

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

RPX CORPORATION,
Petitioner,

v.

COLLISION AVOIDANCE TECHNOLOGIES INC.,
Patent Owner.

Case IPR2017-01336
Case IPR2017-01337¹
Patent 6,268,803 B1

Before BARRY L. GROSSMAN, MATTHEW R. CLEMENTS, and
MICHELLE N. WORMMEESTER, *Administrative Patent Judges*.

GROSSMAN, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Incorporating Decision on
Petitioner's Motion to Exclude Evidence
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

¹ The parties are not authorized to use this joint heading in subsequent papers. See 37 C.F.R. § 42.6(a)(3) ("Combined motions, oppositions, replies, or other combined documents are not permitted.").

I. INTRODUCTION

In these *inter partes* reviews, instituted pursuant to 35 U.S.C. § 314, RPX Corporation (“Petitioner”) challenges claims 1–10, 17–22, 24, 25, and 28 (“the challenged claims”) of U.S. Patent No. 6,268,803 B1 (Ex. 1001, “the ’803 patent”), owned by Collision Avoidance Technologies, Inc. (“Patent Owner”).

As explained in detail below, there is a substantial overlap of the references applied against the challenged claims in each case. Five of the six references applied against the challenged claims in each case are the same. The two cases, collectively, challenge twenty-two claims; three of the challenged claims (claims 21, 22, and 24) are common to both cases. Thus, in these two cases, there are the same parties, the same patent, substantially the same references, and three common claims. A joint hearing was held for these cases. The parties rely on the same declarants in each case for testimonial evidence. Under these circumstances, we determine that a combined Final Decision will promote a just, speedy, and inexpensive resolution of these proceedings. 37 C.F.R. § 42.1(b).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed below, Petitioner has shown by a preponderance of the evidence that claims 1–10, 17–22, 24, and 28 are unpatentable, but Petitioner has not shown by a preponderance of the evidence that claim 25 is unpatentable. Patent Owner’s Motions to Exclude are *denied*.

A. IPR2017-01336 Procedural History

Petitioner filed a petition (Paper 2² (“Petition” or “Pet.”)) requesting an *inter partes* review of claims 1–8, 21, 22, 24, 25, and 28 of the ’803 patent. Patent Owner filed a Preliminary Response to the Petition. Paper 7 (“Prelim. Resp.”). On November 13, 2017, we instituted an *inter partes* review of all the challenged claims on all of the grounds asserted in the Petition. Paper 8 (“Dec. Inst.”).

Thereafter, Patent Owner filed an Amended Response to the Petition (Paper 22, “PO Resp.”), and Petitioner filed a Reply (Paper 25, “Reply”).

Petitioner filed a Motion to Exclude. Paper 27 (“Mot. Excl.”). Patent Owner filed a Response to the Motion to Exclude. Paper 31 (“PO Resp. Mot. Excl.”). Petitioner filed a Reply. Paper 32 (“Reply Mot. Excl.”).

A joint hearing for IPR2017-01336 and IPR2017-01337 was held August 7, 2018. Paper 34 (“Tr.”).

B. IPR2017-01337 Procedural History

Petitioner filed a Petition (IPR2017-01337, Paper 2 (“1337 Pet.”)) requesting an *inter partes* review of claims 9, 10, 17–22, and 24 of the ’803 patent. Patent Owner filed a Preliminary Response to the Petition. IPR2017-01337, Paper 7 (“1337 Prelim. Resp.”). On November 13, 2017, we instituted an *inter partes* review of all the challenged claims on all of the grounds asserted in the Petition. IPR2017-01337, Paper 8 (“1337 Dec. Inst.”).

² Citations are to IPR2017-01336, unless otherwise noted.

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Thereafter, Patent Owner filed an Amended Response to the Petition (IPR2017-01337, Paper 23 (“1337 PO Resp.”)), and Petitioner filed a Reply (IPR2017-01337, Paper 26 (“1337 Reply”)).

Petitioner filed a Motion to Exclude. IPR2017-01337, Paper 28 (“1337 Mot. Excl.”). Patent Owner filed a Response to the Motion to Exclude. IPR2017-01337, Paper 31 (“1337 PO Resp. Mot. Excl.”). Petitioner filed a Reply. IPR2017-01337, Paper 32 (“1337 Reply Mot. Excl.”).

A joint hearing for IPR2017-01336 and IPR2017-01337 was held August 7, 2018. IPR2017-01337, Paper 34 (“Tr.”).

C. *Related Matters*

The parties identify two related federal district court cases involving the ’803 patent: *Collision Avoidance Technologies Inc. v. Ford Motor Company*, Case No. 6:17-cv-00051 (E.D. Tex. filed January 26, 2017) and *Collision Avoidance Technologies Inc. v. Toyota Motor Sales, USA, Inc.*, Case No. 6:16-cv-00971 (E.D. Tex. filed June 30, 2016). Pet. 2–3; Paper 4, 3. Petitioner states it is not a party in either of these litigations. Pet. 3.

The ’803 patent also is the subject of three additional *inter partes* review petitions. IPR2017-01355, filed by Unified Patents Inc., challenging claims 21, 22, and 24–28; IPR2017-01709, filed by Denso Corporation, challenging claims 1–9, 17–22, and 24–28; and IPR2017-01715, filed by Denso Corporation, challenging claims 1–6, 10, 18–22, 24 and 26–28.

The challenged claims and applied references in the five petitions challenging the ’803 patent are summarized in the chart below.

Case	Petitioner	Challenged Claims	References ³
IPR2017-01336	RPX Corporation	1–8, 21, 22, 24, 25, 28	Naruse Gauthier Tagami Cherry Hayashikura Ramer
IPR2017-01337	RPX Corporation	9, 10, 17–22, 24	Naruse Ramer Lemelson Cherry Gauthier Hayashikura
IPR2017-01355	Unified Patents Inc.	21, 22, 24–28	Hayashikura Cherry JP '265
IPR2017-01709	Denso Corporation	1–9, 17–22, and 24–28	Kikuta Nakajima Yamamoto
IPR2017-01715	Denso Corporation	1–6, 10, 18–22, 24 and 26–28	Ichinose Hayashikura Yamamoto

As shown in the summary chart above, the various challenges are filed by three different petitioners; challenge different claims, with minimum overlap; and rely on different combinations of references, again with minimum overlap.

³ We use the shorthand identification used in each Petition to identify the references asserted. Not all references are asserted against all claims in each case. As necessary, in other sections of this Decision, we provide complete citations of the specific references asserted against each claim.

D. The Asserted Grounds

Petitioner challenges the patentability of claims 1–10, 17–22, 24, 25, and 28 on the following grounds, each of which is based on 35 U.S.C. § 103⁴ (see Pet. 4; 1337 Pet. 4):

Claim(s) Challenged	Reference(s)
1–5, 7, 8, 21	Naruse ⁵
2, 3	Naruse and Gauthier ⁶
6, 7	Naruse and Tagami ⁷
17–20 and 24	Naruse and Cherry ⁸
22, 28	Naruse and Hayashikura ⁹
9 and 25	Naruse and Ramer ¹⁰
10 and 21	Naruse and Lemelson ¹¹
21 and 22	Gauthier and Hayashikura
24	Gauthier and Cherry

⁴ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 296–07 (2011), took effect on September 16, 2012. Because the application for the patent at issue in this proceeding has an effective filing date before that date, we refer to the pre-AIA versions of the statute.

⁵ U.S. Pat. No. 4,674,073, issued June 16, 1987 (Ex. 1003, “Naruse”).

⁶ U.S. Pat. No. 5,303,205, issued April 12, 1994 (Ex. 1004, “Gauthier”).

⁷ U.S. Pat. No. 4,349,823, issued September 14, 1982 (Ex. 1005, “Tagami”).

⁸ U.S. Pat. No. 5,235,315, issued August 10, 1993 (Ex. 1006, “Cherry”).

⁹ U.S. Pat. No. 5,654,715, issued August 5, 1997 (Ex. 1007, “Hayashikura”).

¹⁰ U.S. Patent No. 5,877,849, issued March 2, 1999 (Ex. 1008, “Ramer”).

¹¹ U.S. Pat. No. 6,553,130 B1, issued April 22, 2003 (Ex. 1009, “Lemelson”).

II. ANALYSIS

A. The '803 Patent

The '803 patent discloses a system and method to help drivers of vehicles avoid collisions. The disclosed system and method is a multi-sensor collision avoidance system which combines data from two or more sensors to provide range, range rate, or location information of objects in proximity to a vehicle. Ex. 1001, 1:8–10. To put the disclosed system in a specific context, some embodiments of the disclosed invention are in the context of a tractor-trailer truck. *E.g.*, *id.* at 4:51–63 (tractor-trailer avoiding a post behind the truck; *id.* at 6:29–42 (tractor-trailer backing up to a loading dock).

The basic elements of the disclosed system are shown in Figure 1 from the '803 patent, which is reproduced below.

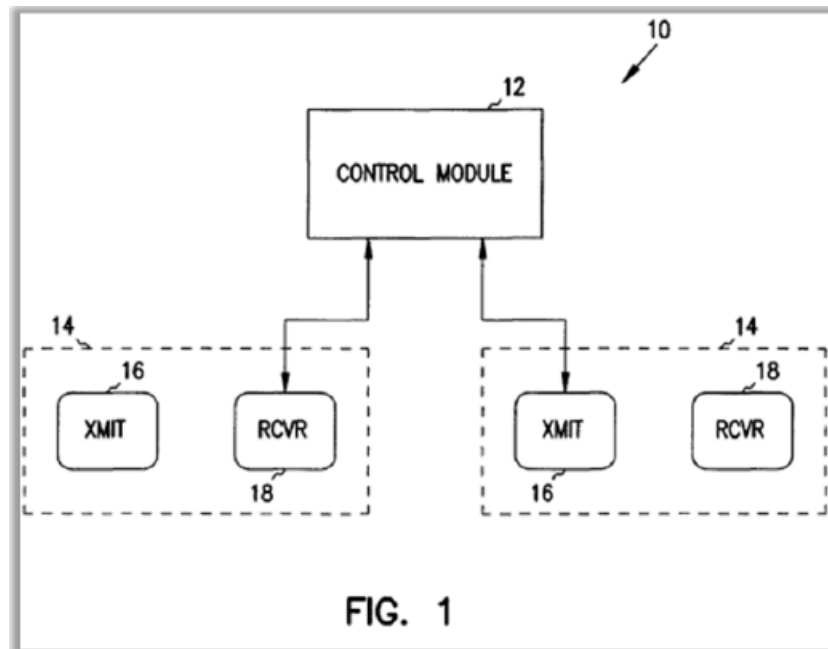


Figure 1 from the '803 patent is a schematic illustration of a control module and two sensors, with each sensor including a transmitter and a receiver.

As shown in Figure 1, collision avoidance system 10 includes control module 12 and at least two sensors 14. Ex. 1001, 3:36–42. Each sensor includes transmitter 16 and receiver 18. *Id.* The sensors may be, for example, acoustic transducers (*id.* at 3:43–44), micropower impulse radar devices (*id.* at 3:54–55), or microwave transceiver devices (*id.* at 3:62–63). A plurality of sensors may be mounted around the periphery of a vehicle. *Id.* at 4:5–7; Fig. 2.

Figure 3 from the '803 patent, reproduced below, shows a system block diagram of a more complete collision avoidance systems, including a plurality of peripheral sensors.

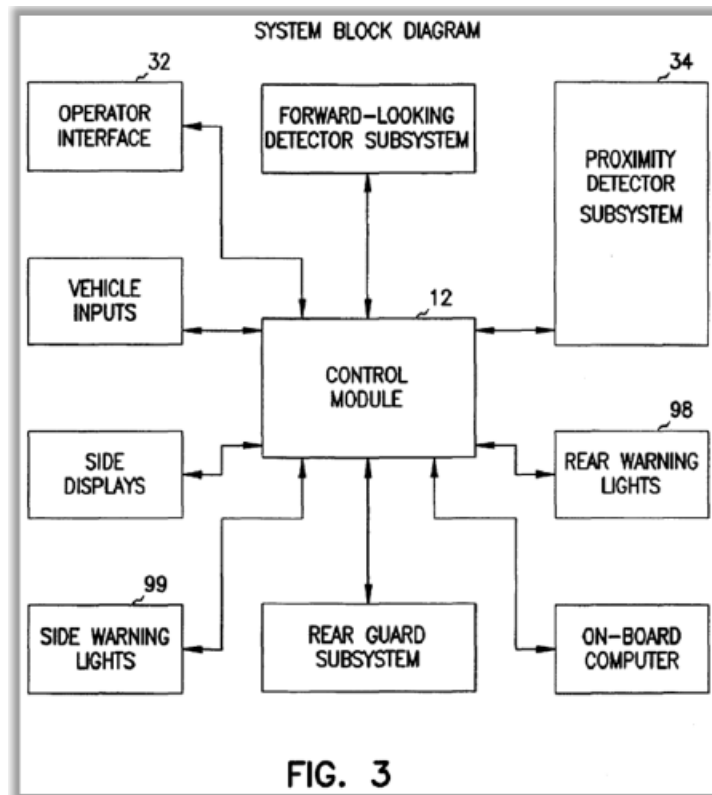


Figure 3 from the '803 patent is a system block diagram of the disclosed collision avoidance system.

As shown in Figure 3, sensors 14 are grouped in peripheral detection subsystems, such as a forward-looking detector subsystem, a proximity detector subsystem, and a rear-guard subsystem. Ex. 1001, 4:15–19. The output of each sensor in each detection subsystem is fed into control module 12. *Id.* at 4:19–20. The system also includes operator interface 32 and optional subsystems, such as rear warning lights 98 and side warning lights 99. *Id.* at 4:21–25.

Control module 12 takes readings from the sensors, triangulates from the data received, and calculates an actual perpendicular distance from the vehicle to an object, and its transverse location. *Id.* at 4:39–42, 60–63. The distance calculated and the “transverse location” of the object are displayed to the driver. *Id.* at 4:60–63; *see also id.* at 5:59–62 (“in one embodiment, control module 12 calculates transverse location and communicates that information via a graphical indicator such as bar graph 22 of FIG. 4a.”). The Specification states that “the transverse location of the object” is a representation of whether the object is “directly behind the vehicle, off to the side, or far enough to the left or right that the driver will not hit it.” *Id.* at 2:12–15.

According to the Specification, the triangulation procedure provides “a precision distance measuring system.” *Id.* at 4:47–48. In order to triangulate, however, the distance between sensors “must be known.” *Id.* at 5:44–45. In general operation, the transmitter of each sensor transmits a signal to its associated receiver, and the receiver receives the signal sent and transmits a return signal. The control module includes measurement

circuitry to process the signals and determine the distance and transverse location of a detected object. *Id.* at 2:49–67.¹²

B. Illustrative Claims

Petitioner challenges claims 1–10, 17–22, 24, 25, and 28. Of the challenged claims, claims 1, 5, 9, 10, 17, and 21 are independent. Independent claims 1, 10, 17, and 21 are directed to a collision avoidance system. Independent claims 5 and 9 are directed to a method. Independent claims 1 and 5 are illustrative and are reproduced below.

1. A collision avoidance system, comprising:
 - a control module;
 - a plurality of transmitting devices connected to the control module, wherein the plurality of transmitting devices includes a first and a second transmitting device, wherein the first and second transmitting devices transmit a first signal and a second signal, respectively;
 - a plurality of receiving devices connected to the control module, wherein the plurality of receiving devices includes a first and a second receiving device, wherein the first receiving device receives a return representative of the signal transmitted from the first transmitting device and transmits to the control module a first return signal representative of the first return and wherein the second receiving device receives a return of the signal transmitted from the second transmitting device and transmits to the control device a second return signal representative of the return; and

¹² We note to ensure full consideration of the entire disclosure of the '803 patent that the patent includes a fifty-one page Certificate of Correction. Ex. 1001, Cert. Correction 48–98. Beginning at column 16, line 64, the Certificate of Correction adds 46 pages of detailed description of the disclosed invention. Numerous other corrections are made to the Specification and drawings.

wherein the control module includes measurement circuitry used to measure the first and second return signals and calculate a transverse location of an object as a function of said first and second return signals and further wherein the control module includes a display means for displaying the transverse location.

5. In a collision avoidance system having a plurality of sensors, including a first and a second sensor, a method of displaying a transverse location, comprising the steps of:

- placing the system proximate an object;
- transmitting a signal from the first sensor to said object;
- sensing a return from the object of the signal transmitted from the first sensor and generating a first return signal as a function of the sensed return of the signal transmitted from the first sensor;
- transmitting a signal from the second sensor to said object;
- sensing a return from the object of the signal transmitted from the second sensor and generating a second return signal as a function of the sensed return of the signal transmitted from the second sensor;
- calculating a transverse location as a function of the first and second return signals; and
- displaying an indication of the calculated transverse location.

C. Motions to Exclude

Before addressing the substance of claim construction, we first address Petitioner's Motions to Exclude Evidence directed to claim construction.¹³

¹³ The Motion to Exclude filed in IPR2017-01337 is substantively identical to the Motion to Exclude filed in IPR2017-01336. For brevity, we cite only to the briefing in IPR2017-01336.

Petitioner moves to exclude Exhibit 2004, a deposition transcript of Mr. Myles Kitchen, a proffered expert from a different, pending, *inter partes* review proceeding, IPR2017-01355, filed by a different petitioner but also involving the '803 patent.¹⁴ Mot. Excl. 1. Petitioner also moves to exclude portions of the record that reference Exhibit 2004. *Id.* According to Petitioner, Exhibit 2004 “is improper hearsay under FRE 802, not relevant under FRE 402, and confuses the issues and wastes time under FRE 403.” *Id.*

Patent Owner argues that Mr. Kitchen’s testimony falls within the hearsay exception of (1) Rule 804(b)(3)(A) because he is “unavailable” only because Petitioner did not subpoena him for deposition; and (2) Rule 807 because it meets the four-part test of the residual exception. PO Resp. Mot. Excl. 1–5.

With few exceptions, the Federal Rules of Evidence apply to *inter partes* proceedings. 37 CFR § 42.62. The moving party has the burden of proof to establish that it is entitled to the requested relief. 37 C.F.R. § 42.20(c), 42.62(a).

We have considered the parties’ arguments and evidence and, as explained below, deny the Motion to Exclude Exhibit 2004. Instead, we

¹⁴ To avoid any confusion, we note that Patent Owner’s Exhibit List identifies “Exhibit No. SMT 2003” as the “Deposition Transcript of Mr. Myles Kitchen.” PO Resp., v. Exhibit 2003 in this proceeding is the Declaration of Patent Owner’s expert, Mr. Greg C. Pfeiffer. *See* Ex. 2003. Exhibit 2004 in this proceeding is the deposition transcript of Mr. Kitchen in IPR2017-01355.

give Mr. Kitchen's deposition testimony, and all reliance on it in this proceeding, no probative weight.

Our general approach for considering challenges to the admissibility of evidence was outlined in *Corning Inc. v. DSM IP Assets B.V.*, IPR2013-00053, Paper 66 at 19 (PTAB May 1, 2014). As stated in *Corning*, similar to a district court in a bench trial, the Board, sitting as a non-jury tribunal with administrative expertise, is well-positioned to determine and assign appropriate weight to evidence presented. *Id.* (citing *Donnelly Garment Co. v. NLRB*, 123 F.2d 215, 224 (8th Cir. 1941) (stating, in the context of reviewing an administrative determination of the National Labor Relations Board based on findings by a Trial Examiner, "We think that experience has demonstrated that in a trial or hearing where no jury is present, more time is ordinarily lost in listening to arguments as to the admissibility of evidence and in considering offers of proof than would be consumed in taking the evidence proffered . . . One who is capable of ruling accurately upon the admissibility of evidence is equally capable of sifting it accurately after it has been received . . ."))).

Moreover, "there is a strong public policy for making all information filed in an administrative proceeding available to the public." *Liberty Mut. Ins. Co. v. Progressive Cas. Ins. Co.*, CBM2012-00010, Paper 59 at 40 (PTAB February 24, 2014). Rather than excluding evidence that is allegedly confusing, misleading, untimely, and/or irrelevant, we will simply not rely on it or give it little or no probative weight, as appropriate, in our analysis. "In an *inter partes* review, we regard it as the better course to have a complete record of the evidence to facilitate public access, as well as

appellate review.” *Sony Computer Entm’t Am. LLC v. Game Controller Tech. LLC*, IPR2013-00634, Paper 32 at 31 (PTAB Apr. 14, 2015); *see also Gnosis S.p.A. v. S. Alabama Med. Sci. Found.*, IPR2013-00118, Paper 64 at 43 (PTAB June 20, 2014) (citing *Donnelly*, 123 F.2d at 224 (“If the record on review contains not only all evidence which was clearly admissible, but also all evidence of doubtful admissibility, the court which is called upon to review the case can usually make an end of it, whereas if evidence was excluded which that court regards as having been admissible, a new trial or rehearing cannot be avoided.”))).

The petition in IPR2017-01355, the proceeding in which Mr. Kitchen was deposed, was filed by a different petitioner than the Petitioner in the proceeding before us.¹⁵ Although there are two references common to both cases, these two cases involve different bases of asserted unpatentability.¹⁶ The common element between IPR2017-01355 and the proceeding before us is that both involve the ’803 patent. Patent Owner argues that “Mr. Kitchen’s deposition testimony is more probative on the points for which it

¹⁵ The petitioner in the case before us is RPX Corporation. The petitioner in IPR2017-01355 is Unified Patents Inc. There is no evidence before us that these two different petitioners are related in way.

¹⁶ Both cases rely on Hayashikura and Cherry. In the case before us, the asserted grounds using these common references are obviousness based on Naruse and Hayashikura and obviousness based on Naruse and Cherry. In IPR2017-01355, the asserted grounds using these common references are obviousness based on Hayashikura alone and obviousness based on Hayashikura and Cherry.

is offered than any other evidence than Patent owner can obtain through reasonable efforts.” PO Resp. Mot. Excl. 5. We disagree.

In the case before us, Petitioner relies on the expert testimony of Dr. Papanikolopoulos.¹⁷ See Exs. 1002, 1011. Patent Owner deposed Dr. Papanikolopoulos. See Ex. 2005. Patent Owner relies on the expert testimony of Mr. Pfeiffer.¹⁸ See Ex. 2003. Petitioner deposed Mr. Pfeiffer. See Ex. 1013.

¹⁷ Dr. Papanikolopoulos is a McKnight Presidential Endowed Professor in the Department of Computer Science and Engineering at University of Minnesota. Ex. 1002 ¶ 1. He also serves as Director for the Center for Distributed Robotics. *Id.* In 1992, Dr. Papanikolopoulos earned his Ph.D. in Electrical and Computer Engineering. *Id.* ¶ 10. Over the last twenty three years, his research and teaching work has focused on computer vision, intelligent transportation systems, and robotics. *Id.* ¶ 11. This research has included autonomous vehicles and collision avoidance systems. *Id.* Dr. Papanikolopoulos is a Senior Editor of the IEEE journal of Transactions on Intelligent Transportation Systems. *Id.* ¶ 12. He previously served as Associate Editor of this journal for twelve years. *Id.* We find that Dr. Papanikolopoulos is qualified, based on his experience, training, and education to testify in the form of an opinion on issues where his scientific, technical, and other specialized knowledge will help the Board, as trier of fact, understand the evidence or to determine a fact in issue. Fed. R. Evid. 702.

¹⁸ Mr. Pfeiffer earned an Electronics Engineering Technology associate's degree from Rochester Community College. Ex. 2003 ¶ 3. He has work experience as a Test Engineer, Senior Design Engineer, Project Engineer, and Engineering Manager. *Id.* Mr. Pfeiffer “designed hardware and firmware for collision-avoidance systems, as early as 2004, and at least part time through 2008.” *Id.* at ¶ 4. We find that Mr. Pfeiffer is qualified, based on his experience, training, and education to testify in the form of an opinion on issues where his scientific, technical, and other specialized knowledge will help the Board, as trier of fact, understand the evidence or to determine a fact in issue. Fed. R. Evid. 702.

Patent Owner cites Mr. Kitchen's deposition testimony as support for its proposed construction of the claim terms "control module" and "fuses data." PO Resp. Mot. Excl. 3–4. Mr. Kitchen's direct Declaration testimony is *not* of record in the case before us. Dr. Papanikolopoulos testified and opined about these same claim terms. Ex. 1002 ¶¶ 58–62, 65–66; Ex. 1011 ¶¶ 14–30. Dr. Papanikolopoulos also was deposed by Patent Owner concerning his opinions on construction of these claim terms. *E.g.*, Ex. 2005, 15:6–21:15. Mr. Pfeiffer, Patent Owner's proffered expert in the proceeding before us, also testified on these same claim construction issues. Ex. 2003 ¶¶ 18–30. Petitioner deposed Mr. Pfeiffer on these terms. *E.g.*, Ex. 1013, 40:5–46:1. Thus, we have a fully developed record in this case on construction of the claim terms at issue, with direct testimony and cross-examination testimony of the parties' chosen experts.

Patent Owner offers no persuasive evidence or argument that the selected excerpts of Mr. Kitchen's deposition testimony in IPR2017-01355 are "more probative" on the points for which it is offered (PO Resp. Mot. Excl. 5) than the direct and cross-examination testimony of Patent Owner's chosen expert in this case, Mr. Pfeiffer, or Petitioner's chosen expert, Dr. Papanikolopoulos. Given the fact that Patent Owner already has obtained, through reasonable efforts, the testimony of its chosen expert, Mr. Pfeiffer, and the cross-examination testimony of Dr. Papanikolopoulos, on these exact same claim construction issues, we find that here is no basis for Patent Owner's argument that Mr. Kitchen's testimony is more probative than "any other evidence than Patent owner can obtain through reasonable efforts." *Id.*

Thus, contrary to Patent Owner's argument (PO Resp. Mot. Excl. 5), there is no persuasive argument or evidence that Mr. Kitchen's selective deposition testimony in IPR2017-01355 is more probative than the complete direct testimony and cross-examination of Patent Owner's chosen expert, Mr. Pfeiffer, and Petitioner's expert, Dr. Papanikolopoulos, in this case.

Accordingly, based on our analysis above, we deny Patent Owner's Motions to Exclude. Instead, we accord Mr. Kitchen's deposition testimony, and all reliance on it in this proceeding, no probative weight.

D. Level of Skill in the Art

Petitioner proposes that a person of ordinary skill in the art at the time of the alleged invention would have had (a) a bachelor's degree in electrical engineering, mechanical engineering, computer engineering, or computer science (or a closely related field) with at least three years of experience working in vehicle or robotic sensor technology; (b) a master's degree in these same disciplines with at least two years of working experience; or (c) a Ph.D. in these same disciplines with no work experience. Pet. 16–17 (citing Ex. 1002 ¶¶ 51–53). Dr. Papanikolopoulos testifies that in opining on the level of ordinary skill he considered: (a) the types of problems encountered by those working in the field and prior art solutions thereto; (b) the sophistication of the technology in question and the rapidity with which innovations occur in the field; (c) the educational level of active workers in the field; and (d) the educational level of the inventor. Ex. 1002 ¶ 51. He also balanced education and work experience to define “approximate” skill levels. *Id.* ¶ 53.

Patent Owner did not propose a specific level of skill in its Patent Owner Response. *See* Tr. 30:17–31:3. Counsel for Patent Owner stated it had no dispute with the level of skill proposed by Petitioner and adopted in our Decision to Institute this proceeding. *Id.* at 31:3–14.

Based on the record and evidence before us, we adopt Petitioner’s proposed level of skill because it reflects the considerations behind it, it is a balanced consideration of education and relevant work experience, and it is consistent with the ’803 patent and the asserted prior art. Accordingly, we determine that a person of ordinary skill in the relevant technology would have had (a) a bachelor’s degree in electrical engineering, mechanical engineering, computer engineering, or computer science (or a closely related field) with at least three years of experience working in vehicle or robotic sensor technology; (b) a master’s degree in these same disciplines with at least two years of working experience; or (c) a Ph.D. in these same disciplines with no work experience.

E. Claim Construction

The Petitions in these proceedings were filed on May 2, 2017. Paper 3; IPR2017-01337, Paper 3. Thus, under the rules applicable to these Petitions at the time they were filed, we would have construed the claims by applying the broadest reasonable interpretation in light of the specification. 37 C.F.R. § 42.100(b) (2016). The patent application that matured into the ’803 patent, however, was filed on August 6, 1998. *See* Ex. 1001, 1 (INID Code “(22)”). Accordingly, the ’803 patent expired on August 6, 2018. 35 U.S.C. § 154(a)(2). Thus, in this specific circumstance, we construe the claims in the ’803 patent in accordance with the principles followed in

district court. *See In re CSB-Sys. Int'l, Inc.*, 832 F.3d 1335, 1341 (Fed. Cir. 2016), *cert. denied sub nom. CSB-Sys. Int'l, Inc. v. Lee*, 137 S. Ct. 1384, 197 L. Ed. 2d 555 (2017) (“When a patent expires during a reexamination proceeding, the PTO should thereafter apply the *Phillips*¹⁹ standard for claim construction.”). “[O]nce a patent expires, the PTO should apply *Phillips* standard for claim construction.” *Id.* at 832 F.3d 1342. *See also Facebook, Inc. v. Pragmatus AV, LLC*, 582 Fed.Appx. 864, 868–69 (Fed. Cir. 2014) (non-precedential) (applying *Phillips* standard when patent expired after the Board’s reexamination decision pending appeal to the Federal Circuit).

In its Petitions, Petitioner proposes constructions for the following claim terms: “control module” (Pet. 17–20); “transverse location” (*id.* at 20–21); “fuses data” (*id.* at 21–22); and “display means” (*id.* at 22–23). In its Reply, Petitioner further discusses constructions for “control module” (Reply 3–9) and “fuses data” (*id.* at 9–11).²⁰ Dr. Papanikolopoulos, Petitioner’s expert, discusses claim constructions in both his Declaration testimony (Ex. 1002 ¶¶ 57–69) and his Supplemental Declaration testimony (Ex. 1011 ¶¶ 14–30). In his initial Declaration, filed on May 2, 2017, *before* the ’803 patent expired, Dr. Papanikolopoulos stated he construed the claims under their “broadest reasonable interpretation (BRI).” At his deposition, Dr. Papanikolopoulos testified that his proposed claim constructions

¹⁹ *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

²⁰ Petitioner proposed the same terms and construction in IPR2017-01337. 1337 Pet. 20–25.

“remained the same” under either the BRI or *Phillips* standards. Ex. 2005, 19:15–20:18. Dr. Papanikolopoulos testified that his claimed constructions remained the same because they were based “on the spec” and the “understanding of a POSITA”²¹. *Id.* at 21:8–10.

Patent Owner proposes constructions for the following ten claim terms: “location;” “distance;” “fuses data;” “control module;” “sensor;” “measure;” “detects an object;” “calculates a distance to . . . the object;” “transverse location;” and “calculates a . . . location of the object.” PO Resp. 5–11; 1337 PO Resp. 5–11.

For six of the proposed constructions (“control module,” “sensor;” “measure;” “detects an object;” “calculates a distance to . . . the object;” and “calculates a . . . location of the object.”), Patent Owner incorporates the claim construction from its Preliminary Response. *Id.* at 9–11.

Incorporation by reference is a direct violation of our rules, which prohibit incorporation by reference from other documents. 37 C.F.R. § 42.6(a)(3).

E.g., see Apple, Inc. v. Ameranth, Inc., CBM2014-00013, Paper 37, 8 (PTAB March 20, 2015), *aff’d-in-part, rev’d-in-part* on other grounds, 842 F.3d 1229 (Fed. Cir. 2016) (“Patent Owner attempts to incorporate certain arguments made in its Preliminary Response (Paper 13) into the Patent Owner Response. Our rules prohibit incorporating arguments by reference.”). As explained in *Apple*, “[i]ncorporation by reference circumvents our rule limiting the pages [or words] in the Patent Owner response.” *Id.* “Arguments that are not developed and presented in the Patent Owner Response, itself, are not entitled to consideration.” *Id.*; *see*

²¹ The acronym for a person of ordinary skill in the art.

also DeSilva v. DiLeonardi, 181 F.3d 865, 866-67 (7th Cir. 1999) (stating that incorporation “by reference amounts to a self-help increase in the length of the [] brief[,]” and “is a pointless imposition on the court's time.”).

Accordingly, we do not consider any proposed constructions that fail to comply with our rules.

For the proposed construction of “transverse location,” Patent Owner provides no evidence to support its argued construction. PO Resp. 11 (stating only that “Because the addition of ‘transverse’ to location suggests the closest location normal to the vehicle, the term ‘transverse location’ should be construed to mean ‘the position of an object relative to the closest portion of the vehicle.’”).

In our Decisions to Institute, we held that an explicit construction of claim terms was not necessary for the purposes of determining whether there is a reasonable likelihood that the Petitioner would prevail with respect to at least one of the claims challenged in the Petition. Dec. Inst. 11; 1337 Dec. Inst. 12. Instead, we stated that “claim construction, in general, is an issue to be addressed at trial. Claim construction will be determined at the close of all the evidence and after any hearing.” *Id.* All the evidence and arguments are now in the record. At the hearing, Petitioner emphasized only two disputed claim construction issues, the construction of the terms “control module” and “fuses data.” *E.g.* Tr. 8:22–9:18. According to Petitioner, the other terms in the claims “haven't actually arisen into controversy.” *Id.* at 9:9–18.

“When the parties present a fundamental dispute regarding the scope of a claim term, it is the court's duty to resolve it.” *O2 Micro Int’l Ltd. v.*

Beyond Innovation Tech. Co., 521 F.3d 1351, 1362 (Fed. Cir. 2008).

Accordingly, we determine that an explicit construction of only two terms, “control module” and “fuses data,” is necessary for the purposes of determining whether the challenged claims would have been obvious in view of the cited references. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (we need to construe only those terms “that are in controversy, and only to the extent necessary to resolve the controversy.”).

1. Control Module

In the Decisions to Institute a trial in these cases, we did not construe the term “control module.” Similarly, in IPR2017-01355, we also did not construe this term. In the decisions to institute a trial in IPR2017-01709 and IPR2017-01715, however, we did construe the term “control module” as used in the ’803 patent. In those two decisions to institute, we construed to the term “control module” to mean “circuitry for interfacing with sensors, performing calculations, and displaying information or interfacing with a display.” See *Denso Corp. v. Collision Avoidance Techs.*, IPR2017-01709, Paper 7, slip op. at 24 (PTAB Jan. 23, 2018) (“1709 DI”).²²

Petitioner asserts that the proper construction of the claim term “control module” is “a processor or microcontroller and accompanying components or circuitry.” Pet. 19–20; Reply 3. Alternatively, Petitioner states it agrees with the Board’s construction of the term “control module” in

²² This same construction also was adopted in the decision to institute a trial in the related case of IPR2017-01715. See *Denso Corp. v. Collision Avoidance Technologies*, IPR2017-01715, Paper 7, slip op. at 30–31 (PTAB Jan. 23, 2018) (“*Denso*, 1715”).

the related case IPR2017-01709. Reply 3–4 (“Petitioner agrees that the Board’s construction [in *Denso*, 1709] is also proper in view of the various embodiments disclosed in the ’803 patent specification.”).

Patent Owner asserts that the proper construction of “control module” is a “customized PC.” PO Resp. 9–10. Alternatively, Patent Owner also states “that we could live with the construction” of “control module” in the 1709 DI.²³ Tr. 35:10–12. Thus, at the hearing, Patent Owner stated an alternative “appropriate construction” for the term “control module” is “circuitry for interfacing with sensors performing measurements, detections, calculations and displaying information or interfacing with a display.” 1709 DI at 14–17.

Thus, both Petitioner and Patent Owner appear to agree that a correct construction of the term “control module” is the Board’s preliminary construction in IPR2017-01709.

In its Reply, Petitioner asserts why it disagrees with Patent Owner’s proposed construction of “control module” as a “customized PC.” Reply 4–9 (citing Ex. 1002 ¶¶58–62; Ex. 1011 ¶¶18–21).

Under the *Phillips* standard, words of a claim are generally given their ordinary and customary meaning. *Phillips*, 415 F.3d at 1312 (“the words of a claim are generally given their ordinary and customary meaning”) (citations and internal quote marks omitted). “[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person

²³ To put Patent Owner’s statement in its proper context, see colloquy in the Transcript. Tr. 34:11–20 (stating that Patent Owner’s reference and discussion of the Board’s decision in *Denso* on its demonstrative slide No. 3 refers to *Denso*, 1709 and *Denso*, 1715).

of ordinary skill in the art in question at the time of the invention.”

Id. at 1313. Importantly, the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification. *Id.*

To provide the ordinary and customary meaning of disputed terms, we look to “the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art.” *Phillips*, 415 F.3d at 1314 (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004)).

Ultimately, the interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim. The construction that stays true to the claim language and most naturally aligns with the patent’s description of the invention will be, in the end, the correct construction.

Renishaw PLC v. Marposs Societa’ per Azioni, 158 F.3d 1243, 1250 (Fed. Cir. 1998) (citations omitted).

a. The Claims

We begin with the words of the claims. The term “control module” appears in independent claims 1, 10, 17, and 21. It does not appear in independent claims 5 and 9.

The “control module” limitations in claims 1, 10, 17, and 21 are similar. The claims recite (1) that a “control module” is a positive element of the claim (“a control module”); (2) that transmitting devices and receiving devices, or transceivers, are connected to the control module and send

signals to the control module; and (3) specific functions of the control module. *Id.* at 1001, 17:7–32; 18:30–55; 19:17–29, 20:11–14.

Claim 1, for example, recites that the control module “includes measurement circuitry” used to measure signals, calculate a location, and display the location. *Id.* at 17:26–31. “Measurement circuitry” arguably adds some structure to perform the recited functions.

Claim 21, for example, recites that the control module performs the following functions: “measures” signals; “detects” an object as a function of the measured signals; “calculates” a distance to and location of the object; and “displays” the distance to and location of the object. *Id.* at 20:11–14.

b. The Specification

The ’803 patent describes several different embodiments, demonstrating the breadth of the claimed control module.

The Specification describes the control module as circuitry that interfaces with a variety of sensors, performs calculations, and either displays information or interfaces with a display. Ex. 1001, 4:9–11 (control module interfaces with sensors), 4:20–22 (same), 4:39–40 (same), 4:40–42 (control module calculates), 4:57–60 (same), 5:16–19 (same), 5:29–31 (same), 5:53–54 (same), 4:60–61 (control module includes display), 5:59–6:6 (same), 6:6–10 (control module communicates with interface unit for display).

In one embodiment, control module 12 is highly programmable and dealers and fleet owners are given an ability to program key parameters that the system can use to more adequately address the needs of that application and the customer. *Id.* at 8:20–31. In another embodiment, if there is no on-

board computer, data storage is provided in control module 12 so that it can store the data internally. *Id.* at 8:64–66. The Specification also discloses that “[p]rocessor speed, memory, and interface drivers will determine the CM [control module] configuration *based on a nominal set of performance requirements and hardware/cost tradeoffs.*” *Id.*, Cert. Corr., 18 (emphasis added).

As support for its proposed construction of “control module” as a “customized PC,” Patent Owner argues “[i]n 1998, a customized PC would have been required to perform all of this functionality.” PO Resp. 10 (citing “Pfeiffer Decl. [Ex. 2003], ¶ 38, p. 9. *See also id.*, at ¶¶ 32–37, 39.”). In paragraph 38, which appears on page 12 of Mr. Pfeiffer’s Declaration, Mr. Pfeiffer testifies that “Naruse fails to disclose a control module of adequate processing capability.” Ex. 2003 ¶ 38. This testimony is not relevant to, or persuasive of, the correct construction of the term “control module” in the ’803 patent. Paragraphs 32–37 of Mr. Pfeiffer’s Declaration also concern the Naruse disclosure. *See, e.g., id.* at ¶ 32 (“Naruse does not disclose a customized PC”). Cited paragraph 39 of Mr. Pfeiffer’s Declaration concerns the disclosure of the Gauthier reference. Thus, Patent Owner’s Response cites no evidence persuasive of its assertion that the term “control module” is a “customized PC.”

The Specification states:

The CM [control module] is a customized PC. *Processor speed, memory, and interface drivers will determine the CM configuration based on a nominal set of performance requirements and hardware/cost tradeoffs.* A functional diagram of the CM 280 is shown in Figure 28. The CM 280

consists of two primary elements: an Interface Card 282 and the Processor Board 284.

Id. at 15 (citing Ex. 1001, Cert. Corr. 18) (emphasis added). This statement appears in a “SYSTEM DESCRIPTION” and is followed by reference to Figure 28: “A functional diagram of the CM 280 is shown in Figure 28.” *Id.*

This passage appears as part of the description of a “Collision Warning System.” *See id.* at Cert. of Correction 4–45. Although that description does not appear to limit itself to a particular embodiment, that it does so is evident in comparison to the preceding portions of the Specification, which describe the invention much more generally. *Compare* Ex. 1001, 3:37–16:64, *with id.* at Cert. of Correction 4–45.

The control module performs various signal/data processing functions, including “data fusion” and operating the display driver. *Id.* at Cert. Corr. 19. In one embodiment of the system, control module 12 takes the readings from rear-mounted sensors 14, determines whether it can triangulate, and calculates an actual perpendicular distance from a vehicle to a detected object. *Id.* at 4:36–41; *see also, e.g.*, 4:57–60 (“Control System 12 calculates that the actual distance to the post as 5.2 feet and determines it is located just to the right of the center of the trailer.”).

To provide more accurate information, in one embodiment, control module 12 calculates transverse location and communicates that information via a graphical indicator such as bar graph. *Id.* at 5:58–63. In addition, control module 12 tests its internal circuitry to ensure “that the system comes up running.” *Id.* at 9:15–16.

We understand Patent Owner not to assert that every detail of the system description written description, including the Certificate of

Correction, is required by every claim. Moreover, Mr. Pfeiffer, Patent Owner's declarant, testified at his deposition that the term "PC" was a "marketing term defined by IBM for [a] personal computer." Ex. 1013, 43:9–11. He also testified that a "POSITA" would identify the term "customized PC as a marketing term." *Id.* at 43:12–16. Mr. Pfeiffer also testified that, "[f]rom a 'technical perspective, I don't think it [the term customized PC] means much. A PC is defined in 1998 as a processor with a certain amount of processing power and the appropriate peripherals.'" *Id.* at 43:18–24.

Patent Owner has provided no persuasive evidence for selectively gleaning the phrase "customized PC" from the numerous disclosed embodiments, at least one of which does *not* use a PC (*see id.*, 8:64–67) or from the extensive disclosure of the "Control Module Functional Description." *See* Ex. 1001, Cert. Correction 18–45.

Read as a whole, the Specification describes multiple possible embodiments for the control module. Those embodiments encompass "a customized PC" as Patent Owner seeks to have the term construed, but they are not limited to a customized PC. *See, e.g.*, Ex. 1001, 8:20–24 ("In one embodiment, control module 12 is highly programmable and dealers and fleet owners are given an ability to program key parameters that the system can use to more adequately address the needs of that application and that customer."), 8:64–66 ("In another embodiment, if there is no on-board computer there, data storage is provided in control module 12 so that it can store the data internally."), 9:17–19 ("[I]f the micro controller or microprocessor in control module 12 were to fail . . ."). Given the various

descriptions of the control module, on the present record, we do not read the Specification as limiting the claimed invention to a customized PC.

As mentioned above, the Specification describes the control module as circuitry that interfaces with a variety of sensors, performs calculations, and either displays information or interfaces with a display. Ex. 1001, 4:9–11 (control module interfaces with sensors), 4:20–22 (same), 4:39–40 (same), 4:40–42 (control module calculates), 4:57–60 (same), 5:16–19 (same), 5:29–31 (same), 5:53–54 (same), 4:60–61 (control module includes display), 5:59–6:6 (same), 6:6–10 (control module communicates with interface unit for display).

c. Other Evidence

Dr. Papanikolopoulos opines that a “POSITA would have understood the control module to include a controller/CPU and additional circuitry to facilitate not only the activation of the various sensors but also the reception and processing of the reflected signals. The ultimate objective was to calculate the distance and the location of the obstacle.” Ex. 1002 ¶ 62.

Mr. Pfeiffer testifies that “the meaning of ‘control module’ is a ‘customized PC’.” Ex. 2003 ¶ 18.

d. Conclusion Regarding “Control Module”

Based on the evidence and analysis above, we determine that the ordinary and customary meaning the term “control module” would have had to a person of ordinary skill in the art in question at the time of the invention is “circuitry for interfacing with sensors, performing calculations, and displaying information or interfacing with a display.” As stated above, both

parties agree that this is a correct construction. See Reply 3–4; Tr. 35:10–12, 14–17.

2. *Fuses Data*

Claim 22 depends from claim 21 and recites that the control module “fuses data received from the plurality of sensors to detect objects within a 360° view surrounding the vehicle.” Ex. 1001, 20:15–17.

Claim 28 also depends from claim 21 and recites that the control module “fuses data received from the plurality of sensors and provides a single picture of all objects within a 360° view surrounding the vehicle.” *Id.* at 20:35–38.

Petitioner asserts that “fuses data” means “resolves distance and location information from the data of multiple sensors.” Pet. 22 (citing Ex. 1002 ¶ 66); Reply 9–10 (citing Ex. 1011 ¶¶ 23–24).

Patent Owner asserts that “fuses data” means “updating the distance and location of an object by combining additional measurements of an object with previous detections of that object.” PO Resp. 6–9 (emphasis deleted) (citing Ex. 2003, “¶40, pp. 10-11”²⁴); 1337 PO Resp. 6–9.

According to Patent Owner, not only is “fuses data” used to detect objects, it is “an iterative process that relies not only on a single detection, but multiple detections.” PO Resp. 7. The reference to “multiple detections” is consistent with Petitioner’s construction using “multiple sensors.”

²⁴ Paragraph 40 of Exhibit 2003 is the wrong cite. It deals with the disclosure of the Gauthier reference. Mr. Pfeiffer opines on the term “fuses data” in paragraphs 27–30.

As described in the Specification, data fusion is “a software feature.” Ex. 1001, 14:8–9 (“Another extremely important software feature for reliable system performance is Data Fusion.”). The Data Fusion algorithm is specifically designed not to require any specific number of sensors, and it adapts as sensors are added. *Id.* at 14:11–13. The algorithm uses a technique called “Deepest Hole” to combine the data from multiple sensors to fuse this data together. *Id.* at 14:24–26. The Specification discloses how the Deepest Hole software functions:

It is assumed that multiple sensor sets may find the same object and that multiple radar modules within a sensor set will often see and report on the same object. The Deepest Hole function resolves these redundant tracks into a set of fused tracks, one per object. The output of this function is a list of track links linking the tracks from multiple radar modules together for one object.

Id. at 14:28–35. This process is summarized in the Specification as simply averaging the speeds of the redundant tracks. *Id.* at 14:37–38 (“The speeds of each track are averaged together.”).

The Specification repeatedly uses the word “resolve” to describe the fusion of data from multiple sensors. *E.g., id.* at 14:31–33 (“The Deepest Hole function resolves these redundant tracks into a set of fused tracks, one per object.”); Cert. Correction 32 (repeating that “The Deepest Hole function will resolve these redundant tracks into a set of fused tracks, one per object.”). The Specification also uses the word “combine” to describe data fusion. *E.g., id.* at 14:24–25 (“The algorithm uses a technique called Deepest Hole to combine the data”).

Dr. Papanikolopoulos opines that “fuses data” means “resolves distance and location information from the data of multiple sensors.”

Ex. 1002 ¶ 66. He explains that a “POSITA would have understood ‘data fusion’ as a methodology of combining multiple data (e.g., from various sources) and representations about the same object(s) to achieve a more accurate and complete knowledge of it (them).” *Id.*

Mr. Pfeiffer also uses the word “resolve” to define the term “fuses data.” Mr. Pfeiffer testifies a “POSITA would understand that in order to ‘fuse’ the data, the data from multiple sensors must be *resolved* for the same object.” Ex. 2003, ¶ 28 (emphasis added).

In the decision to institute in *Denso* 1709, the Board preliminarily construed the term “fuses data” as “combines data from multiple sensors to determine the location of an object.” 1709 DI 25. Petitioner argues that “resolves” and “combines” are “synonyms or they’re interchangeably used.” Tr. 26:12–16. Petitioner states that Petitioner’s proposed construction and the Board’s preliminary construction in *Denso* 1709 “are both accurate.” *Id.* at 27:3–5.

Patent Owner states that Mr. Pfeiffer’s testimony “in and of itself is a true statement.” Tr. 40:21–24. Patent Owner argues, however, “that there is a temporal aspect to data fusion.” *Id.* at 41:1–2. According to Patent Owner’s argument, the evidentiary support for establishing a temporal aspect to the construction of “fuses data” is the disclosure in the Specification that states “the purpose of the data fusion algorithms is to reduce all the tracks and detections down to a small set of object tracks.” *Id.* at 41:1–6 (referring to Ex. 1001, 14:19–21). We disagree because the quoted sentence does not require a temporal aspect. Also, considering the one sentence to which Patent Owner refers, balanced against the entirety of

the Specification, we find no persuasive evidentiary support for establishing a temporal component to the construction of the term “fuses data.” There is no persuasive evidence to which we have been directed that discloses a temporal component different from, or in addition to, combining or resolving the multiple data tracks.

Accordingly, based on the substantial and consistent evidence discussed above, we determine that the “fuses data” is properly construed as “resolves or combines distance and location information from the data of multiple sensors.”

*F. Patentability of Claims 1–5, 7, 8, and 21
Based on Naruse*

Petitioner asserts that claims 1–5, 7, 8, and 21 would have been obvious based on Naruse. Pet. 23–56.

1. Legal Principles of Obviousness

Section 103(a) forbids issuance of a patent when “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 said subject matter pertains.” *KSR*, 550 U.S. at 406. The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when available, evidence such as commercial success, long felt but unsolved needs, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); *see KSR*, 550 U.S. at 407 (“While the sequence of these questions might be reordered in any particular case, the

[Graham] factors continue to define the inquiry that controls.”). The Court in *Graham* explained that these factual inquiries promote “uniformity and definiteness,” for “[w]hat is obvious is not a question upon which there is likely to be uniformity of thought in every given factual context.” 383 U.S. at 18.

The Supreme Court made clear that we apply “an expansive and flexible approach” to the question of obviousness. *KSR*, 550 U.S. at 415. Whether a patent claiming the combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 417. To reach this conclusion, however, it is not enough to show merely that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). Rather, obviousness additionally requires that a person of ordinary skill at the time of the invention “would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention.” *Id.*; see also *Orexo AB v. Actavis Elizabeth LLC*, No. 2017-1333, 2018 WL 4288961, at *7 (Fed. Cir. Sept. 10, 2018) (“The question is not whether the various references separately taught components of the ’330 Patent formulation, but whether the prior art suggested the selection and combination achieved by the ’330 inventors.”).

Moreover, in determining the differences between the prior art and the claims, the question under 35 U.S.C. § 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a

whole would have been obvious. *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F. 2d 158, 164 (Fed. Cir. 1985) (“It is elementary that the claimed invention must be considered as a whole in deciding the question of obviousness.” (citation omitted)); *see also Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1537 (Fed. Cir. 1983) (“[T]he question under 35 U.S.C. § 103 is not whether the differences themselves would have been obvious. Consideration of differences, like each of the findings set forth in *Graham*, is but an aid in reaching the ultimate determination of whether the claimed invention as a whole would have been obvious.” (citation omitted)).

“A reference must be considered for everything it teaches by way of technology and is not limited to the particular invention it is describing and attempting to protect.” *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985).

As a factfinder, we also must be aware “of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning.” *KSR*, 550 U.S. at 421. This does not deny us, however, “recourse to common sense” or to that which the prior art teaches. *Id.*

Against this general background, we consider the references, other evidence, and arguments on which the parties rely.

2. *Naruse*

Naruse discloses an apparatus for use in an automobile for detecting objects or obstacles. Ex. 1003, 1:55–56. The apparatus includes a plurality of ultrasonic transmitting elements and ultrasonic receiving elements. *Id.*, Abstract. The transmitting and receiving elements are electrically switched in a sequential manner thus allowing the existence of an object to be detected over an extended range. The distance to the object and a particular

region in which it is detected are displayed. *Id.*; *see also id.* at 2:7–9 (disclosed apparatus “is capable of providing accurate information relating to the location of and the distance to an object.”).

Naruse discloses an object detection apparatus (labelled SEU) mounted slightly above the rear bumper of an automobile. *Id.* at 4:10–16; Fig. 1. The apparatus includes a plurality of ultrasonic transmitters (labelled TX1 to TX12) and ultrasonic receivers (labelled RX1 to RX12). *Id.* at 4:16–19; Fig. 1. In the Figure 1 example, a display unit (labelled DSU) is disposed on the top of the rear seat of the automobile. *Id.* at 4:23–25.

Figure 3 of Naruse illustrates a general arrangement of the electrical circuit of the object detecting apparatus shown in Figure 1. *Id.* at 4:62–64. The electrical circuit includes microcomputer CPU, drive circuit SDV, a plurality of transmitter switching circuits SA1, SA2 and SA3, a plurality of receiver switching circuits SB1, SB2 and SB3, detector unit SEU, a plurality of step-up transformers T1, T2 and T3, a plurality of decision circuits DS1, DS2 and DS3, input circuit INU, external counter CNT, display driver circuit DDV, and display unit DSU. *Id.* at 4:65–5:4.

The display unit in Figure 3 of Naruse includes indicators LE1 to LE23 that are used to represent the location of an object. *Id.* at 5:39–45. These 23 LED indicators identify the location of the detected object. *See Ex. 1002 ¶ 98.* Petitioner also asserts that it would have been obvious or understood that the location determined in Naruse would have been the “transverse location.” *Pet. 37 (citing Ex. 1002 ¶ 97); Tr. 57:19–58:10.*

Petitioner provides the following annotated Figure 3 from Naruse.

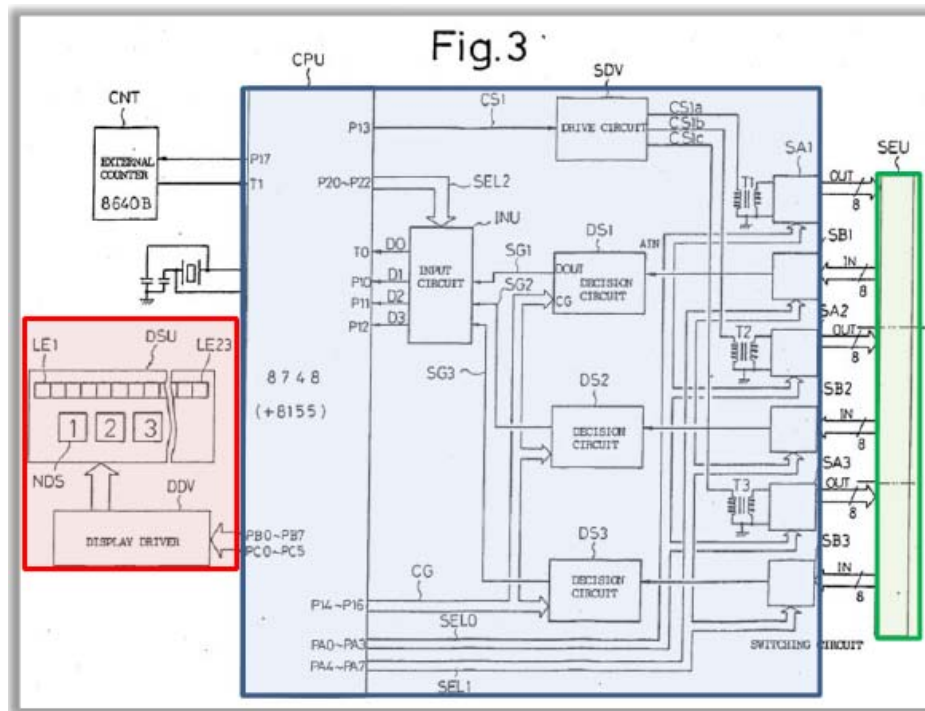


Figure 3 from Naruse (annotated by Petitioner) is a block diagram of an electrical circuit of an object detecting apparatus mounted on an automobile.

Petitioner annotated Figure 3 of Naruse to add color areas showing a control module (blue) to control the collision avoidance sensors (green) and to drive the display (red). Pet. 24 (citing Ex. 1003, 4:62–64).

Figures 9a–9g in Naruse are flowcharts illustrating the operation of the CPU shown in Figure 3. Ex. 1003, 7:5–6. When the power is turned on, an initialization subroutine is executed to initialize various parts of the apparatus. *Id.* at 7:8–10. After initialization, a sequential detection subroutine, a minimum calculation subroutine, and a display subroutine, are run repeatedly through a loop defined by these subroutines. *Id.* at 7:10–13. When the existence of an object is detected, data representing the distance obtained is entered in a memory which corresponds to the location of the

selected detector. *Id.* at 7:18–21. The minimum calculation subroutine searches for data representing the minimum distance among the memories. *Id.* at 7:21–23. The display subroutine displays information which is obtained as a result of the search effected in the minimum calculation subroutine. *Id.* at 7:24–26.

3. Discussion

According to Petitioner, Naruse discloses that transmitter TX1 transmits an ultrasonic wave that is received by receiver RX1. Pet. 29 (citing Ex. 1002 ¶ 89). The system will then transmit an ultrasonic wave from transmitter TX2, which is received by receiver RX2. *Id.* Petitioner concludes that Naruse discloses a plurality of transmitters connected to a control module wherein a first and second transmitter transmit a first and second signal, as recited in claim 1.

Petitioner also asserts that the receivers in Naruse receive reflected ultrasonic waves from a detected object that originated from the transmitters. Pet. 32. Naruse's receivers then send electrical signals, representative of the received ultrasonic waves, to the control module. *Id.* at 32–33 (citing Ex. 1003, 4:30–35, 6:57–62, 7:57–68). According to Petitioner, the piezoelectric portion of the receiver converts the received ultrasonic wave into an electric signal that is processed by the control module. *Id.* at 33 (citing Ex. 1002 ¶ 93).

Petitioner asserts a skilled artisan would understand that while the distance in some embodiments of Naruse is arguably calculated based on a single signal (using Naruse's minimum distance subroutine), the location is always a function of multiple return signals received by each transmitter/receiver pair, because Naruse uses multiple distance

measurements (corresponding to multiple return signals) to determine the object's location. *Id.* at 37 (citing Ex. 1002 ¶ 99).

Patent Owner “does not dispute that Petitioner’s primary reference for all grounds – Naruse - discloses measuring a transmitted signal.” PO Resp. 11. Patent Owner argues, however, that Naruse “fails to disclose a control module in accordance with the ’803 Patent as required by claims 1 and 21, and fails to disclose signal measurement as recited by claim 5.” *Id.*; *see also id.* at 23. Patent Owner also argues that Naruse does not calculate transverse location, or location and distance, as a function of more than one return signal. PO Resp. 12–14, 22–23. We address these, and other, issues below.

a. Control Module

This issue relates only to independent claims 1 and 21, and the claims dependent thereon. Independent claim 5 does not recite a “control module.”

Patent Owner asserts that Naruse fails to teach a control module that is a “customized PC.” PO Resp. 10–11, 23–24. Patent Owner’s declarant, Mr. Pfeiffer, testifies that “the meaning of ‘control module’ is ‘a customized PC.’” Ex. 2003 ¶ 18.

Patent Owner also argues:

Naruse discloses a standard microcontroller that does not have the capability to fuse data in accordance with claim 22. Because the control module of claim 21 must be capable of performing the calculations required in the data fusion functionality of ’803, Naruse fails to disclose the required control module as recited in claim 21.

PO Response 23. Patent Owner does *not* cite any persuasive evidence to support this argument. *See Garrido v. Holt*, 547 F. App’x 974, 979 n.3 (Fed.

Cir. 2013) (citing *In re Schulze*, 346 F.2d 600, 602 (CCPA 1965) (“Argument in the brief does not take the place of evidence in the record.”).

As discussed above, we have *not* adopted Patent Owner’s proposed construction that a “control module” is a “customized PC.” We have construed the term “control module” to mean “circuitry for interfacing with sensors, performing calculations, and displaying information or interfacing with a display.” As explained below, Naruse discloses this circuitry.

Naruse clearly discloses that “the indicators LE1 to LE23 [are] utilized to represent the *location* of an object while the numerical display DS is used to display the *distance* to the object.” Ex. 1003, 5:43–45 (emphases added). Dr. Papanikolopoulos testifies that Naruse discloses a “control module,” depicted in Figure 3, that “takes care of all the necessary steps to produce the position and location information” of an object. Ex. 1002 ¶ 73. Dr. Papanikolopoulos also testifies that “Figure [3]” of Naruse “shows the connectivity of the control module with the transmitters, receivers, display, and other components as the ones found in Patent ’803.” *Id.* ¶ 77. He explains that “Naruse uses a minimum distance subroutine by comparing measurements from different sensors and their associated signals to perform the transverse location calculation (based on first and second return signals). *Id.* Based on this analysis, Dr. Papanikolopoulos concludes that a person of ordinary skill “would understand this process as the same as the one described in the ’803 patent.” *Id.*

Based on the Naruse disclosure and the testimonial evidence of Dr. Papanikolopoulos, we find that Naruse discloses a “control module” as claimed.

b. Claim 5

Patent Owner argues that claim 5 “requires dedicated sensor[s] that each measure the same object. PO Resp. 12. According to Patent Owner, “Naruse, in contrast, discloses transmitters and receivers that rotate on a pre-set basis, including measuring signals transmitted by one transmitter at more than one receiver, which is contrary to Claim 5.” *Id.* We disagree with Patent Owner’s characterization of claim 5 and of Naruse.

Claim 5 recites the method steps of “transmitting a signal from the first sensor” to the object; “sensing a return;” and “generating a first return signal as a function of the sensed return.” Ex. 1001, 17:45–49. As a separate and distinct step, claim 5 recites “transmitting a signal from the second sensor” to the object; “sensing a return” of the second signal; and “generating a second return signal as a function of the sensed return of the signal transmitted from the second sensor.” This is exactly how Naruse functions. See Ex. 1002 ¶ 121 (“Naruse steps sequentially through each of the receiver sensors, including a first and a second receiver sensor, and each receiver receives a reflected ultrasonic wave and generates an electric signal” (citing Ex. 1003, 7:14–18)).

*c. Calculate Location and Distance
as a Function of more than one return signal*

Patent Owner asserts that Naruse does not disclose measurement circuitry that calculates a transverse location of an object as a function of said first and second return signals. PO Resp. 22–23. Claims 1 and 5 recite first and second return signals specifically. Claim 21 simply recites “return signals” (plural).

Moreover, Patent Owner’s argument fails to recognize the substantive differences among the “function of” clauses in each of independent claims 1, 5, and 21.

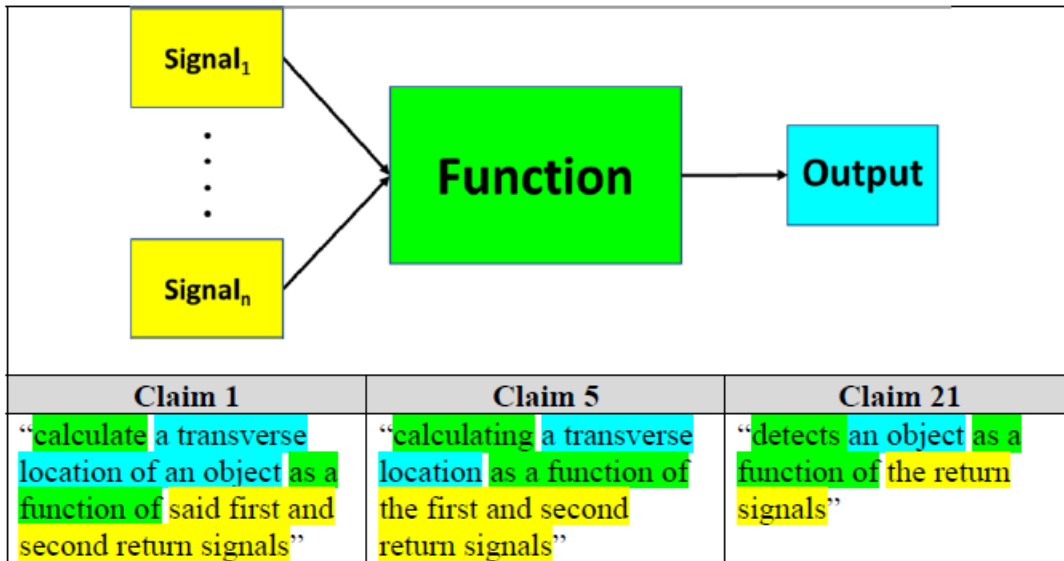
Claim 1 recites that “the control module includes measurement circuitry used to measure the first and second return signals and *calculate a transverse location of an object as a function of* said first and second return signals.” Ex. 1001, 17:26–29 (emphasis added).

Claim 5 does not include a “control module.” It simply recites the step of “*calculating a transverse location as a function of* the first and second return signals.” *Id.* at 17:56–57 (emphasis added).

Claim 21 recites that “the control module measures the return signals, *detects an object as a function of* the return signals.” *Id.* at 20:12–13 (emphasis added).

Thus claims 1 and 5 calculate a *location* as a function of the two signals, whereas claim 21 *detects an object* as a function of plural signals. This is exactly how Naruse functions.

Petitioner provides the following demonstrative illustration to illustrate the “function of” limitations in claims 1, 5 and 21.



Petitioner’s demonstrative illustrating the “function of” limitation in claims 1, 5, and 21. Reply 14 (citing Ex. 1011 ¶ 42).

As asserted by Petitioner, Naruse teaches a sequential detection subroutine that measures values from a plurality of its sensors, and “[w]hen the existence of an object is detected, data representing the distance obtained is entered in a memory [location] which corresponds to the location of the selected detector.” Reply 15 (citing Ex. 1003, 7:14–21; Ex. 1002, ¶¶95-97).

As disclosed in Naruse,

Generally speaking, the sequential detection subroutine selects three sets of detectors (transmitters and receivers) simultaneously for purpose of measurement, and then sequentially shifts the location of the detectors selected when repeating the measurement. When the existence of an object is detected, data representing the distance obtained is entered in a memory which corresponds to the location of the selected detector. The minimum calculation subroutine searches for data representing the minimum distance among the memories. The display subroutine displays information which is obtained as a result of the search effected in the minimum calculation subroutine.

Ex. 1003, 7:14–26. Naruse also discloses that a “distance detection subroutine is executed,” to determine “the presence or absence of any reflected wave and the distance to an object.” *Id.* at 7:57–61.

Naruse summarizes the detailed embodiments disclosed as follows:

a plurality of ultrasonic detectors are used and are sequentially selected to enable the detection of an object at each location. This permits an area over which a detection is possible to be extended by providing a number of detectors, and also enhances the accuracy of measuring the distance. Since an electrical scanning is employed, the entire area can be monitored within a reduced time, allowing its use in applications such as on automobiles where a real operation is required.

Id. at 13:45–54. Naruse also discloses that the display unit in the disclosed embodiment includes twenty-three light emitting diode indicators LE1 to LE23. *Id.* at 5:39–45. The indicators LE1 to LE23 are used to represent the location of an object, while the numerical display is used to display the distance to the object. *Id.*

Thus, Naruse discloses using a plurality of sensors and reflected signals to determine both whether an object is present, and if so, the distance to the object. The plurality of signals in Naruse also determine the location of the object. This is what is recited in the “function of” limitations in each of claims 1, 5, and 21. In Naruse, two or more signals are transmitted, and two or more receivers stand ready to receive any reflected return signals. If there are no objects detected, there will be no return signals, the receivers will register a zero value, and the display will not be activated. If an object is detected by only one of the transmitted signals, only one return signal will be received by the receiver and register a value; the other receiver will register a zero value. Nonetheless, the system will react to the one return

signal and the lack of a second return signal, and thus use both return registered values to determine whether an obstacle is present and its location, thus activating the appropriate LED indicator.

Dr. Papanikolopoulos analyzes in detail the Naruse disclosure (Ex. 1002 ¶¶ 95–96) and concludes that a “POSITA would have understood that these subroutines of Naruse’s object detection system are used to measure and calculate the transverse location of and distance to the detected object” (*id.* at ¶ 97).

Accordingly, based on the evidence and analysis above, we determine that Naruse discloses the “function of” limitations of independent claims 1, 5, and 21.

4. *Rationale*

Having identified that Naruse discloses the elements and limitations in independent claims 1, 5, and 21, Petitioner concedes that Naruse does not explicitly disclose “the term ‘transverse location,’ but does disclose the “concept of a transverse location.” Tr. 57:19–58:16. In the Petition, Petitioner asserts it would have been obvious that the location determined in Naruse would have been the “transverse location.” Pet. 37 (citing Ex. 1002 ¶ 97 (“A POSITA would have understood that these subroutines of Naruse’s object detection system are used to measure and calculate the transverse location of and distance to the detected object.)). As explained by Dr. Papanikolopoulos, the minimum distance subroutine will determine which receiver has measured the shortest distance to the object. Ex. 1002 ¶ 97. The minimum distance will indicate the receiver closest to the object and the transverse location with respect to the rear of the vehicle is immediately known. *Id.* Naruse discloses that the LED corresponding to the receiver

with the minimum distance to the object is illuminated on the display.

Ex. 1003, 5:39–45.

Patent Owner does not challenge this contention.

Based on the evidence and analysis above, we determine that the evidence establishes a persuasive reason for modifying or interpreting Naruse as proposed by Petitioner.

5. Conclusion for Independent Claims 1, 5, and 21

Based on the evidence and analysis above, we determine that Petitioner has established, by a preponderance of the evidence, that independent claims 1, 5, and 21 would have been obvious based on Naruse.

6. Dependent Claims 2, 3, 4, 7, and 8

Petitioner asserts each of the challenged dependent claims 2, 3, 4, 7, and 8 would have been obvious based on Naruse. Pet. 40–41, 49–50. Patent Owner does not address these claims specifically in its Response.

Nonetheless, the burden remains on Petitioner to prove unpatentability by a preponderance of the evidence. 37 C.F.R. §§ 42.1, 20(c).

Claim 2, dependent from claim 1, recites that the first transmitting device and the first receiving device are cooperatively integrated into a single transceiver. Claim 3, dependent from claim 1, recites that the second transmitting device and the second receiving device are cooperatively integrated into a single transceiver. Petitioner contends that Naruse teaches that “a detector comprising a single ultrasonic transmitter and an ultrasonic receiver may be disposed at each location.” Pet. 40 (citing Ex. 1003, 13:34–38.) Although Naruse does not use the term “transceiver,” Dr. Papanikolopoulos testifies it was well-known in the art that the combination of a transmitter and receiver was commonly referred to as a “transceiver.”

Ex. 1002 ¶¶ 101–103, 106. There is no evidence to the contrary. Thus, we find that Naruse discloses the limitations in claims 2 and 3.

Claim 4, dependent from claim 1, recites that the control module logs the transverse location of the object. Petitioner asserts Naruse discloses that the value calculation routine, executed by the object detection system, compares the distance value for each of the 23 locations, and determines which location has the minimum distance. Pet. 42 (citing Ex. 1003, 12:9-41; Ex. 1002 ¶ 109). Dr. Papanikolopoulos testifies that a person of ordinary skill in the art would understand that by storing the transverse location with the minimum distance, the controller is logging the location so that it can later be displayed. Ex. 1002 ¶ 109. There is no evidence to the contrary. Thus, we find that Naruse discloses the limitations in claim 4.

Claim 7, dependent from claim 5, recites that the step of displaying an indication includes the steps of dividing a line into a plurality of zones; selecting a zone from the plurality of zones; and placing an indication within the selected zone. Petitioner asserts that the LED display in Naruse is divided into 23 sections or zones, and one of the sections of the line of 23LED lights is selected in accordance with Naruse's location detection and illuminated by lighting an LED. Pet. 49–50 (citing Ex. 1003, 12:65–13:2; Fig. 3). There is no contrary evidence. Thus, we find that Naruse discloses the limitations in claim 7.

Claim 8, dependent from claim 7, recites that the step of placing an indication includes the step of lighting a light-emitting diode representative of the selected zone. Petitioner asserts that Naruse discloses activating the location indicator in accordance with the content of the register R6, by

energizing one of the twenty-three light emitting diodes LE1 to LE23. Pet. 50. Petitioner notes that positions 1 to 23 within the register R6 of Naruse corresponds to diodes LE1 to LE23. *Id.* (citing Ex. 1003, 12:65–13:2; Fig. 3). There is no contrary evidence. Thus, we find that Naruse discloses the limitations in claim 8.

7. Conclusion Regarding Claims 2, 3, 4, 7, and 8

Based on the evidence and analysis above, we determine that Petitioner has established, by a preponderance of the evidence, that dependent claims 2, 3, 4, 7, and 8 would have been obvious based on Naruse.

G. Patentability of Claims 2 and 3 Based on Naruse and Gauthier

Petitioner asserts that claims 2 and 3 would have been obvious over the combination of Naruse and Gauthier. Pet. 57–59.

1. Gauthier

Gauthier discloses a distance measuring system for a vehicle. Ex. 1004, Abstract.²⁵ The system includes a distance measuring device for detecting a distance to an object and, in response, supplying a distance signal. *Id.* A plurality of transceivers 60 functioning as obstruction distance sensors are mounted on rear bumper 26 of vehicle 20. *Id.* at 5:42–44. The “transmitters/receivers” emit an ultrasonic acoustic energy wave rearward from the vehicle into a detection space immediately behind the vehicle.

²⁵ Gauthier discusses Naruse in the “Background Art” section of Gauthier’s written description. See Ex. 1004, 2:6–13.

Id. at 5:45–48. “[T]ransceiver 60 is wired in parallel to simultaneously emit a pulse of ultrasonic acoustic energy and provide overlapping receive capability of a return ultrasonic echo signal.” *Id.* at 5:57–60. Thus, there can be no reasonable dispute that the transmitting device and the receiving device in Gauthier are cooperatively integrated into a single transceiver.

To provide a detection system for more than just the rear of the vehicle, Gauthier discloses, as shown in Figure 2, multiple transceivers 60 located along the rear and side of trailer 24 to insure full sensor coverage. *Id.* at 6:48–50. The transceiver unit of both the rear and side sensors transmit in parallel to emit ultrasonic acoustic waves. *Id.* at 6:50–52. Return ultrasonic echo signals are separately supplied by each group of sensors to the associated channel and separately processed and displayed on a respective LCD display 44, 46, thus allowing a driver to know both the location of the detected obstacle, i.e., rear or side, as well as the distance to the obstacle. *Id.* at 52–55.

2. Discussion

Petitioner asserts that the transceivers disclosed in Gauthier include a transmitter and a receiver cooperatively integrated into a single transceiver. Pet. 57–59 (citing Ex. 1002 ¶¶ 160, 163). Petitioner asserts a person of ordinary skill in the art would have found it obvious to combine the transceivers disclosed in Gauthier with the object detection system of Naruse. *Id.* at 58–59. Petitioner’s rationale for the proposed modification is that both patents are directed to solving the same problem in a similar way, Gauthier’s combined transceiver was a “known design choice,” and it provided “system simplification (fewer parts).” *Id.* (citing Ex. 1002 ¶¶ 161, 163).

Patent Owner relies on its arguments against claim 1. PO Resp. 24. We considered, discussed, and rejected these arguments above and determine that Naruse discloses the elements and limitations recited in claim 1.

Patent Owner also asserts that Gauthier “does not provide any additional functionality that is required of claims 2 and 3.” *Id.* According to Patent Owner, Gauthier teaches that return ultrasonic echo signals are separately supplied by each group of sensors to the associated channel and separately processed and displayed on an LCD display. *Id.* (citing Ex. 1004, 6:52–55).

As described above, Gauthier provides a system to identify whether the detected object is on the side of the vehicle or at the rear vehicle. Gauthier also discloses a system that determines the distance to the detected obstacle. *E.g.*, Ex. 1004, 5:42–44 (“A plurality of transceivers 60 functioning as *obstruction distance sensors* are mounted on a rear bumper 26 of vehicle 20.”) (emphasis added). Patent Owner argues, without any persuasive supporting evidence, that “like Naruse, Gauthier does not teach calculating a distance and a location as a function of multiple return signals, as those signals are processed separately.” PO Resp. 24. We disagree.

First, we note that Petitioner is relying on Gauthier only for the explicit disclosure that it was well-known, and would have been obvious to use, a system where the transmitting device and the receiving device are cooperatively integrated into a single transceiver. Pet. 57–59. Petitioner is relying on Naruse, *not* Gauthier, for the disclosure of calculating a distance and a location as a function of multiple return signals. As we have

determined and explained above, Naruse discloses the control module recited in the challenged claims.

Second, contrary to Patent Owner’s characterization, Gauthier, like Naruse, uses plural signals to detect an object and determine its location. Ex. 1004, 3:41–55 (disclosing a first sensor channel); 4:3–12 (disclosing a second sensor channel).

3. Conclusion

Based on the evidence and analysis above, we determine that Petitioner has established, by a preponderance of the evidence, that dependent claims 2 and 3 would have been obvious over the combination of Naruse and Gauthier.

H. Patentability of Claims 6 and 7 Based on Naruse and Tagami

Petitioner asserts that claims 6 and 7 would have been obvious over the combination of Naruse and Tagami. Pet. 59–63.

1. Tagami

Tagami discloses a radar system for automobiles and similar vehicles. Ex. 1005, 1:5–8. Tagami’s system is specifically designed to audibly or visually alert the driver of the possibility of a collision. *Id.* at 1:8–12. One of the specific features of Tagami is “an improved radar system display device” that detects objects in the entire area surrounding the vehicle – front, rear, and sides. *Id.* at 2:13–22.

Figure 4 of Tagami is reproduced below.

Fig. 4

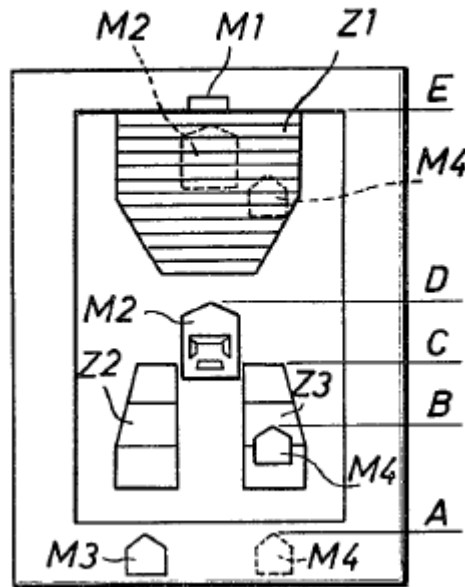


Figure 4 from Tagami is a top plan view of an indicator or display. Ex. 1005, 1:60–62.

As shown in Figure 4, and described in the Specification, the display includes front object marker M1 (Ex. 1005, 4:67–68); vehicle marker M2 (indicating the vehicle being driven) (*id.* at 5:4–5); rear-left marker M3 (*id.* at 5:18–20); and rear-right marker M4 (*id.*). There also are provided various “zones,” designated as Z1, Z2, and Z3. Zone Z1 is a “front area indication zone” (*id.* at 4:67–5:3); Z2 is a rear-left indication zone (*id.* at 5:5–7); and Z3 is a rear-right indication zone (*id.*).

2. Discussion

Claim 6 depends from claim 5 and recites the steps of creating a display showing an area behind the vehicle and showing the object at a location within the display corresponding to the transverse location.

Petitioner asserts that Tagami displays the transverse location of the object by activating markers M3 or M4, depending on whether the detected object is located to the left or right of the rear of the vehicle. Pet. 62 (citing Ex. 1005, 6:26–65; Ex. 1002 ¶ 171).

Petitioner’s rationale for the proposed combination is that a person of ordinary skill in the art would have found it obvious to combine the display of Tagami with the display of Naruse, achieving the expected result of showing the transverse location of the detected object in reference to a display of the side or rear areas of the vehicle. *Id.* (citing Ex. 1002 ¶ 172).

Claim 7 depends from claim 5 and recites the steps of dividing a line into a plurality of zones, selecting a zone from the plurality of zones, and placing an indication within the selected zone.

Petitioner asserts Tagami discloses dividing the display areas into a plurality of zones. *Id.* (citing Ex. 1002 ¶ 174). Based on the same rationale relied on for claim 6, Petitioner asserts a person of ordinary skill in the art would have found it obvious to combine the teachings of Tagami’s display with Naruse’s display. *Id.* at 63 (citing Ex. 1002 ¶ 175).

Patent Owner again argues that Naruse does not disclose the limitation of calculating “any object and distance as *a function* of multiple returns,” as recited in Independent claim 5.²⁶ PO Resp. 24. Patent Owner argues that “Tagami teaches away from performing any calculations as a function of multiple return signals.” *Id.* According to Patent Owner, “[t]here is no

²⁶ The recitation in claim 5 to which Patent Owner appears to refer is the method step of “calculating a transverse location as a function of the first and second return signals.” Ex. 1001, 17:56–57.

calculation of any object and distance as a function of multiple returns, so it teaches away from the recited claim limitations.” *Id.* Patent Owner cites neither evidence nor legal authority to support its “teaching away” argument.

We note that Petitioner is relying on Tagami only for the explicit disclosure that the display steps and limitations recited in claims 6 and 7 were well-known, and would have been obvious to use, with the Naruse system. Petitioner is relying on Naruse, *not* Tagami, for the disclosure of calculating a distance and a location as a function of multiple return signals. We considered, discussed, and rejected Patent Owner’s arguments concerning Naruse and determined that Naruse discloses the elements and limitations recited in claim 5.

The phrase “teaching away” has a defined meaning in patent law. “A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009) (quoting *Ricoh Co., Ltd. v. Quanta Comput. Inc.*, 550 F.3d 1325, 1332 (Fed. Cir. 2008)). A reference does not teach away “if it merely expresses a general preference for an alternative invention but does not ‘criticize, discredit, or otherwise discourage’ investigation into the invention claimed.” *DePuy*, 567 F.3d at 1327 (quoting *In re Fulton*, 391 F.3d at 1201).

Petitioner has provided persuasive evidence, including Tagami and the cited testimony of Dr. Papanikolopoulos, that a person of ordinary skill in the art would have had reason to use Tagami’s display in Naruse’s

system. In contrast, no evidence supports Patent Owner's position that a person of ordinary skill, upon reading Tagami, would be discouraged from using Tagami's display in the Naruse system, as proposed by Petitioner.

3. Conclusion

Based on the evidence and analysis above, we determine that substantial evidence establishes that dependent claims 6 and 7 would have been obvious based on Naruse and Tagami.

I. Patentability of Claim 24 Based on Naruse and Cherry

Petitioner asserts that claims 17–20 and 24 would have been obvious over the combination of Naruse and Gauthier. Pet. 63–67; 1337 Pet. 59–67.

1. Cherry

Cherry discloses an object detection system and method for detecting the presence of objects in the path of a vehicle. Ex. 1006, Abstract. The system includes “a self test operation.” *Id.* Cherry recognizes that “[i]n consideration of the importance of the operability of such object detection systems, it is often desirable for such systems to include self testing capabilities.” Ex. 1006, 1:15–17. In the “Background” section of the written description, Cherry discloses various prior devices that included self testing capabilities. In one device, for example, signals provided by a transmitter are reflected by acoustic shunts or acoustic reflectors for reception by a receiver for self testing purposes.” *Id.* at 1:25–28. Cherry states that the described prior art devices “may be undesirable due to the need for additional structures such as reflecting elements to be attached to the vehicle, and because the systems may require specific positioning of the transmitter and receiver.” *Id.* at 1:40–45. The system disclosed in Cherry

overcomes the problems of prior devices by operating in the following manner:

The system includes a transmitter which transmits object detection signals and a receiver which receives reflections of the transmitted object detection signals. A controller is provided for adjusting the gain and signal threshold of the receiver so that the receiver initially is able to detect reflections from irregularities in the ground surface. Once the receiver receives a signal reflected from the ground surface, an indication is provided that the system is in a ready or operable state. Thereafter, the controller adjusts the receiver gain and signal detection threshold so that signals reflected from the ground surface are effectively ignored and only signals reflected from significant objects in the path of the vehicle are detected.

Ex. 1006, 1:64–2:9. Cherry discloses his system in the context of a vehicle 10 having a single transmitter 14 and a single transmitter 16. *Id.* 2:34–36; Fig. 1.

2. Claim 24²⁷

Claim 24 depends from claim 21 and recites that the control module includes a built-in-test function which sequentially commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of said return to the control module for system verification.

Petitioner asserts that upon initialization of the object detection system, the sequential detection subroutine in Naruse is executed, which steps through each of the transmitters and receivers to determine whether an object is present, and if so, the distance to the object. Pet. 65 (citing

²⁷ Claim 24 was challenged in IPR2017-01336, so we address it first before addressing claims 17–20, which were challenged in IPR2017-01337.

Ex. 1003, 7:38–8:68; Ex. 1002 ¶ 190.). Petitioner asserts that a person of ordinary skill in the art would have understood that the initialization routine in Naruse “would include a built-in-test function to verify proper operation of the system. *Id.* (citing Ex. 1002 ¶ 190). Petitioner acknowledges, however, that Naruse does not explicitly disclose a built-in-test function to test the object detection system. Pet. 65. Petitioner relies on Cherry for the specific disclosure of a detection system with a self-test mode that is entered into when power is initially applied to the system. *Id.* at 67 (citing Ex. 1006, 2:11–14, 2:59–3:10).

Petitioner asserts a person of ordinary skill in the art would have found it obvious to combine the self-test mode of Cherry with the initialization and sequential detection subroutines of Naruse, which, according to Petitioner, would result in sequentially testing each of the transmitters and receivers, according to the self-test mode of Cherry. *Id.* (citing Ex. 1002 ¶ 194). Dr. Papanikolopoulos testifies that the use of Cherry’s self-test mode with Naruse’s object detection initialization and sequential detection subroutines would result in the “expected outcome of stepping sequentially through each transmitter and receiver to verify proper functionality before entering the normal operation mode.” Ex. 1002 ¶ 194.

Petitioner contends this modification would have been obvious because the use of Cherry’s self-test mode with Naruse’s object detection initialization and sequential detection subroutines would verify proper functionality before entering the normal operation mode. Pet. 67 (citing Ex. 1002 ¶ 194).

Patent Owner argues that Cherry is “inapplicable to the claims in view of the specific recitals of claim 21 (it does not disclose a “control module”), it does not include the capability of measuring distance or calculating an object’s relative location. For these reasons, it is improper to combine Cherry with Naruse.” PO Resp. 25. Patent Owner again cites no evidence to support this argument.

Patent Owner’s argument is not persuasive because Petitioner is relying on Cherry only for the explicit disclosure of a test that was known, and would have been obvious to use, with the Naruse system. Petitioner is relying on Naruse, *not* Cherry, for the disclosure of a “control module,” for detecting an object as a function of multiple return signals, and for calculating a distance to and a location of the detected object, all as recited in independent claim 21, from which claim 24 depends. We previously considered, discussed, and rejected Patent Owner’s arguments concerning Naruse and determined that Naruse discloses the elements and limitations recited in claim 21.

Patent Owner also argues that Cherry does not include “any capability of multiple sensor calculation and/or calibration.” PO Resp. 25. Claim 24 is reproduced below:

24. The system of claim 21, wherein the control module includes a built-in-test function which sequentially commands each transmitting device to transmit a signal, detects a return of the signal and sends a signal representative of said return to the control module for system verification.

Ex. 1001, 20:22–26. As is apparent from claim 24, claim 24 does *not* recite a “capability” of “sensor calculation and/or calibration.” Patent Owner has

not asserted any claim construction in this proceeding wherein claim 24 would have the capability argued by Patent Owner.

Patent Owner also argues that “[t]o self-test, the system must verify not only that the sensors are operating normally, but that the control module is operating correctly as well.” PO Resp. 25. Additionally, Patent Owner argues that “Cherry, at best, discloses sensor testing, but not system verification.” *Id.* Again, Patent Owner cites no evidence from the ’803 patent, from its declarant Mr. Pfeiffer, or from elsewhere to support this argument.

Neither party has addressed in any detail the test functions disclosed in the ’803 patent. We look to the Specification for guidance. The ’803 patent discloses two test function embodiments. One embodiment is referred to as a “self test.” Ex. 1001, 9:10–32 (“In one embodiment a self test capability is provided.”). Another embodiment is referred to as a “Built-In Test (BIT).” *Id.* at 9:33–10:5 (“In another embodiment, systems 10 and 30 automatically and sequentially activate a Built-In Test (BIT) function”). Claim 24 clearly recites a “built-in test” function, not a self test function. As described in the Specification, during initial power-up, when power is first turned on, control module 12 performs a BIT of control module 12 functions. Ex. 1001, 9:38–40. The BIT function verifies that sensor transmitter 16, receiver 18, and the electronics of control module 12 and the rest of systems 10 and 30 are working properly. *Id.* at 9:40–42. When the vehicle is in motion, however, the system will perform the BIT on all detector modules and integrate the results into the data acquisition process to insure the integrity of the data being processed. *Id.* at 9:48–51.

Thus, based on the Specification, the BIT verifies that the sensor transmitters, the receivers, the control module “and the rest of systems 10 and 30” are working properly. *See id.* at 9:40–42. Claim 24, however, does not recite “the rest of systems 10 and 30.” It recites only the sensors, receivers and control module.

The sequential detection subroutine in Naruse is executed on start-up, which steps through each of the transmitters and receivers to determine whether an object is present, and if so, the distance to the object. Ex. 1003, Figs. 9a, 9b, 9c; Ex. 1002 ¶ 190. Dr. Papanikolopoulos testifies that a “person of ordinary skill in the art would have understood that the initialization routine would include a built-in-test function *to verify proper operation of the system.*” Ex. 1002 ¶ 190 (emphasis added). Dr. Papanikolopoulos opines that “[l]ack of such a function would limit the applicability and usefulness of the system in a real-world application.” *Id.*

We find that Naruse and Cherry, as combined by Petitioner, meet the limitations of claim 24.

3. Claims 17–20

Claim 17 is an independent claim. Claim 17 recites specifically that the control module includes “a built-in-test function” that sequentially commands each transmitting device to transmit a signal, detects a return of the signal, and sends a signal representative of the return signal to the control module for system verification. Claims 18, 19, and 20 depend directly or indirectly from claim 17.

The issues presented with respect to the patentability of claims 17–20 based on Naruse and Cherry are the same issues with respect to the patentability of claim 24. Indeed, the “built-in-test function” clause recited

in independent claim 17 (*see* Ex. 1001, 19:25–29) is *identical* to the built-in-test function recited in claim 24 (*see id.* at 20:22-26). Thus, our findings and conclusions regarding this built-in-test function for claim 17 are the same as discussed above for claim 24.

Petitioner provides a clause-by-clause analysis of claims 17–20, identifying where in Naruse or Cherry a claimed element is disclosed in the references. 1337 Pet. 59–67. Petitioner relies on the declaration testimony of Dr. Papanikolopoulos for support. *Id.* (citing *passim* Ex. 1002).

Petitioner relies on Naruse for disclosing most of the elements recited in claim 17–20. 1337 Pet. 59–67. Regarding the “built-in-test” function, Petitioner asserts that Naruse discloses a sequential detection subroutine, which steps through each of the transmitters and receivers to determine if an object is present. *Id.* at 60–61 (citing to Figs. 9a and 9b). Petitioner acknowledges, however, that Naruse “does not explicitly disclose a built-in-test function to test the object detection system.” *Id.* at 61. According to Petitioner, Cherry discloses a self-test mode for a vehicle object detection system. *Id.* at 61–63.

Petitioner asserts a person of ordinary skill in the art would have found it obvious to combine the self-test mode of Cherry with the initialization and sequential detection subroutines of Naruse, which would result in sequentially testing each of the transmitters and receivers, according to the self-test mode of Cherry. *Id.* at 63 (citing Ex. 1002 ¶ 194). The proffered rationale for the proposed combination is that both Naruse and Cherry are directed to vehicle object detection systems that use ultrasonic transmitters and receivers, and the use of self-test modes for vehicle systems

was well known and was within the understanding of the skilled artisan at the time of the '803 patent. *Id.* (citing Ex. 1002 ¶ 194.) Dr. Papanikolopoulos testifies that the proposed combination of references would have “reduced the number of system failures in real-world applications” and “was a way to reduce errors and system failures during the vehicle’s operation.” Ex. 1002 ¶ 194.

Patent Owner argues that “not only is Cherry inapplicable to the claims in view of the specific recitals of claim 21²⁸ (it does not disclose a “control module”), it does not include the capability of measuring distance or calculating an object’s relative location.” 1337 PO Resp. 24. Patent Owner concludes “it is improper to combine Cherry with Naruse.” *Id.* Patent Owner cites no evidence to support this argument. This conclusion is based on Patent Owner’s argument that “Cherry does not teach calculation of a distance to, and a location of, an object.” *Id.* at 25.

Patent Owner’s arguments are not persuasive because neither independent claim 17 nor any of dependent claims 18–20 recites any limitations concerning calculating a distance to, and location of, an object. Moreover, Petitioner is relying on Cherry only for the explicit disclosure of a test that was known, and would have been obvious to use, with the Naruse system. Petitioner is relying on Naruse, *not* Cherry, for the disclosure of a “control module,” display module, transmitting devices, and receiving devices, and other limitations as recited in claims 17–20.

²⁸ Patent Owner’s reference to “claim 21” appears to recognize the that the issues presented with respect to the patentability of claims 17–20 are the same issues addressed in our consideration of the patentability of claim 24, which depends from claim 21.

Based on the disclosures in Naruse and Cherry, and the testimony of Dr. Papanikolopoulos, we determine that Petitioner has established, by a preponderance of the evidence, that claims 17–20 would have been obvious based on Naruse and Cherry.

4. Conclusion

Based on the disclosures in Naruse and Cherry, the testimony of Dr. Papanikolopoulos, and the analysis above, we determine that Petitioner has established by a preponderance of the evidence that dependent claims 17–20 and 24 would have been obvious over the combination of Naruse and Cherry.

J. Patentability of Claims 22 and 28 Based on Naruse and Hayashikura

Petitioner asserts that claims 22 and 28 would have been obvious over the combination of Naruse and Hayashikura. Pet. 67–76.

1. Hayashikura

Hayashikura discloses an object detection system for vehicles that detects, for each direction, the presence-of and distance to an obstacle or object on the basis of a phase difference (time difference) between signals transmitted and signals received. Ex. 1007, Abstract. Hayashikura uses a plurality of electromagnetic wave transmitter and receiver sections (radar devices) provided on and along the periphery of the vehicle, to inform the vehicle operator of the conditions around the vehicle. *Id.* at 1:8–12; 8:11–14. The radar devices are disposed in such a manner that their detecting ranges together cover about 360° around the vehicle without substantially overlapping each other. *Id.* at 3:28–31.

2. Discussion

Claim 22, dependent from claim 21, recites that the control module fuses data received from the plurality of sensors to detect objects within a 360° view surrounding the vehicle. Petitioner asserts that both Naruse and Hayashikura disclose using the combined data from multiple sensors to calculate the distance to, and location of, an object. Pet. 68 (citing Ex. 1003, 2:5-9; Ex. 1007, 2:1-6; Ex. 1002 ¶ 213). Petitioner asserts that to the extent that Naruse fails to explicitly disclose detecting objects within a 360° view, Hayashikura more explicitly discloses this limitation. Pet. 71 (citing Ex. 1002 ¶ 219). Hayashikura discloses that the plurality of transmitters and receivers on and along the entire periphery of the vehicle, which permits detection of obstacles around the entire vehicle. *Id.* at 71–72 (citing Ex. 1007, 2:30–33).

According to Petitioner, a person of ordinary skill in the art would have found it obvious to combine the 360° object detection of Hayashikura with the multi-sensor detection system of Naruse, achieving the expected result and benefit of detecting objects in the 360° area surrounding the vehicle. *Id.* at 72–73 (citing Ex. 1002 ¶ 220).

Claim 28, also dependent from claim 21, recites that the control module fuses data received from the plurality of sensors and provides a single picture of all objects within a 360° view surrounding the vehicle. Petitioner asserts a person of ordinary skill in the art would have been motivated to combine the 360° detection and display system of Hayashikura with Naruse’s object detection system for the reasons set forth in the discussion of claim 22 above. *Id.* at 73–76 (citing Ex. 1002 ¶ 227).

Patent Owner argues that “Naruse does not disclose ‘fuses data’ in accordance with claims 22 and 28. PO Resp. 12. According to Patent Owner’s argument, the data fusion disclosed and described by the ’803 Patent “describes data fusion as an iterative process whereby once a track for an object is established, additional data from multiple sensors is resolved to update the object’s relative location to the vehicle and to differentiate between an alarming condition and a false alarm.” *Id.* This argument asserts a meaning to the term “fuses data” that is different from Patent Owner’s proposed construction of this term. *See* PO Resp. 6–7 (asserting that fusing data means “updating the distance and location of an object by combining additional measurements of an object with previous detections of that object.”); *see also* Ex. 2003 ¶ 27 (repeating Patent Owner’s asserted construction for “fuses” data). It also is different from our adopted construction.

Based on our construction of the term “fuses data” (*see* claim construction above, the construction being “resolves or combines distance and location information from the data of multiple sensors”), we find that Naruse discloses the structure for, and function of, fusing data.

Regarding claim 28,

Patent Owner argues that “Naruse cannot be combined with Hayashikura. Hayashikura itself teaches away from the combination.” PO Resp. 25. According to Patent Owner, because Hayashikura uses “transmitter/receiver pairs around a vehicle ‘without substantially overlapping’ . . . Hayashikura cannot ‘fuse[] data’ in accordance with Claims 22 and 28.” *Id.* at 26. Patent Owner cites no evidence to support

these arguments. Patent Owner also argues that Hayashikura “does not include a control module in accordance with Claim 21.”*Id.*

These arguments are not persuasive because Petitioner is relying on Hayashikura only for the explicit disclosure of the 360° detection and display system of Hayashikura that was known, and would have been obvious to use, with the Naruse system. Petitioner is relying on Naruse, *not* Hayashikura, for the disclosure of a “control module” as recited in independent claim 21. As we have determined and explained above, Naruse discloses the control module recited in the challenged claims.

3. Conclusion

Based on the disclosures in Naruse and Hayashikura, the testimony of Dr. Papanikolopoulos, and the analysis above, we determine that Petitioner has established by a preponderance of the evidence that dependent claims 22 and 28 would have been obvious based on Naruse and Hayashikura.

K. Patentability of Claims 9 and 25 Based on Naruse and Ramer

Petitioner asserts that claims 9 and 25 would have been obvious over the combination of Naruse and Ramer. Pet. 76–79; 1337 Pet. 26–33.

1. Ramer

Ramer discloses an “object detection system” for determining an object's relative distance or range, and/or velocity. Ex. 108, Abstract; 1:5–9. The disclosed system is configured such that the object (“O”) and two optical elements are at three remote locations that may represent vertices of a triangle. *Id.* at 3:58–60. In this configuration, the system determines the angles of the triangle to thereby determine the direct or perpendicular distance to the object (“O”).

2. Claim 25²⁹

Claim 25, dependent from claim 21, recites that the control module determines whether it can triangulate and calculates an actual perpendicular distance to the object and location of the object with respect to the vehicle.

According to Petitioner, Ramer discloses calculating the perpendicular distance from the vehicle using a triangulation method. Pet. 77 (citing Ex. 1008, Fig. 7, Abstract, 9:12–38; Ex. 1002 ¶ 254).

Figure 7 of Ramer is reproduced below.

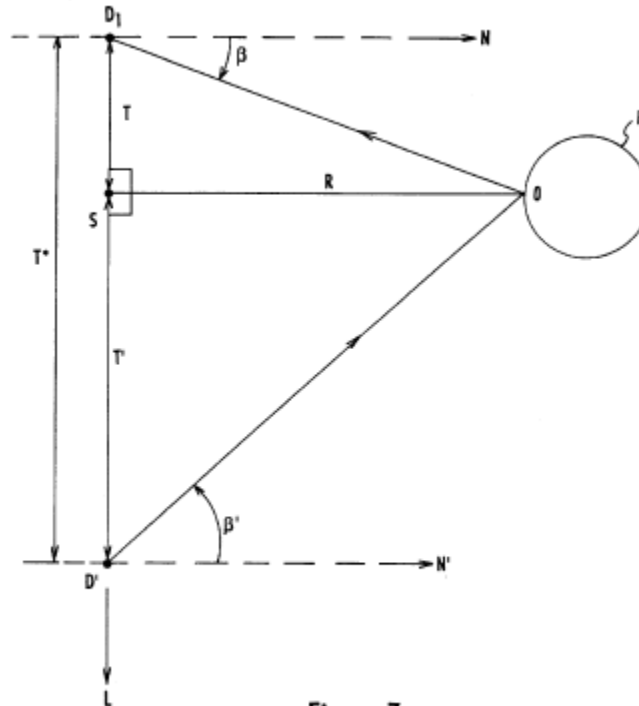


Figure 7

Figure 7 is an illustration of the trigonometric relationships of one embodiment of the Ramer system

²⁹ Claim 25 was challenged in IPR2017-01336, so we address it first before addressing claim 9, which was challenged in IPR2017-01337.

Dr. Papanikolopoulos testifies that Figure 7 of Ramer shows the triangulation method used to determine the perpendicular distance (R) to the detected object (O). Ex. 1002 ¶ 254. As explained by Dr. Papanikolopoulos with respect to Figure 7, Ramer calculates the perpendicular distance (R) to the object based on the determined spacing of the detectors (D and D') and the angle of the return signals received by the detectors. *Id.* (citing Ex. 1008 at 9:12-38.)

According to Petitioner, a person of ordinary skill in the art would understand that “before the Ramer system can triangulate, it must first determine if the detectors can receive reflections of the transmitted signals. *Id.* at 77–78. Petitioner concludes that “the system in Ramer first determines whether it can triangulate before it performs the calculation and therefore teaches both the recited determination and calculation imitations of claim 25. *Id.* at 78 (citing Ex. 1002 ¶ 252). Dr. Papanikolopoulos testifies that “Ramer’s distance calculation relies on the ability to triangulate between the radiating source and the detectors.” Ex. 1002 ¶ 252.

Patent Owner argues that “Naruse teaches away from any type of further data analysis that would include triangulation.” PO Resp. 26. Patent Owner cites no evidence to support this argument. Patent Owner also argues that “Naruse discloses disregarding 22 of 23 return signals in each detection cycle, so any suggestion that Ramer could be combined with Naruse for the purpose of triangulation of return signals is improper. *Id.* Patent Owner cites no evidence to support this argument. Additionally, Patent Owner argues that “Ramer fails to disclose a control module as required by the

claim 21, so it cannot cure the deficiencies of Naruse for a combination with respect to claim 25.”

Patent Owner’s arguments are not persuasive because Petitioner is relying on Ramer only for the explicit disclosure that the triangulation system of Ramer was known, and would have been obvious to use, with the Naruse system. Petitioner is relying on Naruse, *not* Ramer, for the disclosure of a “control module” as recited in independent claim 21. As we have determined and explained above, Naruse discloses the control module recited in the challenged claims.

As a rationale for the proposed combination of Naruse and Ramer, Petitioner asserts that a person of ordinary skill in the art would have been motivated to combine the perpendicular measurement system of Ramer with the object detection system of Naruse. Pet. 78 (citing Ex. 1002 ¶¶ 250–255). As explained by Petitioner, the reason why a person of ordinary skill would have made the proposed modification is that “[b]oth references teach vehicle object detection systems that determine the distance to a nearby object,” and that the “combined system would have operated as expected, providing the perpendicular distance between the rear-most portion of the vehicle and the detected object.” *Id.* at 78–79. Petitioner also argues that a “POSITA would have been motivated to implement triangulation because it is a simple mathematical concept.” Reply 27.

We determine that these reasons are generic to all references concerning object detection systems, conclusory, and fail to establish a persuasive reason why a person of ordinary skill would have combined Naruse and Ramer. All object detection systems “determine the distance to

a nearby object” and “as expected” provide the distance to the detected object. Accepting this rationale would mean that there is a valid rationale to combine any object detection reference with any other object detection reference.

Moreover, the fact that trigonometry may be a “simple” concept, does not suggest claim 25 would have been obvious. Simplicity is not inimical to patentability. *In re Oetiker*, 977 F. 2d 1443, 1447(Fed. Cir. 1992); *see also, Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1572 (Fed. Cir. 1987) (“The statute requires utility, novelty, and nonobviousness, not complexity.”), *cert. denied*, 481 U.S. 1052 (1987). Claim 25 requires the control module to determine whether it can triangulate. It is not claiming the concept of triangulation.

The existence of common elements found in both the challenged claims and the references relied on by Petitioner does not establish that the challenged claims would have been obvious. “[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR*, 550 U.S. at 418. “[I]nventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.” *Id.* at 418–419; *see also Unigene Labs.*, 655 F.3d at 1360.

In determining whether there would have been a motivation to combine prior art references to arrive at the claimed invention, it is insufficient to simply conclude the combination would have been obvious without identifying any reason why a person of skill in the art would have

made the combination. *Metalcraft of Mayville, Inc. v. The Toro Co.*, 848 F.3d 1358, 1366 (Fed. Cir. 2017). Without any explanation as to why the references would have been combined to arrive at the claimed invention, we are left with only hindsight bias that *KSR* warns against. *Id.* at 1367 (citing *KSR*, 550 U.S. at 421). “[W]e cannot allow hindsight bias to be the thread that stitches together prior art patches into something that is the claimed invention.” *Id.*

The proper question to ask is whether a designer of ordinary skill in the relevant technology, facing the wide range of needs created by developments in the field of endeavor, would have seen a benefit to modifying Naruse with a triangulation system as disclosed in Ramer. See *KSR*, 550 U.S. at 420. We determine that Petitioner provides no persuasive explanation, reasoning, or evidence for concluding that one of skill in the art would have combined these particular references to produce the claimed invention. See *id.* Petitioner provides no persuasive reason why a person of ordinary skill in this field would combine Naruse’s sensor-based system with the triangulation system disclosed in Ramer and come up with the system recited in claim 25, which includes the control module determining whether it can triangulate.

3. Claim 9

Petitioner asserts that claim 9 would have been obvious based on Naruse and Ramer. 1337 Pet. 26–33. Petitioner provides a clause-by-clause analysis of claim 9, identifying where in Naruse or Ramer a claimed element is disclosed in one or both of the references. *Id.* Specifically, Petitioner asserts Naruse discloses detecting the distance to a nearby object. *Id.* at 32 (citing Ex. 1003, 2:5-9). Petitioner also asserts that Ramer teaches

calculating the distance from the rear of the vehicle to an object as a function of the spacing between the sensors, the perpendicular distance, and the return signals received by the detectors. *Id.* (citing Ex. 1008, Fig. 7, 9:12-38). Petitioner relies on the declaration testimony of Dr. Papanikolopoulos for support. *Id.* (citing *passim* Ex. 1002).

Petitioner asserts a person of ordinary skill in the art would have been motivated to combine the perpendicular measurement system of Ramer with the object detection system of Naruse in order to rely on Ramer's triangulation method of range estimation to improve the accuracy of Naruse's time-of-flight calculation. 1337 Pet. 33. Specifically, Petitioner asserts Ramer's range calculation is that Ramer's range calculation provides an alternate method (triangulation) of range estimation that would improve the accuracy of Naruse's time-of-flight calculation. *Id.* (citing Ex. 1002 ¶ 250). Another advantage of Ramer's range calculation is that it depends on trigonometric relationships and looks up values in a table rather than using more calculation-intensive and thus potentially slower methods. *Id.*

Patent Owner asserts that Naruse does not calculate transverse location, or location and distance as a "function of" more than one return signal, as recited in claim 9. 1337 PO Resp. 22. It is Patent Owner's position that "Naruse teaches away" from calculating a distance and a location as a function of at least two return signals. *Id.* at 23. According to Patent Owner, the control module of the '803 Patent calculates a distance based on two return signals, whereas Naruse simply disregards all but one signal, and simply reports a location based on the location of the transmitter and receiver detection that represents the shortest time difference between

transmission and detection. *Id.* Patent Owner argues that it does not follow that one reference that utilizes two signals (Ramer) would be combined with another reference (Naruse) that expressly teaches disregarding all but one. *Id.* (citing Ex. 2003 ¶¶ 49, 50). Paragraphs 49 and 50 of Mr. Pfeiffer’s Declaration discuss Cherry, not Ramer. Thus, they are irrelevant to the asserted ground of unpatentability based on Naruse and Ramer. Patent Owner cites no relevant evidence to support its arguments.³⁰

Patent Owner’s “function of” argument is not persuasive for the reasons explained above with respect to claim 25.

4. Conclusion

Based on the evidence and analysis, as discussed above, we find that Petitioner has established, by a preponderance of the evidence, that claim 9 would have been obvious over the combination of Naruse and Ramer, but has not established, by a preponderance of the evidence, that claim 25 would have been obvious over the combination of Naruse and Ramer.³¹

³⁰ We do not search the record looking for evidence that may support a party’s argument. *DeSilva v. DiLeonardi*, 181 F.3d 865, 866–67 (7th Cir. 1999) (“A brief must make all arguments accessible to the judges, rather than ask them to play archeologist with the record.”); *see also Novartis AG v. Torrent Pharms.*, 853 F.3d 1316, 1326 n.2 (Fed. Cir. 2017) (explaining that a party failed to provide sufficient argument in support of its motion before the Board because the motion’s “superficial treatment amounts to little more than a request that the Board peruse the cited evidence and piece together a coherent argument on [the movant’s] behalf”).

³¹ We find nothing inconsistent between the determination for claim 9 and the determination for claim 25 based on Naruse and Ramer. The arguments and reasons to combine Naruse and Ramer in IPR2017-01336 are substantively and significantly different from those in IPR2017-01337.

*L. Patentability of Claims 10 and 21
Based on Naruse and Lemelson*

Petitioner asserts that claims 10 and 21 would have been obvious over the combination of Naruse and Lemelson. 1337 Pet. 34–59.

1. Lemelson

Lemelson discloses a video scanning system, such as a television camera and/or one or more laser scanners mounted on a vehicle, which scans the road in front of the vehicle and generates image information. This information is computer analyzed in combination with a range sensing system to warn the driver of hazardous conditions during driving by operating a display. Ex. 1009, 2:14–20. Petitioner asserts that a person of ordinary skill in the art would have understood that Lemelson’s object detection system would be connected to an on-board computer information system, which would allow the data to be shared with other systems. Pet. 48–49 (citing Ex. 1002 ¶ 273).

2. Discussion

Claims 10 and 21 are independent claims. Claim 10 recites specifically that the control module calculates a transverse location based on the return signals and also includes an interface between the control module and an on-board computer information system. Claim 21 recites specifically that the control module calculates a distance to and location of an object and displays the distance to and the location of the object.

Petitioner provides a clause-by-clause analysis of claim 10, identifying where in Naruse or Lemelson a claimed element is disclosed in

the references. Pet. 34–50. Petitioner relies on the declaration testimony of Dr. Papanikolopoulos for support. *Id.* (citing *passim* Ex. 1002).

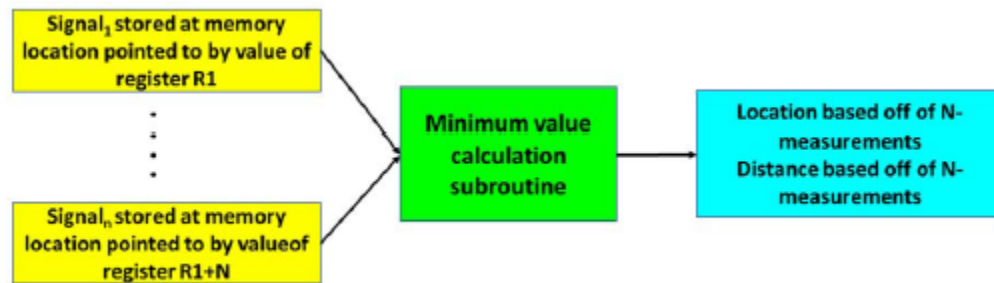
Petitioner also provides a clause-by-clause analysis of claim 21, identifying where in Naruse or Lemelson a claimed element is disclosed in one or both of the references. Pet. 50–59. Petitioner relies on the declaration testimony of Dr. Papanikolopoulos for support. *Id.* (citing *passim* Ex. 1002).

Petitioner asserts a person of ordinary skill in the art would have been motivated to combine Lemelson’s interface to an on-board computer information system with Naruse’s object detection system. Pet. 49. The reason why the proposed combination would have been obvious, according to Petitioner, is that both references are directed to solving the same problem, detecting objects near a vehicle to reduce the likelihood of collisions. *Id.* at 49–50. Petitioner also asserts it was well-known that vehicle systems, including object detection systems, would share information with the onboard computer to allow the information system to combine data from multiple sensors or systems. *Id.* at 50 (citing Ex. 1002 ¶ 274).

Patent Owner repeats its “function of” argument, asserting that Naruse does not disclose a control module that detects an object as a function of more than one signal. 1337 PO Resp. 23–24 (“As discussed throughout this Response, as well as the Response filed in the 1336 IPR, Naruse doesn’t calculate or detect anything as a result of multiple signals”).

We set out in detail above our findings and conclusions concerning Naruse’s disclosure of calculating distance as a function of multiple signals.

In its Reply (1337 Reply 19–20), Petitioner provides the following demonstrative, illustrating how Naruse uses multiple signals to calculate a distance to, and location of, an object. This demonstrative is fully consistent with our findings and conclusions.



Petitioner’s demonstrative illustrating how distance and location are calculated as a function of more than one return signal. 1337 Reply 19–20.

Based on the disclosures in Naruse and Lemelson, and the testimony of Dr. Papanikolopoulos, we determine that Petitioner has established, by a preponderance of the evidence, that claims 10 and 21 would have been obvious based on Naruse and Lemelson.

*M. Patentability of Claims 21 and 22
Based on Gauthier and Hayashikura*

Claim 21 is an independent claim, and has been discussed above in Part 1 of this Decision. Claim 22, dependent from claim 21, also has been discussed in Part 1. Claim 22 recites that the control module fuses data received from the plurality of sensors to detect objects within a 360° view surrounding the vehicle. Ex, 1001, 20:15–17.

Petitioner provides a clause-by-clause analysis of claims 21 and 22, identifying where in Gauthier or Hayashikura a claimed element is disclosed in the references. 1337 Pet. 67–80. Petitioner relies on the declaration testimony of Dr. Papanikolopoulos for support. *Id.* (citing *passim* Ex. 1002).

Petitioner asserts that Hayashikura discloses that the plurality of transmitters and receivers on and along the entire periphery of the vehicle permits detection of obstacles around the entire vehicle. *Id.* at 73 (citing Ex. 1007, 2:30–33).

According to Petitioner, a person of ordinary skill in the art would have found it obvious to combine the 360° object detection of Hayashikura with the multi-sensor detection system of Gauthier, achieving the expected result and benefit of detecting objects in the 360° area surrounding the vehicle in order to reduce the likelihood of collisions. *Id.* at 76–77 (citing Ex. 1002 ¶ 304).

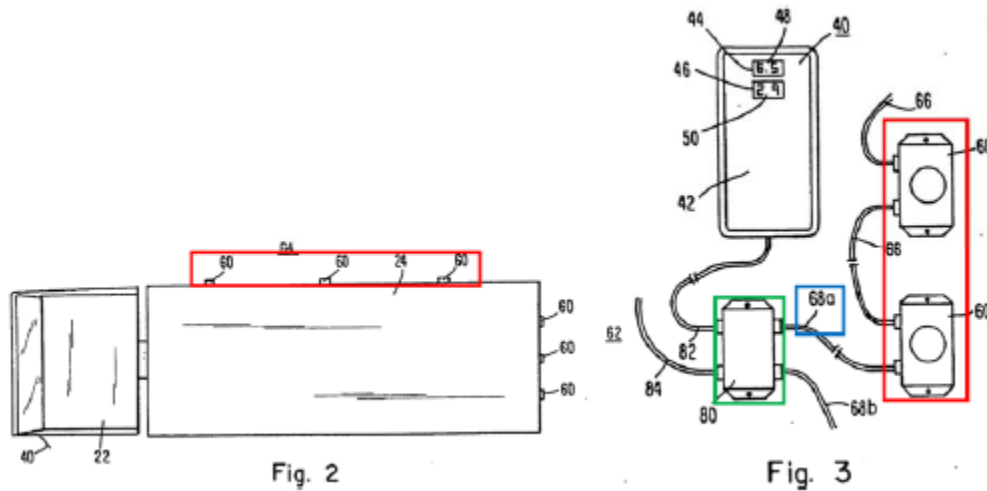
Patent Owner argues that neither Hayashikura nor Gauthier “teach[es] calculating a distance and a location as a function of multiple return signals, as those signals are processed separately,” as recited in claims 21 and 22. 1337 PO Response 25.³² Patent Owner does not cite any evidence to support this argument. Patent Owner also argues that because “each of Gauthier’s detections are based on a single transmitter/receiver pair, it teaches away from making any calculation based on multiple return signals.” *Id.* at 25–26. Again, no evidence is cited to support this attorney argument. According to Patent Owner, Hayashikura “explicitly discloses transmitter/receiver pairs, with no capability of the one receiver capable of receiving a signal from one of the other transmitters.” *Id.* at 26.

³² The heading addressing this ground of unpatentability in Patent Owner’s Response refers in error to “Claims 22 and 28.” PO Resp. 25. The argument, however, addresses challenged claims 21 and 22.

Patent Owner's argument is not persuasive because it is not commensurate with the scope of the claim. Claim 21 recites that the control module "*detects an object* as a function of plural signals." Ex. 1001, 20:12 (emphasis added). It also "*calculates* a distance to and location of the object and *displays* the distance to and the location of the object." *Id.* at 20:13–14.

As shown in Figure 2 of Gauthier, multiple transceivers 60 are located along the rear and side of trailer 24 to insure full sensor coverage. Ex. 1004, 6:48–50. The transceiver 60 is wired in parallel to simultaneously emit a pulse of ultrasonic acoustic energy and provide *overlapping* receive capability of a return ultrasonic transmitter for emitting an ultrasonic echo signal. *Id.* at 5:57–60 (emphasis added). Gauthier is sending out, and receiving information from multiple transceivers. Gauthier discloses that connection box 80 includes a controller for driving transceivers 60 to emit an ultrasonic pulse, receiving a return ultrasonic echo, and computing a distance to the obstruction that is reflecting the ultrasonic wave, and supplying a binary coded decimal (BCD) data signal indicating the computed distance. Ex. 1004, 7:5–10. The detector output from signal processor 212 is supplied to microprocessor 102 on a corresponding channel. *Id.* at 10:1–3. Microprocessor 102 alternately receives signals *from each of the channels* and, using the timer, determines a round trip time required for the acoustic wave energy to travel to, and return from the obstruction. *Id.* at 10:3–7. The microprocessor translates the time into a distance. *Id.* at 10:7–8.

Petitioner provides the following annotated Figures 2 and 3 from Gauthier.



Petitioner’s annotated Figures 2 and 3 from Gauthier. 1337 Reply 23.

As shown, sensors 60 are in a channel (red) connected to controller 80 (green) via cable 68a (blue). *Id.* (citing Ex. 1004, 6:31-7:12). Petitioner asserts a “POSITA would understand that Gauthier determines a location and distance of an object as a function of at least two sensors. *Id.* (citing Ex. 1011, ¶37; Ex. 1002, ¶¶ 309–310).

Hayashikura also discloses measuring the return signals, detecting an object, and calculating both the distance to, and location of, an object. Ex. 1007, 2:7–18. The processor determines a distance to the obstacle on the basis of a phase difference between a signal used for modulating the carrier wave and the demodulated signal. *Id.* at 2:23–26. Hayashikura also discloses that the plurality of the transmitter and receiver sections on and along the entire periphery of the vehicle permits detection of obstacles over an entire (virtually 360°) range around the vehicle. Ex. 1007, 2:30-33. See also 1337 Reply 24 (citing Ex. 1011, ¶ 39.) (showing annotated figures illustrating how Hayashikura calculates distance and location as a function of multiple return signals).

Petitioner asserts a person of ordinary skill in the art would have found it obvious to combine the 360° object detection of Hayashikura with the multi-sensor detection system of Gauthier, achieving the beneficial and expected result of combining data from the sensors surrounding the vehicle to detect objects in the entirety of the 360° area surrounding the vehicle.

1337 Pet. 76–77 (citing Ex. 1002 ¶ 304).

Patent Owner also argues that neither Gauthier nor Hayashikura disclose a control module capable of performing the calculations necessary to “fuse data.” 1337 PO Resp. 26. Patent Owner’s argument is not persuasive because it relies on a construction of “fuses data” that we decline to adopt in this Decision for the reasons discussed above. We also note that claim 21 does *not* require fusing data. In this asserted ground of unpatentability, only claim 22 requires fusing data. As explained above, both Hayashikura and Gauthier resolve or combine distance and location information from the data of multiple sensors, which is how we construe the term “fuses data.”

Based on the disclosures in Gauthier and Hayashikura, the testimony of Dr. Papanikolopoulos, and the corresponding analysis in Part 1 for claims 21 and 22, we determine that Petitioner has established, by a preponderance of the evidence, that claims 21 and 22 would have been obvious over the combination of Gauthier and Hayashikura.

*N. Patentability of Claim 24
Based on Gauthier and Cherry*

Claim 24 depends from claim 21 and recites that the control module includes a built-in-test function.

Petitioner acknowledges that Gauthier does not explicitly disclose a built-in-test function to test the object detection system. 1337 Pet. 81. As discussed above, Petitioner asserts that Cherry discloses a self-test mode for a vehicle object detection system. *Id.* (citing Ex. 1006, 1:6–14). Petitioner asserts that as shown in Figure 2 of Cherry, a controller and supporting circuitry drive the self-test mode by causing the transmitter to emit an ultrasonic wave, and using the return signal from the receiver to determine if the system is correctly receiving reflections of the transmitted signal and is operational. *Id.* (citing Ex. 1006, 2:57–3:10).

Petitioner concludes that a person of ordinary skill in the art would have found it obvious to combine the self-test mode of Cherry with the collision avoidance system of Gauthier, which would result in testing each of the transceivers of Gauthier, according to the self-test mode of Cherry. *Id.* at 83 (citing Ex. 1002 ¶ 323). Dr. Papanikolopoulos testifies that the use of Cherry’s self-test mode with Gauthier’s object detection system would result in the expected outcome of stepping through each transceiver to verify proper functionality before entering the normal operation mode. Dr. Papanikolopoulos also testifies that the test system of Cherry would have “reduced the number of system failures in real-world applications” and “was a way to reduce errors and system failures during the vehicle’s operation.” Ex. 1002 ¶ 194.

Patent Owner argues that “because Gauthier, as discussed above, teaches distinct detection locations, there can be no detection of an object as a function of return ‘signals,’” as recited in claim 21 from which claim 24 depends. 1337 PO Resp. 27. Patent Owner’s argument is not persuasive.

We have discussed throughout this Decision how the cited references disclose the “function of” limitation in claim 21.

Based on the disclosures in Gauthier and Cherry, and the testimony of Dr. Papanikolopoulos, we determine that Petitioner has established, by a preponderance of the evidence, that claim 24 would have been obvious based on Gauthier and Cherry.

III. CONCLUSION

We determine that Petitioner has shown by a preponderance of the evidence that claims 1–10, 17–22, 24, and 28 are unpatentable, but Petitioner has not shown by a preponderance of the evidence that claim 25 is unpatentable.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that:

- A. Claims 1–5, 7, 8, and 21 would have been obvious in view of Naruse, and thus are unpatentable;
- B. Claims 2 and 3 would have been obvious in view of Naruse and Gauthier, and thus are unpatentable;
- C. Claims 6 and 7 would have been obvious in view of Naruse and Tagami, and thus are unpatentable;
- D. Claim 24 would have been obvious in view of Naruse and Cherry, and thus is unpatentable;
- E. Claims 22 and 28 would have been obvious in view of Naruse and Hayashikura, and thus are unpatentable;
- F. Claim 9 would have been obvious based on Naruse and Ramer, and thus is unpatentable;

G. Claims 10 and 21 would have been obvious based on Naruse and Lemelson, and thus are unpatentable;

H. Claims 17–20 would have been obvious based on Naruse and Cherry, and thus are unpatentable;

I. Claims 21 and 22 would have been obvious based on Gauthier and Hayashikura, and thus are unpatentable; and

J. Claim 24 would have been obvious in view of Gauthier and Cherry, and thus is unpatentable.

FURTHER ORDERED that claim 25 has not been shown to be unpatentable; and

FURTHER ORDERED that this is a Final Written Decision under 35 U.S.C. § 318(a), and that parties to the proceeding seeking judicial review of the Decision under 35 U.S.C. § 319 must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2017-01336
IPR2017-01337
Patent 6,268,803 B1

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