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Paper 33
Date: July 15, 2020

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS INC.,

Petitioner,

v.

CARRUM TECHNOLOGIES, LLC

Patent Owner.

IPR2019-00481
Patent 7,925,416 B2

Before LYNNE H. BROWNE, PATRICK R. SCANLON, and JON B. TORNQUIST, *Administrative Patent Judges*.

BROWNE, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background

Unified Patents, Inc. ("Petitioner") filed a Petition (Paper 2, "Pet.") requesting institution of an *inter partes* review of claims 1, 2, 7, and 9–11 of U.S. Patent No. 7,925,416 B2 (Ex. 1001, "the '416 patent"). Carrum Technologies, LLC ("Patent Owner") filed a Preliminary Response (Paper 6). We instituted an *inter partes* review of all challenged claims. Paper 8 ("Inst. Dec.").

After institution, Patent Owner filed a Patent Owner Response (Paper 10, "PO Resp."), Petitioner filed a Reply to Patent Owner's Response (Paper 18, "Pet. Reply"), and Patent Owner filed a Sur-Reply (Paper 20). With prior authorization, Petitioner filed a Motion to Strike Patent Owner's Sur-Reply and the second Shaver Declaration (Ex. 2010). Patent Owner filed an Opposition (Paper 25) to Petitioner's Motion to Strike. We granted Petitioner's Motion to Strike. Paper 26. Patent Owner filed a corrected Sur-Reply (Paper 28, "PO Sur-Reply"). An oral hearing was held on April 21, 2020, and a copy of the transcript was entered in the record. Paper 32 ("Tr.").

We have jurisdiction pursuant to 35 U.S.C. § 6. This Decision is a Final Written Decision under 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 as to the patentability of the challenged claims. 35 U.S.C. § 316(e) (2012); 37 C.F.R. § 42.1(d) (2018). Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc*., 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must prove unpatentability by a preponderance of the evidence. *See* 35 U.S.C. § 316(e);

37 C.F.R. § 42.1(d). Having reviewed the arguments and the supporting evidence, we determine that Petitioner has demonstrated, by a preponderance of the evidence, that challenged claims 1, 2, 7, and 9–11 of the '416 patent are unpatentable.

B. Related Proceedings

The parties indicate that the '416 patent is the subject of *Carrum Technologies, LLC v. BMW of North America, LLC, et al.*, Case No. 1:18-cv-01645 (D. Del.), C*arrum Technologies, LLC v. FCA US, LLC,* Case No. 1:18-cv-01646 (D. Del.), and *Carrum Technologies, LLC v. Ford Motor Company*, Case No. 1:18-cv-01647 (D. Del.). Pet. 1; Paper 5, 2.

C. Real Parties in Interest

Petitioner identifies itself as the real party in interest. Pet. 1. Patent Owner identifies itself and Pratima Instruments, LLC as real parties in interest. Paper 5, 2.

D. Instituted Ground of Unpatentability

Petitioner asserts claims 1, 2, 7, and 9–11 of the '416 patent are unpatentable as set forth in the chart below:

Claims Challenged	35 U.S.C. §[1]	References/Basis
10, 11	103(a)	Harada,[2] Russell,[3] Mazda[4]
1, 2, 7, 9	103(a)	Russel, Fukada,[5] Mazda

[1] The Leahy-Smith America Invents Act ("AIA") included a revision to 35 U.S.C. § 103 that became effective on March 16, 2013. Because the '416 patent issued from an application filed before March 16, 2013, we apply the pre-AIA version of the statutory basis for unpatentability.
[2] Ex. 1004, US 5,508,929, issued April 16, 1996.
[3] Ex. 1005, US 6,675,094 B2, issued January 6, 2004.
[4] Ex. 1006, JP H05-36000, published February 12, 1993.
[5] Ex. 1007, US 5,627,756, issued May 6, 1997.

Petitioner supports its challenge with the Declaration of Scott Andrews, dated December 31, 2018 ("Andrews Declaration") (Ex. 1008).

Patent Owner supports its arguments with the declaration Gregory Shaver, Ph.D. (Ex. 2007).

E. The '416 Patent

The '416 patent is directed to "a method and system for controlling a vehicle having an ACC system." Ex. 1001, 1:12–13. The system used with this method is shown in Figure 2, reproduced below:

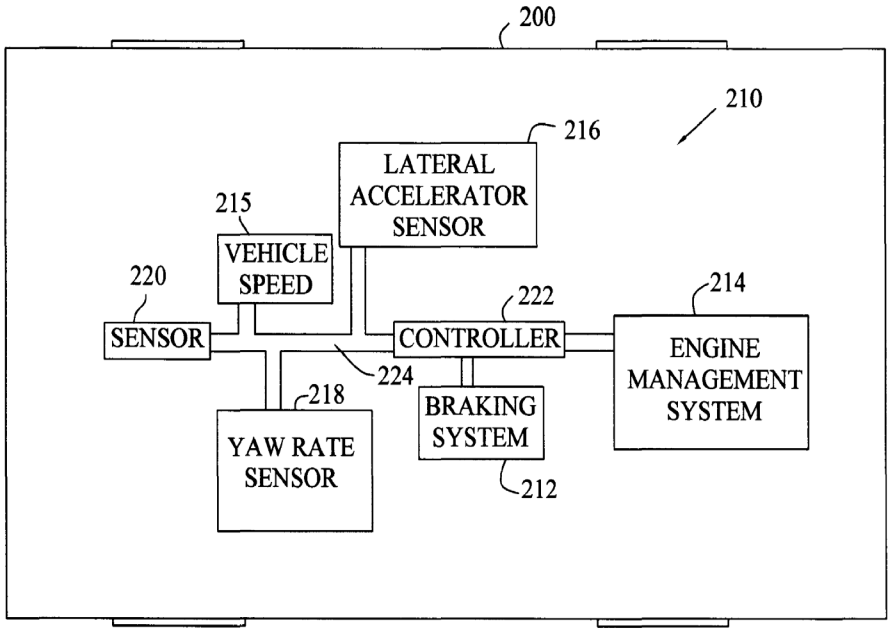

FIG. 2

Figure 2 is a schematic of a vehicle including system 210. *Id.* at 3:54–55. "System 210 is implemented in host vehicle 200 that has braking system 212 and engine management system 214." *Id.* at 4:16–18. "System 210 includes vehicle speed sensor 215 for measuring vehicle's 200 speed, lateral acceleration sensor 216 for measuring the acceleration of vehicle 200 . . . and yaw rate sensor 218 for measuring the rate that vehicle 200 is rotating

about its vertical axis." *Id.* at 4:19–23. "System 210 also includes sensor 220 for generating a range signal corresponding to a distance between host vehicle 200 and a target, and a target range rate signal corresponding to a rate that the distance between host vehicle 200 and the target is changing." *Id.* at 4:23–27.

Figure 4, reproduced below, shows the method used with system 210.

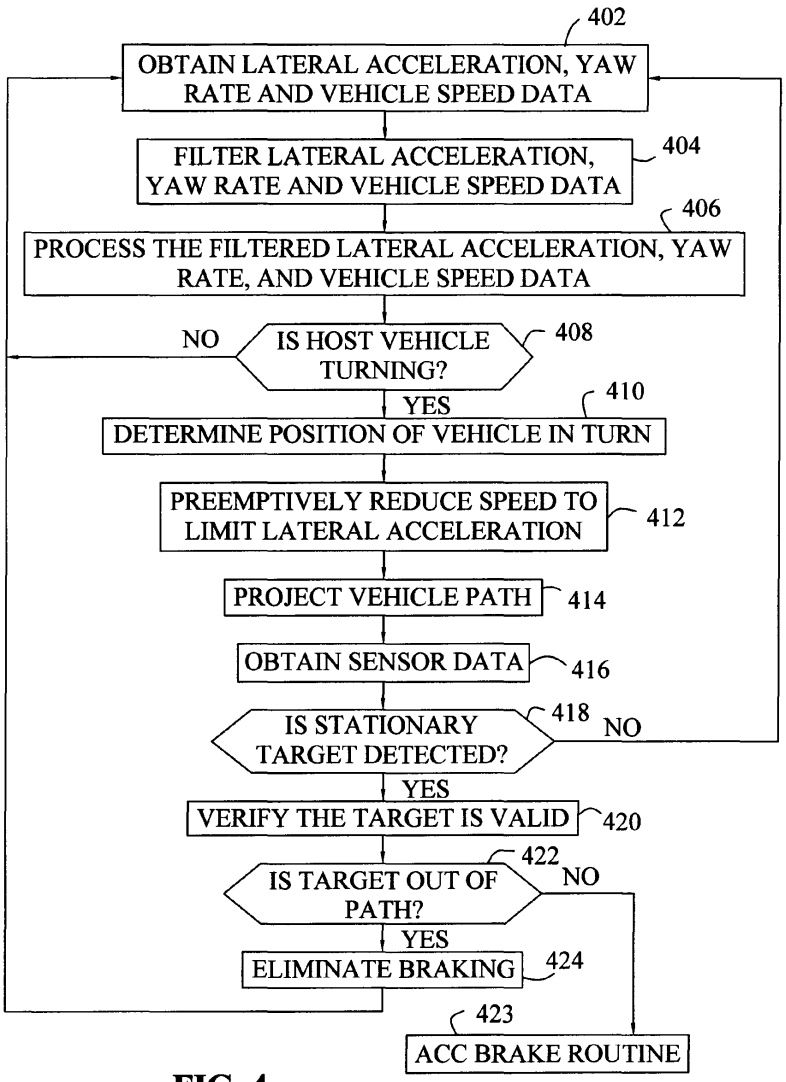

FIG. 4

Figure 4 is a flowchart illustrating this method. *Id.* at 3:58–59. In this method "controller 222 continuously monitors vehicle's 302 speed, lateral

acceleration and yaw rate, each of which is provided to controller 222 as signals from sensors 215, 216, 218 (FIG. 2)." Ex. 1001, 5:19–23. "At step 402, controller 222 obtains and stores vehicle's 302 lateral acceleration data, yaw rate data and vehicle speed data." *Id.* at 5:23–25. "At step 404, controller 222 uses a time lag filter to filter the raw lateral acceleration, yaw rate and vehicle speed data, and at step 406, controller 222 processes this filtered data." *Id.* at 5:25–28.

"[C]ontroller 222 determines vehicle's 302 position within the turn by using programmed instructions that recognize patterns exhibited in lateral acceleration data when a vehicle is in the entry of a turn, in the middle of a tum, or exiting a turn." Ex. 1001, 6:20–24. "After controller 222 determines at step 410 where in tum 306 vehicle 302 is positioned, controller 222 then instructs braking system 212 at step 412 to preemptively reduce vehicle's 302 speed so that vehicle's 302 lateral acceleration speed is reduced to a predetermined maximum limit according to vehicle's 302 position in the turn." *Id.* at 6:24–29.

F. Illustrative Claims

Petitioner challenges claims 1, 2, 7, and 9–11. Claims 1 and 10 are independent. Both claims are reproduced below:

> 1. A method of controlling a vehicle having an adaptive cruise control system capable of obtaining a vehicle lateral acceleration, said method comprising the steps of:
>
> determining when the vehicle is in a turn based on a detected change in the vehicle lateral acceleration;
>
> determining a vehicle path during the turn;
>
> detecting an object;
>
> determining whether the object is in the vehicle path during

the turn;

reducing the vehicle speed if the object is determined to be in the vehicle path during the turn; and

ignoring the object for braking purposes if the object is determined not to be in the vehicle path during the turn.

Ex. 1001, 8:7–19.

10. A system for use in controlling a vehicle at a vehicle speed, said system including:

an adaptive cruise control system;

a controller in communication with said adaptive cruise control system and capable of determining when the vehicle is in a turn, said controller operative to reduce the vehicle speed according to a vehicle position in the tum;

at least one lateral acceleration sensor for generating a signal corresponding to a vehicle lateral acceleration, said lateral acceleration sensor in electrical communication with said controller and operative to detect a change in the vehicle lateral acceleration; and

at least one object detection sensor for detecting an object in a vehicle path of the vehicle during the tum, said object detection sensor in electrical communication with said controller, wherein said controller includes control logic operative to determine whether the object is in the vehicle path during the turn and ignoring the object for braking purposes when the object is not determined to be in the vehicle path.

Ex. 1001, 8:63–9:16.

II. ANALYSIS

A. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill at the relevant time would have had "a bachelor's degree in electrical engineering or mechanical engineering, or a related subject, and two to three years of work experience in the field of automotive control systems" Pet. 9. Petitioner asserts further

that "[a] lack of experience can be remedied with additional education (e.g., a Master's degree), and likewise, a lack of education can be remedied with additional work experience (e.g., 5–6 years)." *Id.* (citing Ex. 1008 ¶¶ 55–58). "Patent Owner [does] not dispute Petitioner's definition of a personal of ordinary skill in the art." PO Resp. 2 (citing Pet. 9; Ex. 2007 ¶ 20). We agree with Petitioner's definition of the level of ordinary skill in the art as it is consistent with the level of ordinary skill reflected in the '416 patent and the prior art of record.

B. Claim Construction

For inter partes reviews filed on or after November 13, 2018, we apply the same claim construction standard used by Article III federal courts and the ITC, both of which follow *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc), and its progeny. *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340, 51,340, 51,358 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018) (now codified at 37 C.F.R. § 42.100(b) (2019)). Because the instant Petition was filed on December 31, 2018, we apply that standard here. Accordingly, we construe each challenged claim of the '416 patent to generally have "the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." *Id.* Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999); *see also Nidec Motor Corp. v. Zhongshan Broad Ocean*

Motor Co., 868 F.3d 1013, 1017 (Fed. Cir. 2017) (applying *Vivid Techs.*in the context of an *inter partes* review).

Petitioner proposes constructions for two limitations. Pet. 12–15. Patent Owner proposes construction of a different limitation. PO Resp. 11–12. We address each of these proposed claim constructions below.

1. *"at least one lateral acceleration sensor . . . operative to detect a change in the vehicle lateral acceleration"*

This limitation appears in claim 10. Ex. 1001, 9:2–7. According to Petitioner, "Patent Owner, in each of its District Court complaints, has taken the position that a 'sensor capable of measuring lateral acceleration will inherently detect a change in the measured lateral acceleration.'" Pet. 12–13 (citing Ex. 1011 ¶ 38; Ex. 1009 ¶ 39; Ex. 1010 ¶ 38 (parenthetical quotations omitted)). Based on these statements, Petitioner asserts that a person of ordinary skill in the art "would have understood that a lateral acceleration sensor disclosed in the prior art necessarily discloses 'at least one lateral acceleration sensor . . . operative to detect a change in the vehicle lateral acceleration.'" Pet. 13 (citing Ex. 1008 ¶¶ 63–65). "Patent Owner does not contest this construction" in its Response. PO Resp. 12.

We agree with and adopt Petitioner's construction of this claim limitation as it is consistent with the Specification of the '416 patent, which states that "the lateral acceleration sensor [is] in electrical communication with the controller and operative to detect a change in the vehicle's lateral acceleration." Ex. 1001, 3:24–26.

2. *"means for generating an object range signal corresponding to a distance between the vehicle and the object; and an object angle signal corresponding to the object's angle in relation to the vehicle"*

This limitation appears in claim 11. Ex. 1001, 9:18–22. As noted by Petitioner, "because this claim term includes the word "means," there is a rebuttable presumption that 35 U.S.C. § 112 ¶ 6 applies." Pet. 14. According to Petitioner, "[t]he claim term recites no structure that overcomes that presumption. Thus, this term is a means-plus-function claim term under 35 U.S.C. § 112 ¶ 6, which must be construed pursuant to 37 C.F.R. § 42.104(b)(3)." *Id.*

Petitioner asserts that "[t]he functions recited in the term are 'generating an object range signal corresponding to a distance between the vehicle and the object and an object angle signal corresponding to the object's angle in relation to a vehicle.'" Pet. 14. Petitioner then identifies portions of the specification that pertain to this function. *Id.* at 14–15 (citing Ex. 1001, 4:23–25, 4:42–46; 4:56–62). In view of these disclosures in the specification, Petitioner asserts that a person of ordinary skill in the art "would have understood the corresponding structure for this means plus-function limitation to include 'any object detecting sensor known in the art,' including those explicitly listed, and equivalents." *Id.* at 15 (citing Ex. 1008 ¶¶ 66–69) (footnote omitted). "Patent Owner does not contest this construction" in its Response." PO Resp. 13.

We agree with and adopt Petitioner's construction of this claim limitation as it is consistent with the Specification of the '416 patent in the portions of the specification cited by Petitioner. *See* Ex. 1001, 4:23–25, 4:42–46; 4:56–62.

3. "controller…capable of determining when the vehicle is in a turn, said controller operative to reduce the vehicle speed according to a vehicle position in the turn"

This limitation appears in claim 10. Ex. 1001, 8:66–9:2. Patent Owner asserts that this limitation requires "a controller that 'detects when a vehicle is in a turn,' because claim 10's controller could not be operative to reduce the vehicle speed according to a vehicle position in the turn—unless it also detects when a vehicle is in a turn." PO Resp. 12. (citing Ex. 2007 ¶¶43–45) (emphasis omitted).

Petitioner asserts that this claim construction should be rejected. Pet. Reply 2. Although, Petitioner agrees that "the claim requires that the controller have knowledge that the vehicle is turning," Petitioner asserts that the controller could gain such knowledge "in many ways; for example, the vehicle's turn could be indicated to the controller rather than detected" by it. *Id.* (citing Ex. 1023 ¶¶ 17–18). Petitioner asserts further that "[i]t could also be 'determined' (e.g., based on the controller receiving an angle of operation of a steering wheel)." *Id.* (citing Ex. 1023 ¶¶ 15–16). Given these alternative ways in which the controller could obtain the necessary information, Petitioner contends that "it does not necessarily follow that *determining when the vehicle is in a turn requires* 'detecting.'" *Id.*

Patent Owner disagrees, asserting that "Petitioner's expert admitted on cross-examination that claim 10 . . . requires 'determining when the vehicle is in a turn,' and that the controller is 'operative to reduce the vehicle speed according to the vehicle's position in the turn.'" PO Sur-Reply 1.

Patent Owner's argument conflates the claim term "determining" with the terms "detect" or "detecting." In other words, Patent Owner construes the claim term "determining" to mean the same thing as the claim term "detecting." Patent Owner, however, does not provide any evidence that these different claim terms mean the same thing. In the absence of sufficient

evidence to the contrary, we "must presume that the use of these different terms in the claim[] connotes different meanings." *CAE Screenplates Inc. v. Heinrich Fiedler GmbH & Co. KG*, 224 F.3d 1308, 1317 (Fed. Cir. 2000). We agree with Petitioner that the claim term "determining" is broader than the claim terms "detect" or "detecting" and encompasses other ways of obtaining the information necessary to ascertain whether the vehicle is in a turn.

Accordingly, we agree with and adopt Petitioner's understanding of this limitation. Specifically, we agree that claim 10 does not require a controller that detects when a vehicle is in a turn. Rather, claim 10 requires a controller "capable of determining when the vehicle is in a turn," which encompasses determination made in ways other than detecting.

C. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and, when presented, (4) objective evidence of nonobviousness.[6] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

[6] Patent Owner provides no such evidence for our consideration. *See generally* PO Resp.

We analyze the asserted grounds of unpatentability in accordance with the above-stated principles.

D. Obviousness of Claims 10 and 11 in View of Harada, Russell, and Mazda

Petitioner contends that claims 10 and 11 are unpatentable under 35 U.S.C. § 103(a) over Harada, Russell, and Mazda. Pet. 15–42. Having now considered the evidence in the complete record established during trial, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that these claims would have been obvious in view of Harada, Russell, and Mazda. We begin our analysis with an overview of the prior art.

1. Harada

Harada is directed to "a vehicle control apparatus which controls one or more running conditions of a vehicle so that the vehicle reaches a target position intended by a driver." Ex. 1004, 1:60–62. Harada's control apparatus is shown in Figure 1 reproduced below:

FIG. 1

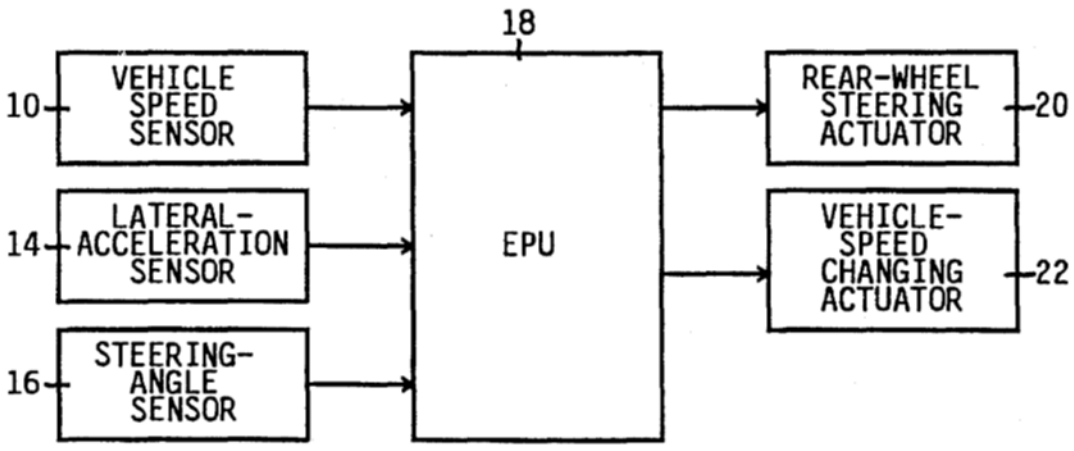

Figure 1 "is a diagrammatic view of an electric construction of a vehicle control apparatus in accordance with the present invention." *Id.* at 3:62–64. As shown in this figure, Harada's vehicle control apparatus includes vehicle-speed sensor 10, lateral-acceleration sensor 14, steering-angle sensor 16, electronic control unit 18, rear-wheel steering actuator 20, and vehicle-speed changing actuator 22. *Id.* at 4:25–35.

Harada's "vehicle-speed sensor 10 detects or estimates a running velocity or speed, V, of the center of gravity of the vehicle, based on the speed of rotation of the output shaft of the engine (not shown) of the vehicle." Ex. 1004, 4:36–39. Harada's "lateral-acceleration sensor 14 detects an acceleration, G_y, of the vehicle in the lateral direction of the vehicle." *Id.* at 4:64–65. And, Harada's "steering-angle sensor 16 detects an angle, θ, of operation or rotation of the steering wheel." *Id.* at 5:1–2.

In Harada, control unit 18 "determines an intended target position and an estimated target position of the vehicle based on the output signals of the above described *three* sensors 10, 14, 16, and controls the rear-wheel steering actuator 20 or vehicle-speed changing actuator 22 based on the difference between the intended and estimated target positions." Ex. 1004, 5:53–59 (emphasis added).

2. Russell

Russell is directed to "a path prediction system and method for use with adaptive cruise control and collision avoidance systems for an automotive vehicle, the path prediction system tracking targets in the same highway lane as the vehicle." Ex. 1005, 1:16–20. Russell's path prediction system is shown in Figure 1 reproduced below:

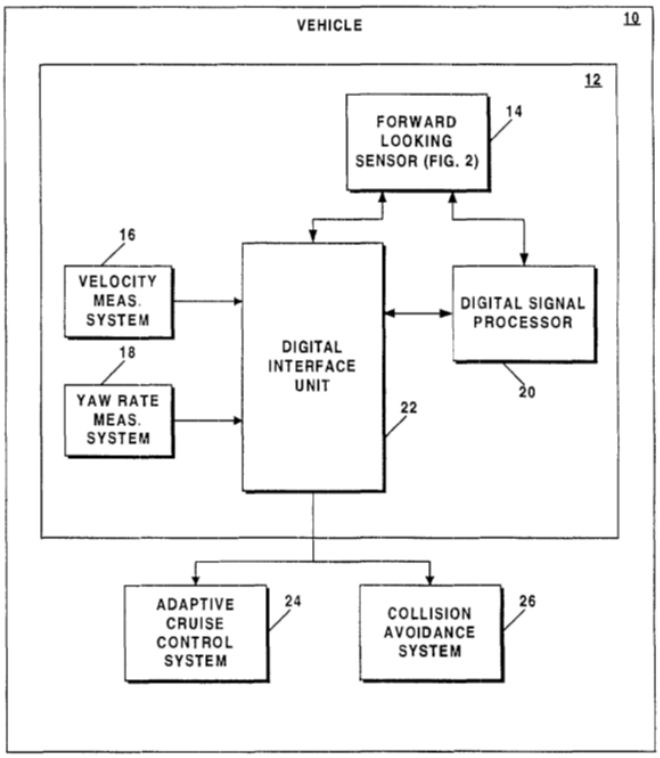

Figure 1

Figure 1 "illustrates a vehicle having a path prediction system in accordance with the present invention." *Id.* at 3:28–29. Russell's detection system 12 includes forward looking sensor 14, velocity measuring system 16, yaw rate measuring system 18, digital interface unit 22, and signal processing system 20. *Id.* at 3:55–4:3. In Russell's system "signal processing system 20 collects the data inputs. From forward looking sensor 14 it receives data, for each tracked target, relating to the range, angle, velocity and acceleration relative to host vehicle 10." *Id.* at 5:36–39. Russell explains that "[f]rom this information, system 20 converts the data to range, angle, velocity and

acceleration. It uses the angle and the range to calculate lateral velocity." *Id.* at 5:39–42.

3. Mazda

Mazda is directed to "a vehicular automatic braking device." Ex. 1006 ¶ 1. The problem solved by Mazda's device is the "unnecessary application of automatic braking as a vehicle negotiates a curved road." *Id.* ¶ 3. Mazda's device achieves this goal by detecting, independently of steering wheel inputs, whether a vehicle is running through a curve and preventing the application of unnecessary automatic braking. *Id.* ¶ 5

4. Independent Claim 10

Petitioner provides claim charts and arguments with citations to the relevant portions of Harada, Russell, or Mazda that teach or suggest the elements of claim 10 with citations to supporting declarant testimony. Pet. 18–40.

a. A system for use in controlling a vehicle at a vehicle speed, said system including: (preamble)

Petitioner contends that "[t]o the extent the preamble is limiting, Harada discloses it or at least renders it obvious." Pet. 18 (citation omitted). Specifically, Petitioner asserts that Harada discloses a vehicle control apparatus for controlling at least one running condition of a vehicle including a vehicle-speed sensor. *Id.* (citing Ex. 1004, Abst., Fig. 1; Ex. 1008 ¶¶ 80–81). Patent Owner does not contest Petitioner's argument that Harada teaches the preamble of claim 10. *See generally* PO Resp.

For the reasons explained by Petitioner above, which we expressly adopt, Petitioner has shown that Harada teaches the preamble of claim 10.[7]

b. an adaptive cruise control system (limitation 10.1)

Petitioner contends "*Harada* discloses a 'control apparatus for an automotive four-wheel vehicle' but does not explicitly disclose that its system is, or includes, an adaptive cruise control system." Pet. 18 (citing Harada, 4:21–23). According to Petitioner, "*[a]daptive cruise control system[s]* were well-known before the time of the '416 Patent, however, and *Russell* explicitly discloses an *adaptive cruise control system*." *Id.* (citing Ex. 1005, 3:51–4:5; 5:5–25; 1:14–20, Ex. 1008). Petitioner asserts that a person of ordinary skill in the art "would have been motivated to combine *Russell's* teachings of an *adaptive cruise control system* for multiple reasons." *Id.* at 19 (citing Ex. 1008 ¶¶ 84–84). Petitioner notes that "*Harada* discloses a vehicle control apparatus, just like the '416 Patent discloses an invention that 'provides smooth vehicle control' and that "*Russell* is also analogous art to the '416 Patent, as both disclose systems for use with adaptive cruise control systems." *Id.* at 19–20 (citing Ex. 1001, Abst.; Ex. 1005, 1:14–19). With these observations in mind, Petitioner contends that "combining the teachings of *Harada* with those of *Russell* would have been no more than the combination of known elements according to known methods to yield predictable and beneficial results." *Id.*

[7] We need not determine whether the preamble of claim 10 is limiting as the parties have not raised that issue before us and Petitioner persuasively demonstrates that the limitations of the preamble are disclosed in Harada. Nonetheless, Patent Owner has waived any argument for patentability directed to the preamble of claim 10. *See* Paper 9, 7–8 ("Patent Owner is cautioned that any arguments for patentability not raised in the response may be deemed waived.").

at 20 (citing Ex. 1008 ¶ 86). According to Petitioner, a person of ordinary skill in the art "would have recognized that incorporating *Russell's* teachings with the teachings of *Harada* would have provided benefits, such as improved safety and mitigation of a wider set of external factors." *Id.*

Petitioner contends further that a person of ordinary skill in the art "would have recognized that *Russell's* adaptive cruise control system . . . could have been incorporated easily into the control apparatus of *Harada* by simply adding the hardware used by *Russell's* adaptive cruise control system 24 into *Harada's* . . . control apparatus." Pet. 20–21 (citing Harada, 4:33–35; Ex. 1008 ¶ 87). According to Petitioner, a person of ordinary skill in the art "would have recognized that any additional programming needed by the combination would be within the level of skill in the art, and would have been accomplished, for example, by adding basic software routines to *Harada's* 'ROM of the ECU 18.'" *Id.* at 21 (citing Harada, 5:49–53). Petitioner also asserts that "*Russell* helpfully roadmaps the use of the adaptive cruise control system with other components of a vehicle control apparatus . . . and provides flow charts and other information to guide a [person of ordinary skill in the art] in implementing its system and methods." *Id.* (citing Russel, 5:5–25). Based on these assertions, Petitioner submits that a person of ordinary skill in the art "would have recognized a reasonable expectation of success in incorporating the adaptive cruise control system and appropriate software routines into the system of *Harada*. *Id.* (citing Ex. 1008 ¶ 88). In addition, Petitioner contends that a person of ordinary skill in the art "would have been motivated to incorporate *Russell's* teachings to provide the benefits of a 'path prediction system and method

which is simple, accurate, cost-effective and reliable.'" *Id.* (citing Russel, 2:6–18, Ex. 1008 ¶ 88).

Patent Owner asserts that "[a]lthough Petitioner asserts numerous purported rationales under which '[a person of skill in the art] would have been motivated to combine [*Harada* with] *Russell's* teachings of an *adaptive cruise control system*,' none of them stand up to the slightest scrutiny. PO Resp. 30 (citing Pet. 19). Patent Owner raises four arguments in support of this position. We discuss each argument in turn below:

i. Analogous Art

Patent Owner contends that Harada is not analogous art because "*Harada* is not directed to [a system for] overriding the driver's intended speed—which is the central purpose of ACC systems." PO Resp. 31 (citing Ex. 1008 ¶¶ 100–103). Patent Owner also asserts that "[f]or the same reasons, *Harada* is also not analogous art to *Russell's* path prediction system for ACC and collision avoidance—and thus a [person of ordinary skill in the art] reviewing *Harada's* stability controller would not have any reason to look to *Russell's* ACC and collision avoidance disclosure." *Id.* (citing Ex. 1008 ¶¶ 105–106). Patent Owner contends further that "even if *Harada* is analogous art . . . Petitioner's assertion that a [person of ordinary skill in the art] would combine the *Harada* and *Russell* references because they 'were drawn from the same general field of art' is 'simply too conclusory to satisfy [Petitioner's] burden.'" PO Resp. 31–32 (citing *Securus Techs., Inc. v. Glob. Tel*Link Corp.*, 701 F. App'x 971, 976 (Fed. Cir. 2017); *Agilent Techs., Inc. v. Bio-Rad Labs., Inc.*, IPR2019-00268, Paper 8, 18–19 (PTAB May 16, 2019)).

In reply, Petitioner contends that Patent Owner's "analogous art test is wrong." Pet. Reply 13. Petitioner asserts that "[a]rt is analogous if it is 'from the same field of endeavor' as the subject patent (*In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004)) and the scope of analogous art is broad." *Id.* citing *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1238 (Fed. Cir. 2010)). Petitioner asserts further that "[a]rt is also analogous 'if the reference is not within the field of the inventor's endeavor' but if reasonably pertinent to the patent's problem." *Id.* (citing *Bigio*, 381 F.3d at 1325).

Turning to the merits of Patent Owner's assertion, Petitioner contends that "PO's expert admits the 'subject matter areas relevant to this matter' are broadly 'vehicle control systems,' not simply adaptive cruise control systems. *Id.* (citing Ex. 2007 ¶ 15).[8] According to Petitioner, "Dr. Shaver's confirmation that the field of vehicle control systems is relevant means *Harada*, which discloses a 'vehicle control apparatus,' (EX1004, Abstract)) satisfies the 'same field of endeavor' analogous art test." *Id.* Petitioner also contends that because the systems described in the '416 patent have lateral acceleration sensors, "*Harada* 'logically would have commended itself' to a [person of ordinary skill in the art]'s attention." *Id.* (citing Ex. 1001, 4:12–29; quoting *In re ICON Health and Fitness, Inc.*, 496 F.3d 1374, 1380 (Fed. Cir. 2007)). Thus, Petitioner asserts that "[u]nder either test, *Harada* is analogous art." *Id.*

Patent Owner disagrees again, contending that the field of endeavor is not vehicle control systems and that Petitioner's expert testimony does not

[8] Petitioner also cites "57:11–15." It is, however, unclear what document Petitioner is referencing at page 57 lines 11–15.

support its position that Harada would have logically commended itself to the attention of a person of ordinary skill in the art. PO Sur-Reply 16.

Petitioner sets forth the correct tests for analogous art. *See Bigio*, 381 F.3d at 1325 ("Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed and, (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved." (citing *In re Deminski*, 796 F.2d 436, 442 (Fed. Cir. 1986); *In re Wood*, 599 F.2d 1032, 1036 (CCPA 1979))). We agree with Petitioner that Harada is in the same field of endeavor as the '416 patent, thus satisfying the first test. We reach this conclusion because, as noted by Petitioner, Harada is directed to a "control apparatus for an automotive four-wheel vehicle" and so is the '416 patent. Ex. 1004, 4:21–23; Ex. 1001, 1:12–13 ("this invention relates to a method and system for *controlling a vehicle* having an ACC system") (emphasis added). The fact that this field of endeavor is large does not negate the fact Harada and the '416 patent are in the same field of endeavor. Moreover, Patent Owner's expert essentially admits as much. Ex. 2007 ¶ 15; Ex. 1022 57:8–60:5). For these reasons, we find that Harada is analogous art to the '416 patent.[9]

ii. No Problem in Harada for Russell to Solve

Patent Owner contends that Petitioner does not identify a problem in Harada that Russell solves. PO Resp. 32. Specifically, Patent Owner asserts that "Petitioner omits the disclosure from *Russell* that explicitly states that it

[9] Having determined that Harada is analogous art under the first test, we need not consider whether it qualifies under the second test.

is directed to 'a path prediction system and method ***for use with adaptive cruise control and collision avoidance systems*** for an automotive vehicle." *Id.* (citing Ex. 1005, 1:15–16). According to Patent Owner, "because *Harada* does not involve cruise control, a [person of ordinary skill in the art] would not look to *Russell*—because those two references are not even directed to the same kind of vehicle control, much less to the same vehicle control problems." *Id.* at 33 (citing Shaver ¶ 111). Patent Owner asserts that "neither Petitioner, nor its expert, nor any of the cited Ground 1 prior art references identifies or points to any problem in *Harada* at all— much less a specific problem in *Harada* that would prompt a [person of ordinary skill in the art] to look to *Russell* to solve." *Id.* (citing Pet., *passim*). Based on this observation, Patent Owner contends that "[t]his failure alone is sufficient to find that Petitioner has defaulted on showing a motivation to combine the two references." *Id.* at 33–34 (citing *Westinghouse Air Brake Techs. Corp. v. Siemens Indus., Inc.*, IPR2017-00582, 16 (Paper 12); *In re Zurko*, 111 F.3d 887, 889–90 (Fed. Cir. 1997).

In reply, Petitioner contends that "obviousness does not require identification of such a problem. Rather, any need in the art 'can provide a reason for combining the elements in the manner claimed.'" Pet. Reply 14 (quoting *KSR*, 550 U.S. at 420). Petitioner asserts that "the prior art recognized that *Russell* addressed intelligent cruise control and collision avoidance applications, and a person of ordinary skill in the art "would have recognized benefits of incorporating such systems" into Harada's vehicle. *Id.* (citing Ex. 1008 ¶ 89). According to Petitioner, a person of ordinary skill in the art "would have appreciated that *Russell* improved safety using its 'forward looking sensor,' (*see* EX1008, ¶¶110–111) motivating a [person of

ordinary skill in the art] to incorporate *Russell's* ACC system with *Harada*." *Id.* (citing Ex. 1018, 1:4–7).

Petitioner contends further that "[i]t's not necessary that the combination be made for the reasons that motivated the '416 Patent's inventors; even before *KSR*, the law did 'not require that the references be combined for the reasons contemplated by the inventor.'" Pet. Reply 14 (quoting *In re Beattie*, 974 F.2d 1309, 1312 (Fed. Cir. 1992); *KSR*, 550 U.S. at 420). Petitioner asserts that Patent Owner's "cited cases do not compel otherwise." *Id.* Petitioner explains that "[i]n *Westinghouse*, the challenger cited the challenged patent as the motivation to combine; the Board found this analysis suggestive of improper hindsight." *Id.* at 14–15 (citing *Westinghouse*, IPR2017-00582, Paper 12, 16). Petitioner also explains that "in *In re Zurko*, the court reversed because the motivation was not found in the references." *Id.* at 15 (citing *In re Zurko*, 111 F.3d at 889–90 (Fed. Cir. 1997). According to Petitioner, the facts of these cases do not apply because "[h]ere, *Russell* provides the motivation." *Id.* (citing Ex. 1008 ¶ 111) (internal citation omitted).

In addition, Petitioner submits that Patent Owner "provides no analysis or evidence to contradict Petitioner's conclusion that a [person of ordinary skill in the art] would have found benefits to incorporating *Harada* and *Russell*." Pet. Reply 15. Rather, according to Petitioner, Patent Owner's expert alleges "only that he would not have been convinced of Petitioner's argument, and he does not contend that a [person of ordinary skill in the art] would not have appreciated the advantages to combining *Harada* and *Russell*." *Id.* (citing Ex. 2007 ¶¶ 107–112). In its Sur-Reply,

Patent Owner does not specifically refute this argument. *See generally* PO Sur-Reply.

Petitioner is correct that there is no requirement that it identify a problem in Harada that Russell solves. Rather, as noted by Petitioner "any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *KSR*, 550 U.S. at 420; *see also* Pet. Reply 15. Petitioner also correctly notes that "the law does not require that the references be combined for the reasons contemplated by the inventor." *See Beattie*, 974 F.2d at 1312 (citing *In re Kronig*, 539 F.2d 1300, 1304 (CCPA 1976); *In re Lintner*, 458 F.2d 1013, 1016 (CCPA 1972)). For these reasons, we agree with Petitioner that Patent Owner's test for obviousness is overly narrow and that Patent Owner's argument that Petitioner fails to identify a problem in Harada that Russell solves does not apprise us of a flaw in Petitioner's reasoning. Pet. Reply 14.

iii. No Motivation to Combine

Patent Owner contends that the fact that a person of ordinary skill in the art could combine Russell with Harada does not provide motivation to combine these references. PO Resp. 34. According to Patent Owner, Petitioner's assertion that "combining the teachings of *Harada* with those of *Russell* would have been no more than the combination of known elements according to known methods to yield predictable and beneficial results," is conclusory because a person of skill in the art "would not have considered all of the elements of *Harada* to be known or to yield predictable results." *Id.* at 34–35 (citing Pet. 20, 32; Ex. 2007 ¶¶ 69–98). Based on this alleged deficiency in Petitioner's reasoning, Patent Owner asserts that Petitioner

"does not address at all *why* a [person of ordinary skill in the art] would have combined" Harada and Russell. *Id.* at 35.

Patent Owner contends further that Petitioner's reasoning "that a [person of ordinary skill in the art] 'would have recognized that *Russell's* adaptive cruise control system . . . could have been incorporated easily into the control apparatus of *Harada* by simply adding the hardware used by *Russell's* adaptive cruise control system 24 into *Harada's* Figure 1 control apparatus,'" likewise "does not address *why* a [person of ordinary skill in the art] would have been combined the references, even if easy to do so." PO Resp. 35 (citing Pet. 20–21, 32).

In reply, Petitioner asserts that its "rationale that combining *Russell's* teachings with *Harada* was no more than combining prior art elements according to known methods" is a rationale suggested with approval in *KSR*. Pet. Reply 15 (citing Pet. 20). Responding to Patent Owner's allegation that "the Petition did not address '*why* a [person of ordinary skill in the art] would have combined the references,'" Petitioner reiterates its position "that the combination 'would have provided benefits, such as improved safety and mitigation of a wider set of external factors.'" *Id.* (citing PO Resp. 35; Pet. 20). In addition, Petitioner asserts that "Petitioner also established 'a reasonable expectation of success' because *Russell* 'roadmaps the use of the adaptive cruise control system with other components of a vehicle control apparatus' and includes details to guide implementation of its teachings." *Id.* at 18 (citing Pet. 21). In its Sur-Reply, Patent Owner does not specifically refute this argument. *See generally* PO Sur-Reply.

As discussed above, Petitioner provides several reasons why a person of ordinary skill in the art at the time of the invention would have combined

the teachings of Harada and Russell. *See*, *e.g.,* Pet. 18–21. Petitioner's reasoning is supported by the testimony of its expert, Scott Andrews. *See*, *e.g.*, Ex. 1008 ¶¶ 84–88. In particular, Mr. Andrews testifies that the proposed combination would yield predictable results. *Id.* ¶ 87. Further, Mr. Andrews explains how the combination could be accomplished. *Id.* We agree with Petitioner that this discussion demonstrates a reasonable expectation of success. Pet. 21.

Further, the fact the Petitioner relies on one of the rationales set forth in *KSR* (i.e., that the combination is no more than combining prior art elements according to known methods) does not demonstrate the Petitioner failed to meet its burden of showing that limitation 10.1 is obvious. When, as in this case, Petitioner provides evidence to support its contention of obviousness and that evidence accords with one of the rationales enumerated in *KSR*, Petitioner meets its burden.

iv. Motivation Too Generic

Noting Petitioner's assertion "that a [person of ordinary skill in the art] 'would have recognized that incorporating *Russell's* teachings with the teachings of *Harada* would have provided benefits, such as improved safety and mitigation of a wider set of external factors,'" Patent Owner contends that "Petitioner does not present any evidence that a [person of ordinary skill in the art] reading *Harada* would have recognized a safety problem that needed to be solved or improved." PO Resp. 36 (citing Pet. 20, 32; also *id.*, *passim*). According to Patent Owner, "[t]hat should end the inquiry." *Id.* Patent Owner contends further that "*Russell's* ACC disclosure is not directed to improved vehicle safety. . . . Rather, Russell acknowledges that its

invention recognizes 'the need for increased automotive convenience.'" *Id.* (citing Ex. 2007 ¶¶ 113–119; Russel, 1:22–26, 2:6–9).

In addition, Patent Owner contends that the facts of this case are similar to those in *ActiveVideo*, where "the Federal Circuit specifically held that an asserted motivation to combine asserting a general desire 'to build something better,' 'more efficient, cheaper,' that 'had more features' or was 'more attractive to [] customers' 'is generic' and thus insufficient to establish obviousness." PO Resp. 37 (citing *ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1328 (Fed. Cir. 2012)). Patent Owner contends further that the Board followed *ActiveVideo* in *Jaguar Land Rover N. Am. v. Blitzsafe Texas*, LLC, IPR2018-00544, slip op. at 18 (PTAB Aug. 10, 2018) and should do so in this case as well. *Id.* at 37–41. Specifically, Patent Owner contends that although "Petitioner argues that a [person of ordinary skill in the art] 'would have recognized that *Harada* provides teachings that enhance vehicle safety when considering natural factors (e.g., wind), while *Russell* provides teachings that enhance vehicle safety when considering obstacles (e.g., other vehicles in traffic),'" "none of the elements for which Petitioner relies on *Harada* have anything to do with 'vehicle safety when considering natural factors (e.g., wind).'" *Id.* at 38–39 (citing Pet. 20).

Similarly, Patent Owner contends that although Petitioner argues that "because '*Russell* presents braking in response to object detection . . . and *Harada* presents a complementary approach of engine throttling in response to lateral slip of a vehicle[, b]y incorporating *Russell's* adaptive cruise control system into *Harada's* 'vehicle control apparatus' [], benefits of each type of control are provided,'" "Petitioner presents no evidence that a

[person of ordinary skill in the art] reading *Harada* would have thought it desirable to add 'braking in response to object detection' to *Harada's* stability control disclosure." PO Resp. 39 (citing Pet. 22, *passim.*). Patent Owner contends further that "none of the elements for which Petitioner relies on *Harada* have anything to do with utilizing engine throttling, particularly in response to lateral slip of a vehicle." *Id.* According to Patent Owner, "Petitioner's motivation to combine allegations are unrelated to whether a [person of ordinary skill in the art] would have combined specific prior art elements to arrive at the specific invention claimed in the '416 Patent, [and as such] Petitioner's allegations are insufficient to establish obviousness." *Id.* at 40 (citing *Jaguar*, slip op. at 18). Thus, Patent Owner asserts that "Petitioner arguments purporting to show a motivation to combine would apply to the combination of almost *any* dynamic stability control reference with almost *any* ACC reference—without regard to anything specific disclosed in *Harada* and *Russell*—a rationale the Federal Circuit has rejected." *Id.*

Petitioner disagrees with Patent Owner's assertion that improved safety is insufficient motivation by distinguishing *ActiveVideo* and *Jaguar*. Pet. Reply 15–19. Regarding *ActiveVideo*, Petitioner asserts that "*ActiveVideo* does not categorically exclude 'improved safety' as a valid motivation." *Id.* at 16 (citing *ActiveVideo*, 694 F.3d at 1328). Rather, according to Petitioner, in *ActiveVideo* "the challenger asserted the 'modular nature of the components' and 'efficiency and market demand' supported obviousness, such that any one of six references could be combined with another using these broad motivations." *Id.* (citing *ActiveVideo*, 694 F.3d at 1327). Petitioner contends that in *ActiveVideo* "[t]he expert provided only

generic motivations: building something better, more efficient, or with more features; all were unrelated to the prior art or claim limitations." *Id.* (citing *ActiveVideo*, 694 F.3d at 1327–28). Petitioner asserts that "[t]he Federal Circuit affirmed that this was insufficient, because the 'expert failed to explain how specific references could be combined, which combination(s) of elements in specific references would yield a predictable result, or how any specific combination would operate or read on the asserted claims.'" *Id.* at 16–17.

In contrast, Petitioner contends that in this proceeding "the Petition's motivations are not 'divorced from the prior art elements.'" Pet. Reply 17 (citing *Apple Inc. v. Qualcomm Inc.*, IPR2018-01316, Paper 7, 37; *ActiveVideo*, 694 F.3d at 1328). According to Petitioner, its "reason to combine is achieved by incorporating an ACC system like *Russell's*" in to Harada's system. *Id.* Petitioner asserts that "[t]his is not generic, but rather directly linked to the prior art." *Id.*

Petitioner contends that *Jaguar* "does [not] categorically exclude 'improved safety'" either. Pet. Reply 18. Petitioner asserts that in *Jaguar*, "the Board found a 'generic goal of providing a single, cohesive system' insufficient, and likewise found assertions of a 'safer driving experience' as "bear[ing] little relation to any *specific combination of elements*.'" Pet. Reply 18 (citing *Jaguar*, 18). According to Petitioner, "[t]hat's not the case here: the combination of *Russell* with *Harada* achieves advantages expressly supported by the references." *Id.* (citing Pet. 20; Ex. 1024). Petitioner asserts further that the proposed combination "and its supporting motivations [unlike the combination and supporting motivation in *Jaguar*], are directly related to 'whether a [person of ordinary skill in the art] would

have combined specific prior art elements to arrive at the specific invention claimed in the '416 Patent.'" *Id.* (citing PO Resp. 40).

In addition, Petitioner contends that its "proposed motivation also provides a 'reasoned explanation' consistent with precedent." Pet. Reply 18. Petitioner contends further that "[e]xplanations of approved motivations to combine include those that 'identif[y] a reason why a [person of ordinary skill in the art] would have combined the prior art references . . . that had a foundation in the prior art.'" *Id.* at 18–19 (citing *In re Nuvasive, Inc.*, 842 F.3d 1376, 1382–83 (Fed. Cir. 2016)). Based on these contentions, Petitioner argues that the Petition provides "a 'reasoned explanation' and supports finding that a [person of ordinary skill in the art] would have been motivated to combine *Harada* and *Russell*. *Id.* at 19.

In its Sur-Reply, Patent Owner essentially reiterates its arguments based on *ActiveVideo* and *Jaguar*. PO Sur-Reply 16–18.

We do not agree with Patent Owner's contention that the benefits identified by Petitioner in support of its "motivation to combine" are too generic and unrelated to the challenged claims. PO Resp. 36; PO Sur-Reply 16. Rather than address these benefits as described by Russell, Patent Owner relies on a superficial similarity between the benefits enumerated in Russell and the benefits alleged in *ActiveVideo* and *Jaguar* to support this contention. *See* Ex. 1005, 1:14–19, 47–53. But in this case, *Russell* explicitly discusses the benefits relied on by Petitioner in support of its rationale. *Id.* Thus, the benefits relied upon by Petitioner (i.e., collision avoidance and object detection) are specific rather than generic. Furthermore, they are related to the challenged claims, which are also concerned with object detection. Ex. 1001, 9:8–15.

For these reasons, we agree with Petitioner that the facts of both *ActiveVideo* and *Jaguar* are distinguishable from the facts of this case.

> c. *a controller in communication with said adaptive cruise control system and capable of determining when the vehicle is in a turn, said controller operative to reduce the vehicle speed according to a vehicle position in the turn (limitation 10.2)*

Petitioner contends the "[t]he combination of *Harada* and *Russell* discloses, or at least renders obvious, this claim limitation." Pet. 23. Specifically, Petitioner asserts that "*Harada* discloses a *controller in communication with* other elements." *Id.* Petitioner identifies these elements as "sensors 10, 14, 16," which "are connected to an input part of an electronic control unit 18 . . . computer including a central processing unit." *Id.* at 23–24. According to Petitioner, "[t]he output part of the ECU 18 is connected to a rear-wheel steering actuator 20 and a vehicle-speed changing actuator 22.'" *Id.* at 24 (citing Ex. 1004, 4:27–35). Petitioner explains that "[i]n the proposed combination with *Russell* . . . the *controller* (ECU 18) is *in communication with said adaptive cruise control system*." *Id.* at 24.

Petitioner asserts further that "*Harada* discloses that its controller is *capable of determining when the vehicle is in a turn*" because Harada describes "that the 'steering-angle sensor 16 detects an angle, θ, of operation or rotation of the steering wheel (not shown) by the driver to steer the front wheels (not shown), from a neutral position (θ=0) of the steering wheel where the vehicle can run straightly frontward in the longitudinal direction thereof.'" Pet. 24–25 (citing Ex. 1004, 5:1–6). According to Petitioner, "*Harada* states that 'ECU 18 determines an intended target position and an estimated target position of the vehicle based on the output signals of the above-described three sensors 10, 14, 16'" and "*Harada* detects when the

vehicle is in the turn (*e.g.*, non-zero lateral displacements versus time in y direction indicate vehicle is in a turn)." *Id.* at 25 (citing Ex. 1004, 5:54–59; Ex. 1008 ¶ 94). Petitioner also asserts that in Russell "the 'intended target position may be represented by a lateral displacement amount, y1,' [and] the 'estimated target position [may be] represented by a lateral displacement amount, y2.'" *Id.* at 27 (citing Ex. 1005, 6:4–16). Based on these assertions, Petitioner argues that a person of ordinary skill in the art "would have understood that, by determining an intended target position and an estimated target position by the signals of the sensors, *Harada* discloses a controller *capable of determining when the vehicle is in a turn*." *Id.* at 26. In addition, Petitioner notes that "a non-zero steering angle θ, fed into ECU 18, additionally shows a controller *capable of determining when the vehicle is in a turn*." *Id.*

Next, Petitioner contends that "*Harada* also discloses *said controller operative to reduce the vehicle speed according to a vehicle position in the turn*. Pet. 26. Specifically, Petitioner asserts that in Harada

> "ECU 18 determines an intended target position and an estimated target position of the vehicle based on the output signals of the above-described three sensors 10, 14, 16, and ***controls the rear-wheel steering actuator 20 or vehicle-speed changing actuator 22*** based on the difference between the intended and estimated target positions."

Id. (quoting Ex. 1004, 5:54–59) (alteration in original). Thus, according to Petitioner, "*Harada* explicitly discloses *reducing the vehicle speed*." *Id.* (citing Ex. 1008 ¶ 96).

Quoting Harada at column 9 lines 41–51 for support, Petitioner also contends that Harada "discloses that this [reduction in vehicle speed] is performed *according to a vehicle position in the turn*." Pet. 26–27.

Petitioner explains that "the 'intended target position may be represented by a lateral displacement amount, y1' which is compared to the 'estimated target position [] represented by a lateral displacement amount, y2' (i.e., the *vehicle position in the turn*), and based on the comparison of the two, *Harada* describes lowering vehicle speed." *Id.* at 27.

Considering the combined teachings of Harada and Russell, Petitioner contends that "by describing a controller that determines an intended target position and which controls a vehicle-speed changing actuator, and an adaptive cruise control system, the combination of *Harada* and *Russell*" disclose this limitation of claim 10. Pet. 27–28 (citing Ex. 1008 ¶¶ 92–99).

Patent Owner disagrees arguing that Harada does not reduce speed according to the vehicle position in a turn, Harada does not disclose determining a positon in a turn, and Harada teaches away from reducing vehicle speed during a turn. PO Resp. 15, 20, 26. We discuss each of these arguments below.

i. Harada Does Not Disclose Determining A Vehicle Position In a Turn, Much Less Reducing Vehicle Speed on This Basis

Patent Owner asserts that "Petitioner wrongly assumes that *Harada* discloses determining a vehicle position in a turn." PO Resp. 20. In support of this assertion, Patent Owner argues that "both Petitioner and its expert marshal nothing more than an 'i.e.' parenthetical to assert (incorrectly) that *Harada's* estimated target position represented by a lateral displacement amount is the same as determining the vehicle's position in the turn." *Id.* at 21 (citing Ex. 1008 ¶ 98). Patent Owner argues further that "Petitioner's conclusory assertion is wrong because a [person of ordinary skill in the art] reading *Harada* would understand that y2 cannot be the same as the vehicle

position in the turn." *Id.* (citing Ex. 2007 ¶¶ 73–75). According to Patent Owner, "y2 does not represent a determination of the vehicle position in a turn—it represents the estimated lateral displacement of the vehicle" and "the fact that y2 can have a high value even when the vehicle is not turning, such that there is no position in the turn to determine, further illustrates that y2 does not represent a determination that a vehicle is in a turn." *Id.* at 21–22 (citing Ex. 1004, 7:1–53; Ex. 2007 ¶¶ 75–76).

In addition, Patent Owner contends that "*Harada* explicitly excludes turns from the situations in which *Harada* teaches that the absolute value $|y_2-y_1|$ may become greater than the reference value d." PO Resp. 22. In support of this contention, Patent Owner quotes Harada as stating "'[w]hen the vehicle is running in a normal manner with, e.g., usual change of the steering angle of the steering wheel, ***there is substantially no case where the absolute value $|y_2-y_1|$ becomes greater than the reference value d.***'" *Id.* (citing Ex. 1004, 10:3–6). Rather, Patent Owner asserts, "*Harada* discloses that in . . . 'sudden disturbance' scenarios [such as a sudden side wind or abrupt change in the road surface friction coefficient], the absolute value of $|y_2-y_1|$ is high and 'may be come greater than the reference value d [width of a lane].'" *Id.* (quoting Ex. 1004, 10:7–10). According to Patent Owner, "because y_1 should be 0 in these 'sudden disturbance' scenarios, the value of y_2 must necessarily be high in order for the absolute value of $|y_2-y_1|$ to be high" and "a high y_2 value cannot represent a determination of a vehicle position in the turn in these scenarios, as Petitioner incorrectly asserts, because they are non-turning events." *Id.* (citing Ex. 2007 ¶ 76). Thus, Patent Owner argues that a person of skill in the art "would understand that y_2 cannot be the same as the vehicle position in the turn" and would further

understand that Harada does not disclose determining a vehicle position in a turn as required by claim 10. *Id.* at 22–23.

Patent Owner contends that "[t]he situations [such as when skidding on a snowy or icy road] where *Harada* discloses reducing vehicle speed have nothing to do with the vehicle position in a turn." PO Resp. 23 (citing Ex. 2007 ¶¶ 78–80). According to Patent Owner, a person of ordinary skill in the art

> would understand that *Harada* teaches that reducing vehicle speed in these unstable situations may occur regardless of any position in a turn, and even when the vehicle is not turning at all—such as "[w]hen the vehicle is receiving a sudden disturbance, such as sudden side wind or abrupt and large change of the friction coefficient μ of the road surface."

Id. at 23–24 (quoting Ex. 2007 ¶¶ 81–82; Ex. 1004, 10:3–9). Thus, Patent Owner asserts, "*Harada* does not teach or render obvious to a [person of ordinary skill in the art] reducing vehicle speed according to the vehicle position in the turn, because *Harada* is simply not addressing turn position at all." *Id.* at 24 (citing Ex. 2007 ¶ 84, Ex. 1004, 3:52–53).

Then, Patent Owner contends that "neither [Harada's] Figure 4 nor its description in the specification mention anything about lowering vehicle speed." PO Resp. 25. Rather, Patent Owner asserts Harada explains "that 'during the time duration τ, the **v*ehicle speed V, steering angle Θ, yaw rate γ, and lateral acceleration Gy each are not changed*' . . . Thus, Figure 4 is explicitly *not* discussing lowering vehicle speed for any reason." *Id.* (quoting Ex. 1004, 6:4–22). Based on this assertion, Patent Owner argues that a person of ordinary skill in the art "would understand that Figure 4 merely shows a comparison between the car's intended and estimated lateral displacement at a single point in time during the turn, ***without regard to the***

vehicle's position (i.e., entry, vertex, or exit) within the turn." *Id.* (citing Ex. 2007 ¶ 91).

In reply, Petitioner contends that Patent Owner misinterprets claim 10 by adding unrecited limitations. Pet. Reply 3. Specifically, Petitioner asserts that Patent Owner's arguments are based on the premise that claim 10 "requires 'determining a vehicle position in a turn,'" but "[c]laim 10 simply requires 'determining when the vehicle is in a turn.'" *Id.* (citing PO Resp. 20–21, Ex. 1001, 8:67–9:1). Petitioner asserts further that "Dr. Shaver's analysis appears to rest on this misinterpretation of the claim (*see, e.g.*, EX2007, ¶77) and thus, his analysis is of little probative weight." *Id.* at 4.

Petitioner also contends that Patent Owner "attempts to implicitly construe 'position' as limited to a turn's "entry, vertex, or exit.'" Pet. Reply 4 (citing PO Resp. 25). Petitioner disagrees, noting that "[t]he specification merely describes the entry, middle, and exit as examples of locations," such that claim 10 "only requires determining when the vehicle is in a turn and reducing a vehicle speed." *Id.* (citing Ex. 1001, 5:41–45). In addition, Petitioner asserts that Patent Owner "adds yet another unrecited limitation to the claim by requiring the vehicle's position in a turn serve 'as a basis or trigger' to reduce speed." *Id.* (citing PO Resp. 24). According to Petitioner, "the claims do not recite any requirement for a 'vehicle position in a turn' to be a 'trigger,' but in any event, as described below, *Harada's* vehicle control apparatus acts to slow a vehicle on the basis of a vehicle's position during a turn, meeting even this unrecited limitation." *Id.*

In response, Patent Owner contends that "[t]he Petition never alleges that *Harada* discloses 'determining a vehicle position in a turn,' and in its

Reply, Petitioner does not dispute this." PO Sur-Reply 2. Then Patent Owner argues that "it is common sense that the controller must determine the vehicle's position in the turn in order to be able to reduce the vehicle speed 'according to a vehicle position in a turn' as claim 10 requires." *Id.* at 3 (citing *Lisle Corp. v. A.J. Mfg. Co.*, 398 F.3d 1306, 1314 (Fed. Cir. 2005); *N. Am. Container, Inc. v. Plastipak Packaging, Inc.*, 415 F.3d 1335, 1346 (Fed. Cir. 2005)). In support of this assertion, Patent Owner quotes sections of the Specification describing the operation of the '416 patent's controller. *Id.* at 3–4.

We agree with Petitioner that Patent Owner's contentions misrepresent the language of limitation 10.2. *See* PO Resp. 20; *see also* PO Sur-Reply 2. This limitation of claim 10 requires "a controller . . . capable of determining when the vehicle is in a turn." Ex. 1001, 8:67–9:1. As explained in Section II.B.3 above, it does not require "determining a vehicle position in a turn" as argued by Patent Owner. PO Resp. 20–26; PO Sur-Reply 2–5. Thus, Patent Owner's argument that y2 is not the vehicle position in the turn misses the point because determining the vehicle position in the turn is not required by claim 10. We further agree with Petitioner that "[a]s shown in Figure 4 of *Harada*, the system of *Harada* detects when the vehicle is in the turn (*e.g.*, non-zero lateral displacements versus time in y direction indicate vehicle is in a turn)." Pet. 27 (citing Ex. 1008 ¶ 94).

Furthermore, we do not agree with Patent Owner that "*Harada* is simply not addressing turn position at all." PO Resp. 23. Although Harada discusses reducing vehicle speed when the vehicle experiences a sudden disturbance (i.e., sudden side wind or abrupt and large change in the coefficient of friction of the road surface), we do not agree that this

disclosure means Harada precludes reducing vehicle speed during a turn. *See* Ex. 1004, 10:3–9. Harada states

> ECU 18 determines an intended target position and an estimated target position of the vehicle based on the output signals of the above-described three sensors 10, 14, 16, and *controls* the rear-wheel steering actuator 20 or *vehicle-speed changing actuator* 22 based on the difference between the intended and estimated target positions.

Ex. 1004, 5:54–59 (emphases added). For this reason, we determine that Harada discloses reducing vehicle speed.

For these reasons, we determine that Petitioner has sufficiently demonstrated that Harada discloses a controller capable of determining when the vehicle is in a turn and operative to reduce the vehicle speed according to a vehicle position in a turn, as required by limitation 10.2.

ii. Harada Teaches Away From Reducing Vehicle Speed During a Turn

Patent Owner contends that "*Harada* specifically ***teaches away from reducing vehicle speed during turns***." PO Resp. 26 (citing Ex. 2008 ¶ 92). Patent Owner asserts that "*Harada* teaches that 'where the absolute value of the difference [between the intended and estimated target positions of the vehicle] is small, it may be unnecessary to effect the vehicle condition control, which the driver may feel as an excessive control.'" *Id.* at 26–27 (citing Ex. 1004, 3:8–11). For this reason, according to Patent Owner, "*Harada* goes on to teach that '[w]hen the value $|y_2\text{-}y_1|$ is smaller than the reference value d [equal to the width of a traffic lane], the vehicle will not deviate out of the lane and therefore it is not necessary to effect the vehicle-condition control.'" *Id.* at 27 (citing Ex. 1004, 8:64–9:2). Patent Owner details Harada's disclosure in this regard. *Id.* at 27–28. Then, Patent Owner

asserts that consistent with Harada's disclosure "turns are excluded from *Harada's* listed scenarios." *Id.* at 28 (citing Ex. 1004, 9:46–47, 11:26–48). Patent Owner asserts further that it is in situations other than turns "that *Harada* teaches that 'the vehicle speed V is lowered for improving the degree of driving safety.'" *Id.*

In addition, Patent Owner contends that in turns "*Harada* discloses controlling 'the vehicle to actually reach a position which is less deviated from the intended target position than a position reached by the vehicle controlled by the [] conventional control device.'" PO Resp. 29 (citing Ex. 1004, 2:38–41, 8:66–67). In support of this contention, Patent Owner asserts that

> Specifically, in the paragraphs that precede the passage Petitioner cites, *Harada* discloses that it accomplishes this more minor control, not by reducing the vehicle speed as Petitioner argues, but by operating "the rear-wheel steering actuator . . . to steer the rear wheels" either "to the phase or side opposite to the side to which the front wheels are being steered through operation of the steering wheel," or "to the same side as the side to which the front wheels are being steered through operation of the steering wheel"—depending on the signs of y_1, y_2 and the value of the difference (y_2-y_1).

Id. (citing Ex. 1004, 9:3–26). Based on these disclosures, Patent Owner argues that a person of skill in the art "would understand that *Harada* actually teaches *away* from reducing vehicle speed during turns." *Id.* (citing Ex. 1004 ¶¶ 93–96, 98; *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009)). Thus, according to Patent Owner, "it would not be obvious to a [person of ordinary skill in the art] reading *Harada* to reduce vehicle speed according to a vehicle position in the turn as claims 10 and 11 of the '416 Patent require." *Id.* at 29–30 (citing

Ex. 2007 ¶ 98); *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1354 (Fed. Cir. 2001)).

Petitioner disagrees, asserting that "P[atent] O[wner] introduced no evidence that *Harada* discourages reducing vehicle speed during a turn." Pet. Reply 12. According to Petitioner, "[a]t most, *Harada* suggests following another path **in other circumstances**, but it does not criticize controlling during instability." *Id.* (citing *In re Ethicon, Inc.*, 844 F.3d 1344, 1351 (Fed. Cir. 2017) (no teaching away where reference did not present "clear discouragement")). In addition, Petitioner does not agree that "turns are excluded from *Harada's* listed scenarios." *Id.* (quoting PO Resp. 28). Rather, Petitioner reiterates that "*Harada* explicitly applies in turning scenarios." *Id.*

In reply, Patent Owner maintains its position that Harada teaches away. PO Sur-Reply 11–15. Patent Owner asserts that

> Because *Harada* teaches exercising vehicle control *other than speed reduction* "[w]hen the vehicle is running in a normal manner with, e.g., usual change of the steering angle of the steering wheel," reserving speed reduction for non-turning unstable situations, *Harada* teaches away from "reduc[ing] the vehicle speed according to a vehicle position in the turn" as claims 10-11 require.

Id. at 12.

We do not agree with Patent Owner. "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 (citing *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004)). The passages identified by Patent Owner in support of its argument, do not criticize, discredit, or

otherwise discourage reducing vehicle speed according to a vehicle position in the turn, they merely suggest a preferred alternative. Such encouragement does not constitute "teaching away" in this case.

> *d. at least one lateral acceleration sensor for generating a signal corresponding to a vehicle lateral acceleration, said lateral acceleration sensor in electrical communication with said controller and operative to detect a change in the vehicle lateral acceleration (limitation 10.3)*

Petitioner contends that "*Harada* discloses, or at least renders obvious, this limitation." Pet. 28. Specifically, Petitioner asserts that Harada discloses a lateral acceleration sensor generating a signal corresponding to a vehicle lateral acceleration and a lateral acceleration sensor in electrical communication with the controller. *Id.* Noting Patent Owner's "position in district court that a 'sensor capable of measuring lateral acceleration will inherently detect a change in the measured lateral acceleration,'" Petitioner asserts that "*Harada's* lateral acceleration sensor is inherently *operative to detect a change in the vehicle lateral acceleration* as recited under Patent Owner's admissions and as the term *lateral acceleration sensor* is construed herein." *Id.* at 29 (citing Ex. 1008 ¶ 103). Petitioner asserts further that "*Harada* also explicitly describes detection of the change of lateral acceleration." *Id.* In support of this assertion, Petitioner quotes Harada at column 7 lines 17–37. *Id.* at 29–30.

According to Petitioner, "[b]y describing that the initial signal magnitude of the output of the lateral-acceleration sensor is 'suddenly changed,' and by describing integration of this output signal of the lateral-acceleration sensor, *Harada* discloses a lateral acceleration sensor *operative to detect a change in the vehicle lateral acceleration* as recited." *Id.* at 30 (citing Ex.1008 ¶¶ 104–105).

Patent Owner does not contest Petitioner's argument that Harada teaches this limitation of claim 1. *See generally* PO Resp.

For the reasons explained by Petitioner above, which we expressly adopt, we determine that Petitioner has demonstrated that Harada teaches "at least one lateral acceleration sensor for generating a signal corresponding to a vehicle lateral acceleration, said lateral acceleration sensor in electrical communication with said controller and operative to detect a change in the vehicle lateral acceleration," as required by claim 10.[10]

> *e. at least one object detection sensor for detecting an object in a vehicle path of the vehicle during the turn, said object detection sensor in electrical communication with said controller, wherein said controller includes control logic operative to determine whether the object is in the vehicle path during the turn and ignoring the object for braking purposes when the object is not determined to be in the vehicle path (limitation 10.4)*

Petitioner contends that Harada, Russel, and Mazda render this limitation obvious. *See*, *e.g.*, Pet. 31. In support of this contention, Petitioner asserts that "*Russell* discloses in its system *at least one object detection sensor* as it states '[f]orward looking sensor 14 utilizes radar technology and is adapted for mounting on a vehicle to detect one or more objects, or targets in the field of view of forward looking sensor 14.'" *Id.* (citing Ex. 1005, 4:23–27). Petitioner asserts further that Russell describes "signal processing system 20 collects the data inputs. From forward looking sensor 14 it receives data, for each tracked target, relating to the range,

[10] Patent Owner has waived any argument for patentability directed to this limitation of claim 10. *See* Paper 9, 7–8.

angle, velocity and acceleration relative to host vehicle 10." *Id.* at 31–32 (quoting Ex. 1005, 5:35–42; Ex. 1008 ¶ 108).

Petitioner argues that a person of ordinary skill in the art "would have been motivated to incorporate these teachings of *Russell* into the system of *Harada* for multiple reasons." Pet. 32. Noting that "both references are analogous art to the '416 [p]atent," Petitioner argues that "combining the teachings of an *object detection sensor* as taught by *Russell* would have again been no more than the combination of prior art elements according to known methods, with a reasonable expectation of success." *Id.* (quoting Ex. 1008 ¶¶ 108, 110). Petitioner argues further that a person of ordinary skill in the art "would have recognized that incorporating *Russell's* teachings with the teachings of *Harada* would have provided benefits, such as improved safety and mitigation of a wider set of external factors, such as 'obstacles in the path of the host vehicle' as described by *Russell*." *Id.* (citing Ex. 1005, 1:14–19, 47–53). According to Petitioner, "*Russell* improves safety by detecting such obstacles in the path of the vehicle using its 'forward looking sensor,' and thus, a [person of ordinary skill in the art] would have been motivated to incorporate these teachings of *Russell* to enhance vehicle safety using the detection of obstacles." *Id.* As an example, Petitioner explains that a person of ordinary skill in the art

> would have recognized that the combination would have required no more than incorporating *Russell's* forward-looking sensor 14 depicted in Figure 1 into *Harada's* system, by simply adding the forward-looking sensor into the apparatus of *Harada's* Figure 1, such that the forward-looking sensor communicated with *Harada's* ECU 18 of its vehicle control apparatus.

Id. (citing Ex. 1008 ¶ 110).

In addition, Petitioner asserts that a person of ordinary skill in the art "would have recognized that any additional software programming needed by the combination would have been within the level of skill in the art, and would have been accomplished, for example, by adding software routines to *Harada's* 'ROM of the ECU 18.'" Pet. 33 (citing Ex. 1004, 5:49–53). Petitioner asserts further that a person of ordinary skill in the art "would have recognized a reasonable expectation of success in incorporating the object detection sensor and appropriate software routines into the system of *Harada*" and "*Russell* provides motivation to incorporate its forward-looking sensor, for example, to provide a 'path prediction system and method which is simple, accurate, cost-effective and reliable . . . ' for both 'intelligent cruise control and collision avoidance applications.'" *Id.* (Ex. 1008 ¶ 111; Ex. 1005, 1:38–65, 2:6–13). Based on these assertions, Petitioner contends that a person of ordinary skill in the art "would have been motivated to incorporate *Russell's* object detection sensor and associated hardware and software" into Harada's system. *Id.* (citing Ex. 1008 ¶¶ 108–112). Petitioner provides further details of the proposed modification of Harada in view of Russell on pages 33–37 of the Petition. In the interest of brevity, we do not reproduce this discussion, but instead turn to Petitioner's proposed modification of the Harada-Russell combination in view of the teachings of Mazda.

Petitioner contends that "*Russell* discloses an object detection sensor that detects objects during a turn . . . [that] has a goal of 'avoiding collisions,' *e.g.*, using an adaptive, or 'intelligent,' cruise control system for 'actuating the vehicle's brakes.'" Pet. 37 (citing Ex. 1005, 1:38–46). Based on this disclosure, Petitioner asserts that although "*Russell* teaches that a

vehicle that is better able to detect objects in its path, such as while in a turn, will improve adaptive cruise control systems," Russell "does not provide specific details connecting its determined object and vehicle path estimates with decisions whether to apply brakes or provide collision avoidance." Pet. at 37–38 (citing Ex. 1008 ¶ 118). According to Petitioner, "*Mazda* supplies such teachings." *Id.* at 38.

Petitioner contends that in Mazda "if the vehicle is traveling through a curve and the obstacle ahead is outside the expected range of travel of the vehicle, flag F is set to '1' in step S66 meaning that automatic braking is restricted." Pet. 38. Petitioner explains that in other words "*Mazda* determines whether the vehicle is turning, and if the vehicle is turning and an object is outside of the vehicle's path, *Mazda* restricts operation of its automatic braking system." *Id.* (citing Ex. 1008 ¶ 118). Thus, according to Petitioner, "*Mazda* discloses i*gnoring the object for braking purposes when the object is not determined to be in the vehicle path* [as required by claim 10]." *Id.*

Based on these disclosures, Petitioner contends that a person of ordinary skill in the art "would have been motivated to incorporate the teachings of *Mazda* for multiple reasons." Pet. 38 (citing Ex. 1008 ¶ 119). Noting that "*Mazda* is analogous art to the '416 Patent, as it discloses a control system for a vehicle," Petitioner asserts that "incorporating the teachings of *Mazda* into the combined system of *Harada* and *Russell* would have been no more than the combination of prior art elements according to known methods, with a reasonable expectation of success." *Id.* As an example, Petitioner asserts that a person of ordinary skill in the art

> would have recognized that the combination would have required no more than applying *Mazda's* teachings in Figure 14 and the associated description to the system of the *Harada–Russell* combination, which, when incorporated, would have controlled operation of either *Harada's* "vehicle-speed changing actuator 22" or *Russell's* "brakes" that are part of adaptive cruise control, instead of *Mazda's* automatic braking apparatus.

Id. at 38–39 (citing Ex. 1008 ¶ 120).

In addition, Petitioner asserts that "[a]pplying the teachings described in *Mazda* would have required no more than routine software programming that would be added to *Harada's* ROM, which already contains a control program, such that the ROM would thus include additional control program(s)." Pet. 39. Based on this assertion, Petitioner argues that a person of ordinary skill in the art "seeking to combine the teachings accordingly would have had a reasonable expectation of success, as performing such programming would have been within the level of skill in the art, guided by *Mazda's* flow chart and textual description" and a person of ordinary skill in the art "would have been motivated to incorporate the teachings of *Mazda* because it describes that it accomplishes 'accurately preventing erroneous automatic braking and further improving the reliability of automatic braking.'" *Id.* (emphasis added) (citing Ex. 1008 ¶ 120; Ex. 1006 ¶ 53). Thus, according to Petitioner, "the teachings of *Russell* and *Mazda*, when incorporated into the system of *Harada*, render obvious" limitation 10.4. *Id.*

Patent Owner disagrees, responding that a person of ordinary skill would not have been motivated to combine Mazda with Harada and Russell. PO Resp. 41. Specifically, Patent Owner contends that "[l]ike *Russell*, *Mazda* is directed to solving a problem that does not exist in *Harada*. *Id.*

According to Patent Owner, "it is axiomatic that a [person of ordinary skill in the art] reviewing *Harada* would not be looking to improve automatic braking in turns." *Id.* (citing Ex. 2007 ¶¶ 126–128). In addition, Patent Owner asserts that "Petitioner also fails to connect *Mazda* to *Russell* in [its] motivation to combine allegation. For this reason, Petitioner has failed to demonstrate a motivation to combine *Mazda* with *Harada* and *Russell*." *Id.* at 42 (citing *HTC Corp. v. Cellular Commc'ns Equip. LLC*, IPR2016-01493, slip op. at 18 (PTAB Feb. 12, 2018) (Paper 33)).

Patent Owner also contends that "Petitioner provides no allegation that a [person of ordinary skill in the art] would combine *Mazda* specifically with *Harada*, other than the generic allegations that Petitioner made with respect to combining *Harada and Russell*." PO Resp. 42 (citing Pet. 38). Patent Owner asserts that Petitioner's allegations with respect to the combination of Harada and Russell "are insufficient to prove obviousness." *Id.* at 42–43 (citing *Apple Inc. v. Uniloc Luxembourg S.A.*, IPR2017-01993, slip op. at 17 (PTAB Mar. 8, 2018) (Paper 10)).

In addition, Patent Owner contends that "Petitioner appears to use the '416 Patent as a roadmap when combining *Mazda* with *Harada* and *Russell*." PO Resp. 43. In support of this contention, Patent Owner notes that prior to introducing Mazda's teaching, Petitioner admits that Russell does not provide specific details regarding the connection between its determined object and vehicle path estimates and its decision process for brake application or collision avoidance. *Id.* (citing Pet. 37–38). Patent Owner also contends that "Petitioner never identifies why a [person of ordinary skill in the art] would have been looking for 'specific details connecting [*Russell's*] determined object and vehicle path estimates with

decisions whether to apply brakes or provide collision avoidance.'" *Id.* at 44.

Petitioner disagrees, responding that it has "explained what the references would have taught in combination, and the unambiguous motivation to combine *Mazda*." Pet. Reply 19 (citing Pet. 38–39; Ex. 1008 ¶ 120; Ex. 1006 ¶ 54). According to Petitioner, "[u]nder a proper obviousness analysis, the Petition sufficiently established reasons to combine." *Id.* Petitioner also asserts "there is again no reason to identify a problem in *Harada* for *Mazda* to solve, nor a reason to point out why a [person of ordinary skill in the art] would look for a particular reference," noting that Patent Owner "cites no authority for such requirements, and this reasoning has been rejected." *Id.* at 20 (citing PO Resp. 41, 44; *Ruiz v. AB Chance Co.*, 357 F.3d 1270, 1276 (Fed. Cir. 2004) (no requirement for express, written motivation before finding obviousness)).

In addition, Petitioner contends that it "did not 'use the '416 Patent as a roadmap.'" Pet. Reply 20 (citing PO Resp. 43–44). Rather, according to Petitioner, "*Mazda* itself provides the motivation, because it provides techniques for avoiding erroneous braking, as would otherwise be present in a system like the *Harada-Russell* combination." *Id.* (citing *In re McLaughlin*, 443 F.2d 1392, 1396 (CCPA 1971) (reconstructions are proper if they only incorporate knowledge at the time of the invention)). Petitioner contends further that a person of ordinary skill in the art "would have been motivated to incorporate *Mazda's* teachings as an advancement to *Russell's*" automatic braking system, as "*Mazda* represents an improvement to *Russell*, because it can 'accurately prevent erroneous automatic braking.'" *Id.* (citing Pet. 38–39; Ex. 1006 ¶ 53).

Patent Owner does not address Mazda or this specific limitation in its Sur-Reply. *See generally* PO Sur-Reply. To the extent that Patent Owner's argument that the benefits identified by Petitioner in support of its articulated reasons for the proposed combination apply to this limitation, those arguments are addressed above in Section II.D.4.b.iv explaining that Petitioner has demonstrated that the benefits relied upon are explicitly disclosed in the references and relate to the challenged claims.

For this limitation, we agree with Petitioner that there is no requirement that it identify a problem in Harada for Mazda to solve. Pet. Reply 20. We also agree that Petitioner has sufficiently established reasons for the proposed modification (namely that Mazda improves on Russell's system by restricting operation of its automatic braking system when a detected object is outside the vehicles path). Pet. 38. Further, as Petitioner has identified explicit teachings in the references relied upon for the proposed combination, we do not agree with Patent Owner that Petitioner has used the '416 patent as a roadmap for the proposed combination.

f. Conclusion Regarding Claim 10

For the reasons discussed above and in view of the full record in this proceeding, we determine that Petitioner has demonstrated by a preponderance of evidence that claim 10 is unpatentable under 35 U.S.C. § 103(a) over Harada, Russell, and Mazda.

5. Claim 11

Petitioner provides claim charts and arguments with citations to relevant portions of Harada, Russell, and Mazda that teach or suggest the elements of claim 11 with citations to supporting declarant testimony. Pet. 40–42. As Patent Owner argues claim 11 with claim 10 and does not present

further arguments for this claim, we do not reproduce Petitioner's challenge to claim 11. For the reasons explained by Petitioner on pages 40–42 of the Petition, which we expressly adopt, Petitioner has demonstrated that claim 11 is unpatentable under 35 U.S.C. 103(a) over Harada, Russell, and Mazda.

E. Obviousness of Claims 1, 2, 7, and 9 in View of Russell, Fukada, and Mazda

Petitioner contend that claims 1, 2, 7, and 9 are unpatentable under 35 U.S.C. § 103(a) over Russell, Fukada, and Mazda. Pet. 42–63. Having considered the evidence in the complete record established during trial, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that these claims would have been obvious in view of Russell, Fukada, and Mazda. As we provided an overview of Russell and Fukada in Section II.D above, we begin our analysis of this challenge with an overview of Fukada.

1. Fukada

Fukada is directed to "a device for controlling turn behavior of a vehicle so as to suppress and reduce undesirable behavior such as drift out or spin which can occur during turn of a vehicle such as an automobile." Ex. 1007, 1:7–10. Fukada's device is applied to a braking system and control system shown in Figure 1 below:

FIG. 1

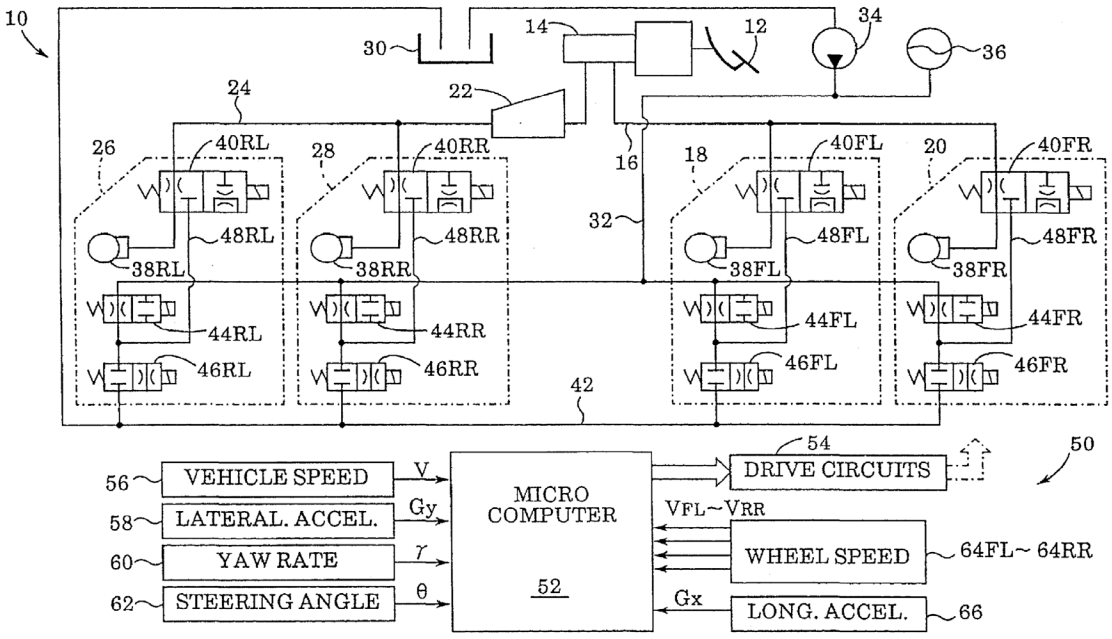

Figure 1 "is a schematic view showing the braking system and the electric control system of a vehicle to which the behavior control device of the present invention is applied." *Id.* at 13:49–51. Fukada's "electric control means 50 consists of a microcomputer 52 and driving circuit 54." *Id.* at 16:41–42. According to Fukada,

> input port means of the microcomputer 52 is supplied with a signal representing vehicle speed V from a vehicle speed sensor 56, a signal representing lateral acceleration G_y of a vehicle body from a lateral acceleration sensor 58 mounted substantially at a center of gravity of the vehicle body, a signal representing yaw rate r of the vehicle body from a yaw rate sensor 60, a signal representing steering angle θ from a steering angle sensor 62, signals representing wheel speeds of left and right front vehicle wheels and left and right rear vehicle wheels VFL, VFR, VRL, VRR from wheel speed sensors 64FL-64RR, and a signal representing longitudinal acceleration G_x of the vehicle body from a longitudinal acceleration sensor 66 mounted substantially at the center of gravity of the vehicle body.

Id. at 16:48–61. As noted by Petitioner, "*Fukada* discloses a 'turn behavior control device that detects lateral acceleration G_y of a vehicle body' and 'presumes the turn behavior of the vehicle' and 'controls the turn behavior of the vehicle based upon the presumed turn behavior.'" Pet. 42 (citing Ex. 1007,[11] Abst.).

2. Independent Claim 1

Petitioner provides claim charts and arguments with citations to the relevant portions of Russell, Fukada, or Mazda that teach or suggest the elements of claim 1 with citations to supporting declarant testimony. Pet. 43–56.

a. A method of controlling a vehicle having an adaptive cruise control system capable of obtaining a vehicle lateral acceleration, said method comprising the steps of: (preamble)

Petitioner contends that "[t]o the extent the preamble is limiting, *Russell* and *Fukada* disclose it or at least render it obvious." Pet. 43. In support of this contention, Petitioner asserts that "*Russell* discloses a *method* performed in a *vehicle having an adaptive cruise control system* as it describes 'a method of detecting objects in a predicted path of a host vehicle moving on a highway lane' and a 'method for use with adaptive cruise control and collision avoidance systems.'" *Id.* (citing Ex. 1005, Abst., 1:14–19; Ex. 1008 ¶ 133). Petitioner admits that "[a]lthough *Russell* discloses a method 'for use with adaptive cruise control' (i.e., *controlling a vehicle*), *Russell* does not explicitly disclose that its method is performed in a vehicle

[11] As Petitioner is citing to the Fukada reference here, it appears Petitioner meant to cite to Exhibit 1007 not to Exhibit 1006, which represents the Mazda reference.

capable of obtaining a vehicle lateral acceleration as recited." *Id.* (citing Ex. 1008 ¶ 134). Petitioner submits, however, that Fukada "discloses 'control[ling] turn behavior of a vehicle' in a system [when] a 'turn behavior control device detects lateral acceleration Gy of a vehicle body . . . ' (*Fukada* (EX1007), Abstract), including use of a 'lateral acceleration sensor 58.'" *Id.* at 43–44 (citing Ex. 1007, 16:51, Fig. 1). Thus, according to Petitioner, "*Fukada* teaches a method of *controlling a vehicle having* a system *capable of obtaining a vehicle lateral acceleration*." *Id.* at 44 (citing Ex. 1008 ¶ 134).

Petitioner reasons that a person of ordinary skill in the art "would have been motivated to incorporate *Fukada's* teachings for multiple reasons." Pet. 44 (citing Ex. 1008 ¶ 135). Specifically, Petitioner asserts that "*Fukada* is analogous art to the '416 Patent, because it discloses a method of controlling a vehicle, much like the claims of the '416 Patent," and a person of ordinary skill in the art "would have recognized that incorporating *Fukada's* teachings with the teachings of *Russell* would have provided benefits, such as improved safety and mitigation of a wider set of factors." *Id.* (citing Ex. 1007, Abst.; Ex. 1001, 8:7–19; Ex. 1008 ¶¶ 136–137). As examples of such benefits, Petitioner asserts that a person of ordinary skill in the art "would have recognized that *Fukada* discloses a vehicle control apparatus which 'reduce[s] undesirable behavior such as drift out or spin,' that is, conditions of the vehicle itself," and that "*Russell* provides teachings of 'automotive driver aids' that assist in mitigating the effects of 'obstacles in the path of the host vehicle,' that is, conditions external to the vehicle." *Id.* (citing Ex. 1007, 1:6–10; Ex. 1005, 1:14–19, 1:47–53). According to Petitioner, a person of ordinary skill in the art

"would have recognized that *Fukada* beneficially provides teachings that enhance vehicle safety based on conditions of the vehicle itself (e.g., a spin), while *Russell* provides teachings that enhance vehicle safety when considering external factors (e.g., other vehicles in traffic)." *Id.* at 44–45.

Petitioner reasons further that "[c]ombining the teachings of *Fukada* with those of *Russell* would have been no more than the combination of prior art elements according to known methods to yield predictable and beneficial results." Pet. 45. Specifically, Petitioner asserts that "[c]ombining the teachings of *Fukada* with those of *Russell* would have required no more than adding into the apparatus of *Russell's* Figure 1 the lateral acceleration sensor 58 and/or yaw rate sensor 60 of *Fukada* and other components of the electric control means 50." *Id.* (citing Ex. 1008 ¶ 139). Thus, according to Petitioner, a person of ordinary skill in the art "would have been motivated to combine the teachings of *Russell* and *Fukada*, and in combination, the references teach *a method of controlling a vehicle having an adaptive cruise control system capable of obtaining a vehicle lateral acceleration* as recited." *Id.* at 47–48 (citing Ex. 1008 ¶¶ 132–144).

In response, Patent Owner asserts that "Petitioner['s] proffered explanations for modifying *Russell* based on *Fukada's* disclosure are conclusory and lack any reasoned analysis or evidentiary support sufficient to establish *why* a [person of ordinary skill in the art] would have modified *Russell* based on *Fukada*." PO Resp. 45 (citing Pet. 44–56). Patent Owner sets forth five arguments in support of this assertion, which are essentially the same as the arguments discussed in Section II.D.4 above except that Patent Owner argues them with respect to Fukada instead of Harada. *Id.* at 45–53. Specifically, Patent Owner's first argument is that Fukada is not

analogous art. PO Resp. 46. Its second argument is that Petitioner's reasoning consists of conclusory statements that are inadequate to demonstrate why a person of skill in the art would have made the proposed modification. *Id.* at 46–47. Patent Owner's third argument is that the reasons to combine identified by Petitioner are too generic. *Id.* at 47–48. Its fourth argument is that Petitioner's reasoning is insufficient to establish obviousness because it bears no relation to any specific combination of prior art elements and its fifth argument simply refers back to its arguments regarding Mazda for Ground 1 without further explanation. *Id.* at 49–53.

Patent Owner's arguments are no more persuasive as applied to Fukada than as applied to Harada. Specifically, we agree with Petitioner that because it is a vehicle control apparatus and for reasons similar to those discussed above in Section II.D.4.b.i. Fukada is analogous art. For reasons similar to those discussed above in Sections II.D.4.b.iii and, II.D.4.b.iv, we determine that Petitioner's reasoning demonstrates why a person of ordinary skill in the art at the time of the invention would have made the proposed modification, that the articulated reasoning is not too generic, and that it bears a relation to a specific combination of prior art elements as set forth in the Petition. Pet. 43–48. In addition, for reasons discussed above in Section II.D.4.e, we determine that Petitioner has demonstrated that a person of ordinary skill in the art would have further modified the Russell-Fukada combination in view of Mazda.[12] Accordingly, we do not further discuss these arguments.

[12] We note that Petitioner does not discuss Mazda in its explanation of how the references meet the preamble of claim 1. Patent Owner has addressed Mazda in this context, however, so we do so as well.

For the reasons explained by Petitioner above, which we expressly adopt, Petitioner has demonstrated that the combined teachings of Russell and Fukada teach the preamble of claim 1.[13]

b. determining when the vehicle is in a turn based on a detected change in the vehicle lateral acceleration (limitation 1.1)

Petitioner contends that "*Fukada* discloses, or at least renders obvious, *determining when the vehicle is in a turn based on a detected change in the vehicle lateral acceleration*." Pet. 48. In support of this contention, Petitioner asserts that

> *Fukada* describes "a device . . . comprising: means for detecting lateral acceleration Gy of a vehicle body, means for detecting vehicle speed V, means for detecting yaw rate r of the vehicle body, [and] ***means for presuming turn behavior of the vehicle*** based upon at least lateral slide velocity Vy of the vehicle by obtaining the lateral slide velocity Vy ***through integration of deviation Gy-Vr with a predetermined integration time constant***."

Id. (citing Ex. 1007, 2:1–8). Petitioner asserts further that "*Fukada* teaches an example of specific algorithm for calculating lateral acceleration deviation (which is integrated) that explicitly involves detected changes in lateral acceleration." *Id*. (citing Ex. 1007, 19:55–65; Ex. 1008 ¶ 145).

Petitioner reasons that a person of ordinary skill in the art "would have understood that *Fukada's* system presumes turn behavior, or

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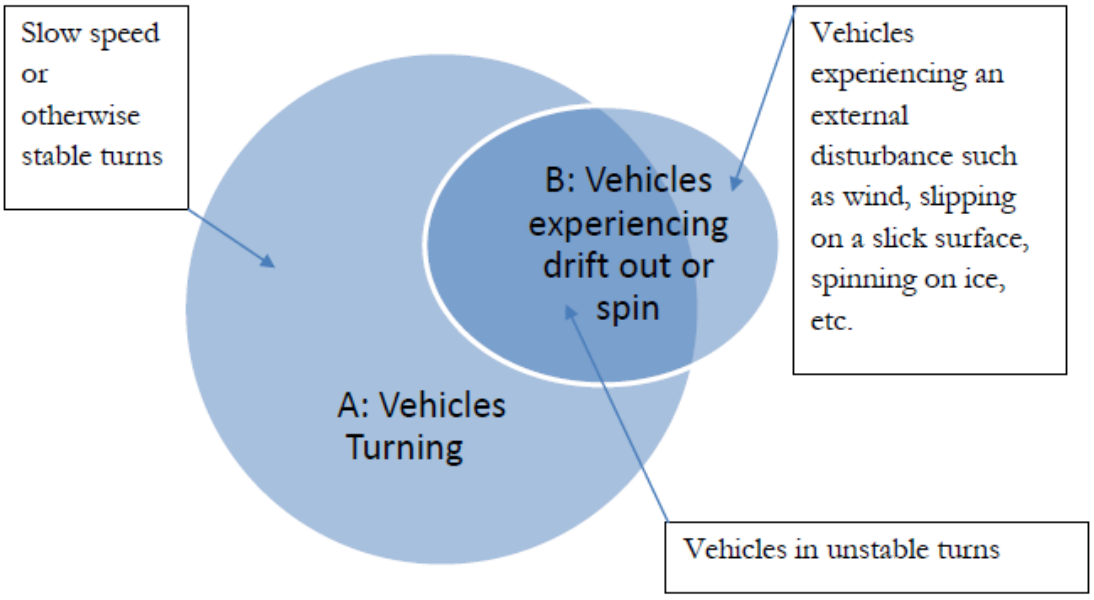
[13] We need not determine whether the preamble of claim 1 is limiting as the parties have not raised that issue before us. Nonetheless, Petitioner has persuasively demonstrated that Russel and Fukada teach or suggest the limitations set forth in the preamble of claim 1 and Patent Owner has waived any argument for patentability directed to this portion of the claim. *See* Paper 9, 7–8 ("Patent Owner is cautioned that any arguments for patentability not raised in the response may be deemed waived.").

determin[es] when the vehicle is in a turn, based on the integration over time of the difference between the lateral acceleration and the product of the speed and yaw rate, which indicates the change over time of that data." Pet. 48–49 (citing Ex. 1008 ¶ 146). Petitioner explains that "[t]he data would have changed over time if one or more of the following occurred: (1) the lateral acceleration Gy changed over time; (2) the vehicle speed changed over time; and/or (3) the yaw rate changed over time." *Id.* at 49 (citing Ex. 1008 ¶ 146). Petitioner explains further that "by incorporating *Fukada*'s lateral acceleration sensor 58 into *Russell*'s path prediction system and using *Fukada*'s measurements and calculations as *Fukada* describes, 'turn behavior of the vehicle can be controlled so as to decrease or suppress an unstable behavior of the vehicle such as spinning.'" *Id.* (citing Ex. 1007, 7:5–33; Ex. 1008 ¶ 146). Thus, according to Petitioner, "*Fukada* describes presuming the turn behavior of the vehicle which, in part, may be based on the change over time in the vehicle's lateral acceleration, which teaches *determining when the vehicle is in a turn based on a detected change in the vehicle lateral acceleration* as recited." *Id.* (citing Ex. 1008 ¶¶ 145–147).

In response, Patent Owner asserts that Fukada does not disclose or suggest "*determining when the vehicle is in a turn based on a detected change in the vehicle lateral acceleration*." PO Resp. 53. In support of this assertion, Patent Owner argues that a person of skill in the art "would not have equated Petitioner's cited disclosure of *Fukada*'s 'means for presuming turn behavior of the vehicle based upon at least lateral slide velocity Vy of the vehicle' with 'determining when the vehicle is in a turn.'" *Id.* at 54–55 (citing Ex. 2007 ¶¶ 145–148). Patent Owner asserts further that

> *Fukada* makes clear that its "means for presuming turn behavior of the vehicle based upon at least lateral slide velocity Vy of the vehicle" does not disclose *determining when the vehicle is in a turn*, but instead detects "an unstable behavior of the vehicle such as spinning," which is the type of unstable behavior that is *sometimes*, **but not always**, *associated with* being in a turn.

Id. at 55 (citing Ex. 2007 ¶ 149). According to Patent Owner, "because spinning vehicles are not always in a turn, a [person of ordinary skill in the art] would understand that *Fukada*'s method of detecting the type of instability associated with only some turns does *not* disclose a method of determining when the vehicle is in a turn." *Id.* (citing Ex. 2007 ¶ 149; Ex. 1007, 7:25–33, 20:13–19). In support of these assertions, Patent Owner provides the following Venn diagram:



Id. at 56. This Venn diagram shows an oval overlapping a circle. The circle is larger than the oval and is labeled "A: Vehicles Turning." The oval (labeled "B: Vehicles experiencing drift out or spin") is positioned near the

top and on the right side of the circle with about three quarters of the oval overlapping the circle. Comments indicate that the portion of circle A that does not overlap with oval B represents "[s]low speed or otherwise stable turns," the overlapping portion represents "[v]ehicles in unstable turns," and the portion of oval B that does not overlap with circle A represents "[v]ehicles experiencing an external disturbance such as wind, slipping on a slick surface, spinning on ice, etc." *Id.*

Next, Patent Owner argues that "[t]he '416 Patent's prosecution history also contradicts Petitioner's argument." PO Resp. 56. Specifically, Patent Owner asserts, "during prosecution of the parent '475 Patent, the Examiner made and then withdrew an argument similar to Petitioner's with respect to *Kato*—a reference with a disclosure similar to *Fukada*." *Id.* According to Patent Owner, "[l]ike *Fukada*, *Kato* discloses a method 'to prevent the turning state of the vehicle from being unstable due to the occurrence of an excessive roll angle on the vehicle,' 'whereby the turning state of the vehicle can be judged to be the understeer state.'" *Id.* at 56–57 (Ex. 2001 ¶¶ 4, 17).

In addition, Patent Owner asserts that "the portions of *Fukada* that Petitioner cites as allegedly disclosing this claim element come from two different embodiments—'construction 1' . . . and 'construction 5.'" PO Resp. 59 (citing Ex. 1007, 2:1–8, 19:55–65).

In reply, Petitioner contends that Patent Owner is attempting "to lead the Board into discounting *Fukada's* explicit text in favor of [Patent Owner's] baseless characterization" of Fukada. Pet. Reply 25. In support of this contention, Petitioner submits that "*Fukada* describes judging the 'absolute value of ***change rate of lateral acceleration Gy***.'" *Id.* (citing Ex.

1007, 19:55–65). Petitioner submits further that "Mr. Andrews explained '*Fukada's* system presumes turn behavior . . . based on the integration over time of the difference between the lateral acceleration and the product of the speed and yaw rate, which indicates the ***change over time of that data***.'" *Id.* (citing Ex. 1008 ¶ 146). Petitioner also submits that Mr. Andrews "explained this data 'would have changed over time if one or more of the following occurred: (1) the ***lateral acceleration Gy changed over time***.'" *Id.* Thus, according to Petitioner, "Mr. Andrews concluded that *Fukada* describes determining the turn behavior of the vehicle which, in part, is based on the change over time in lateral acceleration, thus teaching this limitation." *Id.* at 26.

Petitioner also contends that Patent Owner's "response rehashes its previously-unsuccessful attempt to cast *Fukada* as cumulative of a reference cited during prosecution, *Kato*." Pet. Reply 26 (citing PO Resp. 56–58). Petitioner submits that "the references are distinguishable: *Kato*, unlike *Fukada*, did not disclose a 'means for presuming turn behavior,' and contains substantively dissimilar teachings than *Fukada*." *Id.* According to Petitioner, "*Kato* taught use of lateral acceleration deviation: a difference between a target lateral acceleration and a measured lateral acceleration, and *Kato* assigned the variable **ΔGy** to this deviation" but, "this variable and its associated calculation is **different** than that of *Fukada*." *Id.* (citing PO Resp. 60–61; Ex. 1022, 81:7–20). Thus, Petitioner asserts that Patent Owner's "prosecution arguments over *Kato* are immaterial to whether *Fukada* discloses the limitation." *Id.*

Next, Petitioner contends that Patent Owner's argument that "Petitioner cited two embodiments of *Fukada* is wrong." Pet. Reply 26

(citing PO Resp. 59). According to Petitioner, "*Fukada's* '***first embodiment***' is described in the flowchart shown in FIG. 2" and "[w]ithin this embodiment are steps 300 and 400." *Id.* at 26–27 (citing Ex. 1007, 17:8–11). Petitioner explains that "Step 300 is 'a part of the above-mentioned construction 1' while step 400 'corresponds to a part of the above-mentioned construction 5.'" Pet. Reply 27 (citing Ex. 1007, 19:34–36; 20:13–15). Thus, according to Petitioner, "both construction 1 and construction 5 are part of the same 'first embodiment' of *Fukada's* invention—not separate embodiments." *Id.*

Petitioner also submits that Patent Owner's argument that Fukada's detection of unstable behavior, precisely Patent Owner's statement that this is "the type of unstable behavior that is *sometimes*, **but not always**, *associated* with being in a turn" is an admission that Fukada meets this limitation. Pet. Reply 28 (citing Ex. 2007 ¶ 149; Ex. 1007, 7:25–33). Petitioner asserts that "by acknowledging *Fukada* at least detects a behavior that, ***in some circumstances***, is associated with being in a turn, [Patent Owner] admits *Fukada* teaches this limitation," because "[a]s long as a prior art reference teaches the claimed feature in some circumstances, it renders the limitation obvious." *Id.* (citing *Unwired Planet, LLC v. Google, Inc.*, 841 F.3d 995, 1002 (Fed. Cir. 2016) ("[c]ombinations of prior art that sometimes meet the claim elements are sufficient to show obviousness")).

In addition, Petitioner contends that "[o]ther disclosure of *Fukada* supports Petitioner's contention." *Id.* at 29. In support of this contention, Petitioner submits that "*Fukada's* Abstract indicates its device 'presum[es] the turn behaving of the vehicle at higher precision' and throughout, *Fukada* describes its 'means for presuming turn behavior' based on, for example, the

'absolute value of change rate of lateral acceleration.'" *Id.* (citing Pet. 48). Thus, according to Petitioner, "*Fukada* teaches this limitation." *Id.*

Petitioner concludes its reply by disagreeing with Patent Owner's assertion that "a [person of ordinary skill in the art] would not have understood that *Fukada* presumes turn behavior based on a detected change in the vehicle lateral acceleration" and reiterating its position that "*Fukada* teaches *determining when the vehicle is in a turn* for the same reasons as laid out in the Petition." Pet. Reply 29–30 (citing PO Resp. 59).

In reply Patent Owner essentially repeats its arguments set forth in its Response. PO Sur-Reply 20–24. In particular, Patent Owner reiterates its arguments in support of its assertion that Fukada does not disclose "determining when the vehicle is in a turn," as required by claim 1. *Id.*

For this limitation, we agree with Petitioner that Fukada discloses or suggests "determining when the vehicle is in a turn based on a detected change in the vehicle lateral acceleration," as required by claim 1. Pet. 48. As clearly illustrated by the overlapping portion of circle A and oval B in Patent Owner's Venn diagram reproduced above, Fukada discloses limitation 1.1 of claim 1 because "[a]s long as a prior art reference teaches the claimed feature in some circumstances, it renders the limitation obvious." *Unwired Planet*, 841 F.3d at 1002.

We also agree with Petitioner that the variable ΔGy and its associated calculation in Kato is different than in Fukada, because Fukada discloses means for presuming turn behavior. Pet. Reply 26. In addition, we agree that Petitioner did not cite two separate embodiments of Fukada, because Fukada's steps 300 (construction 1) and 440 (construction 5) are both part of its first embodiment.

For the reasons explained by Petitioner above, which we expressly adopt, Petitioner has demonstrated that Fukada discloses, or at least suggests, limitation 1.1.

c. The Remaining Limitations of Claim 1

Petitioner contends that Russell discloses or suggests "determining a vehicle path during the turn" (limitation 1.2), "detecting an object" (limitation 1.3), and "determining whether the object is in the vehicle path during the turn" (limitation 1.4). Pet. 49–51. Petitioner also contends that Russell and Mazda disclose or suggest "reducing the vehicle speed if the object is determined to be in the vehicle path during the turn" (limitation 1.5). *Id.* at 52–55. In addition, Petitioner contends that Mazda discloses or suggests "ignoring the object for braking purposes if the object is determined not to be in the vehicle path during the turn (limitation 1.6). *Id.* at 55–56. Petitioner supports these contentions with citations to the relevant portions of the references and expert testimony. *Id.* at 49–56.

Patent Owner does not contest Petitioner's contentions regarding these limitations of claim 1. *See generally* PO Resp.

For the reasons explained by Petitioner set forth on pages 49–56 of the Petitioner, which we expressly adopt, we determine that Petitioner has demonstrated that Russell, Fukada, and Mazda disclose or suggest these limitations.[14]

d. Conclusion Regarding Claim 1

For the reasons discussed above and in view of the full record in this proceeding, we determine that Petitioner has demonstrated by a

[14] Patent Owner has waived any argument for patentability directed to these limitations of claim 1. *See* Paper 9, 7–8.

preponderance of evidence that claim 1 is unpatentable under 35 U.S.C. § 103(a) over Russell, Fukada, and Mazda.

F. Claims 2, 7, and 9

Petitioner provides claim charts and argument with citations to relevant portions of Russell, Fukada, and Mazda that teach or suggest the elements of claims 2, 7, and 9 with citations to supporting declarant testimony. Pet. 56–63. As Patent Owner argues claims 2, 7, and 9 with claim 1 and does not present further arguments for these claims, we do not reproduce Petitioner's challenge to these claims. *See generally* PO Resp. For the reasons explained by Petitioner on pages 56–63 of the Petition, which we expressly adopt, Petitioner has demonstrated that claims 2, 7, and 9 are unpatentable under 35 U.S.C. 103(a) over Russell, Fukada, and Mazda.

III. SUMMARY[15]

For the reasons discussed above, Petitioner has demonstrated, by a preponderance of evidence that claims 10 and 11 are unpatentable under 35 U.S.C. §103(a) over Harada, Russell, and Mazda. Petitioner has further demonstrated by a preponderance of evidence that claims 1, 2, 7, and 9 are unpatentable under 35 U.S.C. § 103(a) over Russell, Fukada, and Mazda.

[15] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

The chart below summarizes our conclusions regarding the challenged claims.

Claim(s)	35 U.S.C. §	References	Claims Shown Unpatentable	Claims Not Shown Unpatentable
10, 11	103(a)	Harada, Russell, Mazda	10, 11	
1, 2, 7, 9	103(a)	Russell, Fukada, Mazda	1, 2, 7, 9	
Overall Outcome			1, 2, 7, 9–11	

IV. ORDER

After due consideration of the record before us, and for the foregoing reasons, it is:

ORDERED that claims 1, 2, 7, and 9–11 of the '416 patent are held unpatentable; and

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

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