Administrative Orders & Decisions

Paper 29
Date: May 13, 2020

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SZ DJI Technology Co., Ltd., Petitioner,

v.

Autel Robotics USA LLC, Patent Owner.

IPR2019-00249
Patent **7,979,174** B2

Show Headnotes

Before ERICA A. FRANKLIN, JENNIFER MEYER CHAGNON, and AVELYN M. ROSS, *Administrative Patent Judges*.

ROSS, *Administrative Patent Judge*.

Judgment

Final Written Decision

Determining All Challenged Claims Unpatentable

35 U.S.C. § 318(a)

I. INTRODUCTION

SZ DJI Technology Co., Ltd. ("Petitioner") filed a Petition requesting *inter partes* review of claims 1-8 of U.S. Patent No. **7,979,174** B2 (Ex. 1001, "the **'174** patent"). Paper 2 ("Pet."). Autel Robotics USA LLC ("Patent Owner") did not file a preliminary response to the Petition. *See* **37 C.F.R. § 42.107(b)** (2018) (setting the due date for filing a preliminary response).

Upon consideration of the Petition and the evidence of record, we determined that Petitioner had demonstrated a reasonable likelihood that it would prevail with respect to at least one claim of the **'174** patent. Paper 6 ("Dec."). Thus, we instituted review of all challenged claims on all grounds. *See* Dec.

Following institution of trial, Patent Owner filed a Patent Owner Response (Paper 12, "PO Resp."), Petitioner filed a Reply (Paper 18, "Reply"), and Patent Owner filed a Sur-reply (Paper 20, "Sur-reply"). In support of their respective positions, Petitioner relies on the testimony of Dr. Alfred Ducharme (Ex. 1003), and Patent Owner relies on the testimony of Dr. Charles F. Reinholtz (Ex. 2001).

An oral hearing was held on February 19, 2020, and a transcript of the hearing is included in the record (Paper 28, "Tr.").

We have jurisdiction under **35 U.S.C. § 6** . This Final Written Decision is issued pursuant to **35 U.S.C. § 318(a)** and **37 C.F.R. § 42.73** . For the reasons discussed below, we determine that Petitioner has shown by a preponderance of the evidence that claims 1-8 of the **'174** patent are unpatentable.

A. Related Proceedings

Petitioner identifies SZ DJI Technology Co. Ltd. v. Autel Robotics USA LLC, C.A. No. 16-706-LPS-CJB (D. Del.) and *Certain Unmanned Aerial Vehicles and Components Thereof*, Inv. No. 337-TA-113 (USITC, instituted Sept. 26, 2018) as related matters. Pet. 1. In addition to the matters identified by Petitioner, Patent Owner identifies a separate petition for *inter partes* review of the **'174** patent, concurrently filed with the above-captioned matter, and assigned case number IPR2019-00250. Paper 5 (Mandatory Notice), 2. Concurrently with this Decision, we issue a final written decision in IPR2019-00250, which addresses different claims of the **'174** patent.

B. The '174 Patent

The **'174** patent relates to an autonomous vehicle including a control system having sensors that, in response to sensed conditions, adjusts the movement and speed of the vehicle. Ex. 1001, 2:1-10. Petitioner provides modified Figure 1 (Pet. 9), shown below, to illustrate the prominent features of the **'174** patent.

Figure 1, above, is a block diagram of a system for providing automatic planning and regulation of the speed of autonomous vehicles which Petitioner has annotated to highlight the various elements and to indicate the output and input of "desired speed." Ex. 1001, 2:14-16. In particular, system 100 includes one or more sensors 102 (green) for gathering data, which depend on the type of autonomous vehicle being used, and may include sensors collecting "data regarding speed limit zones, road conditions, tire pressure, etc." *Id.* at **[*2]** 2:57-67. Speed planner 104 (light blue) and path planner 108 (yellow) receive input data from the sensors to calculate the desired speed for a planned path. *Id.* at 3:18-25. Speed controller 101 (purple) then generates a speed command that provides signals to one or more actuators 106 (red) to adjust the vehicle speed according to the desired speed. *Id.* at 7:4-10. Actuators, depending on the type of autonomous vehicle, may include "disc brakes, steering column, gas pedal, etc." *Id.* at 7:12-14. The speed planner may also output a speed command category that "indicates why the desired speed was selected," and the speed command category may be selected based on certain movement constraints. *Id.* at 8:24-44, 3:44-45. Certain constraints are given more weight (i.e., a "higher priority") than others. *Id.* at 3:46-48. For example, collision avoidance has a higher priority than maintaining a certain speed. *Id.*

C. Illustrative Claim

Claim 1, claiming an autonomous vehicle, is the only independent claim of the **'174** patent challenged in the instant proceeding. Claim 1 is reproduced below:

1. An autonomous vehicle comprising:

one or more sensors configured to obtain data regarding conditions which affect movement of the autonomous vehicle;

a speed planner coupled to the one or more sensors and configured to calculate a desired speed based, at least in part, on the data obtained from the one or more sensors;

a control system configured to calculate speed commands based, at least in part, on the speed calculated by the speed planner; and

one or more actuators configured to adjust the speed of the autonomous vehicle based on the speed commands from the control system;

wherein the speed planner is further configured to output a speed command category associated with the desired speed.

Ex. 1001, 9:38-53.

D. Instituted Grounds of Unpatentability

We instituted trial to determine whether claims 1-8 of the **'174** patent would have been obvious[1] in view of the following grounds of unpatentability:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1, 2, 4-7	**103(a)**	Andersson[2], Urmson[3]
3	**103(a)**	Andersson, Urmson, Augenbraun[4]
6	**103(a)**	Andersson, Urmson, Mandow[5]
8	**103(a)**	Andersson, Urmson, Fregene[6]
1, 2, 4-7	**103(a)**	Andersson, Urmson, Ahmed-Zaid[7]
3	**103(a)**	Andersson, Urmson, Ahmed-Zaid, Augenbraun

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
6	103(a)	Andersson, Urmson, Ahmed-Zaid, Mandow
8	103(a)	Andersson, Urmson, Ahmed-Zaid, Fregene

II. ANALYSIS

A. Level of Ordinary Skill in the Art

Relying on the testimony of Dr. Ducharme, Petitioner contends that one of ordinary skill in the art at the time of invention "would have had at least an undergraduate degree in robotics or computer engineering, or equivalent knowledge, training, or experience, with at least two years of experience working with the design and development of autonomous devices or speed control systems for autonomous speed adjustment." Pet. 17; Ex. 1003 ¶¶ 19-20 (same).

Although Patent Owner acknowledges that claims are interpreted from the perspective of one having ordinary skill in the art (PO Resp. 7), Patent Owner does not argue for any particular level of ordinary skill in the art in the Patent Owner Response. *See generally* PO Resp. Dr. Reinholtz, however, testifies that " **[*3]** a person of ordinary skill in the art ('POSA') at the time of the invention of the **'174** patent would have a Bachelor's degree in engineering or computer science and would have had at least two years of experience developing control systems for electromechanical systems, including autonomous vehicles," and that "[a]dditional education could substitute for professional experience and significant work experience could substitute for formal education." Ex. 2001 ¶ 27.

Upon review of the arguments set forth by Drs. Ducharme and Reinholtz, we adopt Dr. Reinholtz's description of one of ordinary skill in the art, as it is consistent with the prior art of record and persuasively considers how the necessary level and type of education may be offset by work experience in the relevant field. We observe that neither party contends that the difference in education and experience level offered by Drs. Ducharme and Reinholtz would have any impact on the parties' arguments or conclusions in this case. We agree with the parties and note that our conclusions in this Decision do not depend on which proposed definition is applied.

B. Claim Construction

In this *inter partes* review, claim terms in an unexpired patent are construed according to their broadest reasonable interpretation in light of the specification of the patent in which they appear. **37 C.F.R. § 42.100(b)** (2018).[8] In determining the broadest reasonable construction, we presume that claim terms carry their ordinary and customary meaning. *See In re Translogic Tech., Inc.*, **504 F.3d 1249, 1257** (Fed. Cir. 2007). A patentee may define a claim term in a manner that differs from its ordinary meaning; however, any special definitions must be set forth in the specification with reasonable clarity, deliberateness, and precision. *See In re Paulsen*, **30 F.3d 1475, 1480** (Fed. Cir. 1994).

In their briefing, the parties dispute the meaning of two claim phrases—(1) speed commands and (2) speed command category. *See* Pet. 17-20; PO Resp. 7-12. Patent Owner additionally identifies "minimum safe speed" and "constraints" as terms for construction. PO Resp. 12-15.

Petitioner proposes that "speed command category" means "information output by the speed planner that 'indicates why the desired speed was selected'" and that "speed commands" means "commands or signals to adjust the vehicle's speed." Pet. 17-18, 20. Patent Owner proposes the following constructions:

"speed commands" to mean "commands relating to the speed of the autonomous vehicle";

"speed command category" to mean "information reflecting the reason for the desired speed";

"minimum safe speed" to mean "desired speed for the vehicle when obstacles are present"; and

"constraint(s)" to mean "a limit that generally cannot be violated."

PO Resp. 7-15.

We discern little difference between the parties' respective constructions. Further, during the hearing, both parties expressed a general view that claim construction was unlikely to affect the parties' positions.[9] Tr. 8:11-13, 9:13-15, 14:11-12, 15:2-4, 28:18-19, 43:3-12, 45:20-22; *see also* Reply 2 (asserting that "the challenged claims are unpatentable even under Patent Owner's constructions"). Only terms that are in controversy need to be construed, and then only to the extent necessary **[*4]** to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, **868 F.3d 1013, 1017** (Fed. Cir. 2017) (applying *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, **200 F.3d 795, 803** (Fed. Cir. 1999) in the context of an *inter partes* review). We determine that none of the identified claim terms require construction to resolve the issues in dispute in this proceeding.

C. Principles of Law

To prevail in its challenges to the patentability of the claims, Petitioner must demonstrate by a preponderance of the evidence that the challenged claims are unpatentable. **35 U.S.C. § 316(e)** (2012); **37 C.F.R. § 42.1(d)** . "In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, **815 F.3d 1356, 1363** (Fed. Cir. 2016) (citing **35 U.S.C. § 312(a)(3)** (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, **800 F.3d 1375, 1378** (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

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. *See KSR Int'l Co. v. Teleflex Inc.*, **550 U.S. 398, 406** (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) if in the record, objective evidence of nonobviousness. *Graham v. John Deere Co.*, **383 U.S. 1, 17-18** (1966). Consideration of the ***Graham*** factors "helps inform the ultimate obviousness determination." *Apple Inc. v. Samsung Elecs. Co.*, **839 F.3d 1034, 1048** (Fed. Cir. 2016) (en banc). To prevail in an *inter partes* review, Petitioner must explain how the proposed combinations of prior art would have rendered the challenged claims unpatentable.

At this final stage, we determine whether a preponderance of the evidence of record shows that the challenged claims would have been rendered obvious in view of the asserted prior art. We analyze the asserted grounds of unpatentability in accordance with these principles.

D. Obviousness of Claims 1, 2, and 4-7 in view of Andersson and Urmson, alone or in combination with Ahmed-Zaid

Petitioner contends the subject matter of claims 1, 2, and 4-7 would have been obvious over the combined disclosures of Andersson and Urmson, alone or in further combination with Ahmed-Zaid. Pet. 20, 65.

1. Andersson

Andersson discloses systems and methods for manually or autonomously controlling vehicle speed. *See* Ex. 1004, 2:32-34, 3:15-18, 4:29-30. Andersson explains:

> [T]he method may also comprise the steps of extracting, from a plurality of sensors, sensor information regarding obstacles on or in [the] vicinity of said road section, and generating, based on information from the input connection, the map database, the driver information database, and the sensor information, a speed plan for the current and/or upcoming road section.

Id. at 2:41-47. The speed plan is generated in speed plan generator 12. *Id.* at 4:24-26. The speed plan is sent to a control device that, in turn, controls brake control unit 9 and throttle control unit 10, in accordance with the speed plan. *Id.* at 3:16-19, 3:58-4:2. Andersson also **[*5]** includes a route planner that enables the speed planner to generate "a speed plan for the entire route . . ., thereby estimating mean speed, travel time, fuel consumption and so on." *Id.* at 6:26-30. Figure 2, reproduced below, is illustrative of one embodiment of Andersson.

Figure 2, above, is a "block diagram disclosing certain preferred additional functions of the block diagram in accordance with [Figure 1]." *Id.* at 3:27-29. The system of Figure 2 includes controller 1, computer 2, and speed plan generator 12. *Id.* at 3:33-4:28. Information from map database 3, driver preference database 4, and input port 5 (which receives positioning signals 11) is used to generate a speed plan that is transmitted to vehicle control system 8. *Id.* at 4:6-34. Additionally, sensor input from environmental sensors 15 may be included as input to speed plan generator 12. *Id.* at 5:43-47. Environmental sensors 15 may include "radar sensors, [infrared ("IR")] sensors or a camera," and can be used to detect "light conditions, visibility, and road friction." *Id.* at 5:47-50. System controller 8 is "connected with [sic] brake control unit 9 and/or an engine control unit such as throttle control unit 10" in order to enable autonomous control of the vehicle. *Id.* at 3:15-19, 3:58-4:2.

2. Urmson

Urmson describes autonomous vehicles, their hardware and software, and modes of operation. *See* Ex. 1008, 468-469. The vehicles of Urmson are equipped with sensors, such as light detecting and ranging ("LIDAR") and radio detecting and ranging ("RADAR") systems and SICK laser measurement sensors ("LMS") to sense terrain and vehicle position. *Id.* at 476-479. The Urmson vehicles have "[o]nboard navigation software [that] combines incoming sensor data with a preplanned route to generate a new safe and traversable route." *Id.* at 479, Fig. 9. These sensors also send desired speed information to a speed controller which operates the throttle and brakes to adjust speed accordingly. *Id.* at 475. Urmson includes a speed planner that "operates on the output of the geometric planner and pre-emptively slows the robot for any sharp turns that may result when the geometric planner generates a plan to avoid obstacles." *Id.* at 488.

3. Ahmed-Zaid

Ahmed-Zaid describes an adaptive cruise control system that controls the speed of a vehicle. *See* Ex. 1007, 1:15-19, 3:24-32. Ahmed-Zaid's system includes a controller that "generates a predicted future path profile" "in response to the object profile [from detection system 28] and the navigation signal," and "inhibits resume speed of the automotive vehicle in response to the predicted future path profile." *Id.* at 2:35-40. Each of the "object profile, the yaw rate, the speed of the vehicle 22, and the navigation signal determines an operating mode of the system 20." *Id.* at 4:14-16. Ahmed-Zaid describes several operational modes, including "follow mode, cruise mode, auto resume mode, or inhibit resume mode," that adjust the speed of the vehicle based on certain conditions. *Id.* at 4:17-18. The "follow mode," for example, continuously adjusts the vehicle speed so that the vehicle maintains a certain distance from a vehicle traveling ahead. *Id.* at 4:18-22. In **[*6]** an auto resume mode or inhibit resume mode, the vehicle either resumes acceleration or prevents acceleration based on sensor information that indicates whether an object is detected in the future path of the vehicle. *Id.* at 2:28-58, 4:24-26.

4. Analysis of Claim 1

Petitioner contends that claim 1 would have been obvious over the combination of Andersson and Urmson. Pet. 20. Alternatively, Petitioner contends that claim 1 would have been obvious over the combination of Andersson, Urmson, and Ahmed-Zaid. *Id.* at 65. Petitioner's alternative position—that Ahmed-Zaid describes a "speed command category"—was presented in the event Patent Owner argued the term requires both *why* and *how* the actuators adjust the vehicles speed. *Id.* at 65-66. Neither party proposes such a construction. PO Resp. 28. Therefore, we do not address this alternative position.

Claim 1 is directed to an autonomous vehicle that includes (1) one or more sensors that obtain data that affects the movement of the vehicle; (2) a speed planner that calculates the desired speed based on data from the sensors; (3) a control system that calculates speed commands based on the

speed calculated by the speed planner; (4) one or more actuators that adjust the speed of the vehicle based on speed commands received from the control system; and (5) where the speed planner outputs a speed command category associated with the desired speed. Ex. 1001, 9:38-53.

Relevant to claim 1, Petitioner contends that Andersson describes an autonomous vehicle.[10] Pet. 21 (citing Ex. 1004, 2:32-34, 3:15-19, 3:67-4:1, 4:28-33).[11] According to Petitioner, the vehicle of Andersson has a plurality of sensors, including a position sensor, a compass, steering angle sensor, yaw sensor, wheel speed sensor, radar sensors, IR sensors, or a camera. *Id.* at 21-23 (citing Ex. 1004, 2:40-42, 3:38, 5:43-51, 6:32-37, Fig. 2; Ex. 1003 ¶ 82). Petitioner argues that Andersson has a speed plan generator, corresponding to the claimed speed planner, that "'extract[s], from a plurality of sensors, sensor information regarding obstacles on or in vicinity of said road section' and then 'generat[es], **based on ... the sensor information**, ***a speed plan*** for the current and/or upcoming road section.'" *Id.* at 23-25 (quoting Ex. 1004, 2:40-47; citing Ex. 1004, 2:64-66, 3:56-60, 4:26-28, Fig. 2; Ex. 1003 ¶ 86, n.6).[12]

Petitioner explains, however, that Andersson "lacks specific details about how the sensor inputs are used to generate the desired speeds," but "Urmson discloses just such specific equations or algorithms . . . for calculating a desired speed," and "use[s] the same or similar inputs as described in Andersson." *Id.* at 25-26. Petitioner explains that the speed planner of Urmson performs a "first pass [that] walks the path in the forward direction and sets a maximum speed at each point" on the path and then performs "a 'second pass [that] walks from the last point to the first point and limits the change in velocity so that it is constrained by [equation] (4).'" *Id.* at 26-27. Petitioner reasons that a person of ordinary skill in the art would have been "motivated to look to another reference disclosing details for calculating speeds, such as Urmson," in **[*7]** light of the teachings of Andersson. Pet. 27-28 (citing Ex. 1008, 490-91; Ex. 1003 ¶¶ 93-94).

Petitioner further reasons that use of "Urmson's algorithms would make Andersson's system safer, more reliable, and more comfortable for passengers." *Id.* at 28 (citing Ex. 1008, 490; Ex. 1003 ¶¶ 93-94). Petitioner also alleges that Andersson describes a vehicle control system (system controller 8) that receives the speed plan and calculates the speed commands, i.e., signals to adjust the vehicle's speed, based on the speed plan. *Id.* at 30-31 (citing Ex. 1004, 3:57-4:2, Fig. 2; Ex. 1003 ¶¶ 98-99).

Petitioner acknowledges, however, that Andersson fails to describe the details of how system controller 8 calculates speed commands, but explains that Urmson similarly teaches a speed controller, which is a piece of software that compares a "measured speed" against a "speed error" and then adjusts the engine or break controllers according to the commands received. *Id.* at 32-33 (citing Ex. 1008, 475, Fig. 9; Ex. 1003 ¶¶ 105-108). Petitioner explains that "[a person having ordinary skill in the art (PHOSITA)] reviewing Andersson's disclosure would thus be motivated to look to another reference disclosing specific details for calculating speed commands based on a desired speed, such as Urmson," for the reasons stated above. *Id.* at 33 (relying on Petition Section VIII(A)(1)(b) and citing Ex. 1003 ¶¶ 105-108).

Petitioner also asserts that Andersson describes a "brake control unit" and a "throttle control unit," which correspond to the "one or more actuators" as claimed. *Id.* at 34-36 (citing Ex. 1004, 3:64-4:2, 5:14-16, Fig. 2; Ex. 1003 ¶¶ 112-114). Petitioner similarly argues that Urmson's controller commands actuators to adjust the speed of the vehicle as claimed by the **'174** patent. *Id.* at 36-37 (citing Ex. 1008, 474-475, Fig. 9; Ex. 1003 ¶ 115).

Lastly, Petitioner urges that Andersson provides a speed plan category providing information about why the desired speed is selected. *Id.* at 37. In particular, Petitioner draws attention to Andersson's teaching that combines two modes of operation, which "display[s] speed changes on the display unit 6, **in order to inform the driver of up-coming speed changes**." *Id.* at 38 (quoting Ex. 1004, 4:2-5; citing Ex. 1004, 3:60-65, 5:14-20, Fig. 2). In one example, display unit 6 "reads 'Slow down!,' '**Dangerous curve ahead**,' and 'Recommended speed 25 mph.'" *Id.* (quoting Ex. 1004, Fig. 2) (citing Ex. 1003 ¶ 123).

Patent Owner's arguments regarding claim 1 focus on three purportedly missing elements and the lack of a motivation to combine the references. *See* PO Resp. 24-32. After reviewing the parties' briefing and evidence of record, we are persuaded by Petitioner's arguments and supporting evidence for the undisputed limitations of claim 1 as summarized above. Accordingly, we determine that Petitioner has established by a preponderance of the evidence that each of the limitations of claim 1 *not* challenged by Patent Owner are present in the combination of Andersson and Urmson. *See In re NuVasive*, **841 F.3d 966, 974** (Fed. Cir. 2016) (explaining that the Board need not make specific findings as to claim limitations that Patent Owner does not dispute are disclosed in the prior art). We address Patent Owner's specific arguments **[*8]** below.

a. whether Andersson discloses an "autonomous vehicle"

Patent Owner contends that Andersson does not disclose an autonomous vehicle, but rather "relates to cruise control technologies and has a driver present at all times." PO Resp. 24. Patent Owner asserts that the **'174** patent describes vehicles that are capable of maneuvering and navigating without the presence of a driver, such that an autonomous vehicle, as understood by the **'174** patent, "control[s] both steering and speed." *Id.* Patent Owner argues that because Andersson relates only to cruise control technology—and not to steering—it describes a very different vehicle than that claimed by the **'174** patent. *Id.* at 24-25.

In weighing the evidence before us, we disagree with Patent Owner's arguments. Based on our review of the arguments and evidence of record, we determine that the term "autonomous vehicle" may include varying levels of autonomy, and that although it *may* include both speed and steering control, it *does not require* the presence of both as Patent Owner urges (PO Resp. 24). This understanding is consistent with Specification of the **'174** patent, which refers to autonomous vehicles embodied in the **'174** patent exclusively in the context of speed control. *See* Ex. 1001, 2:1-10, 2:40-4, 3:29-50, 3:58-4:2, 4:3-5, 4:29-33, 5:1-11, 5:51-55, 6:4-7, 6:15-20, 8:23-27, 8:65-9:7, 9:18-22, Figs. 1, 4. For example, the **'174** patent explains that

> [c]onventional path planning algorithms, however, do not inherently indicate the *speed* at which the vehicle should traverse the path. By *automatically providing appropriate speed targets that are safe, feasible and achievable* by the autonomous vehicle during path traversal, embodiments of the present invention enable an autonomous vehicle to complete tasks safely and quickly.

Id. at 2:43-49 (emphasis added). According to Patent Owner, the **'174** patent's statement that an autonomous vehicle is "capable of navigating and maneuvering without human control," "needs to determine the characteristics of its environment required to enable it to carry out the task it has been assigned," and "needs to plan and follow a path to its destination while detecting and avoiding obstacles" supports its contention that autonomous vehicles require both speed and steering control. *Id.* at 1:53-61; PO Resp. 24; Sur-reply 4; Ex. 2001 ¶ 78. However, this lone statement, describing the goals of the Defense Advanced Research Projects Agency ("DARPA") Grand Challenge—not the embodiments of the **'174** patent—is insufficient to convey to the skilled artisan that the term autonomous vehicle in the context of the **'174** patent requires *only* full autonomy (i.e., a system comprising both speed and steering control). Because we find that the claimed autonomous vehicle does not require full autonomy, we determine that Andersson's teaching of an adaptive cruise control system based on both sensor input and database information is sufficient to teach an autonomous vehicle.[13]

Therefore, having considered the record evidence and arguments advanced, we determine that Petitioner has demonstrated by a preponderance of the evidence that an "autonomous vehicle" **[*9]** is taught or suggested by Andersson.

b. whether the combination of Andersson and Urmson teaches or suggests a "speed planner"

Patent Owner also asserts that "neither Andersson nor Urmson disclose or render obvious element 1[b], which requires a speed planner that 'calculates a desired speed based, at least in part, on sensor input.'" PO Resp. 25. According to Patent Owner, Petitioner's argument that the person skilled in the art "would have understood that generating a speed plan based on sensor information would result in Andersson's speed plan generator performing at least one calculation" must fail because "Andersson's selection of user defined speeds requires no calculation" and because "Petitioner's position falls far short of the standard for inherency, which requires inevitability." *Id.* Patent Owner also argues that "[b]ecause Urmson calculates speeds in advance, its calculations are not based on sensor input as recited in element 1[b]." *Id.* at 26.

We are persuaded by Petitioner's evidence and argument. Andersson teaches that its speed plan generator is responsible for generating or calculating the speed plan transmitted to the vehicle system controller and is responsible for engaging the brake control unit or the engine control unit. Ex. 1004, 2:59, 3:15-19, 3:54-4:34, 6:28-30. Andersson describes a combination of inputs including information from environmental sensors, a map database, a driver information database, and positioning systems as information fed into the speed plan generator. *Id.* at 1:8-10, 2:42-46, 2:52-53, Fig. 2. Andersson explains that the sensor data, which may include "information regarding obstacles on or in the vicinity of said road section," may be used in combination with other input data to generate a speed plan for "the current and upcoming road section[s]." *Id.* at 2:41-47. As a result, the speed plan generated by the speed plan generator may account for "temporary circumstances or objects not present in the map database."[14] *Id.* at 2:47-49. Dr. Ducharme testifies that

> Andersson's speed plan generator must perform one or more calculations to interpret the data from the sensors (*e.g.*, data regarding current vehicle position and speed) in order to calculate a desired speed (*e.g.*, a speed that is 5 mph less than the current speed). Indeed, even simple

> adjustments, such as increasing the vehicle's speed to a higher preferred speed or decreasing the vehicle's speed to a lower preferred speed, necessarily require[s] calculations (*i.e.*, addition and subtraction, respectively).

Ex. 1003 ¶ 88. We credit Dr. Ducharme's unrebutted testimony in this regard.

We acknowledge Dr. Reinholtz's testimony that Andersson does not *calculate* speed because Andersson generates speed using a "neural network that *relates* said plurality of map information with said plurality of driver behavior information." Ex. 2001 ¶ 85 (emphasis added). Even assuming arguendo that a neural network—i.e., a network that "attempt[s] to emulate the human decision-making process by learning to recognize patterns and make decisions in a humanlike way" (*id.*)—does not involve performing **[*10]** calculations as Patent Owner alleges,[15] the neural network of Andersson is part of the computing device and *not* the speed plan generator responsible for generating the speed plan. Ex. 1004, 3:9-11 ("[T]he computing device is suitably realized by means of a neural network."), 4:47-49 (explaining that in a preferred embodiment, "the computing device 2 . . . comprises a neural network unit"). Dr. Reinholtz further testifies that that there is no disclosure in Andersson to indicate whether the speed plan generator also includes a neural network. Ex. 1027, 23:12-24:4 (referring to Ex. 1025, 428:21-429:10). We, thus, determine that Dr. Reinholtz's testimony regarding Andersson's teaching of a neural network does not negate our finding that Andersson's speed plan generator calculates a desired speed.

As discussed above, Petitioner relies on Urmson for teaching specific details of calculating the desired speed. With respect to Petitioner's reliance on Urmson's teachings, we are similarly persuaded that Urmson suggests a speed planner as claimed. Like Andersson, the speed planner of Urmson "is responsible for ensuring driving speeds are safe." Ex. 1008, 490. Urmson uses onboard sensors to avoid and account for obstacles on the planned route. *Id.* at 469, 476 ("LIDAR and RADAR are used to detect obvious obstacles at long ranges."), 478. Navigating obstacles is identified as a principal risk because "[h]itting large obvious obstacles . . . can destroy a vehicle." *Id.* at 481. Sensor information is fed into the geometric planner and then to the speed planner. *Id.* at 480 (Fig. 14). According to Urmson, in "[t]he first stage, the geometric planner, adjusts the path to avoid obstacles . . . [and then] [t]he speed planner operates on the output of the geometric planner and pre-emptively slows the robot for any sharp turns that may result when the geometric planner generates a plan to avoid obstacles." *Id.* at 488; *see also id.* at 491 (explaining that the "speed planner will slow the output path to account for obstacle avoidance"). Urmson makes clear that its speed plan is not based *only* on calculations occurring in advance, but rather, Urmson's speed planner combines *both* preplanned and real-time information to generate a *new* speed plan. *Id.* at 479 ("[I]ncoming sensor data [is combined] with a preplanned route to generate a *new* safe and traversable route." (emphasis added)).

Further, Patent Owner's additional argument that "Urmson's 'Speed Planner' operates on the output of Urmson's 'Geometric Planner' [and therefore] Urmson's sensors do not input to the 'Speed Planner'" lack merit. Sur-reply 9. Patent Owner's claims do not require *direct* input of sensor information into the speed planner; rather, the claims require only that the speed planner calculate a desired speed based, in part, on data obtained from one or more sensors.

Accordingly, the weight of the evidence supports a determination that Petitioner has established by a preponderance of the evidence that the combination of Andersson and Urmson teaches "a speed planner . . . configured to calculate a desired speed based, at least in part, on data obtained from the one **[*11]** or more sensors," as claimed.

c. whether Andersson teaches or suggests a "speed command category"

In addition to the arguments discussed above, Patent Owner asserts that "none of Andersson, Urmson, and/or Ahmed-Zaid disclose or render obvious [the] . . . recited 'speed command category.'" PO Resp. 26. According to Patent Owner, Andersson does not output a speed command category as part of the speed plan, but rather, "Andersson explicitly defines the speed planner output (i.e., the speed plan) as 'speed, accelerations and retardations" and nothing in Andersson suggests that the messages displayed on display unit 6 (illustrated in Figures 1 and 2) are output from the speed planner. *Id.* at 27 (citing Ex. 1004, 3:58-4:5).

We are persuaded by Petitioner's argument and evidence. Figure 2 of Andersson, reproduced below, illustrates the relevant features relating to the "speed command category."

Andersson's Figure 2, above, is a "block diagram disclosing certain preferred additional functions" in accordance with one preferred embodiment. Ex. 1004, 2:40-49, 3:27-29. In the embodiment of Figure 2, in addition to sensor data from environmental sensors 15, a driver behavior model output from computing device 2 is input into speed plan generator 12 to generate a vehicle plan for a current and upcoming road section. *Id.* at 3:50-57. "The speed plan, containing information regarding preferred vehicle speed, accelerations and retardations . . . is thereafter inputted to a mode selector 7," where the user chooses between a manual drive mode, in which speed information and recommendations are displayed on unit 6, or an autonomous control mode where the speed plan is input into system control device 8 to control braking and acceleration. *Id.* at 3:58-67. Andersson explains that it is possible to use both operational modes simultaneously, such that the upcoming changes may be viewed on display 6 in an autonomous control mode. *Id.* at 4:2-5; *see also id.* at 5:14-20 ("[I]n autonomous speed control mode, . . . an indication of a speed limit condition and vehicle control actions may be displayed to the driver . . . ."). The speed plan also includes "information regarding the appropriate changes of the vehicle speed in order to respond to said driver model," which is "transmitted to the manual/automatic mode selector 7, as described above, and the signal is thereafter transmitted to the vehicle system control device 8 for autonomous speed adaptation and/or the display unit 6, for displaying appropriate speed alterations to the driver of the vehicle." *Id.* at 4:25-34. Therefore, the speed plan of Andersson includes more than simply vehicle speed, accelerations, and retardations, as Patent Owner alleges. *See id.* 2:35-39.

Therefore, we determine that Petitioner has demonstrated by a preponderance of the evidence that a "speed command category" is taught or suggested by Andersson.

d. whether a person ordinarily skilled in the art would have had reason to combine Andersson and Urmson

Patent Owner contends that the grounds based on Andersson and Urmson (with or without Ahmed-Zaid) "also fail because there is not motivation **[*12]** to combine the prior art." PO Resp. 28. First, Patent Owner argues that Andersson teaches away from speed calculation and speed command categories because Andersson "selects speeds using a neural network, which is not calculating speed to a POSA." *Id.* Further, Patent Owner contends that "Andersson's disclosure . . . is limited to the display of information that is not based on sensor input, [and] a POSA would not be motivated to modify Andersson to calculate speeds or display information based on sensor input, including speed command categories, because Andersson does not disclose, teach, or suggest calculation of desired speeds based on sensor input." *Id.* Therefore, according to Patent Owner, Andersson teaches away from modification. *Id.*

We do not agree with Patent Owner's argument that Andersson teaches away.[16] To teach away, a reference must discourage one of ordinary skill in the art from following the path set out in the reference, or lead that person in a direction divergent from the path taken by the applicant. *In re Gurley*, **27 F.3d 551, 553** (Fed. Cir. 1994) ("[A] reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant."). "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 Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, **567 F.3d 1314, 1327** (Fed. Cir. 2009) (quoting *In re Fulton*, **391 F.3d 1195, 1201** (Fed. Cir. 2004)). "Silence does not imply teaching away." *Allergan, Inc. v. Apotex Inc.*, **754 F.3d 952, 964** (Fed. Cir. 2014). Therefore, the fact that Andersson exemplifies a neural network—*in a preferred embodiment* (Ex. 1004, 4:47-60, 6:7-9)—does not teach away from pursuing the path taken in the **'174** patent. Similarly, Patent Owner's additional position that because the speed planner of Andersson does not calculate speeds or output speed command categories based on sensor input, it teaches away from modifying Andersson's system, is unsound. Silence, without more, is not a teaching away. Allergan, 754 F.3d at 964.

Next, Patent Owner argues that because Andersson and Urmson address fundamentally different problems, a person of ordinary skill in the art would not have had reason to combine their teachings. PO Resp. 29. According to Patent Owner, "Andersson relates to cruise control technologies and determining speed along route segments," and Urmson "relates to autonomous vehicles where route planning leads to path planning, and both speed and heading (steering angle) must be controlled in coordination." *Id.* Patent Owner explains that because Andersson does not discuss path planning, "Andersson does not relate to autonomous vehicles and is a very different technology from Urmson." *Id.*

On this record, we disagree with Patent Owner's arguments. Whether Andersson's teachings are limited to adaptive cruise control systems, as Patent Owner alleges, is not the inquiry.[17] Perfect overlap in technologies is not required. Rather, one of ordinary skill can use his or her ordinary skill, creativity, and common sense to make the necessary adjustments and further modifications to result in a properly functioning device. *See KSR*, **550 U.S. at 418** ("[A] court can take account of **[*13]** the inferences and creative steps that a person of ordinary skill in the art would employ."). Furthermore, "if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *See **id.*** **at 417** .

Here, Andersson's methods and systems, at a minimum, control vehicle speed. Ex. 1004, 1:57-59 ("By such a method, it is possible to generate a speed plan, which may be used to adapt the speed of the vehicle to the chosen road section in a suitable manner."), 2:25-32 ("[T]he method comprises the step of feeding the outputted speed plan to a throttle control device for controlling the throttle of a vehicle . . . ."), 3:58-4:1 (explaining that the system control device is "connected with a brake control unit 9 and/or engine control unit such as a throttle control unit 10, for autonomous vehicle speed control."). Urmson, similarly, relates to speed control in addition to steering control. Ex. 1008, 474 ("[S]peed control must be accurate and responsive as it is constantly being adjusted to ensure vehicle stability."), 491 ("[T]he algorithm runs on the output of the planner . . . allowing the vehicle to slow for unexpected obstacles."). Petitioner relies on Urmson to describe "how the sensor inputs are used to generate the desired speeds." Pet. 25 ("[A] PHOSITA . . . would have been motivated to look to . . . Urmson to find the details for generating the desired speeds, including specific algorithms used by a speed planner to calculate the desired speeds."). Therefore, overlap exists in the teachings of Andersson and Urmson in the aspect of speed control—the very aspect that is improved by modifying Andersson to include Urmson's algorithms in the combination advanced by Petitioner.

Lastly, Patent Owner argues that Urmson teaches away from a combination with Andersson "because any combination would only add complexity without improving functionality." PO Resp. 30. Here, Patent Owner relies on the testimony of Dr. Reinholtz, who explains that even minor alterations to the programming algorithm would result in "wide ranging impacts on other aspects of the system." *Id.* (citing Ex. 2001 ¶¶ 119-121). According to Patent Owner, because "Urmson focuses on the simplicity of the interaction between its Navigation Subsystem and Vehicle Subsystem" and "[c]alculating desired speeds based on sensor input and outputting speed command category would only add complexity to Urmson's system," Urmson thus teaches away. *Id.* (citing Ex. 1008, sec. 2.2).

Again, we disagree with Patent Owner's teaching away argument. As explained above, teaching away requires that the reference "'criticize, discredit, or otherwise discourage' investigation into the invention claimed." *DePuy Spine*, **567 F.3d at 1327** . In this case, Patent Owner identifies no such criticism in Urmson (and we find none) that would have cautioned the skilled artisan against pursuing the solution described in the **'174** patent. *See generally* PO Resp.; Sur-reply. And while Urmson does discuss the simplicity of its design, "[t]he fact that the motivating **[*14]** benefit comes at the expense of another benefit, however, should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another. Instead, the benefits, both lost and gained, should be weighed against one another." *Winner Int'l Royalty Corp. v. Wang*, **202 F.3d 1340, 1349** n.8 (Fed. Cir. 2000). Furthermore, Petitioner does not propose to modify Urmson as Patent Owner suggests. Instead, Petitioner proposes modifying Andersson with algorithms taught by Urmson. Accordingly, no complexity is added to Urmson.

Therefore, we determine that Petitioner has demonstrated by a preponderance of the evidence that each limitation of claim 1 is taught or suggested by the combination of Andersson and Urmson, and further that the skilled artisan would have had reason to make the suggested combination with a reasonable expectation of success.

5. Analysis of Claims 2 and 4-6

With respect to dependent claims 2 and 4-6, Petitioner identifies where the combination of Andersson and Urmson suggests each limitation of these claims. Pet. 34-38. Petitioner demonstrates that each of Andersson and Urmson suggest the autonomous vehicles are "ground vehicles" as required by claim 2. *See id.* at 41 (citing Ex. 1004, Abstract, 5:49, 6:36; Ex. 1008, Fig. 2). Petitioner further demonstrates that Urmson describes a geometric planner (i.e., path planner) that calculates a planned path and the speed planner determines the maximum safe speed for points on the planned path, as required by claims 4 and 5. *Id.* at 41-46 (citing Ex. 1008, 479, 488, 490-91, Figs. 14, 25; Ex. 1003 ¶¶ 132, 135-36, 140-41; Ex. 1004, 6:27-31 (describing a route planner to calculate a planned path permit "a speed plan for the entire route [to] be calculated in advance")). And, relevant to claim 6, Petitioner shows that Andersson teaches radar sensors, IR sensors, and cameras, which detect obstacles and that the speed planner of Urmson ensures safe driving speeds and adjusts to slow the vehicle and swerve around obstacles. *Id.* at 46-49 (Ex. 1004, 2:40-47, 3:3-4, 5:49-50; Ex. 1008, 490-491; Ex. 1003 ¶¶ 144, 146, 148-49).

Patent Owner does not substantively address Petitioner's arguments with respect to claims 2 and 4-6 in its Patent Owner Response. *See generally* PO Resp. Instead, Patent Owner argues that these claims "are patentable for the same reasons as set forth above with regard to claim 1." *Id.* at 32.

Upon review of the arguments and evidence of record, we determine that Petitioner has demonstrated by a preponderance of the evidence that each of the limitations recited in claims 2 and 4-6 are present in or suggested by the combination of Andersson and Urmson, and that the skilled artisan would have had reason to make the combination with a reasonable expectation of success. *See NuVasive*, **841 F.3d at 974** .

6. Analysis of Claim 7

Claim 7 depends from claim 1 and additionally requires that "the speed planner is configured to calculate a desired speed which does not cause the autonomous vehicle to violate one or more constraints." Ex. 1001, 10:7-10. Petitioner contends that Andersson and Urmson (with or without Ahmed-Zaid) renders claim 7 obvious. Pet. 49-52, 71. Petitioner argues that both Andersson and Urmson suggest the additional **[*15]** limitation of claim 7. *Id.* at 49-52. In particular, Petitioner alleges that the "driver models" of Andersson are used to restrict or limit the execution of the speed plan. *Id.* at 50 (citing Ex. 1004, 5:25-28). Therefore, because "the speed plan generator is limited by each user-specific individual driver model, and consequently, a speed plan would not include speed values that, *e.g.*, differ from '*speed a* **certain driver prefers** when entering a curve,' as doing so would violate this particular constraint," Andersson suggests the added limitation of claim 7. *Id.* at 50-51 (citing Ex. 1004, 5:25-28, 5:32-34; Ex. 1003 ¶ 154). Petitioner also alleges that Urmson teaches or suggests this limitation. *Id.* at 51. According to Petitioner, Urmson describes a "two-pass process" where the maximum safe speed is determined for each point on the path—the first pass constrains the lateral velocity of the vehicle and the second pass limits rate of change in velocity. *Id.* (citing Ex. 1008, 491; Ex. 1003 ¶ 155). Petitioner reasons that the skilled artisan would have had reason to modify the system of Andersson to include constraints suggested by Urmson because "constraint[s] that limit[] the rate at which speed can change (*i.e.*, caps acceleration and deceleration) serve[] the important purpose of preventing dramatic accelerations and decelerations during vehicle operation, thus improving passenger/driver safety and comfort." *Id.* at 51-52 (citing Ex. 1003 ¶ 156).

In addition to the arguments advanced (and rejected) above for claim 1, Patent Owner argues that "Andersson does not disclose claim 7, which requires the speed planner be 'configured to calculate a desired speed which does not cause the vehicle to violate one or more constraints." PO Resp. 32. Patent Owner explains that Andersson's use of speed limits and "what speed a certain driver prefers when entering a curve" is not a "speed calculation to avoid violation of a constraint (e.g. to avoid an obstacle), because it does not effect movement of the vehicle." *Id.* Furthermore, Patent Owner argues that "any speeds selected as part of the speed plan are not based on sensor input . . . and accordingly, are not speed calculations" according to the claim. *Id.* In support of its position, Patent Owner references Dr. Ducharme's annotated Figure 2 of Andersson (*see* Ex. 1003 ¶¶ 153-154) and notes that the "constraint" does "not involve sensor input at all." Sur-reply 12.

We disagree with Patent Owner's arguments. To begin, we reject the suggestion by Patent Owner (*id.*) that the desired speed must be calculated exclusively based on sensor input, as such position is inconsistent with the claims themselves. Ex. 1001, 9:38-53, 10:7-10. Claim 7 requires that the desired speed is calculated so as not to violate one or more constraints, and claim 1 explains that the desired speed is calculated "based, *at least in part*, on data obtained from one or more sensors." *Id.* (emphasis added). Accordingly, Dr. Ducharme's testimony identifying Andersson's "user specific driver models" as a constraint that is not violated, is consistent with the requirements of the **'174** patent. Ex. 1003 ¶¶ 154-155 (citing Ex. 1004, 5:25-28, 5:32-34); *see* ***[*16]*** *also* Pet. 50 (same). We also observe that sensor input may, in fact, be used to create the driver models, i.e., constraints, in Andersson. Ex. 1004, 5:44-55.

Furthermore, we disagree with Patent Owner's contention (PO Resp. 32) that the calculated desired speed identified by Petitioner is not based on a constraint that affects vehicle movement. The **'174** patent describes "constraints" broadly as limits that generally should not be violated. Ex. 1001, 3:7-48; *see also* PO Resp. 14 (describing the plain meaning as "a limit that generally cannot be violated"). Constraints include, for example, speed limits, traffic lights, avoiding obstacles, maintaining valid operating conditions, distance to obstacles, path curvature, turn radius, and road conditions. Ex. 1001, 3:36-39, 4:14-16, 7:21-25, 8:28-38. The speed a driver prefers when entering a turn in Andersson, like the "speed selected to enforce path curvature constraint" of the **'174** patent, does affect vehicle movement because it accounts for the "speed a certain driver prefers when entering a curve, considering factors such as curve radius, speed limits, lane width, pavement and so on." Ex. 1004, 5:32-34; Ex. 1003 ¶¶ 152-154. We, thus, also find that Petitioner has established by a preponderance of the evidence that Andersson alone satisfies the additional limitation of claim 7.

Lastly, as noted, Petitioner also relies on Urmson (separate from Andersson) to meet the additional limitation of claim 7. Pet. 51-52. Patent Owner's arguments relating to Urmson are solely based on those considered and rejected above in Section II.D.4.b, regarding the claim 1 recitation of "speed planner." *See* PO Resp. 32; Sur-reply 12-13. We have reviewed the parties' briefing and evidence cited therein and are persuaded by Petitioner's arguments and supporting evidence regarding Urmson's teachings in relation to claim 7. We, thus, also find that Petitioner has established by a preponderance of the evidence that Urmson alone satisfies the additional limitation of claim 7. *See NuVasive*, **841 F.3d at 974** .

Therefore, we determine that Petitioner has demonstrated by a preponderance of the evidence that claim 7 would have been suggested by the combined disclosures of Andersson and Urmson, and that a person of ordinary skill in the art would have had reason to make the combination with a reasonable expectation of success.

E. Obviousness of Claim 3 in view of Andersson and Urmson, alone or in combination with Ahmed-Zaid, and with Augenbraun

Petitioner contends the subject matter of claim 3 would have been obvious over the combined disclosures of Andersson, Urmson, and Augenbraun, alone or in combination with Ahmed-Zaid. Pet. 53, 71-72. As discussed above, we do not address the parties' contentions regarding Petitioner's alternative position based additionally on Ahmed-Zaid.

1. Augenbraun

Augenbraun "relate[s] generally to the field of robotic devices, and more particularly to a multi-function robotic device having utility in various applications." Ex. 1005 ¶ 3. "[M]ulti-function robotic device ('robot') 100 may generally be characterized by an ability to perform tasks autonomously or automatically **[*17]** with little or no intervention on the part of a user or operator." *Id.* ¶ 49. Augenbraun describes robots having a body with a drive mechanism and a functional cartridge, coupled to the body, to operate "in accordance with the characteristics of the functional cartridge." *Id.* ¶¶ 10-12; *see also id.* ¶¶ 13-14 (same). Embodiments exemplified in Augenbraun include functional cartridges "to perform a mopping function, a vacuuming function, or a sweeping function." *Id.* ¶ 12. "The body may further comprise an electronics module to provide instructions to the drive mechanism to position the robot in an operating environment, and a sensing apparatus to provide data to the electronics module." *Id.* ¶ 10. "The data may be related to the position of the robot relative to an object in the operating environment." *Id.* The electronics module may include any suitable electronics "to provide necessary or desired control functions for robot 100." *Id.* ¶ 57. Suitable electronics include "a microprocessor, an application specific integrated circuit (ASIC), a programmable logic controller (PLC), an arrangement of field programmable gate arrays (FPGA), or any other type of processor or addressable memory capable of providing instructions to influence the behavior of robot 100 or its components." *Id.* The sensor array and a drive mechanism operate under the control of the electronics module, which "enable[s] robot 100 to navigate about an operating environment with precision, while avoiding obstacles." *Id.* ¶ 76. The electronics module also signals the drive mechanism to permit "slowing or speeding one or both motors 241 and 243 as necessary for desired obstacle avoidance." *Id.*

2. Analysis of Claim 3

Claim 3 depends from claim 1 and additionally requires that "the speed planner is implemented in one of an application specific integrated circuit or a field programmable gate array." Ex. 1001, 9:59-61. Petitioner acknowledges that the combination of Andersson and Urmson fails to describe the additional limitation of claim 3, i.e., hardware necessary to implement the speed plan generator. Pet. 53. Petitioner, however, contends that Augenbraun discloses an electronics module for an autonomous vehicle that can include any suitable electrical components and exemplifies implementation as an ASIC or FPGA. *Id.* (citing Ex. 1005 ¶¶ 57, 60, 76; Ex. 1003 ¶ 179). Petitioner contends that a person of ordinary skill in the art at the time of invention would have had reason to combine the teachings of Andersson and Urmson with that of Augenbraun, because Andersson and Urmson are silent about the type of hardware used and a person of ordinary skill would have been "motivated to look to another reference disclosing the specific hardware details." *Id.* at 54 (citing Ex. 1003 ¶ 182). Furthermore, Petitioner alleges the skilled artisan would have known that "implement[ation] on an ASIC or FGPA is a common practice known by those skilled in the art" and there are limited options for implementing a computer program. *Id.* at 54-55 (citing Ex. 1003 ¶ 183).

Patent Owner does not dispute Petitioner's contention that Augenbraun **[*18]** describes an electronics module that may comprise an ASIC or FPGA. *See generally* PO Resp. 33-34. Rather, Patent Owner contends that a person of ordinary skill in the art would not have had reason to modify Andersson or Urmson to include ASIC or FPGA, as suggested by Augenbraun, and would have no reasonable expectation of success in the outcome. *Id.* at 33 (citing Ex. 2001 ¶¶ 123-128, 178-180). Specifically, Patent Owner states that while "ASICs and FPGAs are lower cost in high volume and lower power consumption, . . . they require greater design and programming time, effort and cost," and "the autonomous vehicles of the **'174** patent and Urmson as well as the cruise control technologies of Andersson are not well-suited for such programming." *Id.* (citing Ex. 2001 ¶¶ 123-128, 178-180). Patent Owner explains that "Andersson and Urmson themselves each emphasize the importance of simplicity and flexibility." *Id.* (citing Ex. 2001 ¶¶ 123-128, 178-180; Ex. 1004, 1:39-43; Ex. 1008, Introduction).

We disagree with Patent Owner's argument that the skilled artisan would not have had reason to modify Andersson and Urmson to include the ASICs or FPGAs of Augenbraun. As Dr. Reinholtz testifies, ASICs or FPGAs have certain advantages, i.e., low cost and low power consumption that must

be weighed against disadvantages including difficulty in programming time and design. Ex. 2001 ¶¶ 125-126. As our reviewing court has recognized, "[a] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine." *See, e.g.*, *Medichem, S.A. v. Rolabo, S.L.*, **437 F.3d 1157, 1165** (Fed. Cir. 2006); *Winner Int'l Royalty*, **202 F.3d at 1349** n.8.

Patent Owner also argues that a person skilled in the art would not have had reason to combine Augenbraun with Andersson because "Augenbraun is directed to an entirely different technological area in that it involves small, differentially steered floor cleaning robots" where "Andersson and Urmson, by contrast, involve full-size front-wheel-steered automobiles." PO Resp. 34 (citing Ex. 2001 ¶¶ 127-128). We disagree. Augenbraun embraces certain similarities that are relevant to the combination with Andersson. Specifically, Augenbraun describes an electronics module, similar to Andersson's speed planner, which provides instructions to the drive mechanism to affect vehicle movement. *See* Ex. 1005 ¶¶ 10, 13; Ex. 1004, 3:58-4:2. Furthermore, like Andersson, Augenbraun includes sensors to sense aspects of the operating environment, including obstacles in the vehicle path, which communicate with the drive mechanism to adjust progress of the vehicle. Ex. 1005 ¶¶ 60, 66-67, 76 ("[E]lectronics module 220 may provide appropriate signals to drive mechanism 240, slowing or speeding one or both motors . . . as necessary or desired for obstacle avoidance . . . ."); Ex. 1004, 2:40-47. Given these apparent similarities between Andersson and Augenbraun, a person of ordinary skill in the art would have had reason to look to references describing hardware and software for autonomous vehicle control systems to implement a speed planner to provide instructions the drive mechanism. "[I]f a technique has been used to improve one device, and a person of ordinary **[*19]** skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *KSR*, **550 U.S. at 417** .

Accordingly, we determine that Petitioner has demonstrated by a preponderance of the evidence that the additional limitation of claim 3 would have been suggested by the disclosures of Andersson, Urmson, and Augenbraun, and that a person of ordinary skill in the art would have had reason to make the proposed combination with a reasonable expectation of success.

F. Obviousness of Claim 6 in view of Andersson and Urmson, alone or in combination with Ahmed-Zaid, and with Mandow

Petitioner contends the subject matter of claim 6 would have been obvious over the combined disclosures of Andersson, Urmson, and Mandow, alone or in combination with Ahmed-Zaid. Pet. 55, 72. As discussed above, we do not address the parties' contentions regarding Petitioner's alternative position based additionally on Ahmed-Zaid.

1. Mandow

Mandow describes a speed control system for "autonomous mobile robots," i.e., vehicles. Ex. 1009, 231 ("The paper addresses the control of the vehicle's speed while executing a planned trajectory."). The disclosed speed plan includes "speed commands . . ., which have been computed by considering a number of operational and vehicle speed restrictions." *Id.* These speed restrictions, i.e., speed constraints, impose speed limitations on the vehicle. *Id.* Constraints may set a speed based on vehicle operational parameters, the particular task performed, or dynamic limitations, such as the presence of unexpected obstacles. *Id.* In the event of unexpected obstacles, onboard sensors provide real-time information to "define these dynamic speed limitations, which are needed in order to stop the vehicle smoothly or change its planned speed." *Id.*

2. Analysis of Claim 6

Claim 6 depends from claim 1 and additionally requires that "[1] the one or more sensors are configured to detect obstacles; [2] wherein the speed planner is configured to calculate the desired speed such that the desired speed is the maximum safe speed when no obstacles are detected and the minimum safe speed when obstacles are detected." Ex. 1001, 10:1-6. Petitioner argues that Mandow describes or suggests the additional requirements of claim 6. Pet. 55. In particular, Petitioner argues that Mandow describes an autonomous vehicle that controls vehicle speed and includes ultrasonic sensors or radial laser scanners to sense the robot environment for obstacles and "prevent[] collision with any obstacle which is actually in the robot's path." *Id.* at 55-56 (citing Ex. 1009, 231, 233, 234, 237, Fig 3). In addition, Petitioner asserts that Mandow discloses a maximum safe speed where it describes operation "when obstacles have not yet been detected . . . [and] 'append[s] a **speed component** to each **posture** of the path' during the global speed planning process, and more specifically, assigns a '**top speed v_i**' to each posture of the path based on speed limitations introduced by vehicle features and operational speed constraints." **[*20]** *See* Pet. 57 (citing Ex. 1009, 232-233, 237; Ex. 1003 ¶ 188). According to Petitioner, Mandow similarly describes

"minimum safe speeds," as it explains that the top speed is subject to change when "further speed constraints are detected through the sensor system." *Id.* (quoting Ex. 1009, 233). Petitioner explains that "[w]hen an obstacle is detected, Mandow uses an 'unexpected obstacle controller,' which is part of Mandow's dynamic planner, to slow down the vehicle, and in some instances, stop the vehicle." *Id.* at 57-58 (citing Ex. 1009, 233). Therefore, Petitioner resolves that Mandow—in slowing or stopping a vehicle when an obstacle is detected—describes a "minimum safe speed." *Id.* at 58 (citing Ex. 1009, 233-234, Fig. 5; Ex. 1003 ¶ 190). Petitioner argues that a person of ordinary skill in the art would have had reason to combine Mandow's obstacle sensor and speed control parameters with the proposed Andersson-Urmson system because each of Andersson and Urmson describe a speed planner that slows the vehicle when necessary and the skilled artisan would have looked to another reference "such as Mandow, that discloses ways to calculate a slowest possible safe speed (e.g., stopping the vehicle) depending on the presence of obstacles." *Id.* at 59-60 (citing Ex. 1009, 233-234; Ex. 1003 ¶¶ 191-193; Ex. 1004, 2:40-47; 3:3-4, 3:43-45; Ex. 1008, 490-491).

Patent Owner does not dispute Petitioner's additional allegations that Mandow teaches or suggests "one or more sensors are configured to detect obstacles" or a "speed planner is configured to calculate the desired speed such that the desired speed is the maximum safe speed when no obstacles are detected," as recited in claim 6. Rather, Patent Owner argues only that Mandow fails to disclose a "speed planner is configured to calculate the desired speed such that the desired speed is . . . the *minimum safe speed* when obstacles are detected" and a lack of a motivation to combine the references. *See* PO Resp. 34-35 (emphasis added). Upon review of the arguments and evidence of record, we are persuaded by Petitioner's arguments and supporting evidence for the undisputed aspects of the additional limitation of claim 6, as summarized above. Accordingly, we determine that Petitioner has established by a preponderance of the evidence that each of the limitation of claim 6 *not* challenged by Patent Owner are present in or suggested by the combination of Andersson, Urmson, and Mandow. *See NuVasive*, **841 F.3d at 974** . We address Patent Owner's specific arguments below.

Patent Owner argues[18] that Mandow does not suggest a "minimum safe speed." PO Resp. 35. Patent Owner further contends that "Petitioner's reliance on Mandow's 'zero or close to zero' speed when obstacles are present is not the 'minimum safe speed' as that term would be understood to a POSA in view of the **'174** patent." *Id.* (citing Ex. 2001 ¶¶ 129-135, 181-185).

With respect to the "minimum safe speed" recited in claim 6, we are persuaded by Petitioner's argument and evidence. The term "minimum safe speed," according to the claim, is the desired speed when obstacles are present. Ex. 1001, 10:1-6; PO Resp. 12-13, 34. Mandow relates to a speed control system for autonomous vehicles **[*21]** that include on-board sensors to detect the presence of unexpected obstacles. Ex. 1009, 231-232. Mandow describes dynamic speed planning where "a basic controller is introduced that sets a speed command to slow down the vehicle in the presence of obstacles on the way." *Id.* at 233. In addition, Mandow implements safety rules that allow the robot vehicle to "adapt the speed of the robot to the distance of a moving object driving ahead in the same direction, or to slow down and stop if a mobile obstacle crosses the robot path." *Id.* at 234. According to Mandow, "[o]ne simple way of coping with obstacles found unexpectedly on the robot's way is to adapt its speed according to their measured distance"—if the obstacle is not removed before it is reached, the vehicle stops, but if the obstacle is removed, the robot resumes its operating speed. *Id.* at 233. Mandow's rule set is adaptive such that "objects that will cross a close point in the trajectory after a longer period of time, produce very slow commands [and] [w]hen more than one obstacle is processed, the lowest speed reference is considered. *Id.* at 236. Patent Owner's position that "Mandow's 'zero or close to zero' speed when obstacles are present is not the 'minimum safe speed'" offers little in the way of explanation. PO Resp. 35 (citing Ex. 2001 ¶¶ 131-132). Patent Owner cites to the Declaration of Dr. Reinholtz, however, his testimony is similarly lacking explanation and is conclusory. Ex. 2001 ¶ 131. Mandow's disclosure is not limited to a speed of zero or close to zero but rather embraces the desired minimum speed when obstacles are present.

Turning to the reason to combine, Patent Owner asserts that "[a] POSA would further not be motivated to combine Andersson and Urmson with Mandow . . . because Mandow adds nothing new to Andersson and Urmson, which both teach the need to reduce speed in certain vehicle situations" and because "Mandow is directed to autonomous vehicles, a different technology from Andersson's cruise control technology." PO Resp. 35 (citing Ex. 2001 ¶¶ 133-135, 183).

For the reasons discussed above in Section II.D.4.d., we disagree with Patent Owner's arguments relating to the differences between the technologies described in Andersson, Urmson, and Mandow. Andersson's methods and systems, at a minimum, control vehicle speed. Ex. 1004, 1:57-59 ("By such a method, it is possible to generate a speed plan, which may be used to adapt the speed of the vehicle to the chosen road section in a suitable manner."), 2:25-32 ("[T]he method comprises the step of feeding the outputted speed plan to a throttle control device for controlling the throttle of a vehicle . . . ."), 3:58-4:1 (explaining that the system control device is "connected with a brake control unit 9 and/or engine control unit such as a throttle control unit

10, for autonomous vehicle speed control."). And, like Urmson, Mandow describes an autonomous vehicle, and in particular, relates to speed control of that vehicle. Ex. 1009, 231. In particular, Mandow explains that

> [t]he paper addresses the control of the vehicle's speed while executing a planned trajectory. The plan incorporates speed commands **[*22]** for each point dong the path, which have been computed by considering a number of operational and vehicle speed restrictions. When the robot is actually performing the task, these planned speed commands may have to be dynamically replanned according to run-time restrictions, mainly concerned with safety, detected through the sensor system.

Id. Petitioner relies on Mandow to describe a speed planner that "calculates the maximum safe speed when no obstacles are detected" and a "minimum safe speed (*e.g.*, a ***slowest*** possible speed that is safe: zero or close to zero) when obstacles are detected." Pet. 57-58. Therefore, overlap exists in the teachings of Andersson and Mandow in the aspect of speed control—the very aspect that is improved by modifying the Andersson-Urmson combination to include dynamic planning system in the combination advanced by Petitioner. "[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *See KSR*, **550 U.S. at 417** .

Therefore, we determine Petitioner has established by a preponderance of the evidence that the additional limitation of claim 6 is present in or suggested by the combination of Andersson, Urmson, and Mandow. In addition, we determine that Petitioner has shown by a preponderance of the evidence that the skilled artisan would have had reason to make the suggested combination with a reasonable expectation of success.

G. Obviousness of Claim 8 in view of Andersson and Urmson, alone or in combination with Ahmed-Zaid, and with Fregene

Petitioner contends the subject matter of claim 8 would have been obvious over the combined disclosures of Andersson, Urmson, and Fregene, alone or in combination with Ahmed-Zaid. Pet. 61, 73. As discussed above, we do not address the parties' contentions regarding Petitioner's alternative position based additionally on Ahmed-Zaid.

1. Fregene

Fregene describes methods and systems for collision avoidance for autonomous vehicles. Ex. 1006 ¶¶ 7-10, 22. The disclosed collision avoidance system utilizes two types of constraints. *Id.* ¶ 38. "The first constraint type includes the constraints under normal operation of the vehicle, . . . called the nominal constraints. The second constraint type includes the constraints under an emergency operation of the vehicle, . . . called the emergency constraints." *Id.* "The nominal constraints are more restrictive than the actual operating limits of the vehicle, since maximum performance is used for a vehicle only in emergency situations." *Id.* Emergency constraints "include maximum vehicle acceleration, minimum vehicle acceleration, maximum vehicle speed and minimum vehicle speed." *Id.* ¶ 25. When normal collision avoidance schemes fail, vehicles apply emergency maneuver procedures. *Id.* ¶¶ 53-57. When the emergency has passed, "[t]he onboard processor determines what instruction the vehicle requires to switch out of emergency maneuver mode and back to normal operation **[*23]** mode." *Id.* ¶ 64.

2. Analysis of Claim 8

Claim 8 depends from claim 1 and additionally requires that "each of the one or more constraints is assigned a priority, wherein the speed planner is configured to allow violation of a lower priority constraint in order to avoid violation of a higher priority constraint." Ex. 1001, 10:11-15. Petitioner argues that Fregene describes or suggests the additional requirements of claim 8. Pet. 61-63. Petitioner explains that Fregene assigns priorities to its constraints and that collision avoidance is a high priority constraint. *Id.* (citing Ex. 1006 ¶¶ 7, 9). For example, "Fregene's autonomous vehicle has a 'collision avoidance system' that will 'switch [the] vehicle into an emergency maneuver mode in the event that an object enters the buffer zone and stays there for more than a preset threshold time.'" *Id.* (quoting Ex. 1006 ¶¶ 7, 9). According to Petitioner, "in Fregene's system, avoidance of an obstacle takes higher priority over normal operation of the vehicle," thereby meeting the requirement of assigning priorities to one or more constraints. *Id.* at 61-62 (citing Ex. 1006 ¶¶ 7, 9, 38; Ex. 1003 ¶¶ 198-199). Petitioner further explains that Fregene allows violation of lower priority constraints, such as speed,

acceleration, and deceleration in favor of collision avoidance, a higher priority constraint, during emergency operation. *Id.* at 62-63 (citing Ex. 1006, 25, 47). Petitioner asserts that one skilled in the art would have had reason to include Fregene's functionality in the proposed combination of Andersson and Urmson in order "to improve its autonomous vehicle's ability to avoid collisions" which, in turn, "improv[es] passenger/driver comfort." *Id.* at 64 (citing Ex. 1003 ¶¶ 201-203).

Patent Owner disputes Petitioner's showing for claim 8. In addition to the reasons advanced for claim 1, Patent Owner argues that "none of Andersson, Urmson or Fregene disclose assigning priorities to constraints and violating a lower priority constraint in order to avoid violating a higher priority constraint as recited in claim 8." PO Resp. 35-36. Patent Owner alleges that "Fregene explicitly does not violate constraints at all: this set associated with the emergency constraints of the vehicle is **positively invariant**," which "is entirely different from the concept embodied in the **'174** patent and claim 8—the concept that some constraints are better to violate than others." *Id.* (citing Ex. 1006 ¶ 25; Ex. 2001 ¶¶ 61, 140-141). Patent Owner explains that the nominal and emergency constraints taught by Fregene are two sets of operations that are alternatives to one another and "[w]ithin the set of constraints applied, Fregene makes clear that the constraints are not violated and does not disclose or contemplate a situation where its system confronts two constraints at the same time." Sur-reply 18. Further, Patent Owner alleges that Fregene does not prioritize constraints for speed calculation. *Id.* at 19.

We find persuasive Petitioner's evidence and argument that Fregene suggests assigning priorities to different constraints and that lower priority constraints may **[*24]** be violated in favor of higher priority constraints. *See* Ex. 1006 ¶¶ 7, 9, 25, 38, 47, 67, 72; Ex. 1003 ¶¶ 198-205, 255; Ex. 1025, 418:19-419:9, 420:10-13, 421:1-5; Pet. 61-65, 73; Pet. Reply 21-24. Fregene explains that two types of constraints are employed:

> The first constraint type includes the constraints under normal operation of the vehicle, herein called the nominal constraints. The second constraint type includes the constraints under an emergency operation of the vehicle, herein called the emergency constraints. The nominal constraints are more restrictive than the actual operating limits of the vehicle, since maximum performance is used for a vehicle only in emergency situations.

Ex. 1006 ¶ 38. And Fregene explains that while the set associated with either of the normal constraints and the emergency constraints are positively invariant, "the intersection of two positively invariant sets is not positively invariant." *Id.* ¶ 37. When the collision avoidance system of the normal mode fails, "[t]he vehicles are then operable to switch to an emergency mode and implement an emergency maneuver procedure." *Id.* ¶ 53. Then when the emergency has passed, "[t]he onboard processor determines what instruction the vehicle requires to switch out of the emergency maneuver mode and back to normal operation mode." *Id.* ¶ 64. Fregene adjusts vehicle speed depending on which constraints are applied. *Id.* ¶¶ 25, 38, 43, 52, 58, 71-74. Whether viewed as a set of constraints for different operational modes or as single set of constraints, the nominal constraints yield to emergency constraints when the vehicle transitions between normal and emergency mode. Therefore, we determine Petitioner has demonstrated by a preponderance of the evidence that Fregene suggests "each of the one or more constraints is assigned a priority, wherein the speed planner is configured to allow violation of a lower priority constraint in order to avoid violation of a higher priority constraint," as required by claim 8.

Patent Owner further argues that "[a] POSA would also not be motivated to combine Fregene with Andersson and Urmson." PO Resp. 36 (citing Ex. 2001 ¶¶ 146-152, 189). First, Patent Owner asserts that Andersson teaches away from a prioritized constraint system because it does not contemplate obstacle avoidance or discuss constraint priorities. *Id.*

We disagree with Patent Owner's argument that Andersson teaches away from a prioritized constraint system. As we explained above, Section II.D.4.d., silence does not imply teaching away. Allergan, 754 F.3d at 964. That Andersson is purported to be silent regarding prioritized constraint systems or obstacle avoidance does not constitute a teaching away because such disclosure, or lack thereof, does not criticize, discredit, or otherwise discourage the solution claimed in the **'174** patent.

Second, Patent Owner argues that because of the difficulties associated with the complexity of autonomous vehicle systems and Urmson's teaching away from added complexities, a person of skill in the art would not have had reason to modify the combination of Andersson and Urmson to **[*25]** include the priority constraint system of Fregene. PO Resp. 36-37 (citing Ex. 2001 ¶¶ 146-152, 189). For the reasons discussed above in Section II.D.4.d., we do not agree with Patent Owner's arguments.

And third, Patent Owner contends that "Fregene is directed to obstacle avoidance systems for vehicles which is not in the same technological field as Andersson's cruise control technology or Urmson's autonomous vehicle technology." *Id.* at 37 (citing Ex. 2001 ¶¶ 146-152, 189). Patent Owner also argues that "Fregene's system is based in a controller **external** to the vehicle and a POSA would simply not combine such an external controller with the on-board vehicle systems of Andersson and Urmson." *Id.* (citing Ex. 2001 ¶¶ 146-152, 189).

For the reasons discussed above in Section II.D.4.d., we disagree with Patent Owner's arguments relating to the differences between the technologies described in Andersson, Urmson, and Fregene. Further, we also disagree with Patent Owner's position that Fregene utilizes an external processor for certain tasks such that a person skilled in the art would not seek out the teachings of Fregene. We note that Fregene uses a combination of an external processor, an onboard processor, and vehicle controllers for implementing its collision avoidance system. Ex. 1006 ¶ 8. Furthermore, Petitioner does not propose to substitute Fregene's external processor into the combination of Andersson and Urmson; rather, Petitioner relies on Fregene to suggest a system where "one or more constraints is assigned a priority, wherein the speed planner is configured to allow violation of a lower priority constraint in order to avoid violation of a higher priority constraint." Pet. 61. It is well established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements. *In re Mouttet*, **686 F.3d 1322, 1332** (Fed. Cir. 2012).

Accordingly, Petitioner has shown that the additional limitation of claim 8—"each of the one or more constraints is assigned a priority, wherein the speed planner is configured to allow violation of a lower priority constraint in order to avoid violation of a higher priority constraint" (Ex. 1001, 10:11-15)—is taught or suggested by Fregene. Therefore, Petitioner has established by a preponderance of the evidence that claim 8 is taught or suggested by the combination of Andersson, Urmson, and Fregene, and further that the skilled artisan would have had reason to make the suggested combination with a reasonable expectation of success.

III. CONCLUSION[19]

We conclude that Petitioner has satisfied its burden of demonstrating, by a preponderance of the evidence, that the subject matter of claims 1-8 of the **'174** patent is unpatentable.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2, 4-7	**103(a)**	Andersson, Urmson	1, 2, 4-7	
3	**103(a)**	Andersson, Urmson, Augenbraun	3	
6	**103(a)**	Andersson, Urmson, Mandow	6	
8	**103(a)**	Andersson, Urmson, Fregene	8	

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2, 4-7	**103(a)**	Andersson, Urmson, Ahmed-Zaid[20]		
3	**103(a)**	Andersson, Urmson, Ahmed-Zaid, Augenbraun		
6	**103(a)**	Andersson, Urmson, Ahmed-Zaid, Mandow		
8	**103(a)**	Andersson, Urmson, Ahmed-Zaid, Fregene **[*26]**		
Overall Outcome			1-8	

IV. ORDER

Accordingly, it is:

ORDERED that Petitioner has established, by a preponderance of the evidence, that claims 1-8 of the **'174** patent are unpatentable; and

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

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fn 1 The Leahy-Smith America Invents Act ("AIA"), **Pub. L. No. 112-29** , 125 Stat. 284, 287-88 (2011), revised **35 U.S.C. § 103** , effective March 16, 2013. Because the application from which the **'174** patent issued was filed before this date, the pre-AIA version of **§ 103** applies.

fn 2 Andersson et al., US **6,836,719** B2, issued December 28, 2004 ("Andersson") (Ex. 1004).

fn 3 Urmson et al., *A Robust Approach to High-Speed Navigation for Unrehearsed Desert Terrain*, 23(8) J. Field Robotics 467 (2006) ("Urmson") (Ex. 1008).

fn 4 Augenbraun et al., US **2007/0061040** A1, published March 15, 2007 ("Augenbraun") (Ex. 1005).

fn 5 Mandow et al., *Dynamic Speed Planning for Safe Navigation*, 1 Proceedings of the 1997 IEEE/RSJ Int'l Conf. on Intelligent Robot and Sys. Innovative Robotics for Real-World Applications IROS 97, 231 (Sept. 1997) ("Mandow") (Ex. 1009).

fn 6 Fregene et al., US **2007/0078600** A1, published April 5, 2007 ("Fregene") (Ex. 1006).

fn 7 Ahmed-Zaid et al., US **6,968,266** B2, issued November 22, 2005 ("Ahmed-Zaid") (Ex. 1007).

fn 8 A recent amendment to this rule does not apply here, because the Petition was filed before November 13, 2018. *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** (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)). At the time of the filing of the Petition in this proceeding, the applicable claim construction standard was set forth in **37 C.F.R. § 42.100(b)** (2018).

fn 9 The parties disagree as to what is required for the prior art to teach an "autonomous vehicle," but notably, neither party requested construction of that term in their respective briefs. *See generally* Pet.; PO Resp. We address the interpretation of the term "autonomous vehicle" below to the extent necessary to resolve the dispute raised by the parties' substantive arguments.

fn 10 The term "autonomous vehicle" appears both in the preamble and the body of claim 1. *See* Ex. 1001, 9:38-54. We need not decide for purposes of this Final Written Decision whether the preamble is limiting, because we determine that Petitioner has shown that the recitation of "an autonomous vehicle" is satisfied by the prior art.

fn 11 Petitioner also alleges that Urmson discloses "an autonomous vehicle" as claimed. Pet. 21 n.7.

fn 12 Petitioner further contends Urmson discloses sensors, i.e., LIDAR and RADAR, used to detect obstacles. Pet. 23 n.8.

fn 13 As we observed in our Decision on Institution (Dec. 12 n.4), Petitioner argues that Urmson, in addition to Andersson, describes an "autonomous vehicle." Pet. 21 n.7 (citing Ex. 1008, 468-469); Ex. 1003 ¶ 78 n.4 (same). Patent Owner does not address Petitioner's assertion. *See generally* PO Resp. Rather, Patent Owner, as well as Dr. Reinholtz, describe Urmson as an autonomous vehicle. PO Resp. 18; Ex. 2001 ¶¶ 65-68.

fn 14 Dr. Reinholtz testifies that "Andersson at most discloses the use of sensor data to select a user defined speed," and therefore does not use sensor data to calculate the desired speed. Ex. 2001 ¶ 84 (citing Ex. 1004, 5:44-55). Dr. Reinholtz's testimony is in relation to use of sensor data relevant to "factors not directly related to the upcoming road section, but rather to a driver-vehicle environmental combination" (Ex. 1004, 5:44-48), and does not account for the use of sensor data to account for temporary circumstances or unexpected objects in the vehicle path (*Id.* at 2:41-49).

fn 15 There is evidence of record to suggest that a neural network may involve calculations, in particular by applying "the weighted sum of inputs." Ex. 2005; Ex. 1027, 45:21-46:5.

fn 16 As an initial matter, Patent Owner's "teaching away" argument simply repeats the arguments presented (and rejected) above in Sections II.D.2.b. and c., i.e., Patent Owner's position that the prior art does not teach a "speed planner" or a "speed command category," as claimed.

fn 17 Patent Owner's argument based on its assertion that Andersson does not describe an autonomous vehicle was rejected above in Section II.D.4.a.

fn 18 Patent Owner additionally asserts that "[b]ecause Andersson and Urmson each do not teach speed calculation based on sensor input, they do not teach calculation of a minimum safe speed," as claimed. PO Resp. 34 (citing Ex. 2001 ¶¶ 102-103). We do not address this argument because Petitioner does not rely on either of Andersson or Urmson to teach or suggest calculation of a "minimum safe speed." *See* Pet. 55-58 (arguing only that Andersson and Urmson disclose one or more sensors configured to detect obstacles), 72-73.

fn 19 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)** .

fn 20 As explained above, we do not reach Petitioner's alternative grounds including Ahmed-Zaid, because they are premised on a claim construction position not advanced by either party.