. 2002) (quoting *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571-72 (Fed. Cir. 1997)).

Similarly, Patent Owner argues that “Villar teaches that ‘[t]he geographical locations are sent to the processing device 60 and *can be compiled* with the image data of the track bed.’ Id., ¶ [0037].” PO Resp. 23 (emphasis added). But again the fact that locations *can be* compiled with image data does not necessarily mean the location of the reference points has been verified. It may be obvious to compile the geographical locations and image data, but that alone is insufficient to establish written descriptive support in Villar for the verifying step.

Based on our review of the record, we agree with Petitioner that Villar does not provide written descriptive support for “(b) verifying a location of the reference points.”

“(c) performing mathematical interpolation for at least one feature between the reference points;”

According to Patent Owner,

Villar also discloses the content of element 7[c], which recites “performing mathematical interpolation for at least one feature between the reference points.” In regard to this element, Petitioner relies on its discussion of element 1[d]. Petition at 39. In that discussion, as recognized by Petitioner, the “distance device 66 provides the location data of the imaged railroad track features to the processing device,” and “the disclosed system [of Villar] could ***interpolate between any two capture frames*** to create a new third frame at any desired location along the track” as taught in paragraph [0041] of Villar. Petition at 24-25 (emphasis added); Ex-1005 at ¶¶ [0041], [0039]-[0042]; Ex-1004, ¶¶ 48, 63; see *id.* at 17 (same), 9 (“distance device (66)” of Villar “may perform mathematical interpolation using e.g., vehicle distance data”). Petitioner also recognizes that “Villar’s system us[es] imaged frames locations to determine the spacing between crossties” as taught in paragraph [0045] of Villar. Petition at 17; Ex-1005 at ¶ [0045]; Ex-1004 at 35(¶48). These disclosures are sufficient to support element 7[c].

PO Resp. 22–23.

Petitioner argues that:

In its Response, GREX argues that a single sentence from Villar’s disclosure, namely, “the disclosed system could interpolate between any two captured frames to create a new third frame at any desired location along the track,” Villar, ¶ 41, provides written description support for claim 7[c]’s step of “performing mathematical interpolation for at least one feature between the reference points.” Response, 22-23. That is not so. Although the cited portion from Villar’s disclosure generally acknowledges the concept of interpolation, it does not support

performing mathematical interpolation “for at least one feature between [] reference points,” as required by claim 7. Instead, this portion of Villar’s disclosure simply refers to creating an additional camera frame between two captured frames to reduce data storage and keep frame spacing uniform. Villar, ¶¶40-41. It is not specific to any feature within that frame, let alone for the purposes of determining its location.

... it does not necessarily follow from Villar’s express teachings that an additional feature must be present in the interpolated frame, Villar does not “inherently” provide written description support for “performing mathematical interpolation for at least one feature between [] reference points.” Nor does GREX even provide expert testimony that would support any such inherency argument.

Pet. Reply 18–19.

According to Patent Owner, “Petitioner misses the point. By performing the interpolation and creating a new third frame between any two captured frames, Villar necessarily also performs that interpolation at any point where a railroad track “feature” is present.” PO Sur-reply 20.

We agree with Petitioner that Villar nowhere mentions performing mathematical interpolation “for at least one feature” between the reference points.

Patent Owner relies on the statement “the disclosed system could interpolate between any two captured frames to create a new third frame at any desired location along the track.” Villar ¶41. PO Resp. 22. But, as Petitioner points out, “it does not necessarily follow from Villar’s express teachings that an additional feature must be present in the interpolated frame.” Pet. Reply 19.

We find that the fact that a new third frame could be created at any desired location along the track the location via interpolation is insufficient

to provide written descriptive support for “(c) performing mathematical interpolation for at least one feature between the reference points.” We do not see, and Patent Owner does not adequately explain, how the mere creation of a third frame by interpolation amounts to mathematical interpolation “for at least one feature” between the reference points. There is insufficient evidence showing that in creating a third frame, the frame necessarily includes “at least one feature between the reference points” as the claim requires. It may have been obvious to one of ordinary skill in the art to include “at least one feature between the reference points” when creating said third frame, thereby reaching the claimed “performing mathematical interpolation for at least one feature between the reference points,” but that alone is insufficient to establish written descriptive support in Villar for the interpolating step. *See Huston*, 308 F.3d at 1277.

Based on our review of the record, we agree with Petitioner that Villar does not provide written descriptive support for “(c) performing mathematical interpolation for at least one feature between the reference points.”

“(d) determining the location of the feature between the reference points;”

Patent Owner argues that “Villar also discloses the content of element 7[d], which recites ‘determining the location of the feature between the reference points.’” PO Resp. 23. According to Patent Owner “by way of the creation of this third intermediate frame in ‘between’ those ‘two’ ‘frames,’ by using interpolation of the distances in between those other two frames, Villar discloses ‘determining the location of the feature between the reference points.’ These disclosures are sufficient to support element 7[d].” *Id.* at 23–24.

Petitioner does not appear to have responded to this argument. *See generally* Pet. Reply 18–19.

Be that as it may, as with limitation (c), we find that there is insufficient evidence showing that in creating a third frame as Villar does, the frame necessarily includes “at least one feature between the reference points” as the claim requires. Thus, Villar cannot “determin[e] the location of the feature between the reference points.” It may have been obvious to one of ordinary skill in the art to “determin[e] the location of the feature between the reference points” once a third frame is created, thereby reaching the claimed “determining the location of the feature between the reference points,” but that alone is insufficient to establish written descriptive support in Villar for the determining step. *See Huston*, 308 F.3d at 1277.

For the foregoing reasons, Villar does not provide written descriptive support for subject matter of claim 7.

Thus, the ’145 patent is not entitled to the benefit of the earlier June 30, 2005 filing date of the ’618 application (from which Villar matured) for the subject matter of claim 7. As a result, Villar, which published on June 26, 2006, more than one year before the 2009 effective filing date of the ’145 patent, is prior art to claim 7.

b. Patentability

Patent Owner does not provide any argument challenging Petitioner’s contention as to the patentability of claim 7. *See generally* PO Resp. 15–19.

“A method for determining a location of features along a rail road track, the method comprising the steps of:”

With regard to the preamble, Petitioner states that “Villar discloses claim 7’s preamble.” Pet. 38. Petitioner relies on contentions made regarding the preamble of claim 1. *Id.*

For the reasons discussed in Section II.E.1.[preamble] where we address the same limitation in claim 1, Petitioner has shown that Villar discloses “[a] method for determining a location of features along a rail road track”.

“(a) determining two reference points, the reference points being features of the rail road track;”

Petitioner states that “Villar [] discloses these limitations of claim 7.” Pet. 38. Petitioner relies on contentions made regarding step (a) of claim 1. *Id.*

For the reasons discussed in Section II.E.1.(a) where we address a similar limitation in claim 1, based on our review of the evidence of record, Petitioner has shown that Villar discloses “determining two reference points, the reference points being features of the rail road track.” The difference between claim 1 and claim 7 is that step (a) of claim 1 calls for “determining *at least* two references” rather than “two reference points” (claim 1). This difference, however, does not materially affect the sufficiency of Petitioner’s showing with respect to step (a) of claim 7.

“(b) verifying a location of the reference points;”

Petitioner states that “Villar [] discloses these limitations of claim 7.” Pet. 39. Petitioner relies on contentions made regarding claim 1, step (b). *Id.*

For the reasons discussed in Section II.E.1.(b) where we address a similar limitation in claim 1, Petitioner shows that Dorum discloses “verifying a location of the reference points.” The “verifying” step in claim 7 is broader than that called for by claim 1. Thus, Petitioner’s showing with respect to step (b) of claim 1 is sufficient with respect to step (b) of claim 7.

Accordingly, for the reasons discussed in Section II.E.1.(b), based on our review of the evidence of record, Petitioner has shown that the combination of disclosures suggests “(b) verifying a location of the reference points,” as claimed.

“(c) performing mathematical interpolation for at least one feature between the reference points;”

Petitioner states that “Villar and Dorum render obvious this limitation of claim 7.” Pet. 39. Petitioner relies on contentions made regarding claim 1, step (d). *Id.*

For the reasons discussed in Section II.E.1.(d) where we address the same limitation in claim 1, based on our review of the evidence of record, Petitioner has shown that the combination of disclosures of Villar and Kennedy suggests “(c) performing mathematical interpolation for at least one feature between the reference points”.

“(d) determining the location of the feature between the reference points.”

Petitioner states that “Villar and Kennedy render obvious this limitation of claim 7.” Pet. 40. Petitioner relies on contentions made regarding claim 1, step (e). *Id.*

For the reasons discussed in Section II.E.1.(e) where we address the same limitation in claim 1, based on our review of the evidence of record,

Petitioner has shown that the combination of disclosures of Villar, Kennedy, and Dorum suggests “(d) determining the location of the feature between the reference points,” as claimed.

For the foregoing reasons, we find a preponderance of the evidence supports Petitioner’s position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 7 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

8. *Claim 8*

“A method as defined in claim 7, wherein a customer track chart is utilized to determine the reference points in step (a).”

Petitioner states that “Villar and Kennedy render obvious this limitation of claim 8, and, together with Dorum render obvious claim 8.” Pet. 40. Petitioner relies on contentions made regarding claim 6. *Id.*

Patent Owner relies on its position with respect to claim 6 and does not provide additional argument challenging Petitioner’s contentions as to claim 8. PO Resp. 24.

For the reasons discussed in Section II.E.6., where we address the same limitation in claim 6, and where we address Patent Owner’s arguments, Petitioner shows that the combination of disclosures of Villar and Kennedy suggests “a customer track chart is utilized to determine the reference points in step (a) [of claim 7],” as claimed.

We find a preponderance of the evidence supports Petitioner’s position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 8 and a sufficient rationale for

combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

9. *Claim 9*

[a] “A method as defined in claim 7, wherein step (c) comprises the steps of: determining a distance between the reference points in feet and miles;”

Petitioner states that “Villar and Kennedy render obvious this limitation of claim 9.” Pet. 40. Petitioner relies on contentions made regarding claim 2, step [a]. *Id.*

For the reasons discussed in Section II.E.2.[a] where we address a similar limitation in claim 2, Petitioner shows that the combination of the disclosures of Villar and Kennedy suggests “determining a distance between the reference points in feet and miles” as claimed.

[b] “determining a ratio of feet per mile using the distance between the reference points; and”

Petitioner states that “Villar and Kennedy render obvious this limitation of claim 9.” Pet. 40. Petitioner relies on contentions made regarding claim 2, step [b]. *Id.*

For the reasons discussed in Section II.E.2.[b] where we address a similar limitation in claim 2, Petitioner shows that, given the common knowledge that the ratio of feet/miles is 5,280/1, the combined disclosures of Villar and Kennedy suggest “determining a ratio of feet per mile using the distance between the reference points” as claimed.

[c] “determining a milepost value for the feature between the reference points.”

Petitioner states that “Villar and Kennedy render obvious this limitation of claim 9, and, along with Dorum render obvious claim 9.”

Pet. 41. Petitioner relies on contentions made regarding claim 2, step [c].
Id.

For the reasons discussed in Section II.E.2.[c], where we address a similar limitation in claim 2, Petitioner shows that the combination of the disclosures of Villar and Kennedy suggests “determining a milepost value for the feature between the reference points,” as claimed.

Patent Owner relies on its position with respect to claim 2 and does not provide additional argument challenging Petitioner’s contentions as to claim 9. PO Resp. 24.

We find a preponderance of the evidence supports Petitioner’s position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 9 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

10. Claim 10

“A method as defined in claim 9, wherein an encoder is utilized to determine the distance between the two reference points in feet and miles.”

With regard to this limitation, Petitioner states that “Villar renders obvious this limitation of claim 10, and, along with Dorum and Kennedy render obvious claim 10.” Pet. 41. Petitioner relies on contentions made regarding claim 5. *Id.*

Patent Owner relies on its position with respect to claim 9 and does not provide additional argument challenging Petitioner’s contention as to claim 10. PO Resp. 24.

For the reasons discussed in Section II.E.5., where we address the same limitation in claim 5, Petitioner shows that Villar discloses using an

encoder to determine the distance between two reference points, and that the combination of Villar and Kennedy suggests “an encoder is utilized to determine the distance between the two reference points in feet and miles” as claimed.

We find a preponderance of the evidence supports Petitioner’s position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 10 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

11. Claim 11

“A method as defined by claim 7, wherein the verification of step (b) is accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points.”

With regard to this limitation, Petitioner states that “Villar and Dorum render obvious these limitations of claim 11, and, along with Kennedy render obvious claim 11.” Pet. 41. Petitioner relies on contentions made regarding claim 1, step (b). *Id.*

Patent Owner relies on its position with respect to claim 1(b) and does not provide additional argument challenging Petitioner’s contention as to claim 11. PO Resp. 25.

For the reasons discussed in Section II.E.1.(b), where we address the same limitation in claim 1, Petitioner shows that the combination of the disclosures of Villar and Dorum suggests “the verification of step (b) [of claim 7] is accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points,” as claimed.

We find a preponderance of the evidence supports Petitioner's position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 11 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

12. Claim 12

"A method as defined in claim 11, wherein the imaging data is received from a system for inspecting a rail road track, the system being mounted on a vehicle for movement along the rail road track."

With regard to this claim, Petitioner states that "Villar discloses these limitations of claim 12, and, along with Dorum and Kennedy renders obvious claim 12." Pet. 42. Petitioner relies on contentions made regarding claim 4. *Id.*

Patent Owner relies on its position with respect to claim 11 and does not provide additional argument challenging Petitioner's contention as to claim 12. PO Resp. 25.

For the reasons discussed in Section II.E.4., where we address the same limitation in claim 4, Petitioner has shown that Villar discloses "the imaging data is received from a system for inspecting a rail road track, the system being mounted on a vehicle for movement along the rail road track," as claimed.

We find a preponderance of the evidence supports Petitioner's position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claim 12 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

Conclusion

On this record, Petitioner has shown by a preponderance of the evidence that claims 1–12 would have been obvious over Villar, Dorum, and Kennedy to one of ordinary skill in the art at the time of the invention.

F. Ground II

Petitioner challenges claim 7 as obvious under 35 U.S.C. § 103 over Schnieder and Dorum. Pet. 42–50.

1. Independent Claim 7

[preamble] “A method for determining a location of features along a rail road track,”

Petitioner states “Schnieder [] discloses claim 7’s preamble.” Pet. 43. In support thereof, Petitioner provides an annotated version of Fig. 1 of Schnieder (Ex.1007), reproduced below, showing a rail-bound vehicle with a device to determine the position of the vehicle, and explains that

As shown below in annotated FIG 1, Schnieder’s device includes sensors 2a, 2b (red) that generate a signal based on the presence of rail components along the track, memory means 5 (orange) to store information about the position of the rail components along the track, an identifying means 6 (navy) to detect and identify the rail components by comparing the signal and the stored information, and a calculating means 7 (green) to determine the position of the vehicle based on the position of the identified rail components. *Id.*, Abstract, 4:14-25, 5:31-6:20.

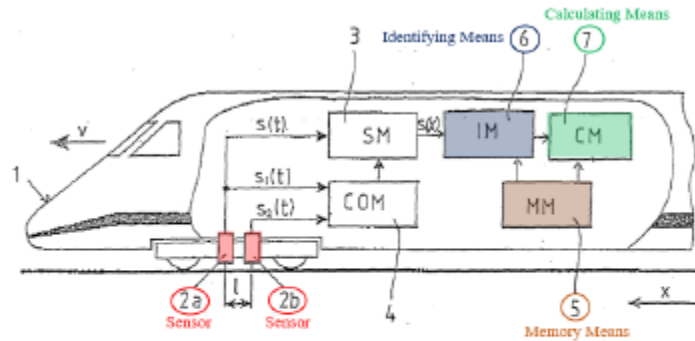


FIG 1

Schnieder, FIG. 1 (annotated).

Patent Owner does not provide any argument challenging Petitioner's contentions. *See generally* PO Resp.

Schnieder discloses, *inter alia*, using a device in a rail-bound vehicle (1) that detects (via sensors 2a and 2b) various features (such as switches, rail joints, and guide rails) of a railroad track, and stores position information about the features. Ex. 1007, 2:26–32:

By storing information in advance, such as position and features, about a number of topological irregularities in the track caused by rail components, such as switches, rail joints, and guide rails, along the possible routes of the vehicle and by identification of these rail components during travelling, the position can be determined with high accuracy and independently of signal systems adapted outside the vehicle.

Accordingly, based on our review of the evidence of record, Petitioner has shown that Schnieder discloses “determining a location of features along a rail road track” as claimed.

“(a) determining two reference points, the reference points being features of the rail road track;”

Petitioner states “Schnieder [] discloses this limitation of claim 7.”
Pet. 45.

Regarding the claim phrase “reference points”, Petitioner contends that the rail components (e.g., “switches, crossings, rail joints, and rail clamps” (Ex. 1007, 23–24)) disclosed in Schnieder are “reference points” as that phrase is used in the ’145 patent specification. Petitioner explains that

Schnieder’s description of detecting locations of rail components for use in determining a location of a vehicle is consistent with the ’145 patent’s description of determining “reference points”. As discussed in Ground 1, claim 1[a], the ’145 patent provides a method of interpolating a location of a point/feature between two or more reference points. The ’145 patent describes, for example, that “once all desired *points of reference* have been marked, mathematical interpolation is performed for the points/features between the *reference points*.” ’145 patent, 14:49-51 (emphasis added). The ’145 patent further explains that “[t]he *reference points* used to determine the location of the crossties in FIG. 20 are railroad crossings. However, any other railroad feature may also be used as a *point of reference*, such as, for example, crossties or spikes.” Id., 15:34-38 (emphasis added).).

Pet. 44.

Patent Owner does not provide any argument challenging Petitioner’s contentions. *See generally* PO Resp.

The ’145 patent states that “any other railroad feature may also be used as a point of reference, such as, for example, crossties or spikes.” Ex. 1001, 15:36–38. This would suggest that the ’145 patent intends “point of reference” to refer to any railroad feature that may be used as reference points. In our view, based on our review of the evidence of record,

Petitioner has shown that that, in light of the '145 Patent specification, the switches, crossings, rail joints, and rail clamps that Schnieder discloses can be “reference points.”

Petitioner further contends that Schnieder’s system uses reference points in a way similar to that disclosed in the '145 Patent. Petitioner explains that

Like the '145 patent, Schnieder’s rail components are used to determine the location of a feature along the railroad track (i.e., the vehicle). Schnieder, claim 3 (emphasis added) (“interpolating the position of the vehicle between the detected rail components”). *See also e.g., id.*, Abstract (“the rail components are detected and identified, and the position of the vehicle is determined based upon the identified rail components and their stored position.”), 2:29-31 (“by identification of these rail components during travelling, the position can be determined with high accuracy).

Pet. 45.

Patent Owner does not provide any argument challenging Petitioner’s contentions. *See generally* PO Resp.

As Petitioner points out, Schnieder discloses, *inter alia*, that “the rail components are detected and identified, and the position of the vehicle is determined based upon the identified rail components and their stored position.” Ex. 1007, Abstract. As Dr. Papanikolopoulos explains,

Based on these disclosures, in my opinion, one of ordinary skill in the art would understand that Schneider’s detected rail components are similar to the reference points of the '145 patent, in which reference points or features (e.g., imaged track features) are used to determine or assess, e.g., an attribute or location of something else (e.g., another feature along the track).

Ex. 1004 ¶ 108.

Given that, based on our review of the evidence of record, Petitioner has shown that, in light of the '145 Patent specification, “reference points” cover the rail components disclosed in Schnieder, and that Schnieder’s system uses reference points in a way similar to that disclosed in the '145 Patent. Petitioner has further shown that Schnieder discloses “(a) determining two reference points, the reference points being features of the rail road track” as claimed.

“(b) verifying a location of the reference points;”

Petitioner states that “Schnieder and Dorum [] render obvious this limitation of claim 7.” Pet. 46.

Petitioner states that “[t]o the extent Patent Owner argues Schnieder does not disclose verifying a location of detected railroad track components, it would have been obvious to one of ordinary skill in the art to do so, as evidenced by, *e.g.*, Dorum.” Pet. 45. Petitioner relies on its explanation with respect to the similar “verifying” limitation in claim 1, step (b). *Id.*; see Section II.E.1.(b).

Patent Owner argues that “Schnieder does not teach verifying a location of the reference points.” PO Resp. 25. But this is not in dispute because Petitioner relies on Dorum, not Schneider, as evidence that it would have been obvious to one of ordinary skill in the art to “verify” the location as claimed. *See* Pet. 45.

In addressing Dorum, Patent Owner relies on its position with respect to the “verifying” step in claim 1. PO Resp. 26.

For the reasons discussed in Section II.E.1.(b), based on our review of the evidence of record, we are persuaded that Petitioner has shown that

Dorum discloses verifying a location of the reference points; e.g., railroad track components, as claimed.

Patent Owner further argues that

Schnieder not only does not disclose the use of GPS signals, Schnieder expressly teaches away from the use of GPS because “[a] disadvantage of that system [GPS] is that the information is not accessible everywhere, in tunnels, for instance,” and “they are dependent upon equipment adapted outside of the vehicle.” [Ex. 1007] at 2. Thus, a POSITA would not look to combine the supposed GPS teachings of Dorum (as Petitioner’s expert contends) in view of the express teaching away from external systems, and in particular GPS, taught by Schnieder.

PO Resp. 27.

The difficulty with this argument is that claim 7 does not call for using GPS in, for example, a tunnel. It is broader than that. Schnieder’s disclosure of “[a] disadvantage of that system [GPS] is that the information is not accessible everywhere, in tunnels, for instance” (Ex. 1007, 2) cannot be a teaching away when the claimed subject matter is not limited to using GPS in areas where accessibility to information is a problem.

In our view, based on our review of the evidence of record, Petitioner has shown that the combination of Schnieder and Dorum suggests “(b) verifying a location of the reference points,” as claimed.

“(c) performing mathematical interpolation for at least one feature between the reference points;”

Petitioner states that “Schnieder discloses performing mathematical interpolation to determine the location of a feature between two known railroad track features.” Pet. 50. Petitioner explains that

Schnieder discloses detecting and storing locations of railroad track components as reference points. Schnieder, 2:26-3:10, 5:35-6:1, 8:11-16. Schnieder explains that the determined

location of the components is used to “*interpolat[e]* the position of [a] vehicle *between* [] detected rail components.” *Id.*, claim 3 (emphasis added), see also, 2:26-3:10.

Pet. 47.

Patent Owner argues that

Schnieder does not perform mathematical interpolation *for a feature of the railroad track* between the reference points, but rather for the determining the position of a vehicle moving along the railway. As would be recognized by a POSITA, a rail-bound vehicle is not a “feature” of a “railroad track.”

PO Resp. 28 (emphasis added).

Schnieder discloses “interpolating *the position of [a] vehicle* between [] detected rail components.” Ex. 1007, 10, claim 3 (emphasis added).

Thus, Patent Owner is correct that Schnieder discloses determining the position of a vehicle, rather than a feature of the railroad track.

However, Petitioner contends that “[t]here is nothing in the intrinsic record suggesting any definition or disclaimer by Applicant limiting the feature to be stationary.” *Id.* at 49.

In other words, Petitioner’s position is that Schnieder would disclose the claim limitation “(c) performing mathematical interpolation for at least one feature between the reference points” if the claim term “feature” is construed as encompassing the position of the vehicle.

In support, Petitioner points out that “the preamble recites ‘features *along* a rail road track,’ not ‘features *of* the rail road track’ [Ex. 1001,] 17:19-20.” Pet. 47–48 (emphasis added).

Petitioner acknowledges that step (a) of claim 7 recites “the reference points being features *of* the railroad track” (*id.* at 49) but argues, inter alia,

that said phrase refers to the claimed reference points, not “at least one feature *between* the reference points” as step (c) calls for.

To be sure, claim 7[a] separately recites “features of *the* rail road track,” but this phrase refers to the claimed reference points, not the “at least one feature between the reference points,” as recited in claim 7[c]. ’145 patent, 17:21-22 (emphasis added), 17:24-25. Furthermore, because Patent Owner chose to use different terminology in claim 7[preamble] and 7[a], it is readily apparent that Patent Owner could have used the same terminology (i.e., “of the rail road track”) in 7[c] but intended that the terms (i.e., claim 7[preamble]’s “features *along* a rail road track” and claim 7[a]’s “*of the* rail road track”) have different scope. Thus, there is no support for limiting claim 7[c]’s “at least one feature,” in such a manner.

Id. at 49.

For its part, other than arguing Schnieder is not directed to a feature *of* the railroad track, Patent Owner does not otherwise challenge Petitioner’s contentions that the ’145 patent does not expressly limit the term “feature” to only features of the track.

We have reviewed the evidence. In our view, a plain reading of the claim weighs against construing the claim term “feature” in step (c) as limited to track components. Step (c) itself does not limit the “feature” to any particular element. Further, step (c) is a step in the “method for determining a location of features *along* a rail road track” (preamble). In that context, when step (c) calls for “performing mathematical interpolation for at least one feature between the reference points,” the “at least one feature between the reference points” needs only to be “along a rail road track” (preamble).

We agree with Petitioner therefore that step (a), which calls for “the reference point [to be] features *of* the rail road track,” does not limit the

scope of the “at least one feature between the reference points” of step (c) but rather covers any feature “along a rail road track.”

Accordingly, based on our review of the evidence of record, since Schnieder discloses “interpolating the position of [a] vehicle between [] detected rail components” (Ex. 1007, 10, claim 3) and said vehicle position is “along a rail road track,” Petitioner has shown that Schnieder discloses “(c) performing mathematical interpolation for at least one feature between the reference points,” as claimed.

“(d) determining the location of the feature between the reference points.”

With regard to limitation (d), Petitioner contends that “Schnieder discloses performing mathematical interpolation to determine the location of a feature between two known railroad track features.” Pet. 50.

Patent Owner does not provide any argument challenging Petitioner’s contention.

Since performing a mathematical interpolation for at least one feature between the reference points necessarily “determin[es] the location of the feature between the reference points,” in our view, it follows that Petitioner has further shown that Schnieder discloses “(d) determining the location of the feature between the reference points,” as claimed.

Conclusion

On this record, we find a preponderance of the evidence supports Petitioner’s position that the combination of Schnieder and Dorum discloses or suggests the subject matter of claim 7 and that Petitioner has articulated a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter.

G. Ground III

Petitioner challenges claims 8 and 9 as obvious under 35 U.S.C. § 103 over Schnieder, Dorum, and Kennedy. Pet. 50–56.

1. Claim 8

“A method as defined in claim 7, wherein a customer track chart is utilized to determine the reference points in step (a).”

Petitioner states that “Schnieder does not specifically disclose using ‘a customer track chart’ to determine the imaged railroad track features of claim 7(a). But it would have been obvious to do so.” Pet. 50. Petitioner relies on Kennedy as evidence that it was well known to implement “localization and mapping systems to incorporate a customer track chart.”

Id. at 51. According to Petitioner,

One of ordinary skill in the art would have been motivated to combine Schnieder and Kennedy because they both refer to railroad tracks. Ex-1004, ¶122. And utilizing an already existing database of customer data, including locations of reference points reduces the memory space required of the storage device in Schnieder, an important feature of localization and mapping systems, like Schnieder’s. Ex-1004, ¶122.

Id. at 51–52.

Patent Owner relies on its position with respect to claim 6 under Ground I and does not provide additional argument challenging Petitioner’s contention as to claim 8. PO Resp. 28–29.

For the reasons discussed in Section II.E.6., where we discuss a similar limitation in claim 6, Petitioner shows that, in light of the ’145 Patent specification, a “customer track chart” gives detailed information, including location, of railroad features. In disclosing using detailed information, including location, of railroad features, Kennedy satisfies the use of a “customer track chart” to determine reference points as required by claim 8.

Kennedy provides an incentive to store a “customer track chart” in Schnieder’s device, in that it ensures Schnieder’s device contains detailed information, including location, of railroad features. As Dr.

Papanikolopoulos explains,

In my opinion, implementing Schnieder’s system to select stored imaged railroad track features from a customer track chart would have yielded the predictable advantage of providing a more populated and detailed geographical database of known locations of various features of the railroad track, as taught by Kennedy. Also, increasing the volume of data about the railroad track provides more reliable information, as taught by Kennedy. One of ordinary skill in the art would have been motivated to combine Schnieder and Kennedy because they both refer to railroad tracks. And utilizing an already existing database of customer data, including locations of reference points reduces the memory space required of the storage device in Schnieder, an important feature of localization and mapping systems, like Schnieder’s.

Ex. 1004 ¶ 122. Pet. 51.

Accordingly, based on our review of the evidence of record, Petitioner has shown that the combination of Schneider and Kennedy suggests “wherein a customer track chart is utilized to determine the reference points in step (a) [of claim 7],” as claimed.

2. Claim 9

[a] “A method as defined in claim 7, wherein step (c) comprises the steps of: determining a distance between the reference points in feet and miles;”

Petitioner states that “Schnieder [] renders obvious this limitation of claim 9.” Pet. 54.

Petitioner contends, *inter alia*, that Schnieder “explains that ‘a conventional tachometer adapted on the wheels’ is used to determine a

velocity of the vehicle and interpolate a location of the vehicle. [Ex. 1007] 6:11-16.” Pet. 52.

Patent Owner relies on its position with respect to claim 2 under Ground I and does not provide additional argument challenging Petitioner’s contention as to claim 9. PO Resp. 29–30.

Schnieder discloses that “[t]o obtain also a positioning between the rail components, the distance between the latest passed rail component and the vehicle is calculated by integrating the velocity of the vehicle. The velocity to be integrated can, for instance, be obtained from a conventional tachometer adapted on the wheels.” Ex. 1007, 6:11–16. Accordingly, Schnieder discloses calculating a distance *via* the results obtained from a tachometer. Schnieder discloses using this technique when “interpolating the position of the vehicle between the detected rail components.” *Id.* at 3:1–10. As Dr. Papanikolopoulos explains,

Schnieder’s device “determines the distance” between rail components, as recited by claim 9[a]. For example, when interpolating the vehicle position between the track components through use of a tachometer or integrating the vehicle velocity, Schnieder specifically refers to “the distance between the track components.” Schnieder, 3:3-5; see also, 3:6-10, 6:12-18. And when interpolating the vehicle position between the detected track components using the number of detected rail clamps, Schnieder discloses detecting and counting the total number of rail clamps between the detected track components representing the distance between the detected track components.

Ex. 1004 ¶ 124. Pet. 53.

With respect to determining a distance between the reference points *in feet and miles*, according to Dr. Papanikolopoulos, “[i]t is [] well-known in the railroad industry to use feet and mile measurement units to facilitate

calculation of the corresponding milepost location of the feature along the railroad track.” Ex. 1004 ¶ 125; Pet. 55.

Given that determining a distance between the reference points in feet and miles was well known in the railroad industry, Petitioner shows that, in determining a distance between the reference points, it would have been obvious to one of ordinary skill in the art given Schnieder to make the determination in feet and miles.

Accordingly, based on our review of the evidence of record, Petitioner has shown that the combination of Schneider and Kennedy suggests “wherein step (c) [of claim 7] comprises the steps of: determining a distance between the reference points in feet and miles,” as claimed.

[b] “determining a ratio of feet per mile using the distance between the reference points; and.”

Petitioner states that “Schnieder [] renders obvious this limitation of claim 9.” Pet. 55.

Patent Owner relies on its position with respect to claim 2 under Ground I and does not provide additional argument challenging Petitioner’s contention as to claim 9. PO Resp. 29–30.

Petitioner contends that it was common knowledge that “there are 5,280 feet in a mile, and that the ratio of feet per mile is 5,280/1 (or 1/5,280 in terms of miles per feet).” Pet. 54. As Dr. Papanikolopoulos explains,

The fact that there are 5,280 feet in a mile, and that the ratio of feet per mile is 5,280/1 (or 1/5,280 in terms of miles per feet), is common knowledge and is certainly understood by one of ordinary skill in the art. Thus, regardless of the determined distance, the ratio of feet per mile would stay the same. Therefore, taking this common knowledge into account, in my opinion, it would have been obvious to one of ordinary skill in the art to use the determined distance between the two reference

points, measured in feet and miles, to determine a ratio of feet per mile.

Ex. 1004 ¶ 127. Pet. 127

In our view, Petitioner shows that, given the common knowledge that “there are 5,280 feet in a mile, and that the ratio of feet per mile is 5,280/1 (or 1/5,280 in terms of miles per foot)” (*id.*), Schnieder suggests determining a ratio of feet per mile using the distance between the reference points.

Accordingly, based on our review of the evidence of record, Petitioner has shown that that the combination of Schneider and Kennedy suggests “determining a ratio of feet per mile using the distance between the reference points,” as claimed.

[c] “determining a milepost value for the feature between the reference points.”

Petitioner states that “Schnieder and Kennedy [] render obvious this limitation of claim 9, and along with Dorum, render obvious claim 9.”

Pet. 56.

Patent Owner relies on its position with respect to claim 2 under Ground I and does not provide additional argument challenging Petitioner’s contention as to claim 9. PO Resp. 29–30.

Petitioner contends that “[u]sing milepost values to represent the location of a railroad feature in the railroad industry was also well-known at the relevant time, as evidenced by, *e.g.*, Kennedy.” Pet. 55. In that regard, Kennedy discloses that “[b]y the 1970’s most transportation agencies had the well-developed milepost (or kilometer-post) measuring systems that are now called linear reference systems.” Ex. 1009, 10. As Dr. Papanikolopoulos explains, “[i]n my opinion, using milepost values to represent the location of a railroad feature in the railroad industry was also

well-known at the relevant time, as evidenced by, *e.g.*, Kennedy.”

Ex. 1004, ¶ 129. Pet. 55.

In our view, Petitioner has shown that, given that it was well known to use milepost values to represent the location of a railroad feature as evidenced by Kennedy, the combination of Schneider and Kennedy suggests “determining a milepost value for the feature between the reference points,” as claimed.

Conclusion

We find a preponderance of the evidence supports Petitioner’s position that the combination of Villar, Kennedy, and Dorum discloses or suggests the subject matter of claims 8 and 9 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

H. Ground IV

Petitioner challenges claims 1 and 3–5 as obvious under 35 U.S.C. § 103 over Schnieder, Dorum, and Nejikovsky. Pet. 56–66.

1. Independent Claim 1

[preamble] “A method for determining a location of features along a rail road track”

Petitioner relies on contentions made under Ground II with respect to the preamble of claim 7. Pet. 56.

Patent Owner does not provide a sufficient basis for challenging Petitioner’s contentions. *See* PO Resp. 30.

For the reasons discussed in Section II.E.1.[preamble] where we discuss the same limitation in claim 7, has shown that Schnieder discloses “[a] method for determining a location of features along a rail road track.”

“(a) determining at least two reference points, the reference points being features of the rail road track;”

Petitioner states that “Schnieder [] discloses these limitations of claim 1.” Pet. 57. Petitioner relies on contentions made under Ground II regarding step (a) of claim 7. *Id.* at 56.

Patent Owner does not provide a sufficient basis for challenging Petitioner’s contentions. *See* PO Resp. 30.

For the reasons discussed in Section II.F.1.(a), where we address a similar limitation in claim 7, Petitioner has shown that Schnieder discloses “determining two reference points, the reference points being features of the rail road track.” The difference is that here step (a) of claim 1 calls for “determining *at least* two references” rather than “two reference points” (claim 7(a)). The difference is immaterial to the sufficiency of Petitioner’s showing with respect to step (a) of claim 1 because, being broader in scope, step (a) of claim 1 necessarily encompasses that of claim 7.

“(b) verifying a GPS location of the reference points, the verification being accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points;”

Petitioner contends that “Schnieder, Nejikovsky, and Dorum [] render obvious this limitation of claim 1.” Pet. 60.

Petitioner relies on Dorum as evidence that the prior art discloses “verifying” “by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points.” *Id.*

For the reasons discussed in Section II.E.1.(b) where we discuss the same limitation in claim 1, Petitioner has shown that Dorum discloses “verifying by comparing imaging data to satellite images of GPS signatures”

as claimed. As we discussed there, Dorum provides a system for verifying geographical location data — by comparing image data to satellite images. Dorum provides an incentive to incorporate its verifying system into the Schnieder device (as modified by Nejikovsky) because it ensures that the location data for railroad features that such a device records are accurate. As Dr. Papanikolopoulos further explains,

The combination would have provided the predictable advantage of more accurate geographical location data of the railroad track features, leading to an increase in the reliability of the information stored in the database, as taught by Dorum. Dorum, Abstract, 2:43-54, 6:51-63, 7:21-39. Dorum specifically teaches that its system may be used to verify geographical locations of “railroad tracks” and other similar transportation regions. Dorum, 5:45-58. And, each of the Schnieder, Nejikovsky, and Dorum’s systems target the application of localization and mapping in the railroad industry. Also, updating an existing geographic database, including verified locations of reference points, provides better accuracy (and fewer errors) in determining locations of unknown points, an important feature of localization and mapping systems, like Schnieder’s and Nejikovsky’s.

Ex. 1004 ¶ 139; Pet. 59.

For the reasons discussed in Section II.E.1.(b), the Schnieder device (as modified by Nejikovsky) with Dorum’s system for verifying geographical locations yields, predictably, a system that records and verifies GPS locations of said reference points. “The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *KSR*, 550 U.S. at 416.

Patent Owner argues that Petitioner has not provided an adequate reason to combine the reference and thereby reach the claimed verifying step because, inter alia, Dorum does not “deal” with railroad tracks. PO

Resp. 30–31. We addressed that argument in Section II.E.1.(3) and, for the reasons discussed there, find it unpersuasive.

Patent Owner argues that Schnieder expressly teaches away from the use of GPS. PO Resp. 32. We addressed that argument in Section II.F.1.(b) and, for the reasons discussed there, find it unpersuasive.

Finally, Patent Owner argues that “Dorum does not disclose or suggest verifying a GPS location of the tiny-scale reference points (e.g., features along a track).” PO Resp. 33. We addressed a similar argument in Section II.E.1.(3) with respect to the combination of Dorum and Villar. As with those references, Patent Owner here argues that “[v]erifying the geographical location of a railroad track, or a similar ‘transportation region,’ [i.e., Dorum] is very different than verifying the geographical location of small-scale features, such as a crosstie, tie plate, or spike, along a railroad track.” PO Resp. 33–34. For the reasons discussed in section II.E.1.(3), the argument is unpersuasive.

For the reasons discussion in those earlier sections, we are unpersuaded by Patent Owner’s arguments that the evidence undermines Petitioner’s position. To the contrary, based on our review of the evidence of record, Petitioner has shown that the combination of Schnieder, Nejikovsky, and Dorum suggests “(b) verifying a GPS location of the reference points, the verification being accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points,” as claimed.

“(c) marking the location of the reference points;”

Petitioner states that “Schnieder and Dorum [] render obvious this limitation of claim 1.” Pet. 61.

Patent Owner does not provide any argument for challenging Petitioner's contentions.

As discussed in Section II.F.1.[preamble] with respect to claim 7 under Ground II, Schnieder discloses, *inter alia*, using a device in a rail-bound vehicle that detects various features (such as such as switches, rail joints, and guide rails) of a railroad track and stores position information about the features in a memory as part of an interpolation process. *See* Ex. 1007, 2:26–32, 5:31–6:1.

By storing position information, Schnieder in effect “mark[s]” the position, according to Dr. Papanikolopoulos, who states that

in my opinion, one of ordinary skill in the art would understand that Schnieder's system marks the geographic location information of certain rail components (i.e., rail clamps), in order to use those locations to interpolate a position of the rail vehicle. Schnieder thus discloses this limitation of claim 1, in my opinion.

Ex. 1004 ¶ 141.

In our view, Petitioner has shown that Schnieder discloses “(c) marking the location of the reference points,” as claimed.

Given that (1) Schnieder discloses storing position data, in effect “marking” those positions; and (2) the combined disclosures of Schnieder, Nejikovsky, and Dorum suggest “(b) verifying a GPS location of the reference points, the verification being accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points,” it would have been obvious to one of ordinary skill in the art to store the “verified” position data, in effect “marking” the “verified” position data.

Accordingly, Petitioner has shown that the combination of Schnieder and Dorum suggests “(c) marking [a verified] location of the reference points” as claimed.

“(d) performing mathematical interpolation for at least one feature between the reference points;”

Petitioner contends that “[a]s discussed in Ground 2, claim 7[c], Schnieder discloses this limitation of claim 1.” Pet. 61.

Patent Owner does not provide any argument for challenging Petitioner’s contention.

For the reasons discussed in Section II.F.1.(c), where we address the same limitation in claim 7, given the explanation advanced by Petitioner for the use of the term “feature,” in our view, Petitioner has shown that Schnieder discloses “(d) performing mathematical interpolation for at least one feature between the reference points,” as claimed.

“(e) determining the location of the feature between the reference points.”

Petitioner contends that “[a]s discussed in Ground 2, claim 7[d], Schnieder discloses this limitation of claim 1, and, along with Nejikovsky and Dorum, renders obvious claim 1.” Pet. 62.

Patent Owner does not provide any argument for challenging Petitioner’s contention. *See generally* PO Resp.

For the reasons discussed in Section II.F.1.(d), where we address the same limitation in claim 7, Petitioner has shown that Schnieder discloses “(e) determining the location of the feature between the reference points,” as claimed.

We find a preponderance of the evidence supports Petitioner’s position that the combination of Schnieder, Dorum, and Nejikovsky

discloses or suggests the subject matter of claim 1 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been established.

2. *Claim 3*

“A method as defined in claim 1, wherein the features are at least one of a crosstie or rail base.”

Petitioner contends that “Schnieder and Nejikovsky [] render obvious the limitation of claim 3, and along with Dorum render obvious claim 3.”

Pet. 62.

Patent Owner does not provide any argument challenging Petitioner’s contention. *See generally* PO Resp.

For the reasons discussed in Section II.E.1.(a), where we address the claim limitation “reference points being features of the rail road track” in step (a) of claim 7 under Ground II, Petitioner demonstrates by a preponderance of the evidence that, in light of the ’145 patent specification, the switches, crossings, rail joints, and rail clamps that Schnieder discloses can be “reference points.”

Petitioner cites Nejikovsky as disclosing other rail components, such as the “rails themselves.” Pet. 60. *See* Ex. 1006, 5:39–40.

In our view, it would have been obvious to one of ordinary skill in the art, given Nejikovsky, that a rail base is a “feature” of a rail road track.

Accordingly, Petitioner has shown that the combination of Schnieder and Nejikovsky suggests “wherein the features are at least one of a crosstie or rail base,” as claimed and, thus, further shows that the combination of Schnieder, Dorum, and Nejikovsky suggests the subject matter of claim 3.

3. *Claim 4*

“A method as defined in claim 1, wherein the imaging data is received from a system for inspecting a rail road track, the system being mounted on a vehicle for movement along the rail road track.”

Petitioner contends that “Schnieder and Nejikovsky [] render obvious claim 4, and, along with Dorum, render obvious claim 4.” Pet. 63.

Patent Owner does not provide any argument challenging Petitioner’s contention.

As Petitioner points out,

Nejikovsky [] discloses that the imaging data are received from a system for inspecting a railroad track, and that *the inspection system is mounted on a vehicle for movement along the track*. Nejikovsky, Title, Abstract, 5:56-62, 56-57, 6:61-63; *see also id.*, 5:60-62 (explaining that camera 14 is “located under a railcar or a vehicle such as a hi-railer that is adapted to travel on the rails 6 and 7 of the railroad track.”).

Id. (emphasis added).

The combination of the Nejikovsky system, which is adapted for receiving imaging data and mounted on a vehicle for movement along the track, with Schnieder’s vehicle, which also moves along a track, yields, predictably, “a system for inspecting a rail road track, the system being mounted on a vehicle for movement along the rail road track” so as to receive imaging data, as claimed.

Accordingly, Petitioner has shown that the combination of Schnieder, Nejikovsky, and Dorum suggests “wherein the imaging data is received from a system for inspecting a rail road track, the system being mounted on a vehicle for movement along the rail road track,” as claimed.

4. *Claim 5*

“A method as defined in claim 3, wherein an encoder is utilized to determine the distance between the two reference points in feet and miles.”

With regard to claim 5, Petitioner argues, *inter alia*, that Nejikovsky discloses an encoder and “[i]t would have been obvious to one of ordinary skill in the art to have implemented Schnieder’s device to determine the distance between reference points using an encoder to provide more accurate information about rail components along the track as taught by Nejikovsky.” Pet. 65. And, although “[n]either Schnieder nor Nejikovsky discloses using measurements having ‘miles’ or ‘feet’ as the units of measurement” (*id.* at 66), “one of ordinary skill in the art at the relevant time would have found it obvious to use either well-known unit of measurement to represent the determined distance between the known reference points” (*id.*).

Patent Owner does not provide any argument challenging Petitioner’s argument.

As discussed in Section II.G.2.[a] with respect to claim 9 under Ground III, Schnieder discloses that “[t]o obtain also a positioning between the rail components, the distance between the latest passed rail component and the vehicle is calculated by integrating the velocity of the vehicle. The velocity to be integrated can, for instance, be obtained from a conventional tachometer adapted on the wheels.” Ex. 1007, 6:11–16.

Nejikovsky discloses an encoder. *See* Ex. 1006, 10:25-34:

The encoder 36 is adapted to detect the rotation of the wheel 2 as the vehicle or railcar travels on the railroad track. The encoder 36 may be implemented as an optical encoder, and functions as a tachometer for the video inspection system 10. For example, the encoder 36 of the illustrated embodiment provides a pulse to the counter/timer device 34 for every 0.5 millimeter of linear

distance traveled by the wheel 2 of the vehicle or railcar on which the video inspection system 10 is implemented.

According to Dr. Papanikolopoulos, “[o]ne of ordinary skill in the art would have understood that Nejikovsky’s encoder converts wheel revolutions of a vehicle to distance travelled by the vehicle, which in turn may be used to interpolate a location between known reference points.” Ex. 1004 ¶ 151.

Nejikovsky’s encoder and Schnieder’s conventional tachometer both measure velocity and use the information to calculate a distance.

“[I]mplementing Schnieder’s device to determine the distance using an encoder would simply provide another well-known technique for obtaining accurate location information of the railroad track components.” *Id.* ¶ 152.

According to Petitioner,

[n]either Schnieder nor Nejikovsky discloses using measurements having ‘miles’ or ‘feet’ as the units of measurement, but, as discussed above regarding claim 9[a] [see Section II.F.2.[a]], one of ordinary skill in the art at the relevant time would have found it obvious to use either well-known unit of measurement to represent the determined distance between the known reference points.

Pet. 66.

In that regard, as we indicated in Section II.G.2.[a], where we discuss claim 9 under Ground III, Dr. Papanikolopoulos has testified that “[i]t is [] well-known in the railroad industry to use feet and mile measurement units to facilitate calculation of the corresponding milepost location of the feature along the railroad track.” Ex. 1004 ¶ 125. Pet. 53. Dr. Papanikolopoulos reiterates the point with respect to claim 5. *See* Ex. 1004 ¶ 153; Pet. 66.

Given that determining a distance between the reference points in feet and miles was well known in the railroad industry, Petitioner shows that, in determining a distance between the reference points, it would have been

obvious to one of ordinary skill in the art for Schnieder or Nejikovsky to make the determination in feet and miles.

Accordingly, based on our review of the evidence of record, Petitioner has shown that the combination of Schnieder, Nejikovsky, and Dorum suggests “wherein an encoder is utilized to determine the distance between the two reference points in feet and miles,” as claimed.

Conclusion

We find a preponderance of the evidence supports Petitioner’s position that the combination of Schnieder, Dorum, and Nejikovsky discloses or suggests the subject matter of claims 3, 4, and 5 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

I. Ground V

Petitioner challenges claims 2 and 6 as obvious under 35 U.S.C. § 103 over Schnieder, Dorum, Nejikovsky, and Kennedy. Pet. 67–68.

1. Claim 2

[a] “A method as defined in claim 1, wherein step (d) comprises the steps of: determining a distance between two reference points in feet and miles;”

Petitioner states “[a]s discussed in Ground 4, claim 1, Schnieder, Dorum, and Nejikovsky render obvious the limitations of claim 1. As discussed in Ground 3, claim 9[a], Schnieder renders obvious this limitation of claim 2.” Pet. 67.

Patent Owner does not provide additional argument challenging Petitioner’s contention. PO Resp. 34.

For the reasons discussed in Section II.G.2.[a], where we address the same limitation in claim 9, Petitioner has shown that Schnieder suggests “wherein step (d) [of claim 1] comprises the steps of: determining a distance between two reference points in feet and miles,” as claimed.

[b] “determining a ratio of feet per mile using the distance between the two reference points;”

Petitioner states “[a]s discussed in Ground 3, claim 9[b], Schnieder renders obvious this limitation of claim 2.” Pet. 67.

Patent Owner does not provide additional argument challenging Petitioner’s contention. PO Resp. 34.

For the reasons discussed in Section II.G.2.[b], where we address the same limitation in claim 9, Petitioner has shown that Schnieder suggests “determining a ratio of feet per mile using the distance between the two reference points,” as claimed.

[c] “determining a milepost value for the feature between the two reference points.”

Petitioner contends “[a]s discussed in Ground 3, claim 9[c], Schnieder and Kennedy render obvious this limitation of claim 2. Thus, Schnieder, Dorum, Nejikovsky, and Kennedy render obvious claim 2.” Pet. 67.

Patent Owner does not provide additional argument challenging Petitioner’s contention. PO Resp. 34.

For the reasons discussed in Section II.G.2.[c] where we address the same limitation in claim 9, Petitioner has shown that the combination of Schnieder and Kennedy suggests “determining a milepost value for the feature between the two reference points,” as claimed.

2. *Claim 6*

“A method as defined in claim 1, wherein a customer track chart is utilized to determine the reference points in step (a).”

Petitioner states “[a]s discussed in Ground 4, claim 1, Schnieder, Dorum, and Nejikovsky render obvious the limitations of claim 1. As discussed in Ground 3, claim 8, Schnieder and Kennedy render obvious this limitation of claim 6. Thus, Schnieder, Dorum, Nejikovsky, and Kennedy render obvious claim 6.” Pet. 67–68.

Patent Owner does not provide additional argument challenging Petitioner’s contention. PO Resp. 35.

For the reasons discussed in Section II.G.1., where we address the same limitation in claim 8, Petitioner has shown that the combination of Schnieder and Kennedy suggests “wherein a customer track chart is utilized to determine the reference points in step (a) [of claim 1],” as claimed, and thus, claim 6 would have been obvious over the combination of Schnieder, Dorum, Nejikovsky, and Kennedy.

Conclusion

We find a preponderance of the evidence supports Petitioner’s position that the combination of Schnieder, Dorum, Nejikovsky, and Kennedy discloses or suggests the subject matter of claims 2 and 6 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

J. Ground VI

1. Claim 10

“A method as defined in claim 9, wherein an encoder is utilized to determine the distance between the two reference points in feet and miles.”

Petitioner challenges claim 10 as obvious under 35 U.S.C. § 103 over Schnieder, Dorum, Kennedy, and Nejikovsky. Pet. 68.

Petitioner states “[a]s discussed in Ground 3, claim 9, Schnieder, Dorum, and Kennedy render obvious the limitations of claim 9. And as discussed in Ground 4, claim 5, Schnieder and Nejikovsky render obvious this limitation of claim 10. Thus, Schnieder, Dorum, Kennedy, and Nejikovsky render obvious claim 10.” Pet. 68.

Patent Owner does not provide additional argument challenging Petitioner’s contention. PO Resp. 35.

For the reasons discussed in Section II.G.4., where we address the same limitation in claim 5, Petitioner has shown that the combination of Schnieder and Nejikovsky suggests “wherein an encoder is utilized to determine the distance between the two reference points in feet and miles,” as claimed.

Conclusion

We find a preponderance of the evidence supports Petitioner’s position that the combination of Schnieder, Dorum, Kennedy, and Nejikovsky renders obvious the subject matter of claim 10 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

K. Ground VII

Petitioner challenges claims 11 and 12 as obvious under 35 U.S.C. § 103 over Schnieder, Dorum, and Nejikovsky. Pet. 69.

1. Claim 11

“A method as defined by claim 7, wherein the verification of step (b) is accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points.”

Petitioner states “[a]s discussed in Ground 2, claim 7, Schnieder and Dorum render obvious the limitations of claim 7. As discussed in Ground 4, claim 1[b], Schnieder, Dorum, and Nejikovsky render obvious this limitation of claim 11. Thus, Schnieder, Dorum, and Nejikovsky render obvious claim 11.” Pet. 69.

Patent Owner does not provide additional argument challenging Petitioner’s contention. PO Resp. 35.

For the reasons discussed in Section II.G.1.[b]., where we address the same limitation in claim 1, Petitioner has shown that the combination of Schnieder, Dorum, and Nejikovsky suggests “wherein the verification of step (b) [of claim 7] is accomplished by comparing imaging data of the reference points to satellite images of GPS signatures of the reference points,” as claimed, and thus, the combination of Schnieder, Dorum, and Nejikovsky suggests the subject matter of claim 11.

2. *Claim 12*

“A method as defined in claim 11, wherein the imaging data is received from a system for inspecting a rail road track, the system being mounted on a vehicle for movement along the rail road track.”

Petitioner states “[a]s discussed in Ground 4, claim 4, Schnieder and Nejikovsky render obvious these limitations of claim 12. Thus, Schnieder, Dorum, and Nejikovsky render obvious claim 12.” Pet. 69.

Patent Owner does not provide additional argument challenging Petitioner’s contention. PO Resp. 36.

For the reasons discussed in Section II.G.3., where we address the same limitation in claim 4, Petitioner has shown that the combination of Schnieder and Nejikovsky suggests “wherein the imaging data is received from a system for inspecting a rail road track, the system being mounted on a vehicle for movement along the rail road track,” as claimed, and thus, the combination of Schnieder, Dorum, and Nejikovsky suggests the subject matter of claim 12.

Conclusion

We find a preponderance of the evidence supports Petitioner’s position that the combination of Schnieder, Dorum, and Nejikovsky discloses or suggests the subject matter of claims 11 and 12 and a sufficient rationale for combining the teachings of the references with a reasonable expectation of success in arriving at the claimed subject matter has been articulated.

III. CONCLUSION⁵

For the foregoing reasons, Petitioner has proven by a preponderance of the evidence that the challenged claims of the '145 patent are unpatentable, as summarized in the following table:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–12	103	Villar, Dorum, Kennedy	1–12	
7	103	Schnieder, Dorum	7	
8, 9	103	Schnieder, Dorum, Kennedy	8, 9	
1, 3–5	103	Schnieder, Dorum, Nejikovsky	1, 3–5	
2, 6	103	Schnieder, Dorum, Nejikovsky, Kennedy	2, 6	
10	103	Schnieder, Dorum, Kennedy, Nejikovsky	10	
11, 12	103	Schnieder, Dorum, Nejikovsky	11, 12	
Overall Outcome			1–12	

⁵ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1–12 of the '145 patent have been proven to be *unpatentable*; and

FURTHER ORDERED that because this is a Final Written Decision, parties to this proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2019-01409
Patent 8,209,145 B2

FOR PETITIONER:

Aaron Parker
David Reese
Nicholas Cerulli
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
aaron.parker@finnegan.com
david.reese@finnegan.com
nicholas.cerulli@finnegan.com

FOR PATENT OWNER:

Rexford Johnson
Dana Herberholz
C. Kevin Speirs
Jordan Stott
PARSONS BEHLE & LATIMER
rjohnson@parsonsbehle.com
dherberholz@parsonsbehle.com
kspeirs@parsonsbehle.com
jstott@parsonsbehle.com