Trials@uspto.gov
571-272-7822

Paper 53
Entered: January 30, 2026

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ALLSTATE INSURANCE COMPANY,
Petitioner,

v.

ATOS, LLC,
Patent Owner.

IPR2021-01449
Patent 9,846,174 B2

Before KRISTINA M. KALAN, JON M. JURGOVAN, and RYAN H. FLAX, *Administrative Patent Judges*.

Opinion concurring filed by *Administrative Patent Judge* FLAX.

JURGOVAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision on Remand
Determining Challenged Claims 1 and 2 Not Unpatentable
Determining Challenged Claims 3–5 Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Allstate Insurance Company ("Petitioner") filed a Petition for *inter partes* review of claims 1–5 of U.S. Patent No. 9,846,174 B2 (Ex. 1001, "the '174 patent"). Paper 1 ("Petition" or "Pet."). ATOS, LLC (d/b/a "RideMetric") ("Patent Owner") filed a Preliminary Response. Paper 5 ("Prelim. Resp."). Trial was instituted as to all challenged claims. Paper 8 ("Dec. on Inst.").

Patent Owner filed a Patent Owner Response (Paper 13, "PO Resp."); Petitioner filed a Reply to the Patent Owner Response (Paper 16, "Pet. Reply"); and Patent Owner filed a Sur-reply (Paper 20, "PO Sur-reply").

Petitioner filed the Declaration of William R. Michalson, Ph.D. (Ex. 1003) in support of the Petition. Patent Owner filed the Declaration of Ioannis Kanellakopoulos, Ph.D. (Ex. 2001) with its Response. Petitioner and Patent Owner ("the parties") also filed transcripts of the depositions of Dr. Michalson (Ex. 2019) and Dr. Kanellakopoulos (Ex. 1020).

An oral hearing was held on December 8, 2022, and a transcript of the hearing is included in the record. Paper 29 ("Tr.").

The Board entered a Final Written Decision determining that claims 1–4 had not been proven by a preponderance of the evidence to be unpatentable, and that claim 5 had been proven to be unpatentable. Paper 31, "Final Written Decision" or "Dec." Patent Owner appealed (Paper 32) to the Court of Appeals for the Federal Circuit ("Federal Circuit"). This Final Written Decision was appealed to the U.S. Court of Appeals for the Federal Circuit ("Federal Circuit"), which affirmed the Board's conclusions as to claims 1, 2, and 5, but determined that the Board's construction of the language "movement vector" recited in claims 3 and 4 of the '174 patent

was incorrect, vacated the Final Written Decision as to claims 3 and 4, and remanded the case to the Board to determine the ordinary and customary meaning of "movement vector" and decide the outcome for claims 3 and 4 in accordance with that meaning. *Atos, LLC v. Allstate Insurance Company*, 2025 WL 1482404, at *5 (Fed. Cir. May 23, 2025); Paper 35 ("Federal Circuit Remand," "Remand," or "Fed. Cir. Remand").

Pursuant to the Federal Circuit's instructions, the Board authorized the parties to submit remand briefing. Paper 42. Petitioner and Patent Owner submitted opening remand briefs setting out their respective views on the ordinary and customary meaning of "movement vector." Paper 43 ("PO Remand Br."); Paper 46 ("Pet. Remand Br."). The parties also submitted responses to each other's opening remand briefs. Paper 49 ("Pet. Resp. Br."); Paper 50 ("PO Resp. Br.").

In addition, Patent Owner submitted a motion for authorization to submit a supplemental expert declaration on this meaning (Paper 44), which Petitioner opposed (Paper 48). We granted Patent Owner's motion and the supplemental expert declaration is entered in the record as Exhibit 2021. *See* Paper 52.

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision on Remand under 35 U.S.C. § 318(a) as to the patentability of claims 3 and 4 of the '174 patent following our determination of the ordinary and customary meaning of "movement vector." For the reasons discussed below, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 3 and 4 are unpatentable. As noted above, the Federal Circuit affirmed the original Final Written Decision as to claims 1, 2, and 5, so our determinations that claims 1 and 2 were not

proven unpatentable and that claim 5 was unpatentable have not changed in this Final Written Decision on Remand. *See* Fed. Cir. Remand 12.

A. Real Parties-in-Interest

Petitioner identifies Allstate Insurance Company, Esurance Insurance Services, Inc., and Arity, LLC as the real parties-in-interest. Pet. 3. Patent Owner identifies itself (ATOS, LLC) as the real party-in-interest. Paper 4. Neither party contests or objects to these identifications.

B. Related Proceedings

The parties identify the following litigation involving the '174 patent as a related matter: *ATOS, LLC v. Allstate Insurance Company*, No. 1:20-cv-06224 (N.D. Ill.). Pet. 3; Paper 4 § II. Patent Owner identifies two additional patents involved in this litigation: U.S. Patent Nos. 8,527,140 ("the '140 patent") and 9,152,609 ("the '609 patent"). Paper 4 § II. The '174 patent incorporates by reference the disclosure of the '140 patent. Ex. 1001, 1:18–28.

Patent Owner also identifies the following IPR Petitions as pertaining to related matters: IPR2021-01118 challenging the '140 patent; and IPR2021-01209 challenging the '609 patent. Paper 4 § II.

C. The '174 Patent

The '174 patent, titled "Computer-Implemented Methods and Computer Systems/Machines for Identifying Dependent and Vehicle Independent States," describes detecting and analyzing "states" relating to the environment outside a portable device, such as a smartphone or tablet. Ex. 1001, code (54), 1:8–12. The patent describes using sensors on the portable devices to detect motion and determine if the motion is "vehicle dependent movement (acceleration, deceleration, accidents and cornering

operational states, etc) . . . [or] vehicle independent movement of the phone (movement caused by the user handling the phone, phone falling to the ground, etc)." *Id.* at 1:14–18. According to the patent, the methods of the invention can be used for a driver evaluation service, such as to score "driving riskiness, or fuel efficiency" and for detection "that a vehicle has started and stopped driving, automatically and transparently to the user." *Id.* at 4:20–43.

The '174 patent incorporates by reference the '140 patent's disclosures about vehicle dependent and independent states. *Id.* at 1:20–28. Figure 1 of the '140 patent is reproduced below.

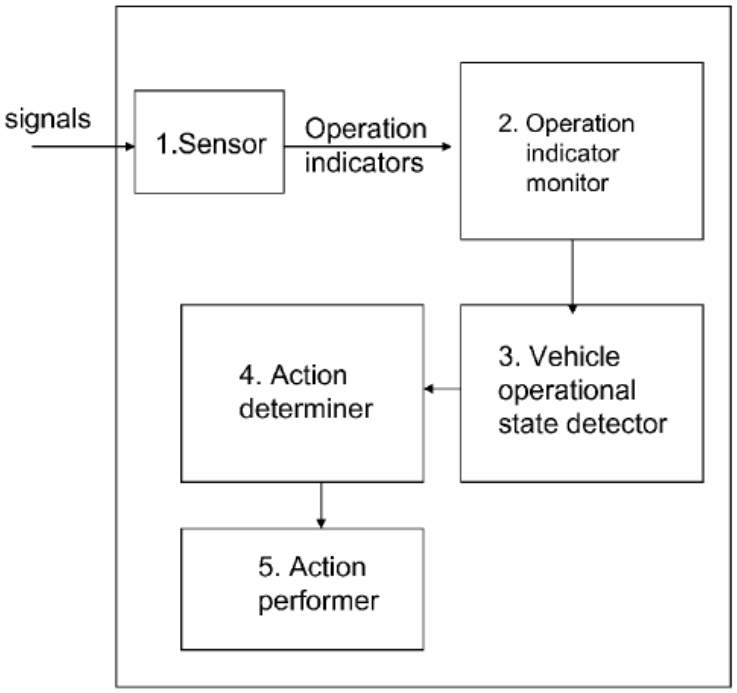


Figure 1 above generally illustrates (as connected boxes) components included in a portable device for taking action based on the state of the associated vehicle and, generally, their sequence of activity. Ex. 1014, 3:17–18. The top left corner of Figure 1 depicts a sensor receiving "signals" as an input and generating "[o]peration indicators" as an output. *Id.* at

Fig. 1. The '140 patent describes basing a decision to perform an action on "determining the operational state of a vehicle surrounding the portable device," which in turn involves monitoring "an onboard sensor on the device." *Id.* at 3:49–51. According to the '140 patent, the sensor receives signals from the environment and converts them to "operation indicators." *Id.* at 3:50–52. The operation indicators from the sensor "are forwarded to the operation indicator monitor unit (unit 2) which continuously monitors and collects the operation indicators over time." *Id.* at 4:4–8. The monitor unit then forwards the operation indicators to an "operational state detector unit" that "uses pre-determined criteria which are a set of rules to help determine the operational state of the vehicle." *Id.* at 4:8–12.

Returning to the explicit disclosure of the '174 patent, it describes that it has "identified a unique condition that is associated with turning in a vehicle . . . that at the time of the turn, the vector of rotation will be roughly parallel to the vector of gravity." Ex. 1001, 1:52–56. The patent describes using this condition to identify the probability of turning, but also to determine that, "[i]f the vectors of rotation and gravity are not roughly parallel, this is an indicator that the phone has been picked up, or fallen." *Id.* at 1:63–65.

Figure 1 of the '174 patent is reproduced below:

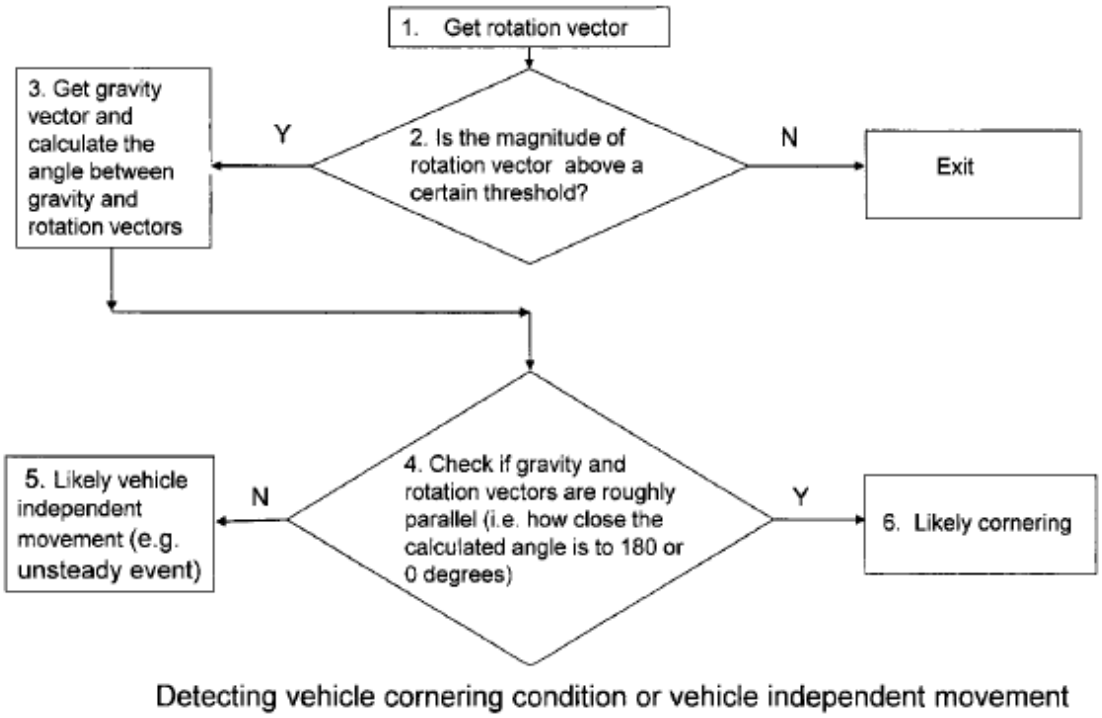


Figure 1 illustrates detection of vehicle cornering or independent movement. *Id.* at 1:66–67.

The '174 patent also describes detecting speed changes, and specifically "detecting whether a speed change vector is associated with acceleration or deceleration." *Id.* at 2:14–19.

Figure 2 of the '174 patent is reproduced below:

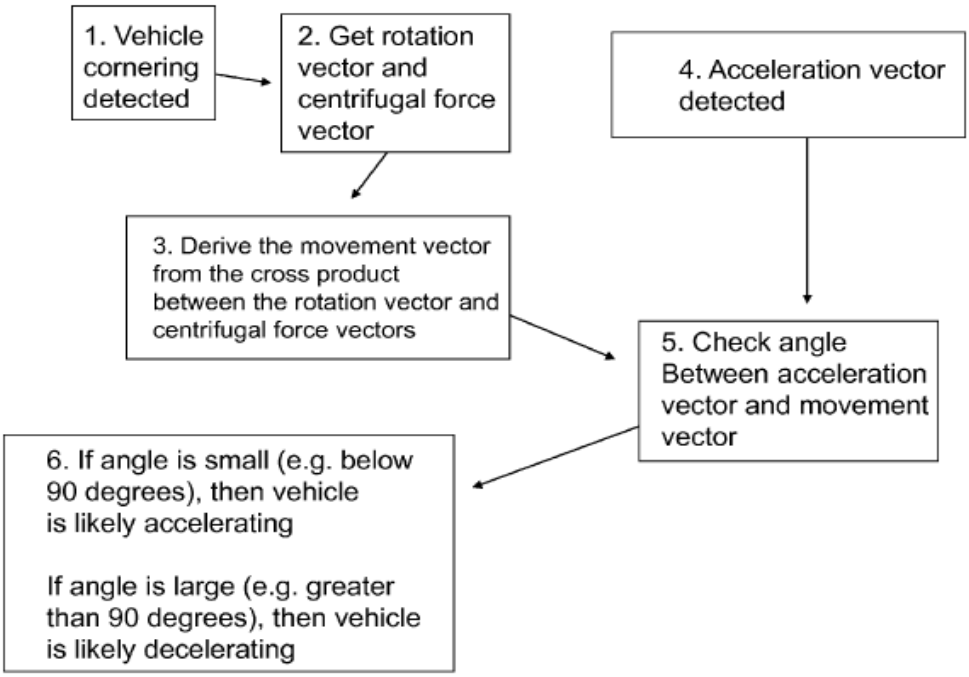


Figure 2: Detecting direction (accelerating or braking) of acceleration vector

Figure 2 illustrates detecting acceleration or braking of the acceleration vector. *Id.* at 4:1–2. In the initial steps of Figure 2, the rotation vector and centrifugal force vector of a turning vehicle are used to derive the movement vector, which is the cross product of those two vectors. *Id.* at 2:37–38. In step 5, the angle between the movement vector and acceleration vector is checked, and the result (step 6) determines if the vehicle is likely accelerating or decelerating. *Id*. at Fig. 2.

D. The Challenged Claims

Petitioner challenges claims 1–5 of the '174 patent. Pet. 1. Claim 2 depends from claim 1, and claim 4 depends from claim 3. Independent

claims 1 –5, reproduced below, set forth the subject matter of the challenged claims:

> 1. The method of detecting the condition of a vehicle turning, comprising estimating an angle of how closely a rotation vector is aligned with a gravity vector.
>
> 2. The method of claim 1 further comprises estimating the probability of the vehicle turning as a function of the angle between the rotation vector and the gravity vector.
>
> 3. The method of detecting a direction of a speed change vector, comprising:
>
> a. detecting a condition of a vehicle turning;
>
> b. detecting a movement vector during the turn;
>
> c. estimating the angle between movement vector and speed change vector;
>
> d. determining that the speed change vector is acceleration vector if the estimated angle below certain threshold and determining that the speed change vector is deceleration vector if the estimated angle is above certain threshold.
>
> 4. The method of claim 3 further comprises estimating the probability of the speed change vector to be an acceleration or deceleration vector-as a function of the angle between the speed change vector and the movement vector.
>
> 5. The method of performing one or more actions on a portable device carried by an individual, comprising:
>
> a. monitoring at least one operation indicator transparently to the individual, wherein the at least one operation indicator is created by an on-board component of the device when the portable device is located inside a vehicle;
>
> b. detecting when the at least one operation indicator meets one or more predetermined criteria;
>
> c. determining entirely or in part the following states based on the one or more predetermined criteria:

i. one or more vehicle independent states;

ii. one or more vehicle dependent states.

Ex. 1001, 4:58–60; 4:64–5:7; 5:12–24. As noted above, only claims 3 and 4 remain at issue in this decision, per the Federal Circuit Remand.

E. Instituted Grounds of Unpatentability

We instituted *inter partes* review on the following grounds of unpatentability, which are all the grounds presented in the Petition:

Ground	Challenged Claim(s)	35 U.S.C.[1]	Reference(s)/Basis
1	1–4	§ 103	Kleppner[2]
2	1, 2	§ 103	Johnson,[3] Kleppner
3	3, 4	§ 103	Abramson,[4] Kleppner
4	5	§ 102	Schwartz 2010[5]
5	5	§ 102	Kim[6]

[1] The Leahy-Smith America Invents Act ("AIA") included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. Because the '174 patent issued from an application filed after March 16, 2013, we apply the AIA versions of the statutory bases for unpatentability. Our conclusions would not change regardless of the version of the statute applied.

[2] Daniel Kleppner, et al., AN INTRODUCTION TO MECHANICS, McGraw Hill Book Company, 1973 (Ex. 1007).

[3] Derick A. Johnson, et al., "Driving Style Recognition Using a Smartphone as a Sensor Platform," 2011 14th International IEEE Conference on Intelligent Transportation Systems Washington, DC, USA. October 5–7, 2011 (Ex. 1010).

[4] U.S. Patent No. 8,750,853 B2 to Abramson, et al., issued June 10, 2014 (Ex. 1009).

[5] U.S. Patent Pub. No. 2010/0204877 A1 by Schwartz, published Aug. 12, 2010 (Ex. 1008).

[6] Korean Registered Patent Number 10-0775006 to Kim, S., et. al., issued Nov. 8, 2007 (Ex. 1005).

Pet. 4.

II. ANALYSIS

A. Level of Ordinary Skill in the Art

Factors pertinent to a determination of the level of ordinary skill in the art include: "(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field." *Envtl. Designs, Ltd. v. Union Oil Co*., 713 F.2d 693, 696–697 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.,* 707 F.2d 1376, 1381–82 (Fed. Cir. 1983)). Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case. *Id.*

Petitioner argues a person of ordinary skill in the art (ordinarily skilled artisan, "Skilled Artisan," or "POSITA") at the time of the invention "would have been someone with a bachelor's or master's degree in the field of mechanical engineering, electrical engineering, or physics or with a bachelor's or master's degree in a related field and at least three years of experience in designing or developing portable device systems." Pet. 4 (citing Ex. 1003 ¶ 52). Petitioner further argues the "[s]killed [a]rtisan would have been aware of the types of portable devices discussed below and would have known how to utilize the portable devices and their accelerometers to detect motion while inside a vehicle," and "would have known how to model the forces on moving objects in line with Newtonian Mechanics." *Id.*

Patent Owner does not address Petitioner's proposed definition of the ordinarily skilled artisan, or offer a competing proposal. *See generally* PO Resp.

Having considered the parties' arguments and evidence, we adopt the definition of the person or ordinary skill in the art proposed by Petitioner because it is consistent with the disclosures of the '174 patent and the prior art of record. We note, however, that neither party contends that any issue in this case turns on the differences between the parties' definitions or understanding of one of ordinary skill in the art.

B. Claim Construction

As noted above, there is one claim construction issue to be addressed on remand, namely, the meaning of the claim term "movement vector," which appears in claims 3 and 4 We address this below and also include our prior discussion of other claim language from the original Final Written Decision.

We apply the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b). Under that standard, claim terms "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303 at 1312–13 (Fed. Cir. 2005) (en banc). "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

Petitioner argued constructions of the terms "operation indicator" and "on-board component" in the Petition. Pet. 11–15. In our Decision on Institution, we determined that we did not need to explicitly construe any claim term at that stage of the proceeding. Dec. on Inst. 9; *see Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("we need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))). During trial, the parties argued the construction of several claim terms, including "rotation vector," "movement vector," "vehicle independent state," "operation indicator," and "transparently." *See* PO Resp. 7–19; Pet. Reply 1–6.[7] Additionally, Patent Owner argued that the term "on-board component" does not need to be construed. PO Resp. 17. We agree with Patent Owner and determine that we need not construe "on-board component." In the tables below, we set forth Petitioner's and Patent Owner's positions as to the terms "rotation vector," "movement vector," "operation indicator," "transparently," and "vehicle independent state," and in the right-hand column, our construction after considering the entire record. Apart from the five claims terms discussed below, we determine that no other terms require express construction. *See Vivid Techs.*, 200 F.3d at 803.

[7] Throughout their papers, the parties have underlined reference names, italicized claim language, and bolded portions of text. *See, e.g.,* PO Resp. 2, 8; Pet. Reply 10. For consistency and readability, we remove all such emphasis in our quotation of the parties' papers.

1) "rotation vector"

Petitioner	Patent Owner	PTAB
a vector that describes the motion of a body that is rotating around a point (i.e. ordinary meaning)	a vector with magnitude proportional to the angle traversed by a rotating body around a center point and with direction orthogonal to the plane of rotation	a vector that describes the motion of a body that is rotating around a point

Claim 1 recites "estimating an angle of how closely a rotation vector is aligned with a gravity vector."

Patent Owner argues a rotation vector is a well-known concept used to represent the rotation of an object around an axis, and that we should construe "rotation vector" based on its technical definition. PO Resp. 8 (citing Ex. 2001 ¶¶ 46, 48). Dr. Kanellakopoulos testifies "rotation vector" would be understood by a person of ordinary skill in the art to describe the motion of a body that is rotating around a point, and having magnitude proportional to the angle traversed by a rotating body around a center point and direction orthogonal to the plane of rotation. Ex. 2001 ¶ 46. Dr. Kanellakopoulos explains that this definition is consistent with the prevailing definition in the literature. Ex. 2001 ¶ 48 (citing Exs. 2003, 2007–2009).

Patent Owner argues its construction of rotation vector is consistent with the use of the term in the '174 patent. PO Resp. 9 (citing Ex. 1001, 1:59–60; Ex. 2001 ¶¶ 47, 69–74). According to Patent Owner, the '174 patent specification explains a vehicle's rotation vector is derived

from gyroscope samples. *Id.* (citing Ex. 1001, 1:59–60). Patent Owner further argues a rotation vector is fundamentally different from an angular momentum vector, which is not inherent to an object and cannot be measured by gyroscope samples. *Id.* (citing Ex. 2001 ¶¶ 69, 70, 72). Patent Owner argues a person of ordinary skill in the art would know that a rotation vector can be used to detect whether a vehicle is turning because its magnitude and direction depend on whether a rotation is occurring, but an angular momentum vector exists even when a vehicle is travelling in a straight line, and cannot be used to detect if a vehicle is turning. *Id.* (citing Ex. 2001 ¶¶ 46, 69, 73).

Petitioner agrees with Dr. Kanellakopoulos that "rotation vector" would be understood by a person of ordinary skill in the art to describe the motion of a body that is rotating around a point. Pet. Reply 2 (citing Ex. 2001 ¶ 46). Petitioner argues, however, that Patent Owner's proposed construction of "rotation vector" "either incorporate[s] unrecited claim elements or confirm[s] that a plain and ordinary meaning is appropriate." *Id.* Petitioner further argues that Dr. Kanellakopoulos's opinion regarding the characteristics of a rotation vector includes attributes identical to an angular momentum vector, except for magnitude, which is irrelevant to the challenged claims. *Id.* at 2–3.

Having reviewed the parties' arguments and evidence, we determine that Petitioner's proposed construction of "rotation vector" is consistent with the '174 patent's usage of the term "rotation vector" (or "vector of rotation"). *See* Ex. 1001, 1:54–2:11. Dr. Kanellakopoulos's opinion supports that "rotation vector" would be understood by a person of ordinary skill in the art to describe the motion of a body that is rotating around a

point. As to the other aspects of Patent Owner's proposed construction, describing the characteristics of magnitude and direction, we determine that those attributes are not necessary to interpreting how a skilled artisan would understand "rotation vector" in light of the claim language and specification. *See* Tr. 47:26–48:7 (in Patent Owner's proposed construction of "rotation vector," "the magnitude requirement is not particularly important"). We address the parties' arguments as to differences between a rotation vector and angular momentum vector in Section II.D.2 below, because they underlie Petitioner's challenges involving Kleppner.

2) "movement vector"

Petitioner	Patent Owner	PTAB Original Final Written Decision	PTAB Final Written Decision on Remand
a vector indicating the direction of movement of an object	a vector derived from the cross product of the centrifugal force vector and the rotation vector while a vehicle is turning	a vector derived from the cross product of the centrifugal force vector and the rotation vector	a vector indicating movement of an object

Claims 3 and 4 recite a "movement vector."

The Federal Circuit indicated that "[o]n remand, and with more fulsome briefing by the parties, the Board shall construe 'movement vector' in accordance with its ordinary and customary meaning." *Atos*, 2025 WL 1482404, at *5 (Fed. Cir. May 23, 2025). As directed by the

Federal Circuit, having considered the intrinsic and extrinsic evidence and the parties' arguments, we determine that "movement vector" should be construed as "a vector indicating the movement of an object" in accordance with its ordinary and customary meaning, as explained below.

Petitioner proposes that the construction of "movement vector" should be "a vector indicating the direction of movement of an object." Pet. Remand Br. 1–3; Pet. Resp. Br. 4–5. Although Petitioner acknowledges that a "movement vector" has both direction and magnitude, Petitioner asserts that, in the '174 patent, vectors are only compared by their direction, so the construction of movement vector should be likewise restricted. Pet. Remand Br. 3; Pet. Resp. Br. 4–5.

Patent Owner asserts that the "movement vector" must have "(a) a direction parallel to the direction of movement of the object" and "(b) magnitude and units equal to the magnitude and units of the cross product of the centrifugal force vector and the rotation vector." PO Remand Br. 1.

Turning to the intrinsic evidence, the '174 patent's specification informs what is meant by "movement" in the context of claims 3 and 4. For example, the specification states:

> The methods described in this invention pertain specifically to detecting various kinds of vehicle dependent movement (acceleration, deceleration, accidents and cornering operational states, etc) as well as vehicle independent movement of the phone (movement caused by the user handling the phone, phone falling to the ground, etc).

Ex. 1001, 1:12–18. Hence, examples of "movement" can be acceleration, deceleration, accidents, and cornering of the vehicle, or movement caused by

the user handling the phone, or the phone falling to the ground, as described in the '174 patent's specification.

The '140 patent, incorporated by reference in the '174 patent, similarly mentions vehicle-dependent movement and vehicle-independent movement of a portable device. Ex. 1016, 1:8–33. The '140 patent also mentions velocity and acceleration patterns detected by a portable device in relation to "movements of vehicles." Ex. 1016, 5:56–61.

The '174 patent's specification further states that the "movement vector can be derived from the cross product between the centrifugal force and rotation vector, while the vehicle is turning." *Id.* at 2:29–31, Fig. 2. The Federal Circuit held that this description of the movement vector is "permissive and thus not definitional." *Atos*, 2025 WL 1482404, at *5. Thus, we reject Patent Owner's proposal that the "movement vector" must have "magnitude and units equal to the magnitude and units of the cross product of the centrifugal force vector and the rotation vector" (although it permissibly could have). *Atos*, 2025 WL 1482404, at *5; PO Remand Br. 1.

We have reviewed the prosecution file history (Ex. 1002) for the '174 patent and do not find it useful with respect to the ordinary and customary meaning of "movement vector." Ex. 1002. The '174 patent issued without any rejection requiring the applicant to explain the meaning of "movement vector." *Id.* at 93–98 (Office Action).

In essence, the parties agree that the "movement vector" indicates the direction of movement of an object. Pet. Remand Br. 1; PO Remand Resp. Br. 1–2; PO Resp. Br. 1. Although Petitioner omits magnitude from its proposed construction, the dictionary definitions Petitioner cites indicate that vectors are commonly understood to include magnitude as well as direction.

For example, the cited Kleppner text and dictionary definitions of record support that this is the ordinary and customary meaning of the term. *See* Ex. 1021, 3; Ex. 3001 (*Vector*, Merriam-Webster, www.merriamwebster.com/dictionary/vector); Ex. 3002 (*Vector*, The Penguin Dictionary of Science 701 (M.J. Clugston ed. 2009)).[8]

In addition to the Kleppner textbook and dictionaries, other proffered extrinsic evidence includes testimony from the parties' experts. Exs. 1003, 1020, 2001, 2018, 2019, 2021. For example, Patent Owner and its expert assert that the "movement vector" must have "units equal to the magnitude and units of the cross product of the centrifugal force vector and the rotation vector." PO Remand Br. 1; Ex. 2021 ¶ 8.

Although we agree with Patent Owner and its expert that a vector associated with a physical phenomenon (like the '174 patent's vehicle's movement or a portable device's movement) has units of some kind, we do not agree that the '174 patent requires that they must be the same units as the cross product of the rotation vector and centrifugal force vector (i.e., $kg \cdot m/s^2$). *Id.* The Federal Circuit's holding that "movement vector" is not limited to this cross product suggests that neither is "movement vector" limited to being expressed in the units corresponding to the cross product.

[8] *See* Pet. Remand Br. 7–8 (Paper 46) (citing *Ex Parte Mukul Julius Rocque & Jens Muehlsteff*, No. 2017-010709, 2018 WL 5996588, at *3 (PTAB Oct. 25, 2018) (defining a vector as "a quantity that has magnitude and direction and that is commonly represented by a directed line segment") (quoting *Vector*, Merriam-Webster, www.merriamwebster.com/dictionary/vector); *Ex Parte Gregory House*, No. 2020-000955, 2021 WL 1614323, at *3 (PTAB Apr. 22, 2021) (defining a vector as "[a] physical quantity that has magnitude and direction") (quoting *Vector*, The Penguin Dictionary of Science 701 (M.J. Clugston ed. 2009)).

Dec. 11. Moreover, the '174 patent describes acceleration and deceleration, for example, as types of vehicle movement. Ex. 1001, 1:12–15. Acceleration and deceleration have different units (m/s^2) than the cross product ($kg \cdot m/s^2$). Hence, we do not agree with Patent Owner's argument regarding units.

Based on the record, we find that the terms "movement" and "vector," considered individually and together, have well-understood, common meanings to ordinarily skilled artisans as of the invention date, reflected by the '174 patent's specification and other evidence of record noted above. Accordingly, we determine that the ordinary and customary meaning of "movement vector" is "a vector indicating movement of an object."

3) "operation indicator"

Petitioner	Patent Owner	PTAB
a sensor measurement determined from signals from the environment	information derived by converting sensing device output determined from signals from the environment	a sensor measurement determined from signals from the environment

Claim 5 recites the step of "monitoring at least one operation indicator transparently to the individual."

Petitioner argues we should construe "operation indicator" to mean "a sensor measurement determined from signals from the environment." Pet. 11. Petitioner argues that although the '174 patent does not expressly define "*operation indicator*," it provides a description by incorporating by reference the '140 patent, which "provide[s] context for that term" in

describing vibration sensors that measure forces over time and "convert them into number of vibrations measured per second (operation indicators)." *Id.* at 12 (citing Ex. 1014, 3:52–55). Petitioner further relies on the following descriptions of an embodiment in the '140 patent: "an onboard sensor receives signals from the environment and converts them into operation indicators. Examples of signals from the environment include vibrations, acceleration, change in forces, noise, etc." and "we require that a sensor that converts sensory signals to operation indicators be part of the portable device." *Id.* (citing Ex. 1014, 3:58–61, 4:1–3).

Patent Owner argues we should construe "operation indicator" to mean "*information derived by converting sensing device output determined from signals from the environment*." PO Resp. 12. Patent Owner argues Petitioner's construction improperly "would equate the measurements taken by a sensing device with 'operation indicators,'" while under Patent Owner's construction, "sensing device measurements are not, standing alone, 'operation indicators.'" *Id.* According to Patent Owner, "the output from the sensing device must be converted into operation indicators." *Id*. Patent Owner argues the '140 patent specification (which the '174 patent incorporates by reference) supports its construction because it emphasizes that operation indicators result from a conversion. *Id*. at 13 (citing Ex. 1014, 3:49–52, 3:58–59, 4:1–3). Specifically, Patent Owner argues "signals from the environment" as described in the '140 patent specification are signals measured by a sensing device, because a sensing device is necessary to determine what the signals from the environment are. *Id.* at 13–14 (citing Ex. 1014, 3:38–41). Patent Owner also relies on the '140 patent specification's description of a vibration sensor that measures forces over

time, which are converted into an operation indicator, as supporting its argument that an operation indicator is derived from the output of a sensing device. *Id.* at 14 (citing Ex. 1014, Figs. 2–4; Ex. 2001 ¶¶ 21, 36 (explaining that an accelerometer is a sensing device that outputs units of m/s^2 which are further processed to create an operation indicator of vibrations per second)).

Petitioner responds that Patent Owner's construction improperly adds "[a]n additional 'converting sensing device output"' step into the claims. Pet. Reply 6-7. Petitioner argues claim 5 never mentions converting the output of a sensor, and the portion of the '140 patent specification Patent Owner relies upon does not support any additional conversion step as Patent Owner contends, because it merely describes sensors that "take in environmental signals" and output "'operation indicators,' without any additional process acting on the sensor's output." *Id.* (citing Ex. 1001; Ex. 1014, Fig. 1). Petitioner further argues Dr. Kanellakopoulos's testimony contradicts the intrinsic record by referring to a conversion step that the '140 patent specification never describes. *Id.*

Based on our review of the parties' arguments and evidence, we determine that the claim language and specification support Petitioner's proposed construction of "operation indicator." Claim 5 recites an "operation indicator is created by an on-board component" and the related portion of the '140 patent specification describes an on-board sensor that converts signals from the environment into operation indicators. Ex. 1014, 3:49–52. As an "example," the specification describes a "vibration sensor" used to "measure forces over time (i.e. the signals) and convert them into [the] number of vibrations measured per second (operation indicators)." *Id.* at 3:52–55. The specification also states that "[a]n example of a vibrational

sensing device is an accelerometer." *Id.* at 3:56–57. Thus, the '140 patent specification states that an accelerometer may be used to convert signals from the environment and output operation indicators in the form of vibrations measured per second, undermining Patent Owner's argument that accelerometers alone cannot produce operation parameters. *See* PO Resp. 14–15; PO Sur-reply 7–8.

Patent Owner's argument that an operation indicator requires a conversion step is not persuasive. The claim language does not require an accelerometer or vibration sensor; claim 5 recites that an on-board component creates an operation indicator. In the "monitoring …" step of claim 5 (Ex. 1001, 5:14–15), nothing in the claim language suggests anything more than monitoring an operation indicator created by an on-board component, such as converting the on-board component's output. The example in the '140 patent specification describing a multi-component sensor converting the output of an accelerometer does not limit the claim term "operation indicator" to require a conversion step. *See* Ex. 1014, 3:49–57. Converted output from the multi-component sensor described in the '140 patent specification would still be an "operation indicator" under our construction of the term, which is consistent with the specification. *See* Pet. Reply 8. Patent Owner's reliance on expert testimony is not persuasive because it lacks support in the intrinsic evidence. *See* PO Resp. 14–15 (citing Ex. 2001 ¶¶ 21, 36; Ex. 2018 ¶ 46); PO Sur-reply 8. *See Phillips*, 415 F.3d at 1317 (extrinsic evidence that contradicts the intrinsic record carries little weight).

Accordingly, we construe "operation indicator" to mean a sensor measurement determined from signals from the environment.

4) "transparently"

Petitioner	Patent Owner	PTAB
no construction necessary	without requiring user interaction	no construction necessary

The term "transparently" also appears in the monitoring step of claim 5.

Petitioner argues construction of "transparently" is unnecessary to resolve its challenges to claim 5, and so it need not be construed. Pet. Reply 9 (citing *Vivid Techs.,* 200 F.3d at 803).

Patent Owner argues we should construe "transparently" to mean "without requiring user interaction." PO Resp. 19. Patent Owner argues a method that acts automatically fails to meet this construction if it "requires the user to perform an explicit action to effect the process." *Id.* (citing Ex. 2001 ¶ 126). Patent Owner argues the "notion of transparency in computing is well understood" (*id.*) and

> a transparent process is one in which the user is not required to be aware of the circumstances required for the process to be performed and one in which no interaction between the user and the device is required to effect the process.

Id. at 20. Patent Owner also argues the '140 patent's specification supports this construction because it describes certain actions as being undertaken "*automatically and transparently* to the user," which implies that "transparently" means something different from "automatically." *Id.* at 20 (citing Ex. 1014, 6:66–7:7). Patent Owner also argues that an example provided in the specification, in which the device detects the speed of the vehicle and adjusts the volume of music based on that speed, supports its

construction, because the user does not need to interact with the device to change the volume. *See id.* at 20–21 (citing Ex. 1014, 7:1–7).

Petitioner responds that Patent Owner's proposed construction of "transparently" does not distinguish between the monitoring step of claim 5 and the asserted prior art, Kim, and therefore construction of the term is unnecessary. Pet. Reply 9. Petitioner further argues that Patent Owner improperly relies on a portion of the '140 patent specification that does not relate to the monitoring step of claim 5, but rather to "performing" an action, which is not a step of claim 5. *Id.* at 9–10.

We agree with Petitioner that we need not construe "transparently," because even under Patent Owner's construction, Kim would disclose the limitation. We discuss this in detail in Section II.G.2, below. Accordingly, we determine that we need not expressly construe the term "transparently."

5) "vehicle independent state"

Petitioner	Patent Owner	PTAB
a state triggered when the portable device is moved independently of the movement of the vehicle	a state that is the result of movement of a portable device within the vehicle, independent of or unrelated to the movement of the vehicle	a state triggered when the portable device is moved independently of the movement of the vehicle

The term "vehicle independent state" appears in claim 5.

Patent Owner argues it should be construed as "*a state that is the result of movement of a portable device within the vehicle, independent of or unrelated to the movement of the vehicle*." PO Resp. 11. Patent Owner

relies on statements in the Background of the '174 patent specification that describe the methods of the invention as pertaining to

> detecting various kinds of vehicle dependent movement (acceleration, deceleration, accidents and cornering operational states) as well as vehicle independent movement of the phone (movement caused by the user handling the phone, phone falling to the ground, etc).

Id. at 11-12 (citing Ex. 1001, 1:12–18). *See also id.* (citing Ex. 1001, 1:24–26 ("[v]ehicle independent states are 'triggered when the portable device is moved independently of the movement of the vehicle"')).

Petitioner agrees that the statements in the specification relied upon by Patent Owner make clear that vehicle independent states result from movement of the portable device independently of movement of the vehicle. Pet. Reply 5. Petitioner argues, however, that "[n]owhere does the specification demand this occur within a vehicle." *Id.* at 6. Petitioner further argues "Patent Owner has not pointed to a meaningful difference between the '174 Patent and prior art based on [its construction of "vehicle independent state"] so it need not be construed." *Id.* at 5 (citing *Vivid Techs*., 200 F.3d at 803).

Patent Owner responds "[a] main premise of the '174 patent is to distinguish between different types of movement that occur while a portable device is inside a vehicle" and argues the purpose of the invention—to "*eliminate or significantly reduce the chances of erroneous driving events being registered*"—only applies if the vehicle independent events occur while the device is in the vehicle. PO Sur-reply 6–7 (citing Ex. 1001, 1:38–45). Patent Owner also relies on the specification's statement that the method of the '174 patent distinguishes between "vehicle dependent states such as cornering, accelerating and braking, *while also recognizing vehicle*

independent event (movement caused by the user handling the phone, phone falling to the ground, etc.)" (*id.* (emphasis in original) (citing Ex. 1001, 1:38–43)), and argues if the device is detecting vehicle dependent states *while also* detecting vehicle independent events, then the vehicle independent events must also occur while the device is in the vehicle. *Id.* at 7.

We decline to adopt Patent Owner's construction because it improperly reads into claim 5 a requirement that the specification and claim language do not support. The specification passages relied on by Patent Owner do not expressly state that a vehicle independent state must be determined while the device is inside a vehicle, and contrary to Patent Owner's argument, they also do not necessarily imply that. For example, the descriptions of "vehicle independent movement" and "vehicle independent event" in the specification (*see* Ex. 1001, 1:16, 42) refer to "phone falling to the ground." "Falling to the ground" implies that the phone may be outside a vehicle, not inside. Further, the specification's reference to detecting a vehicle dependent state "while also" recognizing a vehicle independent event does not necessarily imply that the vehicle dependent state and vehicle independent event are being detected simultaneously, as Patent Owner argues.

In the language of claim 5, a "vehicle independent state" is recited in the determining step (step c), and the requirement that the portable device is located "inside a vehicle" relates to creation of an operation indicator, as part of the detecting step (step b). Patent Owner does not dispute this, and agrees that a portable device "not in the vehicle" can satisfy the determining step (step c). Tr. 73:5–8. Patent Owner, however, argues step c's recitation that

a "vehicle independent state" is based on step b's "predetermined criteria" creates a link between "vehicle independent state" and step b, and thus an "express requirement" in step c that the device is located inside the vehicle. *See* Tr. 73:8–26, 76:1–3. We decline to read this requirement into the claim language. Although the claim language states that determining a "vehicle independent state" is based on "predetermined criteria," and step b describes comparing "predetermined criteria" to an "operation indicator" that is created when the device is inside a vehicle, it does not limit the step of determining a vehicle independent state to a time when the portable device is inside a vehicle.

Accordingly, we construe "vehicle independent state" to mean a state triggered when the portable device is moved independently of the movement of the vehicle.

C. Principles of Law

"Anticipation requires that every limitation of the claim in issue be disclosed, either expressly or under principles of inherency, in a single prior art reference," *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 868 F.2d 1251, 1255–56 (Fed. Cir. 1989), and that the claim limitations be "arranged or combined in the same way as recited in the claim[]," *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008). However, "the reference need not satisfy an *ipsissimis verbis* test." *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009).

A claim is unpatentable under 35 U.S.C. § 103 if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said

subject matter pertains." *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when available, evidence of objective indicia of obviousness or nonobviousness, such as commercial success, long felt but unsolved needs, and failure of others. *Graham v. John Deere Co*., 383 U.S. 1, 17–18 (1966); *see KSR*, 550 U.S. at 407 ("While the sequence of these questions might be reordered in any particular case, the [Graham] factors continue to define the inquiry that controls.").

The Supreme Court made clear that we apply "an expansive and flexible approach" to the question of obviousness. *KSR*, 550 U.S. at 415. Whether a patent claiming the combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id*. at 417. Reaching this conclusion, however, requires more than merely showing that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc*., 655 F.3d 1352, 1360 (Fed. Cir. 2011). Rather, obviousness additionally requires that a person of ordinary skill at the time of the invention "would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention." *Id*.

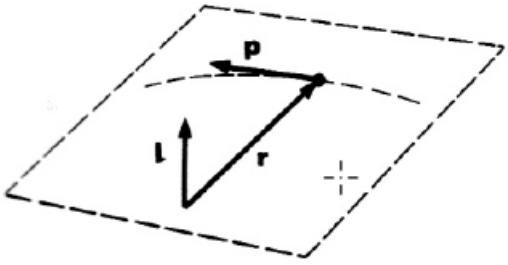
D. Alleged Obviousness Based on Kleppner

Petitioner contends claims 1–4 are unpatentable as having been obvious over Kleppner. Pet. 27–48. At issue on Remand are claims 3 and 4;

our analysis and conclusions as to the other claims do not change from the original Final Written Decision.

1) Kleppner (Ex. 1007)

Kleppner is a textbook titled "An Introduction to Mechanics." Ex. 1007, xv. The text begins with an introduction to mathematical concepts to apply to physical problems, such as vector products, and the use of vectors to describe velocity and acceleration. *Id.* at xix, 6–14. Kleppner describes using the "right hand rule for vector multiplication," such that if two trajectory vectors are in the xy plane, their vector product is in the positive z direction if the "sense of rotation" of the point about the origin is counterclockwise, and in the negative z direction if the rotation is clockwise. *Id.* at 234. The case where the rotation is counterclockwise is illustrated in the figure reproduced below.



Id. at 234. The figure reproduced above shows vectors r and p in a plane, with the vector L at a right angle to the motion of the particle at the intersection of the r and p vectors. *Id.*

2) Analysis

The Board's determinations for claims 1 and 2 were affirmed by the Federal Circuit so our analysis for those claims remains unchanged in this Final Written Decision on Remand. For claims 3 and 4, we apply the ordinary and customary meaning of "movement vector" as instructed by the

Federal Circuit. We conclude that claims 3 and 4 would have been obvious over Kleppner for the reasons explained below.

a) Claim 1

Petitioner contends it would have been obvious to perform the method of claim 1 based on Kleppner and the knowledge of a skilled artisan. Petitioner argues Kleppner discloses a gravity vector by representing a gravitational force on an object as "gravitational force *W*" with a vector pointing straight down, in addition to multiple examples applying the principles of mechanics. Pet. 28 (citing Ex. 1007, 49, 61, 72–73, 84, 107, 335; Ex. 1003 ¶ 154). Petitioner argues Kleppner discloses a rotation vector as "the vector used to describe the angular momentum of an object in circular motion" which is "the cross product between its momentum and position vectors." *Id.* at 29 (citing Ex. 1007, 6, 233). Petitioner relies on Kleppner's illustration of angular momentum vector L as having a direction perpendicular to the plane of an object's motion. *Id.* (citing Ex. 1007, 233–234; Ex. 1003 ¶ 155). Petitioner argues Kleppner discloses that the direction of vector L, i.e., positive or negative, depends on whether the object is turning clockwise or counterclockwise, which corresponds to "the condition of a vehicle turning" as recited in claim 1. *Id.* at 30 (citing Ex. 1007, 234; Ex. 1003 ¶ 156). Petitioner argues Kleppner thus discloses a relationship between the gravity vector and rotation vector of an object, including how closely they are aligned, i.e., "when an object's rotation vector points upwards or downwards, it is aligned with the gravity vector (which for the purposes of a car or object traveling in a plane will point downwards), and the object is turning." *Id.* at 31 (citing Ex. 1007, 234; Ex. 1003 ¶¶ 157–158).

Petitioner further argues Kleppner discloses "estimating an angle" as recited in claim 1, because it discloses how to calculate the angle between two vectors, and includes a section detailing "Mathematical Approximation Methods" "using simple approximate expressions instead of exact but complicated formulas." Pet. 31–32 (citing Ex. 1007, 6, 9, 39–47, 49; Ex. 1003 ¶ 159). Petitioner further argues that, to the extent Kleppner does not expressly disclose "*estimating an angle*," a person of ordinary skill in the art would have known how to estimate the angle between two vectors, with a reasonable expectation of success. *Id.* at 32–33 (citing Ex. 1003 ¶¶ 159–160).

Patent Owner argues Kleppner's angular momentum vector L is not a "rotation vector" under Patent Owner's proposed construction (PO Resp. 26–27), or even under the construction we have adopted. PO Sur-reply 12. Specifically, Patent Owner argues Kleppner's angular momentum vector describes an object's total angular momentum with respect to an origin point, and is the cross product of an object's linear momentum and its position vector from the chosen origin point. PO Resp. 27 (citing Ex. 1007, 233–234; Ex. 2001 ¶ 51). Patent Owner argues angular momentum is not inherent to an object, but is entirely dependent on the origin point chosen; it is fundamentally different from a "rotation vector" because it cannot be derived from a gyroscope. *Id.* at 27–28 (citing Ex. 2001 ¶¶ 69–72).

Patent Owner and Dr. Kanellakopoulos explain that Kleppner's angular momentum vector would not work in claim 1 because it does not have the characteristics of a rotation vector that can be used to determine whether a vehicle is turning: (1) an object has an angular momentum relative to an origin point even if the object is traveling in a straight line;

(2) an object's angular momentum vector is entirely dependent on the choice of an arbitrary origin point, and therefore the alignment of an angular momentum vector with an object's gravity vector gives no indication of whether a vehicle is turning, unlike a rotation vector that is aligned with a gravity vector only when the vehicle is turning on the plane of a road; (3) because angular momentum is entirely dependent on the choice of an origin point, if a person of ordinary skill in the art calculated angular momentum for a vehicle turning on an incline by choosing the origin point at the center of the vehicle's turning radius on the plane of the road, the method of claim 1 would not detect that a turn occurred. PO Resp. 28–31 (citing Ex. 1001, 1:54–65; Ex. 1007, 233–234; Ex. 2001 ¶¶ 69, 72–74).

Petitioner responds that even if Kleppner does not expressly disclose a rotation vector, it is undisputed that "rotation vector" is a term of art, and therefore a person of ordinary skill in the art would have read Kleppner with knowledge of a rotation vector, thus rendering claim 1 obvious. Pet. Reply 11 (citing Ex. 2001 ¶ 46). Petitioner argues claim 1 does not include the requirements on which Patent Owner's arguments are based, such as turning on an incline or discerning different sources of movement, and does not guarantee accuracy in all road conditions. *Id.* at 11–12. Petitioner argues it is irrelevant if Kleppner requires a person of ordinary skill to define an origin point before detecting a turn, because claim 1 is a "comprising" claim with a single-step method, and it does not matter if Kleppner's method requires an extra step of defining an origin point. *Id.* at 12. Petitioner further argues it is irrelevant that a rotation vector is only aligned with a gravity vector when rotational motion is occurring on the plane of the road,

because claim 1's single-step method does not require "conclusively establish[ing] turning." *Id.* at 13–14.

In reply, Patent Owner argues Kleppner does not disclose a "rotation vector," even under Petitioner's proposed construction as "a vector that 'describes the motion of a body that is rotating around a point.'" PO Sur-reply 12. Patent Owner reiterates Dr. Kanellakopoulos's explanation that an angular momentum vector "actually describes an aspect of an object's *linear* motion" *Id.* (citing Ex. 2001 ¶ 69). Patent Owner further argues Kleppner itself indicates the "sense of rotation" in the figure on Kleppner 234 "would be experienced even if the object is traveling in a straight line." *Id.*

After considering the full record, we find Petitioner has not established by a preponderance of the evidence that the method of claim 1 would have been obvious to a person of ordinary skill in the art, based on Kleppner's teaching. We agree with Patent Owner that Kleppner's angular momentum vector is not a "rotation vector" under our construction of that term, i.e., a vector that describes the motion of a body that is rotating around a point. Dr. Kanellakopoulos credibly explains the differences between Kleppner's angular momentum vector and a rotation vector. For example, Kleppner's angular momentum vector is defined with respect to its point of origin and does not describe an angle, but rather has units of $kg \cdot m^2/s$ (Ex. 2001 ¶ 51 (citing Ex. 1007, 233)). Dr. Kanellakopoulos also explains angular momentum of a body rotating around a point is the same as angular momentum of the same body moving in a straight line with the same linear speed and at the same perpendicular distance to the same point, and therefore, angular momentum cannot be used to differentiate between an object turning and an object moving in a straight line. *Id.* ¶ 69.

Dr. Kanellakopoulos's explanation that angular momentum is not inherent to an object, and its computation requires an arbitrary choice of a point of origin that has no physical meaning in the context of vehicle motion, also supports Patent Owner's position. *Id.* ¶ 71 (citing Ex. 2004, 262). Accordingly, Patent Owner's argument, that angular momentum cannot be used to detect a vehicle turning, is persuasive. *Id.* We also find persuasive, as Dr. Kanellakopoulos explains, that Petitioner's argument regarding the figure on Kleppner 234 is based on misinterpretation of the vectors in that figure. *Id.* ¶ 67 (explaining that Kleppner 233–234 does not depict a gravity vector).

Petitioner does not argue that any of Dr. Kanellakopoulos's statements are incorrect (*see generally* Pet. Reply), but rather argues they are irrelevant. *See* Pet. Reply 12–13. For example, Petitioner argues claim 1 only requires estimating an angle between vectors, but not a vehicle turning. *See id.* at 13. We do not find Petitioner's argument persuasive because it is inconsistent with the Petition, which relies on Kleppner as teaching that principles of mechanics applying to an object also apply to a vehicle turning. *See* Pet. 28, 31 (citing Ex. 1003 ¶ 157). Therefore, we determine Petitioner has not shown that Kleppner (in the portions Petitioner relies upon) discloses a rotation vector.

We also do not find persuasive Petitioner's argument that even if Kleppner does not disclose a rotation vector, a person of ordinary skill would have used the knowledge of a rotation vector (because it is a term of art) alongside Kleppner's teaching, to arrive at claim 1. *See* Pet. Reply 11. This argument does not satisfy Petitioner's burden to provide articulated reasoning with some rational underpinning to support the conclusion of

obviousness. *See KSR,* 550 U.S. at 419 (citing *In re Kahn,* 441 F.3d 977, 988 (Fed. Cir. 2006)). Petitioner does not explain which teaching of Kleppner a person of ordinary skill would have selected and combined with their knowledge of a rotation vector to yield the method of claim 1, or explain why a person of ordinary skill would have recognized based on Kleppner that estimating the angle between a rotation vector and gravity vector could be used to detect a vehicle turning. Nor does Petitioner respond to Patent Owner's assertion that Kleppner provides no rationale for estimating an angle of alignment between a rotation vector and gravity vector as a way of detecting a vehicle turning. *See* Ex. 2001 ¶ 65.

We also do not find Petitioner's argument persuasive because it is inconsistent with the Petition, which in fact relied on Kleppner's angular momentum vector as disclosing the rotation vector of claim 1. Pet. 29–31. The only obviousness analysis of Kleppner in the Petition was based on applying Kleppner's angular momentum vector to the "rotation vector" of claim 1. *Id.* Petitioner's reply argument is also untimely; "Petitioner may not submit new evidence or argument in reply that it could have presented earlier, e.g. to make out a prima facie case of unpatentability." Consolidated Trial Practice Guide ("TPG") 73 (Dec. 2025), *available at* www.uspto.gov/sites/default/files/documents/tpgnov.pdf. Petitioner had the burden to provide the rationale to support its obviousness challenge in the Petition; its attempt to present a rationale in the Reply was not in response to Patent Owner's Response. In view of the inconsistent argument Petitioner presented in the Petition, and Patent Owner and Dr. Kanellakopoulos's interpretation of Kleppner, which we find persuasive, we determine that Petitioner has not met its burden to show that a person of ordinary skill in

the art would have applied knowledge of a rotation vector to Kleppner's teaching to arrive at the method of claim 1.

b) Claim 2

Claim 2 depends from claim 1 and includes the following additional step: "estimating the probability of the vehicle turning as a function of the angle between the rotation vector and the gravity vector." Petitioner's argument as to claim 2 does not remedy the deficiency discussed above with respect to independent claim 1. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that it would have been obvious to a person of ordinary skill in the art to arrive at the method of claim 2 based on Kleppner's teaching.

c) Claim 3

Petitioner contends claim 3 would have been obvious based on Kleppner and the knowledge of a skilled artisan. Pet. 38–46. We address each limitation of claim 3 below, per the instruction of the Federal Circuit Remand.

i) Preamble

The preamble of claim 3 recites *"[t]he method of detecting a direction of a speed change vector, comprising.*" As an initial matter, although claim 3 begins (as does every other claim) with the language, "[t]he method," it does not refer to any other claim and is an independent claim.

Petitioner contends that Kleppner discloses vectors describing the motion of a moving object, including the magnitude and direction of an acceleration vector ("*direction of a speed change vector*"), as the mathematical derivative of the velocity vector. Pet. 38–39 (citing Ex. 1007, 14, 17, 18); Ex. 1003 ¶¶ 184–185).

Patent Owner argues that Kleppner "says nothing about any method and does not show how to detect anything." PO Resp. 40. However, Petitioner notes that the use of gyroscopes and accelerometers in moving vehicles to detect their motion was widespread by 2013. Pet. 7, 33–34 (citing Ex. 1006, Abstract; Ex. 1010, 1611; Ex. 1012, 201; Ex. 1013, Abstract, ¶¶ 6, 7; Ex. 1003 ¶ 50). And, Kleppner specifically mentions gyroscopes. *See, e.g.*, Ex. 1007, ix, 335. Kleppner further discloses finding velocity and acceleration in relevant contexts and makes clear that the disclosed principles and techniques may be applied to problems of real physical interest. *See, e.g.*, Ex. 1007, xv, 9, 16, 17, 36, 37. Hence, we do not agree with Patent Owner's arguments.

Accordingly, we agree with Petitioner that Kleppner discloses the preamble of claim 3. Thus, we do not decide here whether the preamble is limiting.[9]

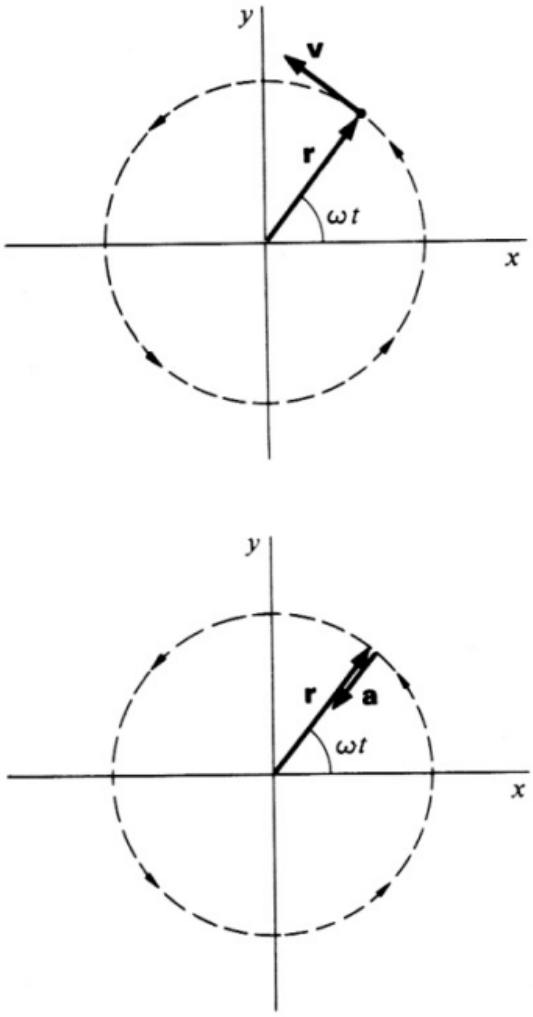
ii) Step (a)

Step (a) of claim 3 recites "*detecting a condition of a vehicle turning*."

Petitioner argues that Kleppner discloses detecting the condition of an object turning, based on its disclosure of the direction of angular momentum vector L, on Kleppner 234, as discussed in § II.D.2.a *supra*. *See* Pet. 38–39 (citing Ex. 1007, 234; Ex. 1003 ¶¶ 154–157, 187). Petitioner argues that acceleration vector a, depicted in a figure at Kleppner 18, corresponds to claim 3's "speed change vector" and that a person of ordinary skill in the art would have understood Kleppner as describing that the acceleration vector is

[9] *See Catalina Mktg. Int'l., Inc. v. Coolsavings, com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002) (whether preamble is a claim limitation depends upon the circumstances presented in a particular case).

the derivative of the velocity vector. Pet. 38–39, 41 (citing Ex. 1007, 14, 17–18; Ex. 1003 ¶ 184). The figures at Kleppner 18 are reproduced below.



Ex. 1007, 18. The top figure shows velocity vector v tangent to a particle's circle trajectory (indicated in dashed line) centered at the origin of the x-y plane. The particle is at angle ωt in polar coordinates. The bottom figure shows vectors r and a, with vector r directed radially outward from the x-y intersection and vector a directed radially inward. *Id.*

In the bottom figure, the acceleration vector a points toward the origin because the particle in this Kleppner example is moving in a circle at

constant velocity. *Id.* According to basic mechanics, were the particle to accelerate, thereby increasing its velocity around the circle trajectory, vector a would swing upward to the left to be closer to parallel with the velocity vector v or momentum vector p tangent to the circle trajectory (*see, e.g.*, momentum vector p at Kleppner 234). Conversely, if the particle were to decelerate, thereby decreasing its velocity but still moving in the counter clockwise direction around the circle, vector a would swing upward to the right to be closer to parallel with the velocity vector v or momentum vector p but pointing toward the opposite direction.

Patent Owner argues that Kleppner does not disclose "*detecting a condition of a vehicle turning*" because the cited parts of Kleppner only relate to an object traveling on the x-y plane in a straight line. PO Resp. 41. However, the Kleppner figure above shows an object traveling in a circular turn. In any case, Petitioner notes examples in Kleppner of vehicles turning on a banked road, as well as acceleration of a car driving on a rotating platform. Pet. 33–34 (citing Ex. 1007, 107, 335). The cited pages of Kleppner further disclose several examples of turning objects. *See, e.g.*, Ex. 1007, 14, 16–18, 34–38, 234. Thus, we do not agree with Patent Owner's argument.

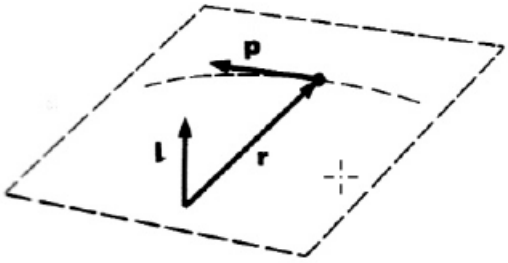
Accordingly, we agree with Petitioner that Kleppner discloses step (a) of claim 3.

iii) Step (b)

Step (b) of claim 3 recites "*detecting a movement vector during the turn*." Ex. 1001, 4:67.

In the Petition, Petitioner contends that Kleppner discloses the mechanics of an object turning, including the directions of the relevant

vectors during a turn, because it "discloses that for an object traveling in the *x-y* plane turning around a circle of radius r, its position vector p ('*a movement vector during the turn*') is illustrated in the following figure, along with angular momentum vector L (a rotation vector):"



Pet. 40 (citing Ex. 1007, 234; Ex. 1003 ¶ 191).[10]

Petitioner further contends that Kleppner teaches that, for the same object in circular motion, acceleration vector a is directed radially inward, and the centripetal force vector will point in the same direction as the acceleration vector, under Newton's Second Law of Mechanics, F = ma. Pet. 40–41 (citing Ex. 1007, 15, 18; Ex. 1003 ¶¶ 104, 191). Thus, Petitioner argues, the movement vector (in this scenario) is the cross product of the rotation vector and centrifugal force vector for a turning object. *Id.* at 41 (citing Ex. 1003 ¶ 192).

Patent Owner argues that Kleppner does not disclose "any, let alone all, of the steps in claim 3," based on Patent Owner's construction of "movement vector" as "the vector derived from the cross product of the centrifugal force vector and the rotation vector," which the Board adopted in

[10] In our Decision on Institution, we noted that the Petition's description of this figure appeared to be inconsistent with the text of Kleppner, which refers to r as the position vector and p as the momentum vector. Ex. 1007, 233–234. In its Reply, Petitioner stated that the Petition should have identified p as the momentum vector. Pet. Reply 16.

the original Final Written Decision. PO Resp. 38-39; PO Sur-reply 13–14. However, the Federal Circuit rejected this claim construction and remanded the case to the Board to determine the ordinary and customary meaning of "movement vector." Fed. Cir. Remand 12. As explained in § II.B.2, *supra*, we determine that the meaning of "movement vector" is "a vector indicating movement of an object.".

Patent Owner argues that Petitioner has not shown that Kleppner discloses a "movement vector" because Petitioner misinterprets the top left figure of Kleppner 234 (reproduced immediately above). PO Resp. 39–40. Patent Owner argues that Kleppner's figure does not disclose radius r and "position vector p" as Petitioner asserts (*see* Pet. 40 (identifying radius r and position vector p)), but rather identifies **r** as the position vector and p as the momentum vector. *Id.* at 33 (citing Ex. 1007, 234). Patent Owner further argues that Petitioner fails to explain how Kleppner discloses a *movement vector*, and that neither position vector r nor momentum vector p is a *movement vector*, because neither is derived from the cross product of a rotation vector and a centrifugal force vector. *Id.* at 40.

In reply, Petitioner relies on its argument that Kleppner discloses a rotation vector, as we discussed in § II.D.2.a, *supra*, and further argues that a centrifugal force vector and the cross-product operation were well known. Pet. Reply 15. Petitioner further argues that momentum vector p in the figure at Kleppner 234 discloses a *movement vector* because momentum vector p is "the product of mass and velocity (a movement vector)" (which makes Kleppner's variable r less critical to Petitioner's position than Patent Owner suggests) *Id.* at 16.

Patent Owner argues that Petitioner presented a new obviousness argument in its Reply by asserting that the claimed "movement vector" would have been obvious because a rotation vector, centrifugal force vector, and cross product were all known. PO Sur-reply 14. Patent Owner argues that Petitioner failed to explain how these distinct concepts could be combined without reading the '174 patent. PO Sur-reply 14–15.

However, upon considering the parties' positions and the record at this point, we agree with Petitioner that Kleppner's momentum vector p discloses a "movement vector" as claimed. Pet. 40–41; Pet. Reply 16; Ex. 1007, 234. Like all vectors, Kleppner's momentum vector p has direction, magnitude, and units associated with a physical phenomenon. The units of the momentum vector p are kg·m/s. In other words, the momentum vector is the product of mass (kg) times velocity (m/s). Because velocity is associated with an object's movement (distance moved over time), we determine that Petitioner has demonstrated by a preponderance of the evidence that Kleppner's momentum vector p discloses the claimed "movement vector." We also find that Kleppner discloses a "velocity vector v," which also corresponds to the claimed "movement vector." Ex. 1007, 18.

Accordingly, we agree with Petitioner that Kleppner discloses step (b) of claim 3.

iv) Step (c)

Step (c) of claim 3 recites "*estimating the angle between movement vector and speed change vector*." Ex. 1001, 5:1–2.

Petitioner contends that Kleppner discloses the directions and relationships of the *movement vector* and acceleration vector, and contends

that vector mathematics dictates that the component of the acceleration vector associated with the object's speed around the circle will be parallel to the object's movement vector or position vector. Pet. 42 (citing *id.* §§ VIII.A.3.a; Ex. 1007, 14, 15, 17, 18, 234; Ex. 1003 ¶¶ 194–195). Petitioner further states that Kleppner discloses mathematical formulas and approximation techniques for determining an angle between vectors, and asserts it would have been obvious to "estimate[e] the angle" between the movement vector and acceleration vector. Pet. 43 (citing *id.* §§ VIII.A.1; Ex.1003 ¶¶ 159–161, 197, 198).

Patent Owner argues that Kleppner does not disclose step (c) of claim 3 because a POSITA would not have been motivated to estimate the angle between two vectors for the purpose of determining whether a vehicle is accelerating or decelerating even if they could do so based on Kleppner's disclosure. PO Resp. 41 (citing Ex. 2001 ¶ 94). According to Patent Owner, reference to Kleppner's general teachings about estimating the angle between two vectors fails to show why a POSITA would have been motivated to apply those teachings to estimate the angle between a movement vector and a speed change vector in order to detect the direction of the vehicle's acceleration. PO Sur-reply 15.

However, Petitioner's expert, Dr. Michalson, notes that Kleppner discloses calculations involving the angle between two vectors ("*estimating the angle*"). Ex. 1007, 6, 9, 49; Ex. 1003 ¶ 159. In addition, Dr. Michalson states that Kleppner discloses mathematical approximation methods using approximate expressions instead of exact, but complicated, formulas ("*estimating*"). *Id.* (citing Ex. 1007, 39–47). We have already discussed Kleppner's disclosure of the "*movement vector*" (step (b)) and "*speed*

change vector" (preamble). In addition, Kleppner shows figures illustrating velocity vector v and acceleration vector a together, thus inviting their comparison and estimation of the angle between them in various scenarios. Ex. 1007, 18. Consequently, we do not agree with Patent Owner's argument that this limitation would not have been obvious over Kleppner.

Accordingly, we agree with Petitioner that Kleppner discloses, or at least suggests, step (c) of claim 3.

v) Step (d)

Step (d) of claim 3 recites "*determining that the speed change vector is acceleration vector if the estimated angle below certain threshold and determining that the speed change vector is deceleration vector if the estimated angle is above certain threshold*."

Petitioner contends that Kleppner explains that the tangential component of the acceleration vector ("*the speed change vector*") points in the direction of the object's movement around the circle ("*movement vector*" denoted "**θ**") if the formula $r\ddot{\theta} + r\dot{\theta}$ is greater than zero, and in the opposite direction if the formula is less than zero. Pet. 43–46 (citing *id.* § VIII.A.3.a; Ex. 1007, 14, 15, 17, 18, 30, 34, 37, 234; Ex. 1003 ¶¶ 159–161, 194–195, 197, 198, 201, 203–208).

Patent Owner argues that "merely pointing to a mathematical formula in Kleppner and Petitioner's expert's manipulations of that formula is not enough to show that Kleppner discloses the claim limitation." PO Resp. 42. According to Patent Owner, "[t]here is nothing in Kleppner about estimating the angle between a speed change vector and a movement vector to determine whether a speed change is an acceleration or a deceleration." *Id.*

Patent Owner's argument does not negate Petitioner's contention that the tangential component of Kleppner's acceleration vector ("*the speed change vector*") points in the direction of the object's movement around the circle ("*movement vector*" denoted "θ") if the formula $r\ddot{\theta} + r\dot{\theta}$ is greater than zero, and in the opposite direction if the formula is less than zero. Pet. 43–46. Hence, the claimed "*threshold*" in Kleppner is considered zero in this example. Kleppner's differential equation $r\ddot{\theta} + r\dot{\theta}$ relating the movement vector to acceleration vector according to the angle between them in polar coordinates (Pet. 43–44; Ex. 1007, 37) discloses, or at least suggests, step (d) of claim 3.

Accordingly, we agree with Petitioner that Kleppner discloses, or at least suggests, step (d) of claim 3. Thus, Petitioner has accounted for and shown how the prior art teaches or suggest each step and element of claim 3.

vi) Long-Felt Need

Graham v. John Deere recognized that secondary considerations (i.e., objective indicia) of nonobviousness may include evidence of a long-felt but unsolved needs in the art. 383 U.S. at 17. Evidence of objective indicia of nonobviousness must have a nexus to the claims in order to carry substantial weight. *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392 (Fed. Cir. 1988). The patentee bears the burden of showing that a nexus exits. *WMS Gaming Inc. v. Int'l Game Tech.*, 184 F.3d 1339, 1359 (Fed. Cir. 1999). To determine whether the patentee has met that burden, we consider the correspondence between the objective evidence and the claim scope. *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1332 (Fed. Cir. 2019).

Presuming nexus is proper "when the patentee shows that the asserted objective evidence is tied to a specific product and that product 'embodies the claimed features, and is coextensive with them.'" *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1072 (Fed. Cir. 2018); *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1130 (Fed. Cir. 2000); *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed. Cir. 2019) (citing *Demaco*, 851 F.2d at 1392). Conversely, when the product or process is not coextensive with the patented invention (such as when it is a component of a machine or process) the patent is not entitled to a presumption of nexus. *Demaco*, 851 F.2d at 1392.

In contesting Petitioner's obviousness arguments, Patent Owner contends that there was a long-felt but unmet need for the invention of the '174 patent. PO Resp. 43–45 (citing Ex. 1001, 1:52–2:11; Ex. 2013, 1, 2; Ex. 2015, 3; Ex. 2016, 10); PO Sur-Reply 16. Specifically, Patent Owner asserts there was a long-felt need in the usage-based insurance ("UBI") industry for detecting the condition of a vehicle turning that distinguishes between movement of a portable device (such as a smartphone) independently from movement of the vehicle and estimates the probability that the turning sensed by the portable device was the result of the vehicle turning. *Id.* at 45 (citing Ex. 1001, 1:52–2:11).

Petitioner contends that Patent Owner failed to establish a nexus between the alleged need for a cell phone's accelerometer to detect a vehicle's operational state and any feature recited in the claims, which do not recite any accelerometer. Pet. Reply 18. Petitioner argues that Patent Owner failed to demonstrate that any product embodies the claimed features and is coextensive with them, and consequently no presumption of nexus

applies in this case. *Id.* at 18–19 (citing *Fox Factory*, 944 F.3d at 1373). Petitioner further states that use of a smartphone to monitor driving behavior was known in the prior art. *Id.* at 19 (citing Ex. 1005, 11; Ex. 1008, claim 1). Petitioner asserts that Patent Owner cannot point to prior art features to establish nexus between the claims and evidence of non-obviousness. *Id.* (citing *Magseis FF LLC v. Seabed Geosolutions (US) Inc.*, 860 Fed. App'x. 746, 751–52 (Fed. Cir. 2021)).

We agree with Petitioner that no presumption of nexus applies in this case because Patent Owner has not provided evidence that a specific product or method is coextensive with the claimed invention. *Demaco*, 851 F.2d at 1392. Simply put, we find no evidence in the record of any attempt by Patent Owner to demonstrate that the claims are coextensive with any product or method.

In addition, Patent Owner has not established that the unclaimed features are insignificant in an effort to establish a presumption of nexus. *See Fox Factory*, 944 F.3d at 1373–74. For example, Patent Owner has emphasized throughout this proceeding that the cross product of the rotation vector and centrifugal force vector is important to calculating the "*movement vector*." *See, e.g.*, PO Resp. 10–11, 38–40; PO Sur-Reply 4–5. However, the claims do not recite that the "*movement vector*" is derived from this cross product. Ex. 1001, 2:29–31.

We further agree with Petitioner that Patent Owner has not otherwise established a nexus between the alleged satisfaction of any long-felt need and any claimed feature that is novel and nonobvious. Patent Owner asserts that the '174 patent teaches a novel method of reestablishing the reference frame of a portable device (e.g., a mobile phone) within a vehicle by

calculating the "movement vector" during a turn. PO Resp. 2. However, no such reestablishing of a reference frame or details of calculation of a "movement vector" during a turn are recited in the claims.

Similarly, although Patent Owner attempts to distinguish use of global positioning sensors (GPS) from a cell phone's accelerometer (PO Resp. 44), there is no recitation of an accelerometer in the claims to support this argument. And, as just discussed, Kleppner teaches or suggests each of the limitations of claim 3.

Patent Owner's proffered evidence of long-felt need includes Exhibits 2013, 2015, and 2016. Exhibit 2013 indicates that data quality acquired by smartphone-based insurance telematics has poor integrity and lacks reliability compared to traditional in-car mounted devices. Ex. 2013, 1. However, Patent Owner does not present evidence to explain adequately how any claimed feature overcomes these problems. For example, the claims (except for claim 5) do not recite a smartphone or mobile device carries out the claimed methods; they could just as well be carried out by another in-car device or a smartphone that is fixed or mounted. And the ability to detect an acceleration or deceleration vector as in claim 3, for example, does not necessarily lead to an improvement in data quality or reliability.

Exhibit 2015 indicates that "the smartphone is a great source of high-quality data" in the UBI industry, but indicates there are problems interpreting data generated by events such as when a phone is placed on a dash and the car enters a curve, causing the phone to slide across the dash and fall to the floor. Ex. 2015, 3. Patent Owner does not explain adequately how any claimed feature solves this problem. For example, claims 1–4 do

not require that a smartphone performs the recited methods, nor do the claims provide enough detail to indicate how movement of a smartphone or mobile device can be distinguished from movement of the vehicle. Determining an acceleration vector or deceleration vector, as in claim 3, standing alone, does not solve the problem of movement of a phone being misinterpreted as movement of a vehicle.

Exhibit 2016 similarly indicates smartphone-based telematics programs have a weakness slowing deployment due to data quality and reliability. Ex. 2016, 10. Exhibit 2016 states that the cause of these problems is that a smartphone's accelerometer data is not calibrated, and the cellular gyroscopes need to be constantly adjusted based on the phone's changing positions. *Id.* at 10–11. Again, Patent Owner does not explain in any detail how any claimed feature solves this problem. The claims (except for claim 5) do not recite that a smartphone or any comparable device carries out the recited methods. And, Exhibit 2016 suggests that the data quality and reliability problems stem from lack of calibration of accelerometer data and the need to constantly adjust gyroscopes when the unrecited phone changes positions, which are not recited in the claims.

Accordingly, Patent Owner has not carried its burden to show nexus of the alleged evidence of long-felt need to the claims. *See WMS Gaming*, 184 F.3d at 1359. This analysis is discussed most directly regarding claim 3, but it applies to all other challenged claims in the same way.

vii) Conclusion for Claim 3

In sum, we determine that Petitioner has demonstrated by a preponderance of the evidence that Kleppner discloses the preamble and each limitation of claim 3 of the '174 patent, as discussed above. Patent

Owner has not demonstrated nexus between any feature of claim 3 and Patent Owner's evidence of an alleged long-felt but unmet need. Thus, we decline to give Patent Owner's argument and evidence significant weight on this point. Accordingly, Petitioner has shown that claim 3 is unpatentable as obvious over Kleppner.

d) Claim 4

Claim 4 depends from claim 3 and recites that the method "*further comprises estimating the probability of the speed change vector to be an acceleration or deceleration vector—as a function of the angle between the speed change vector and the movement vector*."

Petitioner contends that Kleppner discloses that for a turning vehicle, the "*angle between the speed change vector and the movement vector*" is either 0 or 180 degrees, where 0 degrees corresponds to acceleration, and 180 degrees corresponds to deceleration. Pet. 46–47 (citing *id.* § VIII.A.3.e; Ex. 1007, 37; Ex. 1003 ¶ 227). Petitioner argues that Kleppner provides the same disclosure as the '174 patent that when "the angle is 0 between the movement vector and speed change vector, the probability of speed change vector being acceleration vector will be 1." *Id.* at 47 (citing Ex. 1001, 2:46–51; Ex. 1007, 37; Ex. 1003 ¶ 228). In other words, according to Petitioner, Kleppner discloses that "for any turning object the speed change vector points in the direction of travel for positive acceleration, and in the opposite of the direction of travel for deceleration." *Id.* (citing Ex. 1007, 17, 37; Ex. 1003 ¶ 229).

Petitioner's expert, Dr. Michalson, adds that a skilled artisan would understand that if the difference between the speed change vector and the direction of the movement vector is near zero, then the object is accelerating,

and if the direction of the movement vector is near 180 degrees, it is likely that the object is decelerating. Pet. 47–48 (citing Ex. 1003 ¶ 230). Petitioner further contends that to the extent it is argued that Kleppner does not expressly disclose "*estimating the probability*," it would have been obvious to include this functionality. Pet. 48 (citing *id.* § VIII.A.2; Ex. 1003 ¶¶ 159, 231, 232).

Patent Owner argues that Kleppner "does not disclose calculating an angle between two vectors, determining any probabilities about any vector, or conducting any estimates regarding any probabilities." PO Resp. 42–43 (citing Ex. 2001 ¶ 96); PO Sur-reply 15.

Petitioner replies that Patent Owner admitted that the concepts of "estimating an angle," "determining any probabilities," and "conducting any estimates" were known to a POSITA. Pet. Reply 18 (citing PO Resp. 36, 43). Petitioner further states that no such techniques are taught in the '174 patent, implying that they need not have been because they were known in the prior art. *Id.* (citing Ex. 1001; *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1570 (Fed. Cir. 1997) (cited for proposition that patent owner cannot require more of the prior art than the patent itself discloses)).

Patent Owner replies that Petitioner fails to explain how a POSITA would have understood that the angle between a speed change vector and the claimed movement vector can be used to estimate the probability that an acceleration or a deceleration has occurred. PO Sur-reply 15. In addition, Patent Owner argues that Petitioner incorrectly asserts that no such techniques are taught in the '174 patent because it expressly provides that "[t]he estimation of the acceleration and deceleration can depend on the

probability as a function of the angle between [the] speed change vector and movement vector." *Id.* (citing Ex. 1001, 2:45–47).

Petitioner has shown that claim 4 is disclosed or at least suggested by Kleppner. For example, Petitioner shows that Kleppner discloses estimating the probability of the speed change vector being an acceleration or deceleration vector as a function of the angle between the speed change vector and the movement vector according to the equation $r\ddot{\theta} + r\dot{\theta}$. Pet. 47–48; Ex. 1007, 37; Ex. 1003 ¶¶ 228, 229. We agree with Petitioner that Kleppner's disclosure is similar to the '174 patent's disclosure concerning the direction of acceleration or deceleration. *Compare* Ex. 1007, 37, *with* Ex. 1001, 2:46–51.

We have already discussed why we find unpersuasive Patent Owner's assertion that the claims satisfy a long-felt but unmet need in the art. *See* § II.D.2.c, *supra*; PO Resp. 43–45; PO Sur-Reply 16. Patent Owner has not established that a specific product or method is coextensive with the subject matter of claim 4 and that there are no significant unclaimed features. *See Fox Factory*, 944 F.3d at 1373–74. Nor has Patent Owner demonstrated that its proffered evidence that the satisfying of a long-felt need has nexus to any claimed characteristic of claim 4. As we have explained above, each limitation of claim 4 is taught or at least suggested by Kleppner.

Accordingly, Petitioner has shown by a preponderance of the evidence that the subject matter of claim 4 is taught or suggested by Kleppner. Patent Owner has not established that objective indicia of nonobviousness support the patentability of claim 4. Consequently, we determine that claim 4 would have been obvious over Kleppner.

E. Alleged Obviousness Based on Johnson and Kleppner (Claims 1 and 2)

Petitioner contends claims 1 and 2 would have been obvious over the combination of Johnson and Kleppner. Pet. 48–53.

1) Johnson (Ex. 1010)

Johnson is titled "Driving Style Recognition Using a Smartphone as a Sensor Platform," and describes a method for monitoring driver behavior "that is inexpensive, accessible, and intelligently uses the sensors available on a mobile phone," using "Dynamic Time Warping (DTW) and smartphone based sensor-fusion (accelerometer, gyroscope, magnetometer, GPS, video) to detect, recognize and record [aggressive driving] actions without external processing." Ex. 1010, 1609.

Johnson's system, named MIROAD, utilizes the rear-facing camera, accelerometer, gyroscope and GPS (for event location and speed only) of a mobile phone. Figure 1, reproduced below, shows how the coordinate axes of the phone are assigned.

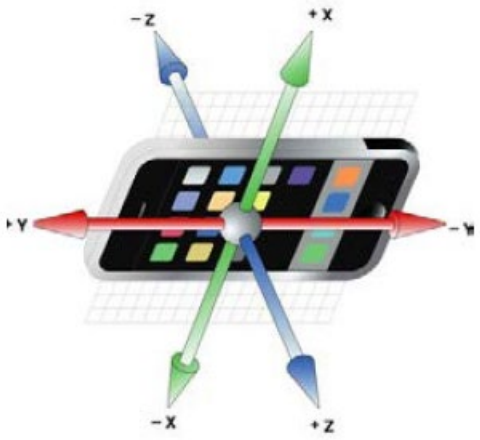


Figure 1 shows a mobile phone, rotated on its side for mounting on a vehicle dashboard, with x, y, and z axes identified. *Id.* at 1610–1611. The system uses accelerometer, gyroscope and magnetometer (compass) sensors

to detect and classify vehicle movement, and to detect turning and lateral movement. *Id.* at 1611.

2) Analysis

Petitioner argues Johnson discloses methods for detecting driving actions using the accelerometer and gyroscope of a smartphone. Pet. 48–49 (citing Ex. 1010, Abstract, 1611; Ex. 1003 ¶ 163). Petitioner argues Johnson's gyroscope measures a rotation around the x axis, g_x, which corresponds to a "rotation vector," and its accelerometer outputs a gravity vector. *Id.* at 49. Petitioner argues Johnson also discloses Euler angle rotation with respect to the x axis, e_x, which Dr. Michalson explains a person of ordinary skill in the art would understand as describing orientation of the smartphone with respect to a fixed coordinate system. *Id.* at 19, 49 (citing Ex. 1010, 1611; Ex. 1003 ¶ 163).

Petitioner argues that to the extent Johnson does not expressly disclose estimating an angle of how closely a rotation vector is aligned with a gravity vector, it would have been obvious to include "such functionality" in Johnson, in view of Kleppner's disclosure. Pet. 49. Petitioner relies on Kleppner as teaching the mathematical relationships of the rotation vector and gravity vector for an object traveling in a plane, and argues that a person of ordinary skill in the art would have been able to estimate the angle between two vectors with a reasonable expectation of success, because the steps for estimating an angle were well-understood mathematical concepts. *Id.* at 49–50. Petitioner argues Kleppner and Johnson are analogous art to the '174 patent because each involves estimation of rotation vectors as related to the gravity vector for a turning object, and are in the same field of "the physics of turning." *Id.* at 50 (citing Ex. 1007, 234; Ex. 1010, 1611;

Ex. 1001, claim 1). Petitioner argues it would have been obvious to implement the disclosure of Kleppner in Johnson's smartphone because the combination would have implemented known teachings of physics and smartphones detecting vehicle rotation, to achieve a predictable result with a reasonable expectation of success. *Id.* at 51 (citing Ex. 1003 ¶ 170).

Patent Owner argues Johnson does not disclose a rotation vector, and that Johnson's gyroscope value g_x is a measure of angular velocity, not a rotation vector. PO Resp. 46 (citing Ex. 2001 ¶ 100). Patent Owner further argues Johnson does not estimate an angle of how closely a rotation vector is aligned with a gravity vector, and that Johnson uses the angular velocity from its gyroscope signals in a calculation that does not involve estimating how closely a rotation vector and gravity vector are aligned. *Id.* (citing Ex. 2001 ¶¶ 101–105). Dr. Kanellakopoulos notes that the device used in Johnson's method is mounted on the dashboard and cannot move independently from the vehicle. Ex. 2001 ¶ 98 (citing Ex. 1010, Fig. 2). Dr. Kanellakopoulos explains that in Johnson's method, if a turning event is detected, Johnson then uses acceleration information to compare acceleration and jerk characteristics to pre-recorded templates of driving events according to the "DTW" algorithm, which is a "completely different approach than 'estimating an angle of how closely a rotation vector is aligned with a gravity vector.'" Ex. 2001 ¶¶ 103–104.

Patent Owner relies on its argument that Kleppner does not disclose a rotation vector, or estimating how closely a rotation vector is aligned with a gravity vector (*see* Section II.D.2.a supra). PO Resp. 47. Patent Owner further argues a person of ordinary skill in the art would not have been motivated, in view of Johnson's disclosure, to use an estimation of how

closely a rotation vector is aligned with a gravity vector in order to detect if a vehicle is turning, because Johnson's device is mounted to the vehicle and thus can easily determine if a turn is occurring without resorting to the method of claim 1. *Id.* at 47–48 (citing Ex. 2001 ¶ 106).

After considering the full record, we find Petitioner has not established by a preponderance of the evidence that the methods of claims 1 and 2 would have been obvious to a person of ordinary skill in the art, based on Johnson's and Kleppner's teachings. We agree with Patent Owner that Johnson does not disclose estimating an angle of how closely a rotation vector is aligned with a gravity vector, in order to detect the condition of a vehicle turning. Although Petitioner attempts to use Patent Owner's acknowledgement that a gyroscope (such as Johnson's) can be used to derive a vehicle's rotation vector (*see* Pet. Reply 16 (citing Ex. 1010, 1611)), and argues it did not concede Johnson fails to disclose "estimating an angle" (*id.*), Dr. Michalson agrees that Johnson "does not expressly disclose '*estimating an angle of how closely a rotation vector is aligned with a gravity vector*.'" Ex. 1003 ¶ 165. Further, Petitioner and Dr. Michalson's explanation of how Johnson purportedly uses g_x and e_x signals to determine "turning movements" does not persuade us that a person of ordinary skill in the art would have understood that Johnson's method detects the condition of a vehicle turning by estimating an angle between the vehicle's rotation vector and gravity vector, in part because Petitioner and Dr. Michalson do not identify a specific aspect of Johnson's disclosure that performs the estimation. *See* Ex. 1010, 1613; Pet. 49 (citing Ex. 1010, 1611; Ex. 1003 ¶ 163). We find more persuasive Dr. Kanellakopoulos's explanation that

Johnson's DTW algorithm uses a different method, not based on estimating vector alignment, than Kleppner's disclosure. *See* Ex. 2001 ¶ 104.

For the reasons discussed in Section II.D.2.a *supra*, we also find that Kleppner does not teach estimating an angle of how closely a rotation vector is aligned with a gravity vector. We also agree with Patent Owner that Petitioner fails to explain sufficiently how or why a person of ordinary skill would have combined Johnson's and Kleppner's teachings to arrive at the methods of claims 1 and 2, because Petitioner has not provided adequate reasoning or evidentiary support for its proposed combination. *See* II.D.2.a *supra* (citing *KSR*, 550 U.S. at 419). Therefore, we determine Petitioner has not established that a person of ordinary skill in the art would have been motivated to use Kleppner's disclosure with Johnson's teachings to arrive at the methods of claims 1 and 2.

F. Alleged Obviousness Based on Abramson and Kleppner (Claims 3 and 4)

Petitioner contends claims 3 and 4 would have been obvious over the combination of Abramson and Kleppner. Pet. 48–53.

1) Abramson (Ex. 1009)

Abramson is titled "Sensor-Based Determination of User Role, Location, and/or State of One or More In-Vehicle Mobile Devices and Enforcement of Usage Thereof," and describes determining roles and usages of a mobile device within a vehicle. Ex. 1009, code (54), 1:19–22.

Abramson discusses that "[d]rivers using a hand-held cellular phone or smartphone for talking, text messaging, and/or for executing other applications or 'apps' while driving has become a problem of near epidemic proportions." *Id.* at 1:33–36. Abramson attempts to

> identify the user of a particular mobile device (for instance, with respect to their role as a driver or passenger in the car), to identify various aspects of the usage of the device itself (for instance that the device is executing a text messaging application), and to identify instances when a mobile device deviates from its expected or regular operation.

Id. at 11:16–27. Abramson describes using sensors and GPS units of a mobile device to determine if the user is a passenger or driver in the car. *Id.* at 11:13–44.

2) Analysis

1) Claim 3

We address the parties' positions on patentability and each challenged claim limitation below.

a) Preamble

The preamble of claim 3 recites "*[t]he method of detecting a direction of a speed change vector, comprising.*"

Petitioner contends that Abramson discloses a method using accelerometer measurements of a mobile device in scenarios where the mobile device was in a very tight turn, or there was forward acceleration or deceleration of a vehicle, or some combination thereof. Pet. 54 (citing Ex. 1009, 45:21–23, 46:45–55). For example, Petitioner asserts that Abramson discloses using accelerometer measurements to determine both "positive forward acceleration (e.g., stepping on the gas)" and "negative forward acceleration (e.g. braking)" ("*direction of a speed change vector*"). *Id.* at 55 (citing Ex. 1009, 52:5–32; Ex. 1003 ¶ 211).

Patent Owner argues that Abramson's method is not able to distinguish forward acceleration and deceleration. PO Resp. 49–50; PO Sur-reply 19. However, as just stated, Petitioner notes that Abramson uses its

accelerometers to determine positive forward acceleration (e.g., stepping on the gas) and negative forward acceleration (e.g., braking). Pet. 55 (citing Ex. 1009, 52:5–32). Abramson mentions that its mobile device has x, y, and z accelerometers (as well as a gyroscope, GPS sensor, magnetometer, and other sensors) known in the art. Ex. 1009, 45:63–46:4. In addition, Abramson expressly states that the mobile device can detect lateral acceleration and forward acceleration or deceleration when a car is turning. *Id.* at 46:45–55. Thus, Abramson is able to distinguish forward acceleration and deceleration.

Patent Owner further argues that a particular section of Abramson, i.e., Ex. 1009, 52:5–32, relied upon by Petitioner does not disclose the preamble of claim 3 because it relates to determining whether a mobile device is located in the front or rear of a vehicle during acceleration. PO Resp. 49–50 (citing Pet. 54; Ex. 1009, 52:5–32). However, Petitioner relies on this section for its discussion of forward acceleration and deceleration, and not determining the position of the mobile device in the vehicle. Thus, Patent Owner's arguments are unavailing.

Accordingly, we agree with Petitioner that Abramson discloses claim 3's preamble (thus, whether the preamble is limiting is immaterial).

b) Step (a)

Step (a) of claim 3 recites "*detecting a condition of a vehicle turning*."

Petitioner contends that Abramson discloses using sensors 145 of mobile device 105 to detect turns and measure lateral acceleration associated with a turning vehicle, including measuring "timing and magnitude of the lateral acceleration (from the turn's centripetal force) and/or changes thereto that occur to a mobile device 105 as the vehicle in which it is located travels

in a turn" ("*detecting a condition of a vehicle turning*"). Pet. 54–55 (citing Ex. 1009, 47:12–14, 52:5–32; Ex. 1003 ¶ 213).

We agree with Petitioner that Abramson discloses this limitation.

c) Step (b)

Step (b) of claim 3 recites "*detecting a movement vector during the turn*." Ex. 1001, 4:67.

Petitioner contends that Abramson discloses tracking an object's position by double integrating acceleration figures and gyroscope values as done in inertial navigation systems and known to those skill in the art ("*detecting a movement vector*"). Pet. 55 (citing Ex. 1009, 2–10, 53). According to Petitioner, Abramson discloses measuring the acceleration of a turning vehicle and determining the movement vector by integrating the acceleration vector to produce the velocity vector and then integrating again to produce the position vector ("*movement vector*"). *Id.* at 55–56 (citing Ex. 1009, 50:11–20; Ex. 1007, 14–19; Ex. 1003 ¶ 215).

Patent Owner argues that double integration of an accelerometer results in a position vector and double integration of a gyroscope's output results in a meaningless quantity. PO Resp. 50–51; PO Sur-reply 19 (citing Ex. 2001 ¶¶ 111–113). We agree with Patent Owner that a position vector does not disclose a "movement vector" because position indicates where an object is and not its movement.

However, as already discussed, Abramson's mobile device has x, y, and z accelerometers (as well as a gyroscope, GPS, magnetometer, and other sensors). Ex. 1009, 45:63–46:4. These components detect lateral and forward acceleration, and changes thereto, and thus detect movement vectors (including velocity and acceleration) during a turn. *Id.* at 46:45–55.

In addition, Petitioner further contends that Kleppner discloses step (b) of claim 3 for the reasons explained previously in the Petition. Pet. 56–57 (citing *id.* § VIII.A.3.c; Ex. 1007, 233, 234; Ex. 1003 ¶ 216). We agree with Petitioner that Kleppner's velocity vector v and momentum vector p disclose a "movement vector" as claimed because velocity is associated with movement and momentum is the product of mass times velocity. Pet. 40–41; Pet. Reply 15; Ex. 1007, 18, 234; *see also supra* Section II.D.2.c.

Petitioner contends that Kleppner and Abramson are analogous art (and therefore combinable for consideration of obviousness) because they are in the field of the physics of turning objects. *Id.* at 57 (citing Ex. 1007, 234; Ex. 1009, 54:45–61). Petitioner argues that it would have been obvious to implement Kleppner's teachings with Abramson's smartphone "because this combination would implement old elements (relationships of physics and sensors detecting movement in a vehicle) to achieve a predictable result (detecting direction of a vector through a sensor)." *Id.* (citing Ex. 1009, 58:15–16; Ex. 1011, 5; Ex. 1003 ¶ 217).

Petitioner further asserts that Kleppner and Abramson both are directed to use of mathematical estimations to determine the physics of objects that are turning. Pet. 57–58 (Ex. 1007, 233, 234; Ex. 1009, 50:11–15). Petitioner argues that use of Abramson's method to detect a vehicle turning along with Kleppner's rotation vector calculations would have been well within the level of ordinary skill in the art, would not have resulted in unpredictable results, and could have been readily accomplished without undue experimentation with a reasonable expectation of success. *Id.* at 58 (citing Ex. 1003 ¶ 218).

Petitioner contends that a skilled artisan would have had reason to combine Abramson and Kleppner because Kleppner discloses the basic mathematical and physics relationships of objects turning, and Abramson discloses a specific implementation based on those relationships as applied to vehicles turning. Pet. 58. Petitioner further states that Abramson discloses a need to monitor driving events when using cell phones, and monitoring vehicle turns and driving events had become "increasingly popular" by the '174 patent's priority date. *Id.* at 58–59 (citing Ex. 1006, 4:4–7, 6:23; Ex. 1008, claim 18; Ex. 1009, 1:39–40; Ex. 1013 ¶ 13; Ex. 1003 ¶ 219).

Patent Owner's arguments against Petitioner's showing for this limitation hinge mostly on Patent Owner's proposed construction of "movement vector" as the cross product of the rotation vector and centrifugal force vector for a moving object, or having units corresponding to this cross product ($kg \cdot m/s^2$). PO Resp. 50–51; PO Remand Br. 1. Patent Owner's arguments are not aligned with the Federal Circuit's instructions on Remand (and thus we have not adopted them in this Final Written Decision on Remand) because the '174 patent describes the cross product permissively, not definitionally, as an example of what a "movement vector" may be. Thus, Patent Owner's arguments are unavailing. *See supra* Section II.B.2.

Patent Owner also argues that a POSITA would not have combined Abramson and Kleppner, and that the two are nonanalogous art. PO Resp. 51. We do not agree with Patent Owner's assertions.

As Petitioner contends, Kleppner discloses the basic mathematical and physics relationships of turning objects (including vehicles), and Abramson

discloses a specific implementation applying those relationships to turning vehicles. Pet. 58. Hence, Abramson and Kleppner teach similar concepts that would have led a POSITA to consider them together. *See KSR*, 550 U.S. at 417 ("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.").

In addition, Petitioner demonstrates that Abramson identifies market and design demands for monitoring use of a cell phone causing dangerous driving behaviors, which would have led a POSITA to consider Abramson with Kleppner to understand details of the physics associated with such safety concerns. Pet. 59; Ex. 1009, 1:32–35 ("Drivers using a hand-held cellular phone or smartphone for talking, text messaging, and/or for executing other applications or 'apps' while driving has become a problem of near-epidemic proportions."), 22:12–16 (insurance companies may provide incentives or mandate transformations or probability thresholds to turn off mobile phone features distracting drivers), 26:42–49 ("if certain highly erratic typing tendencies perceived at mobile device 160, occur just prior and/or closely correlate to various driving operations (reflected in the inputs from vehicle data system 164) such as accelerating, braking, and/or swerving, one or more user determination characteristics can be identified with regard to the input(s) from mobile device 105, indicating that there is a high likelihood that the in-vehicle role of the user of mobile device 105 is a driver"); *KSR*, 550 U.S. at 419 ("In many fields it may be that there is little discussion of obvious techniques of combinations, and it often may be the case the market demand, rather than scientific literature, will drive design

trends. Granting patent protection to advances that would occur in the ordinary course without real innovation retards progress and may, in the case of patents combining previously known elements, deprive prior inventions of their value or utility.").

A reference is analogous art to a claimed invention if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). *In re Icon Health and Fitness, Inc.,* 496 F.3d 1374, 1379-80 (Fed. Cir. 2007) (quoting *In re Clay,* 966 F.2d 656, 658 (Fed. Cir. 1992)); *In re Klein,* 647 F.3d 1343 (Fed. Cir. 2011); *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004).

As we determined in the Institution Decision, we agree with Petitioner that Abramson and Kleppner are in the same field of endeavor as the '174 patent's claims because they address the physics of turning objects. Pet. Reply 20; Inst. Dec. 24; Ex. 1007, 18, 36, 37, 107, 234; Ex. 1009, 50:7–51:23. In addition, Abramson is reasonably pertinent to the problem addressed by '174 patent's claims of using a portable device (e.g., mobile phone) to determine the operational state of a vehicle. Inst. Dec. 24–25; Ex. 1001, claims; Ex. 1009, 50:7–51:23. Kleppner is reasonably pertinent to the problem addressed by the '174 patent's claims of determining the physics of turning objects such as vehicles. Ex. 1007, 18, 36, 37, 107, 234. Accordingly, Petitioner has shown that the combination of Abramson and Kleppner discloses step (b) of claim 3 and would have been made by the ordinarily skilled artisan with a reasonable expectation of success.

d) Step (c)

Step (c) of claim 3 recites "*estimating the angle between movement vector and speed change vector*." Ex. 1001, 5:1–2.

Petitioner relies on Kleppner to disclose this limitation. Pet. 59 (citing *id.* §§ VIII.A.3.d, VIII.C.1.c; Ex. 1003 ¶ 222). As explained in § II.D.2.c, *supra*, we agree with Petitioner that Kleppner discloses calculations involving the angle between two vectors, and discloses mathematical approximation methods ("*estimating the angle*"). Ex. 1007, 6, 9, 49; Ex. 1003 ¶ 159. We have already discussed Kleppner's disclosure of the "*movement vector*" and "*speed change vector*" in relation to the preamble and step (b) of claim 3. We also discussed that Kleppner 18 discloses the velocity vector v and acceleration vector a together, inviting their comparison under different scenarios including forward acceleration and deceleration discussed in Abramson. Accordingly, Patent Owner's argument that Kleppner fails to disclose this limitation is unavailing.

e) Step (d)

Step (d) of claim 3 recites "*determining that the speed change vector is acceleration vector if the estimated angle below certain threshold and determining that the speed change vector is deceleration vector if the estimated angle is above certain threshold*."

Petitioner contends that Abramson discloses using accelerometer measurements to determine both "positive forward acceleration (e.g. stepping on the gas)" ("*the speed change vector is acceleration vector*") and "negative forward acceleration (e.g. braking)" ("*the speed change vector is*

deceleration vector"). Pet. 60 (citing Ex. 1009, 53:5–32[11]). Petitioner further states that Abramson discloses a "method for orienting a coordinate system of a mobile device" containing x, y, and z accelerometers (and gyroscope, GPS, and magnetometer sensors) in a scenario in which "the mobile device 105 was in a very tight turn (right or left) or because there was very strong forward acceleration or deceleration—**or some combination thereof**." *Id.* at 54, 60 (citing Ex. 1009, 45:21–23, 45:63–46, 46:45–55). Petitioner asserts that Abramson thus discloses "*determining that the speed change vector is acceleration vector*" or "*deceleration vector*" for a turning vehicle. *Id.* (citing Ex. 1003 ¶ 224).

Petitioner contends that, to the extent one may argue Abramson does not disclose this limitation, it would have been obvious in view of Kleppner because Kleppner discloses relationships between the vectors describing an object's movement while turning in a circle and the vectors describing an object's acceleration. Pet. 60 (citing *id.* §§ VIII.A.3.e, VIII.C.1.c; Ex. 1003 ¶¶ 222, 224).

Patent Owner argues that Abramson "says nothing about estimating any angle and says nothing about comparing any estimate to any threshold." PO Resp. 51 (citing Ex. 2001 ¶ 114). Patent Owner asserts that Abramson merely detects that a vehicle is accelerating, braking, or turning. *Id.* Patent Owner further contends that Kleppner does not disclose this limitation. *Id.* In addition, Patent Owner argues that a skilled artisan would not be motivated to combine Abramson and Kleppner to yield a method that includes limitations appearing in neither reference. *Id.*

[11] The Petition contains a typographical error. The cite should have been Ex. 1009, **52**:5–32 (see, e.g., Pet. 55).

We have already addressed Patent Owner's arguments concerning "*estimating the angle between movement vector and speed change vector*" under step (c) of claim 3 in this section. As to comparing the estimate with a *"threshold*," Abramson distinguishes between positive forward acceleration (e.g. stepping on the gas) and negative forward acceleration (e.g., braking). *See, e.g.*, Ex. 1009, 5–32. In this case, the threshold is zero (the boundary between positive and negative acceleration).

For reasons already explained, we do not agree with Patent Owner's argument that Kleppner fails to disclose step (d) of claim 3. PO Resp. 51; PO Sur-reply 19–20; § II.D.2.c, *supra*. Patent Owner's argument does not negate Petitioner's contention and evidence that the tangential component of Kleppner's acceleration vector ("*the speed change vector*") points in the direction of the object's movement around the circle ("*movement vector*" denoted "**θ**") if the formula $r\ddot{\theta} + r\dot{\theta}$ is greater than zero, and in the opposite direction if the formula is less than zero. Pet. 43–46. In other words, the claimed "*threshold*" in Kleppner is zero.

f) Long-Felt Need

We have already addressed Patent Owner's assertion that the claims satisfy a long-felt need. *See supra* Section II.D.2.c. As Petitioner contends, Patent Owner has not established that a presumption of nexus exists, or that its evidence of long-felt need has a nexus to any unique characteristic in the claims of the '174 patent. *Id.*

g) Conclusion for Claim 3

Accordingly, Petitioner has demonstrated by a preponderance of the evidence that Abramson and Kleppner are analogous art and that a POSITA would have had reason to combine them with a reasonable expectation of

success. Petitioner has further demonstrated that the preamble and each limitation of claim 3 are disclosed by the combination, such that claim 3 would have been unpatentable as obvious over the combination of Abramson and Kleppner.

2) Claim 4

Claim 4 depends from claim 3 and recites that the method "*further comprises estimating the probability of the speed change vector to be an acceleration or deceleration vector—as a function of the angle between the speed change vector and the movement vector*."

Petitioner contends that this limitation would have been obvious over the combination of Abramson and Kleppner. Pet. 61 (citing Ex. 1003 ¶ 234). Petitioner states that Abramson discloses that contemporary smartphones incorporate sensors including accelerometers, GPS receivers, and gyroscopes, and the inputs and notifications can be used to ascribe probabilities to conclusions determined from the sensors. *Id.* at 61 (citing Ex. 1009, 11:30–40; Ex. 1003 ¶ 235). Petitioner further argues that Abramson determines the probability of a user being in a vehicle based on accelerometer data, and that this could be applied to determine that a speed change vector is either an acceleration or deceleration vector. *Id.* at 62.

Patent Owner argues that the probability that a mobile device is traveling in a particular class of vehicle is "not even close" to the limitation of claim 4, and that it is a different probability than claimed. PO Resp. 52 (citing Ex. 1009, 35:44–65); PO Sur-reply 20. Although the probability disclosed by the reference may be different than that of the claim, this does not negate that Abramson discloses the concept of determining probabilities in relation to sensed movement/acceleration, which would apply to the prior

art teachings on which Petitioner relies. *See* Pet. 61–62. Thus, we do not agree with Patent Owner's argument.

Petitioner also relies on Kleppner to disclose this limitation. Pet. 62. For reasons explained in § II.D.2.d, *supra*, we agree with Petitioner that Kleppner discloses this limitation. For example, Petitioner shows that Kleppner discloses estimating the probability of the speed change vector to be an acceleration or deceleration vector as a function of the angle between the speed change vector and the movement vector according to the equation $r\ddot{\theta} + r\dot{\theta}$ notwithstanding Patent Owner's arguments. Pet. 47–48; PO Resp. 52; PO Sur-reply 20; Ex. 1007, 37; Ex. 1003 ¶¶ 228, 229.

We have addressed Petitioner's asserted motivation to combine the analogous Abramson and Kleppner references with a reasonable expectation of success, and determined that Petitioner has demonstrated this by a preponderance of the evidence. *See supra* Section II.F.2.b.

Patent Owner has not demonstrated that the claims satisfy a long-felt but unmet need because Patent Owner has not shown a presumption of nexus exists or that its evidence has a nexus to any unique characteristic of the claims of the '174 patent. *See supra* Sections II.D.2.vi, II.F.2.f.

Accordingly, Petitioner has demonstrated by a preponderance of the evidence that a POSITA would have had reason to combine Abramson and Kleppner with a reasonable expectation of success, and that the limitations of claim 4 are taught or at least suggested by the combination of Abramson and Kleppner such that claim 4 would have been obvious thereover.

G. Alleged Anticipation Based on Kim

Petitioner contends Kim anticipates claim 5. Pet. 67–76.

1) Kim (Ex. 1005)

Kim "relates to a terminal device for providing a context aware-based mobile service." Ex. 1005, code (57). More specifically, Kim discloses a terminal device that includes sensors that output data to a "context awareness unit" that estimates the environment surrounding the user of the terminal device. *Id.* The terminal device then outputs context-appropriate content to the user. *Id.* According to Kim, using its disclosed system, "it is possible to seamlessly provide a mobile service suitable for the user's current location and context automatically without the user's intentional selection inside of a vehicle, outdoors or indoors." *Id.*

In one embodiment, Kim discloses terminal 100 having sensing unit 110 that includes a number of sensors, including camera 111, microphone 112, GPS 113, and acceleration sensor 114. Ex. 1005 ¶¶ 38–40. Acceleration sensor 114 detects "the motion state of an object by detecting dynamic forces such as acceleration, vibration, and impact" and can detect engine and vehicle vibrations. *Id.* ¶¶ 40–41. Kim discloses sending the data from sensing unit 110 to context recognition unit 120, which "estimates an external context or a user's behavior by comparing the sensor data sensed through the sensor unit 110 with a pattern of reference signals stored therein." *Id.* ¶ 42. According to Kim, "the context awareness unit 120 continuously detects a change in the user's context and detects a change in a service environment, for example, an area such as inside, outdoors, or indoors of the vehicle 200." *Id.* ¶ 43. After examining the user's context, user intention setting unit 130 examines the context and determines the

user's intention based on information previously input and stored by the user, and service creation unit 140 selects an appropriate service based on the context and user intention. *Id.* ¶¶ 44–45.

2) Analysis

Petitioner provides a limitation-by-limitation analysis with specific citations to Kim and Dr. Michalson's Declaration, as to every limitation of claim 5. Pet. 67–76 (citing various portions of Exs. 1003, 1005). Based on the evidence and arguments presented by Petitioner, we find that Kim discloses each limitation of claim 5. We focus our discussion below on the limitations that Patent Owner argues Kim does not disclose: "monitoring at least one operation indicator transparently to the individual" and "determining … one or more vehicle independent states." PO Resp. 58–65. *See In re NuVasive, Inc.*, 841 F.3d 966, 974 (Fed. Cir. 2016) (holding that the Board "was not required to address undisputed matters."). We organize our discussion by the disputed terms in claim 5 because Patent Owner's arguments are based on its proposed construction of those terms.

1) operation indicator

Petitioner relies on its proposed construction of "operation indicator" (which we have adopted) in arguing that Kim discloses "monitoring at least one operation indicator." Pet. 69. According to Petitioner, Kim discloses a terminal having sensor unit 110 that detects an external context or action using various sensors and outputs the corresponding sensor data (i.e., "*monitoring at least one operation indicator*"), GPS 113 that recognizes the location of the terminal, and acceleration sensor 114 for instantaneous detection of the motion state of an object by detecting dynamic forces such as acceleration, vibration, and impact (i.e., "*wherein the at least one*

operation indicator is created by an on-board component of the portable device"). *Id.* (citing Ex. 1003 ¶ 246; Ex. 1005 ¶¶ 39–40). Petitioner further argues Kim discloses a terminal providing a context awareness-based mobile service having context recognition unit 120 that acquires physical signals through sensor unit 110 (i.e., "*detecting when the at least one operation indicator*") and estimates context by comparing output of the sensor unit "with a pattern of reference signal stored therein" (i.e., "*meets one or more predetermined criteria*"). *Id.* at 71–72 (citing Ex. 1003 ¶¶ 251–252; Ex. 1005, Figs. 1, 2, ¶ 42). Specifically, Petitioner argues the sensor unit of Kim's context recognition unit acquires physical signals relating to vehicle engine vibration and estimates context by comparing them with self-stored reference signals. *Id.* at 72–73 (citing Ex. 1003 ¶¶ 253; Ex. 1005, Fig. 1, ¶ 74).

Patent Owner argues Kim does not disclose an operation indicator, under Patent Owner's proposed construction of that term, because in Kim, sensor data is never converted. PO Resp. 58–59. Specifically, Patent Owner argues Kim's acceleration sensor does not produce an operation indicator because it does not perform a conversion. *Id.* at 59. Patent Owner further argues physical signals acquired by Kim's context recognition unit are not operation indicators because no conversion is performed before they are input to the context recognition unit. *Id.* at 60; *see also* PO Sur-reply 8 (citing Ex. 2001 ¶¶ 36–39).

Because Patent Owner's argument is based on a claim construction requiring converting of sensor data (which we have not adopted), we do not agree with Patent Owner that Kim does not disclose an operation indicator. Rather, because we have adopted Petitioner's construction of the term

"operation indicator" as "a sensor measurement determined from signals from the environment," we are persuaded by Petitioner's arguments that Kim discloses this limitation based on our adopted construction. Accordingly, we find that Petitioner establishes by a preponderance of the evidence that Kim discloses the "operation indicator" limitation.

2) transparently

Petitioner relies on Kim's disclosure of context recognition unit 120 comparing sensor data with previously stored pattern data and continuously detecting a change in the user's context, such as whether the user is in the driver's seat. Pet. 25–26 (citing Ex. 1005 ¶¶ 42–44);*see also* Ex. 1003 ¶¶ 88–89. Petitioner argues Kim's user interface unit 195 supports interaction with a user and includes a visual output device, an audible output device, a keypad, and a touch pad. *Id*. at 70–71 (citing Ex. 1005 ¶ 51; Ex. 1003 ¶ 248).

Patent Owner argues, based on its proposed construction of "transparently," that Kim does not disclose "monitoring at least one operation indicator transparently to the individual" because it does not monitor without requiring user interaction. PO Resp. 61–62. Patent Owner further argues Petitioner concedes that Kim's monitoring process requires user interaction, and instead relies on Kim's disclosure of determining whether a user is the passenger or driver of a vehicle, based on whether the device is mounted. *Id.* (citing Pet. 70–71; Ex. 1005 ¶¶ 73–74, 79; Ex. 2001 ¶ 126).

Petitioner responds that Kim discloses monitoring without user interaction, as Patent Owner's construction requires, and Kim does not require that "a device is mounted to determine the user is a driver," as Patent

Owner argues. Pet. Reply 26 (citing PO Resp. 61–62; Ex. 1005 ¶ 79). Petitioner asserts "Kim discloses that its device also monitors when 'the user is directly carrying the terminal 200 on their body or in a bag'" (*id.* (quoting Ex. 1005 ¶ 79)), and thus discloses "monitoring … transparently to the individual" even under Patent Owner's construction. *Id.* (citing PO Resp. 24). Petitioner further argues claim 5 does not require determining whether a user is a driver, or that the "determining" step be performed transparently to a user. *Id.*

We find that Petitioner establishes by a preponderance of the evidence that Kim discloses "monitoring … transparently to the individual." Petitioner shows, with supporting testimony from Dr. Michalson, that Kim detects changes in a user's context via its context recognition unit and sensor unit, and monitors that information without user input or observation. *See* Ex. 1003 ¶¶ 88–89.

To the extent Patent Owner's construction would require *performing* an action transparently, it is not supported by the language of claim 5, which only recites "transparently" in the monitoring step. Also, we note that Patent Owner's proposed construction of "transparently" as "without requiring user interaction" does not prohibit user interaction with a device, outside of the monitoring step. *See* PO Sur-reply 8 ("under the invention of the '174 Patent, the monitoring process functions properly regardless of where the device is positioned and without interaction from the user."). For example, user interaction to position the device prior to the monitoring step would not preclude "transparently" (without user interaction) monitoring an operation indicator. Accordingly, we do not read the "without requiring user interaction" construction as precluding user interaction with the device to

prepare it for transparent monitoring (e.g., powering the device on and bringing it inside the vehicle in a proper position to monitor). Based on the foregoing, we determine that "transparently" is only a requirement of the monitoring step of claim 5, and thus claim 5 does not require that powering on the device or mounting it in the vehicle be transparent to the individual. Thus, we disagree with Patent Owner that Kim's method of determining if a user has mounted the device in the vehicle does not satisfy the "monitoring … transparently" limitation.

We also disagree with Patent Owner's assertion that Kim's method requires a user to interact with the device (by mounting it) in order for the device to sense vehicle vibrations and determine if the user is a passenger or a driver, and therefore Kim's method of monitoring is not transparent. *See* PO Resp. 61–62 (citing Ex. 1005 ¶ 73; Ex. 2001 ¶ 126). The claim limitation, however, merely requires "monitoring at least one operation indicator transparently to the individual" and does not specify the type of operation indicator monitored. Kim also discloses monitoring when the user is inside the car and carrying the device in a bag, which is a monitoring step that can be performed without user interaction.

Accordingly, we find that Petitioner establishes by a preponderance of the evidence that Kim discloses the "monitoring … transparently" limitation.

3) vehicle independent state

Petitioner relies on its proposed construction of "vehicle independent state" (which we have adopted) in arguing that Kim discloses "determining … based on the…predetermined criteria … … one or more vehicle independent states." Pet. 73–76. Petitioner asserts Kim's Figures 1, 2, and 5 depict a context awareness-based mobile service that recognizes a user is in

a vehicle by context recognition unit 120 comparing data from sensor unit 110 to previously stored pattern data to estimate current context of the user. *Id.* at 74–76 (citing Ex. 1005 Figs. 1, 2, 5, ¶¶ 33, 64; Ex.1003 ¶¶ 258–259). Petitioner relies on the following example from Kim as disclosing the use of specific vehicle-independent information:

> [W]hen the vehicle 200 stops, the user carries the terminal 100 and comes out of the vehicle 200 and is located outdoors, this context is recognized by the terminal 100 and it switches to an outdoor service mode to provide an outdoor service to the user.

Id. at 76 (citing Ex. 1005 ¶ 34).

Patent Owner argues Kim does not disclose "determining … based on the predetermined criteria … one or more vehicle independent states" because under Patent Owner's proposed claim construction, a vehicle independent state must be determined while the device is in the vehicle, and "[t]his never occurs in Kim." PO Resp. 63. Patent Owner argues Petitioner's reliance on Kim's disclosure of using a portable device outside a vehicle does not meet the requirement of determining a vehicle independent state while inside the vehicle. *Id.* (citing Ex. 1005 ¶ 34; Ex. 2001 ¶ 130).

As explained in II.B.5 *supra*, we do not adopt Patent Owner's construction of the "vehicle independent state" limitation that would require determining a vehicle independent state to occur while the device is inside a vehicle. Because Patent Owner's argument is based on a claim construction that we have not adopted, we instead agree with Petitioner that Kim discloses "determining … based on the predetermined criteria … one or more vehicle independent states." Accordingly, we find that Petitioner establishes by a preponderance of the evidence that Kim discloses this limitation of claim 5.

H. Alleged Anticipation Based on Schwartz 2010

Under this Ground, Petitioner asserts that claim 5 is anticipated by Schwartz. Our original Final Written Decision's conclusion as to claim 5 was affirmed, and the Federal Circuit Remand instructs our analysis of only claims 3 and 4. Thus, this Ground is not at issue.

For the reasons discussed above, Petitioner has shown that claims 3–5 of the '174 patent are unpatentable, by a preponderance of the evidence, but has not shown that claims 1 and 2 are unpatentable. We have, thus, addressed all of the challenged claims. *See* 35 U.S.C. § 318(a) (requiring the Board to "issue a final written decision with respect to the patentability of any patent claim challenged by the petitioner and any new claim added under section 316(d)"); *see also SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding that a petitioner "is entitled to a final written decision addressing all of the claims it has challenged"). Accordingly, we need not and do not decide whether Petitioner has shown by a preponderance of the evidence that claim 5 is anticipated by Schwartz 2010. *Cf. In re Gleave*, 560 F.3d at 1338.

I. Grant of Patent Owner's Motion for Authorization to Submit Supplemental Expert Declaration

By separate Order (Paper 52), for reasons explained therein, we grant Patent Owner's motion to submit the supplemental expert declaration in the record (Paper 44).

III. CONCLUSION

Petitioner has shown, by a preponderance of the evidence, that claims 3–5 are unpatentable,[12] but has not shown that claims 1 and 2 are unpatentable, as summarized below:

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

Outcome of Decision on Federal Circuit Remand:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
3, 4	103	Kleppner	3, 4	
3, 4	103	Abramson, Kleppner	3, 4	
Overall Outcome			3, 4	

Final Outcome of Decision on Federal Circuit Remand:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–4	103	Kleppner	3, 4	1, 2
1, 2	103	Johnson, Kleppner		1, 2
3, 4	103	Abramson, Kleppner	3, 4	
5	102[13]	Schwartz 2010		
5	102	Kim	5	
Overall Outcome			3–5	1, 2

[13] As explained in the previous section, we do not reach the § 102 ground based on Schwartz 2010, because Petitioner has shown that Kim anticipates challenged claim 5.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 3–5 of the ’174 patent are held to be unpatentable, but that claims 1 and 2 of the ’174 patent have not been proven to be unpatentable; and

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

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ALLSTATE INSURANCE COMPANY,
Petitioner,

v.

ATOS, LLC,
Patent Owner.

IPR2021-01449
Patent 9,846,174 B2

FLAX, *Administrative Patent Judge*, concurring.

I concur with the outcome of this Final Written Decision on Remand. In particular, I agree with the Panel's analysis regarding the ordinary and customary meaning of the claim term "movement vector."

PETITIONER:

Michael D. Hatcher
Nathanial C. Love
SIDLEY AUSTIN LLP
mhatcher@sidley.com
nlove@sidley.com

PATENT OWNER:

Reginald J. Hill
Nicole Keenan
Adam Unikowsky
JENNER & BLOCK LLP
rhill@jenner.com
nkeenan@jenner.com
aunikowsky@jenner.com