

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

METAPLATFORMS, INC.,
Petitioner,

v.

THALES VISIONIX, INC.,
Patent Owner.

IPR2022-01305
Patent 6,922,632 B2

Before WILLIAM V. SAINDON, HYUN J. JUNG, and
JASON W. MELVIN, *Administrative Patent Judges*.

JUNG, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background and Summary

Meta Platforms, Inc. (“Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting institution of an *inter partes* review of claims 30–36, 44, 45, 47–55, and 57–61 of U.S. Patent No. 6,922,632 B2 (Ex. 1001, “the ’632 patent”). Thales Visionix, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 9 (“Prelim. Resp.”). With our authorization, the parties filed additional briefs directed solely to the issue of our discretion under 35 U.S.C. § 314(a). Papers 10, 11.

Under 35 U.S.C. § 314, an *inter partes* review may not be instituted “unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” Upon consideration of the Petition and for the reasons explained below, we determine that Petitioner has shown a reasonable likelihood of prevailing with respect to at least one of the challenged claims.

Thus, we institute an *inter partes* review of claims 30–36, 44, 45, 47–55, and 57–61 of the ’632 patent on all presented challenges. *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018).

B. Real Parties in Interest

Petitioner identifies Meta Platforms, Inc. and Meta Platforms Technologies, LLC as real parties in interest. Pet. 1. Patent Owner identifies Thales Visionix, Inc. and Gentex Corporation as real parties in interest. Paper 4, 1.

C. Related Matters

The parties identify *Gentex Corp. v. Meta Platforms, Inc.*, 4:22-cv-03892 (N.D. Cal.) as a related matter.¹ Pet. 1–2; Paper 4, 1. Petitioner notes that the related litigation was transferred from the Western District of Texas. Pet. 1–2. Patent Owner additionally identifies as related matters IPR2022-01304 that also challenges the ’632 patent and IPR2022-01308. Paper 4, 1–2.

D. The ’632 Patent (Ex. 1001)

The ’632 patent issued on July 26, 2005 from an application filed on August 11, 2003 and claims priority to a provisional application filed on August 9, 2002. Ex. 1001, codes (22), (45), (60). The ’632 patent “relates to tracking, navigation, pose estimation, localization, auto-calibration, scene modeling, structure-from-motion and/or map-building based on sensor inputs.” *Id.* at 1:12–15. Reproduced below is Figure 1 of the ’632 patent.

¹ The case was originally filed in the U.S. District Court for the Western District of Texas (No. 6:21-cv-00755-ADA) and was subsequently transferred to the U.S. District Court for the Northern District of California. Pet. 2. The parties incorrectly identify the case number in the Northern District of California as “5:22-cv-03892.” *Compare* Pet. 2; Paper 4 (Patent Owner’s Mandatory Notices), 1, *with* Ex. 2002 (Joint Order Regarding Claim Construction and Discovery).

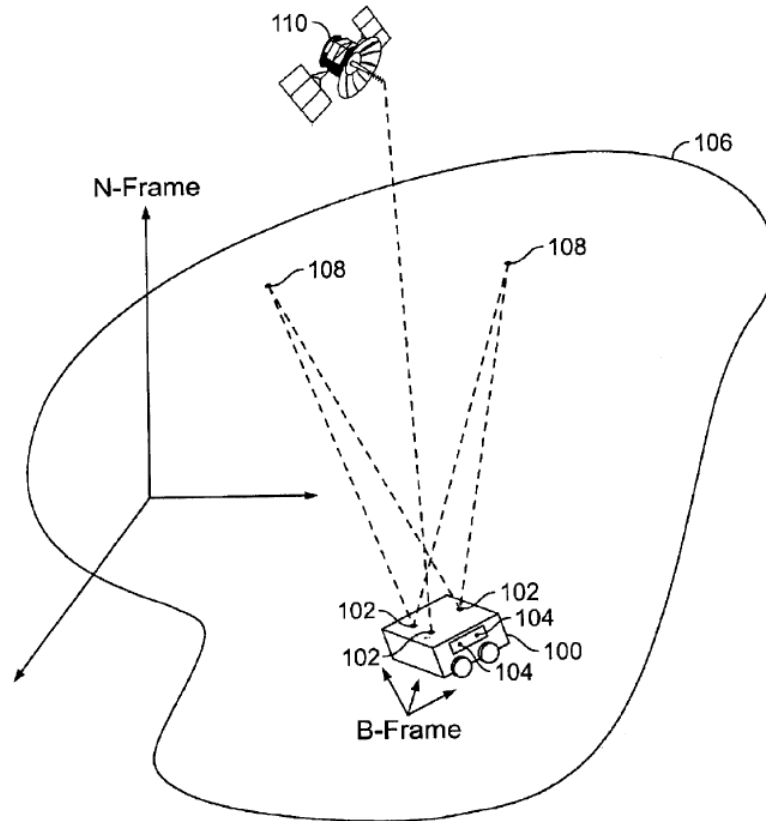


FIG. 1

Figure 1 “shows a vehicle navigating an environment.” Ex. 1001, 11:48. Navigation system 90 (shown in Figure 2 reproduced below) tracks vehicle 100 in environment 106, in particular “the position and the orientation (together referred to as the 6-dimensional ‘pose’) of vehicle 100 based on both inertial measurements as well as sensor measurements between sensing devices or targets in the vehicle 100 and sensing devices or targets that are fixed in the environment 106.” *Id.* at 12:3–4, 12:11–16.

Sensors and targets fixed to vehicle 100 or environment 106 are collectively referred to as pose sensing elements (“PSE”). Ex. 1001, 13:6–8. The ’632 patent states that “[f]or an ‘inside-out’ measurement, the sensor is attached to the vehicle and the target is fixed in the environment,” and “[f]or an ‘outside-in’ measurement, a sensor fixed in the environment observes a

target fixed to the moving vehicle.” *Id.* at 14:47–51. Reproduced below is Figure 2 of the ’632 patent.

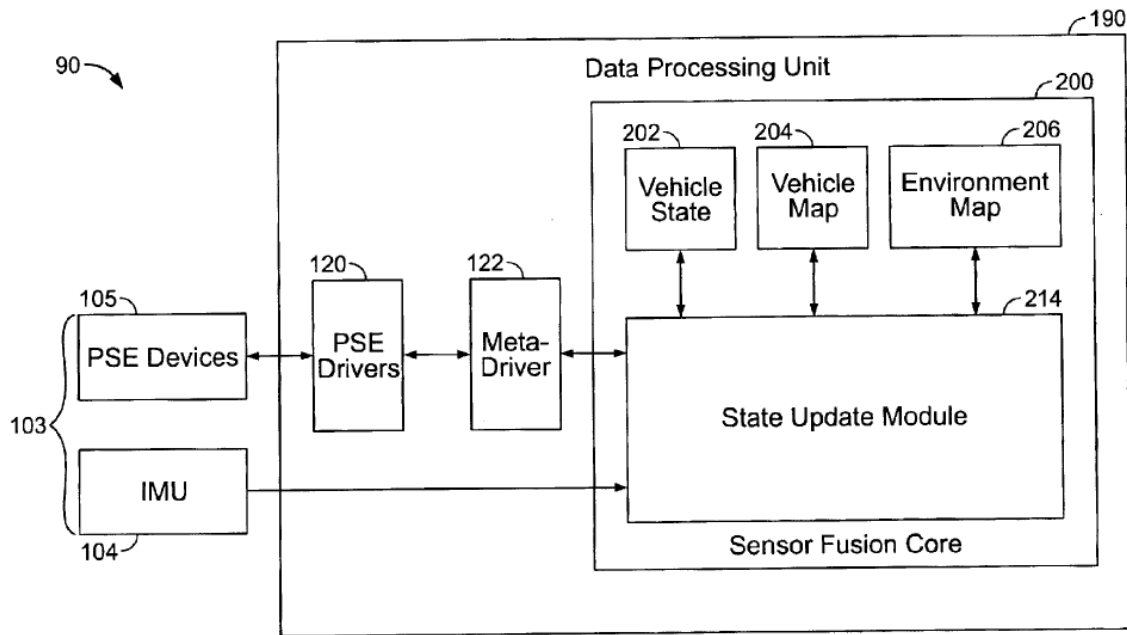


FIG. 2

Figure 2 is a block diagram of a navigation system. Ex. 1001, 11:49. Navigation system 90 includes sensors 103 and data processing unit 190. *Id.* at 12:5–7. Sensors 103 include PSE devices 105 and inertial measurement unit (“IMU”) 104. *Id.* at 12:45–48.

According to the ’632 patent, “a wide variety of sensors and targets may be used” because “[n]avigation system 90 is modularized and configurable such that different sensors and targets can be selected for a particular vehicle without necessarily having to re-implement and re-test the implementation of the navigation system.” Ex. 1001, 13:32–37. The ’632 patent “provides a ‘plug and track’ capability in which sensors and targets and their associated software drivers can be ‘plugged’ into the navigation system 90.” *Id.* at 13:37–40.

“[S]ensor specific computations are isolated in PSE drivers 120” that “are software modules,” and “meta-driver 122 provides an interface between the PSE drivers 120 and a sensor fusion core 200, which does not need to include sensor-specific aspects.” Ex. 1001, 16:40–44, 16:46. “By dividing data processing unit 190 into portions specific to PSE devices 105 and a portion specific to updating the states of the navigation system 90, the navigation system can be easily reconfigured.” *Id.* at 17:29–32. Sensor fusion core 200 “processes information from sensors 103” that updates estimates of vehicle location and orientation. *Id.* at 16:57–58. Sensor fusion core 200 includes state update module 214 that has measurement management unit (“MMU”) 304. *Id.* at 16:59, 17:40–44, 18:24–25, Figs. 2, 3.

“When system 90 powers up, it starts in initialization mode, which includes the enumeration and self-configuration procedures.” Ex. 1001, 22:54–56. MMU 304 requests meta driver 122 to “enumerate the sensing hardware,” and meta driver 122 then loads available PSE drivers and requests each PSE driver 120 enumerate PSE devices 105 available to navigation system 90. *Id.* at 18:39–43, 18:48–49; *see also id.* at 22:15–36 (describing the enumeration process). Meta driver 122 also “receives the configuration information from PSE drivers 120.” *Id.* at 18:59–60. “By using meta-driver 122 to enumerate the PSEs available upon power-up of navigation system 90, the navigation system is able to automatically reconfigure itself.” *Id.* at 19:1–3.

“Once a valid system configuration has been achieved and stored in the requisite configuration files,” “the system moves into acquisition mode . . . to find out the approximate location or pose of the vehicle.” Ex. 1001, 22:57–61. “This initial pose estimate allows the system 90 to enter the

tracking update loop, which involves a recursive estimation filter that uses an approximate initial guess of states.” *Id.* at 22:62–64. A “difference between expected measurement based on the estimated pose . . . and the actual sensor measurement . . . is referred to as the ‘innovation’ in the measurement.” *Id.* at 15:48–51.

“In tracking mode, MMU 304 communicates with meta-driver 12[2] to determine which PSE pairs (including target and sensor) are available to make measurements during the next measurement cycle,” and “selects a pair of PSEs from among the pairs of PSEs that are available to make measurements.” Ex. 1001, 19:29–34. The selection is “based on an ‘information gain’ that represents the utility (or usefulness) of a measurement by the pair of PSEs to navigation system 90.” *Id.* at 19:34–37.

E. Illustrative Claim

The ’632 patent includes 69 claims, of which Petitioner challenges claims 30–36, 44, 45, 47–55, and 57–61. Of the challenged claims, claims 30, 33, 44, and 47 are independent, and reproduced below is claim 30.

30. A sensor module comprising:
a sensor interface for communicating with a measurement sensor;
a communication interface for communication with an estimation system;
wherein the sensor module is configured to
receive information related to an expected sensor measurement over the communication interface,
receive a measurement signal over the sensor interface,
provide measurement information based on the measurement signal over the communication interface.

Ex. 1001, 48:7–17.

F. Asserted Prior Art and Proffered Testimonial Evidence

Petitioner identifies the following references as prior art in the asserted grounds of unpatentability:

Name	Reference	Exhibit
Harris	US 5,307,289, issued Apr. 26, 1994	1011
Horton	US 5,615,132, issued Mar. 25, 1997	1010
Welch Thesis	Gregory F. Welch, SCAAT: Incremental Tracking with Incomplete Information (Oct. 1996).	1009
Welch 1997	Greg Welch & Gary Bishop, SCAAT: Incremental Tracking with Incomplete Information (1997).	1008
Welch 2001	Greg Welch et al., <i>High-Performance Wide-Area Optical Tracking</i> , PRESENCE TELEOPERATORS AND VIRTUAL ENVIRONMENTS, Feb. 2001 at 1.	1007

Petitioner contends that the above-listed references are prior art under §§ 102(a) and (b).² Pet. 4–5. Petitioner also provides a Declaration of Dr. Ulrich Neumann. Ex. 1005.³

² The relevant sections of the Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284 (Sept. 16, 2011), took effect on March 16, 2013. Because the ’632 patent issued from an application filed before that date, our citations to 35 U.S.C. §§ 102 and 103 in this Decision are to their pre-AIA versions. *See also* Pet. 4 n.1 (“Based on the claimed priority date of the ’632 Patent, Pre-AIA versions of § 102(a) and § 103 apply.”).

³ Petitioner also includes several declarations directed toward the public availability of several references. *See, e.g.*, Exs. 1018–1021, 1027–1029.

G. Asserted Grounds

Petitioner asserts that claims 30–36, 44, 45, 47–55, and 57–61 are unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
30–36, 44, 45, 47–49, 51–53, 59–61	103(a)	Welch 2001, Welch 1997
50	103(a)	Welch 2001, Welch 1997, Welch Thesis
54, 55, 57, 58	103(a)	Welch 2001, Harris
30–33, 47, 50–53, 59–61	103(a)	Horton
34–36	103(a)	Horton, Welch 1997
54, 55, 57, 58	103(a)	Horton, Harris

Pet. 5.

II. 35 U.S.C. § 314(a)

As noted above in Section I.C., the parties identify a related matter in the U.S. district court for the District of Northern California. Pet. 1–2; Paper 4, 1.

Petitioner argues that most of the factors of *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”) weigh against exercising our discretion under § 314(a) to deny the Petition. Pet. 7–9. According to Petitioner, only factors 1 and 4 are neutral. *Id.* at 8, 9. Patent Owner responds that trial in the related litigation will take place in late January 2024 before a Final Written Decision is expected in this proceeding. Prelim. Resp. 63–64. Patent Owner also argues that factors 4–6 weigh in favor of discretionary denial. *Id.* at 64–65. With our authorization, the parties filed reply arguments that elaborate on the arguments summarized above. Papers 10, 11.

Fintiv instructs us to consider whether to deny institution in certain circumstances when there is parallel district court litigation, upon consideration of six factors:

1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
2. proximity of the court's trial date to the Board's projected statutory deadline for a final written decision;
3. investment in the parallel proceeding by the court and the parties;
4. overlap between issues raised in the petition and in the parallel proceeding;
5. whether the petitioner and the defendant in the parallel proceeding are the same party; and
6. other circumstances that impact the Board's exercise of discretion, including the merits.

Fintiv, Paper 11 at 6.

Our analysis of *Fintiv* is guided by the USPTO Director's Memorandum issued on June 21, 2022, titled "Interim Procedure for Discretionary Denials in AIA Post Grant Proceedings with Parallel District Court Litigation" ("Director's Memo"). We turn to the *Fintiv* factors.

1. Factor 1: Stay

Neither party has moved for a stay of the district court proceeding. Pet. 8; Paper 9, 2; Paper 10, 5. This factor is, thus, neutral.

2. Factor 2: Proximity to Trial Date

The parallel litigation began in the U.S. District Court for the Western District of Texas, but was transferred to the U.S. District Court for the Northern District of California. Pet. 8; Prelim. Resp. 63. No trial date has been set. Pet. 8. Patent Owner argues that we should deny institution based

on the expected trial date using the median time to trial from when the case was filed in the Western District of Texas. *See, e.g.*, Prelim. Resp. 64; Paper 11, 2.

Fintiv factor 2 discusses consideration of a *trial date*. The Director’s Memo states that it may be useful to compare a trial date with evidence of a median time to trial. Director’s Memo 8. The purpose of doing so is in order to ascertain the likelihood of the scheduled trial date actually occurring on or around that date. *Id.* at 8 (“Stakeholders correctly noted that scheduled trial dates are unreliable and often change[,]” and a “scheduled trial date . . . is not by itself a good indicator of [when] the district court trial will occur.”). The Director’s Memo does not state that median time-to-trial statistics are themselves a trial date, or otherwise replace consideration of a trial date under *Fintiv* factor 2. And, in the circumstances here, where the case was transferred from the Western District of Texas, the usefulness of the median time to trial statistics is less clear. Ultimately, though, we will not speculate on when a trial may be scheduled. Accordingly, factor 2 favors not exercising our discretion to deny institution.

3. *Factor 3: Investment in Parallel Proceeding*

Patent Owner argues that “[t]he parties have fully briefed claim construction and exchanged infringement and invalidity contentions, and are almost eight months into general fact discovery.” Prelim. Resp. 64. Petitioner argues that “the most burdensome parts of the case still remain,” for example fact discovery does not close for several months, and expert discovery has yet to begin. Paper 10, 3. Petitioner also notes that there have not been any claim construction rulings. *Id.* Patent Owner responds that “Petitioner has proposed that all document production be substantially complete by March 16, 2023.” Paper 11, 4 (citing Ex. 2003, 1).

We determine that factor 3 does not favor discretionary denial. Although there has been work completed, as Petitioner points out, “the most burdensome parts of the case still remain.” Paper 10, 3; *see also* Ex. 1031 (Case Management and Pretrial Order).

4. *Factor 4: Overlap with Parallel Proceeding*

Petitioner offers to file a *Sand Revolution* type of stipulation, indicating that it will not pursue the grounds raised in this proceeding in the parallel litigation if we institute trial. Paper 10, 3–4; *Sand Revolution II, LLC v. Cont’l Intermodal Grp. Trucking LLC*, No. IPR2019-01393, Paper 24 at 11–12 (PTAB June 16, 2020) (informative) (finding that a stipulation not to pursue the same grounds in the parallel litigation “mitigates to some degree the concerns of duplicative efforts”). Patent Owner argues that such a narrow stipulation does not mitigate the concerns of overlap. Paper 11, 4–5.

We are not aware of any precedent that *Sand Revolution* type stipulations are no longer valid or not entitled to weight in the *Fintiv* analysis. We recognize that *Sand Revolution* stipulations are narrower in scope than *Sotera* type stipulations, and perhaps may require a different result in a case with different facts. *See Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 18–19 (PTAB Dec. 1, 2020) (precedential as to § II.A) (finding that a broad stipulation not to pursue any ground raised or that could have been reasonably raised in the parallel litigation weighs strongly toward institution). Here, Petitioner’s stipulation still eliminates specific overlap with the parallel proceeding. As in *Sand Revolution*, we weigh this factor as marginally favoring not exercising our discretion to deny institution. *Sand Revolution*, Paper 24 at 12.

5. *Factor 5: Whether Petitioner and Defendant are the Same Party*

“If a petitioner is unrelated to a defendant in an earlier court proceeding, the Board has weighed this fact against exercising discretion to deny institution” *Fintiv*, Paper 11 at 13. Petitioner is also a defendant in the related district court litigation. *See* Pet. 2; Prelim. Resp. 64. Thus, this factor weighs marginally in favor of exercising our discretion to deny institution. *Sotera*, Paper 12 at 19.

6. *Factor 6: Merits and Other Considerations*

Patent Owner argues that Petitioner does not make out a compelling case on the merits. Prelim. Resp. 49. As specified in the Director’s Memo, “compelling, meritorious challenges will be allowed to proceed at the PTAB even where district court litigation is proceeding in parallel.” Director’s Memo 4. Accordingly, the Director’s Memo states that the *Fintiv* analysis will not lead to discretionary denial if it can be established that a case presents compelling merits. *Id.* at 4–5. But, the Director’s Memo does not require a Petitioner to establish compelling merits to avoid discretionary denial.

Additionally, the Director recently clarified the Interim Procedure, stating that “[t]he Board should first assess *Fintiv* factors 1–5; if that analysis supports discretionary denial, the Board should engage the compelling merits question.” *CommScope Techs. LLC v. Dali Wireless, Inc.*, IPR2022-01242, Paper 23 at 6 (PTAB Feb. 27, 2023) (precedential). Here, we determine that, on balance, *Fintiv* factors 1–5 do not favor exercising our discretion to deny institution and, therefore, there is no need to determine whether the Petition establishes compelling merits.

7. *Conclusion on Fintiv Factors*

Based on a holistic analysis of the *Fintiv* factors taking into consideration “whether efficiency and integrity of the system are best served by denying or instituting review” (*Fintiv*, Paper 11 at 6), we decline to exercise our discretion under 35 U.S.C. § 314(a) to deny institution of *inter partes* review.

III. ANALYSIS

A. *Legal Standards*

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent [claim] it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016). This burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). The Board may authorize an *inter partes* review if we determine that the information presented in the Petition shows that there is a reasonable likelihood that Petitioner will prevail with respect to at least one of the claims challenged in the petition. 35 U.S.C. § 314(a).

Petitioner contends that the challenged claims of the ’632 patent are unpatentable under § 103. Pet. 3. A claim is unpatentable under § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art;

(3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also “determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of elements produces a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

B. Level of Ordinary Skill in the Art

Petitioner argues that one of ordinary skill in the art “would have had a Bachelor’s degree in Computer Science, or an equivalent field, and three to five years of experience working with computer implemented tracking systems.” Pet. 13 (citing Ex. 1005 ¶ 37). Petitioner also argues that “[a]dditional education might compensate for less experience, and vice-versa.” *Id.* (citing Ex. 1005 ¶ 37).

“For purposes of this preliminary response only, Patent Owner accepts the Petition’s proposed definition of a person of ordinary skill in the art.” Prelim. Resp. 10 (citing Pet. 13). “However, for any other purpose, Patent Owner disagrees with Petitioner that such [a person of ordinary skill in the art] should be limited to a maximum of five years’ experience and reserves the right to offer an alternative definition based on expert evidence.” *Id.* at 10–11.

Based on the preliminary record, we adopt Petitioner’s asserted level of ordinary skill only to determine whether there is a reasonable likelihood that Petitioner would prevail with respect to at least one of the claims challenged in the Petition.

C. Claim Construction

In an *inter partes* review, the claims are construed

using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

37 C.F.R. § 42.100(b) (2021); *see Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc).

Petitioner argues that “no terms need construction because the claims read on the prior art under any construction consistent with *Phillips*.”

Pet. 13–14. Patent Owner does not propose expressly any interpretation for any claim term. *See generally* Prelim. Resp.

At this preliminary stage, because determining whether Petitioner shows a reasonable likelihood of prevailing does not depend on a particular interpretation for any claim term, we determine that no claim term requires express interpretation. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those 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)).

D. Asserted Obviousness Based on Welch 2001 and Welch 1997

1. Welch 2001 (Ex. 1007)

Welch 2001 is an article titled “High-Performance Wide-Area Optical Tracking” and presents “a complete description of our most recent electro-

optical system, the HiBall Tracking System.” Ex. 1007, 1. Reproduced below is Figure 6 of Welch 2001.

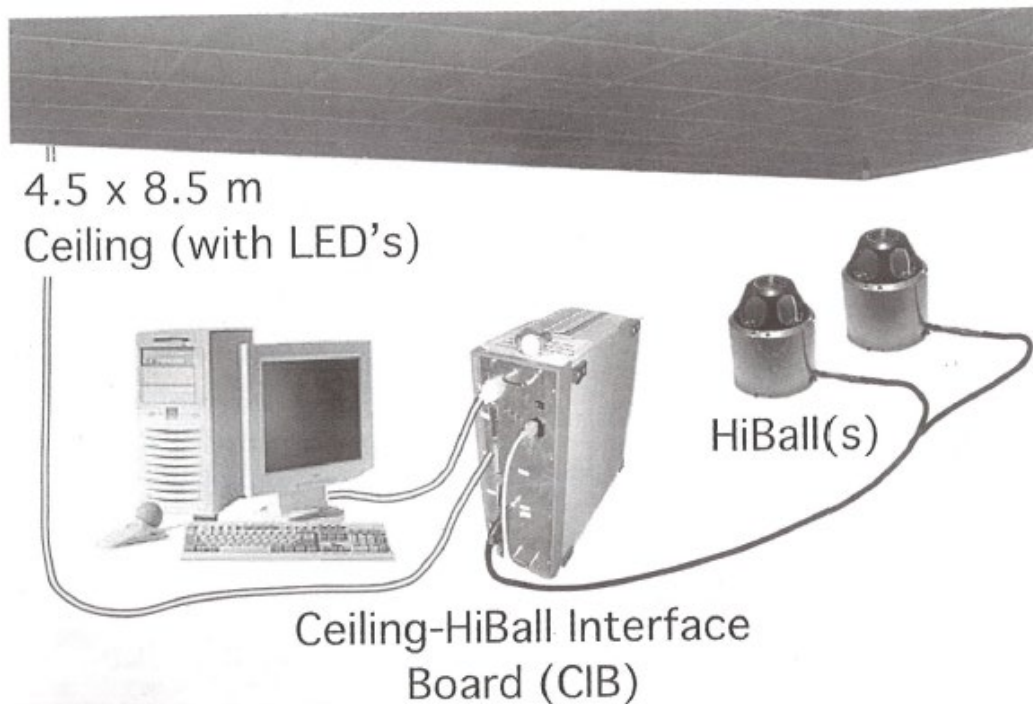


Figure 6.

Figure 6 shows that the “HiBall Tracking System consists of three main components.” Ex. 1007, 5. “An outward-looking sensing unit” called the HiBall “is fixed to each user to be tracked” and “observes a subsystem of fixed-location infrared LEDs” called the Ceiling. *Id.*; *see also id.* at 4 (explaining that the system uses “an *inside-looking-out* configuration, in which the optical sensors are on the (moving) user and the landmarks (for instance, the LEDs) are fixed in the laboratory,” and a “corresponding *outside-looking-in* alternative would be to place the landmarks on the user and to fix the optical sensors in the laboratory”), Fig. 4 (showing the HiBall unit and the unit on a person), Fig. 5 (depicting the outside-looking-in and inside-looking-out configurations).

“Communication and synchronization between the host computer and these subsystems is coordinated by the *Ceiling-HiBall Interface Board* (CIB).” Ex. 1007, 5–6. “Each HiBall observes LEDs through multiple sensor-lens views that are distributed over a large solid angle.” *Id.* at 6. “LEDs are sequentially flashed (one at a time) such that they are seen via a diverse set of views for each HiBall,” and “[i]nitial acquisition is performed using a brute-force search through LED space, but, once initial lock is made, the selection of LEDs to flash is tailored to the views of the active HiBall units.” *Id.* “Pose estimates are maintained using a Kalman-filter-based prediction-correction approach known as *single-constraint-at-a-time* (SCAAT) tracking” that “has been extended to provide self-calibration of the ceiling, concurrent with HiBall tracking.” *Id.*

2. *Welch 1997 (Ex. 1008)*

Welch 1997 is a paper titled “SCAAT: Incremental Tracking with Incomplete Information.” Ex. 1008, 1. It “present[s] a promising new mathematical method for tracking a user's pose (position and orientation)” that is referred to as “single-constraint-at-a-time or SCAAT tracking.” *Id.* at Abstr.

3. *Independent Claim 30*

Petitioner argues that Welch 2001 teaches “[a] sensor module” because it describes the CIB paired with HiBall sensors. Pet. 17–18 (citing Ex. 1005 ¶¶ 232–233; Ex. 1007, 9, Fig. 6). Petitioner also argues that Welch 2001 teaches “a sensor interface for communicating with a measurement sensor” because the CIB “has two tether interfaces that can communicate with up to four daisy-chained HiBall units” and the “HiBall units are measurement sensors.” *Id.* at 18 (citing Ex. 1005 ¶¶ 234–235; Ex. 1007, 9, 10).

For “a communication interface for communication with an estimation system,” Petitioner argues that Welch 2001 teaches that the CIB has an “IEEE1284C extended parallel port” for communicating with a PC, the asserted estimation system. Pet. 19 (citing Ex. 1005 ¶¶ 239–237; Ex. 1007, 9). Petitioner also argues that the ’632 patent’s description of an estimation subsystem supports its position. *Id.* (citing Ex. 1001, 2:35–46, 4:11–20; Ex. 1007, 6; Ex. 1008 § 3.1.2).

Regarding “wherein the sensor module is configured to receive information related to an expected sensor measurement over the communication interface,” Petitioner contends that Welch 2001 teaches that at each estimation cycle, a particular sensor and LED are selected, and the CIB causes the selected LED to flash to make a single measurement. Pet. 19 (citing Ex. 1005 ¶¶ 238–239; Ex. 1007, 9, 10, 13). Petitioner also contends that the measurement is compared to a predicted measurement, and that one of ordinary skill in the art would have understood that the predicted measurement would be the recited “expected sensor measurement.” *Id.* at 19–20 (citing Ex. 1005 ¶ 238; Ex. 1007, 12–13). According to Petitioner, the calculation for the “expected sensor measurement” “is performed by the computer within the system, and then is provided to the sensor subsystem when it is compared against the actual measurement from the LED and HiBall sensor.” *Id.* at 20 (citing Ex. 1005 ¶ 238).

For the sensor module being configured to “receive a measurement signal over the sensor interface,” Petitioner contends that Welch 2001 teaches that a HiBall sensor takes a measurement when a selected LED flashes, and that one of ordinary skill in the art “would have understood that the CIB would necessarily have to receive the measurement signal from the HiBall.” Pet. 20 (citing Ex. 1005 ¶¶ 240–241; Ex. 1007, 10, 12–13). For the

sensor module being configured to “provide measurement information based on the measurement signal over the communication interface,” Petitioner contends that one of ordinary skill in the art “would have understood that the CIB would necessarily have to provide measurement information based on the measurement signal from the HiBall to the PC over the communication interface.” Pet. 20–21 (citing Ex. 1005 ¶¶ 242–243; Ex. 1007, 10, 12–13).

On the present record, it is not clear how Welch 2001 teaches that the asserted sensor module (the CIB paired with HiBall sensors) is configured to receive information related to the asserted expected sensor measurement (the predicted measurement), as required by the wherein clause of claim 30. Pet. 19–20 (citing Ex. 1005 ¶¶ 238–239; Ex. 1007, 9, 10, 12–13). The cited portions of Welch 2001 describe how a measurement is taken and how the measurement “is used to update the filter state and covariance matrices using the Kalman gain matrix.” Ex. 1007, 9, 10, 12–13. The cited portions also state that “[t]he Ceiling-HiBall Interface Board (CIB) (figure 11) provides communication and synchronization between a host personal computer, the HiBall (section 4.1), and the ceiling (section 4.2)” and that “[o]nce a particular view and LED have been chosen in this fashion, the CIB (section 4.3) is instructed to flash the LED and take a measurement as described in section 5.2.” *Id.* at 9, 13.

None of the cited portions appear to expressly teach that the CIB and HiBalls receive information related to the predicted measurement. *See* Ex. 1007, 9, 10, 12–13. Also, Petitioner’s arguments substantially repeat the cited testimonial evidence. *Compare* Pet. 19–20, *with* Ex. 1005 ¶¶ 238–239.

Furthermore, Petitioner’s asserted motivation to combine argues that one of ordinary skill in the art “would have understood that the SCAAT calculations performed by the PC use the online configuration measurements

as inputs to estimate the HiBall's pose, and that using these measurements as inputs constitutes 'configuring the estimate system,'" and that "the SCAAT tracking approach described in Welch 2001 and Welch 1997 updates the sensor state estimate according to the accepted measurement and configuration data from the sensor subsystem." Pet. 16–17 (citing Ex. 1005 ¶¶ 56, 57). These asserted understandings for the motivation to combine do not seem to relate to the wherein clause of independent claim 30. *See id.*

Turning to the other asserted reference, Petitioner cites § 3.1.2 of Welch 1997 for the recited "communication interface." Pet. 19. The cited section of Welch 1997 describes that, when a measurement becomes available, the SCAAT algorithm cycles through steps that include predicting the measurement and computing the residual between the actual and predicted measurements. Ex. 1008 § 3.1.2. The section concludes with a statement in parenthetical that the "SCAAT filter computations" were executed "on a 200 MHz PC-compatible computer." *Id.*; *see also id.* at § 4.4 (stating that the "SCAAT algorithm [was demonstrated] with the HiBall tracker, a head-mounted display, and a real application" and that "[t]he SCAAT code runs on a 200 MHz PC-compatible computer with a custom interface board"). Welch 1997 indicates that information related to the predicted measurement is not provided to the asserted sensor module, the CIB paired with HiBall sensors.

To the extent that Petitioner is arguing that there is a connection between the predicted measurement and the instruction sent from the PC to the CIB to flash a particular LED, the relied-upon portion of Welch 2001 does not appear to support such an argument. Petitioner cites to a portion of Welch 2001 states that "[a]t each estimation cycle, the next of the 26 possible views is chosen randomly," "[o]ne of the candidate LEDs is then

chosen in a least-recently-used fashion to ensure a diversity of constraints,” and “[o]nce a particular view and LED have been chosen in this fashion, the CIB (section 4.3) is instructed to flash the LED and take a measurement.”

Ex. 1007, 13. These statements in Welch 2001 indicate that random selection and time since last measurement, not the predicted measurement, influence which LED is flashed for the next measurement “to ensure diversity of constraints” for the SCAAT algorithm. *See id.*

On the present record, the cited portions of the asserted references do not appear to support Petitioner’s argument that the asserted sensor module (the CIB paired with HiBall sensors) receives an expected or predicted sensor measurement, because the references do not appear to indicate that the predicted measurement “is provided to the sensor subsystem when it is compared against the actual measurement from the LED and HiBall sensor,” as argued by Petitioner. Pet. 20; Ex. 1008 §§ 3.1.2, 4.4.

4. Dependent Claims 31 and 32

Claims 31 and 32 depend from claim 30 and recite that “the sensor module is configured to provide information over the communication interface related to an uncertainty in the measurement information” and “the received information related to an expected sensor measurement includes a predicted pose of a sensing element relative to the measurement sensor,” respectively. Ex. 1001, 48:18–25. Petitioner’s analysis for claims 31 and 32 does not appear to resolve the potential issues we identified above with claim 30.

5. Independent Claim 33

Petitioner argues that both Welch 2001 and Welch 1997 disclose a method for tracking an object. Pet. 22 (citing Ex. 1005 ¶¶ 248–249). Petitioner also argues that Welch 2001 discloses “enumerating a set of

sensing elements available to a tracking system that includes an estimation subsystem that estimates a position or orientation of an object.” *Id.* (citing Ex. 1005 ¶¶ 250–251).

According to Petitioner, “the sensing elements include the source LEDs and the HiBall sensors,” and “[e]ach HiBall sensing unit has multiple sensing lenses.” Pet. 22–23 (citing Ex. 1007, 6, Fig. 6). Petitioner also argues that “CIB couples the LEDs and HiBalls (sensor subsystem) to the PC (estimation subsystem), and the PC estimates an object’s position or orientation.” *Id.* at 23.

For “providing parameters specific to the set of sensing elements to the tracking system to enable the estimation subsystem to be configured based on the parameters specific to the set of sensing elements,” Petitioner argues that Welch 2001 discloses the limitation because Welch 2001 uses offline and online calibrations that estimate noise by measuring signal strength. Pet. 23 (citing Ex. 1005 ¶¶ 252–253; Ex. 1007, 9–10). Petitioner, thus, argues that Welch 2001 provides calibration parameters from a HiBall sensor for configuring the estimation subsystem. *Id.*

For “generating a sequence of candidates of pairs of sensing elements selected from the set of sensing elements, the sequence based on an expected utility of a measurement associated with said elements to the estimation subsystem,” Petitioner argues that Welch 2001 discloses the limitation because Welch 2001 teaches flashing every thirteenth LED in sequence when collecting data from HiBall-LED pairs. Pet. 24 (citing Ex. 1005 ¶¶ 254–255; Ex. 1007, 13–14). Petitioner also argues that this sampling of candidate sensing elements is used to calculate the HiBall’s yaw. *Id.* (citing Ex. 1007, 14). According to Petitioner, one of ordinary skill in the art would

have understood that the measurement is “based on an expected utility of a measurement,” the yaw of the HiBall. *Id.* (citing Ex. 1005 ¶ 254).

a) Patent Owner’s Preliminary Response

Patent Owner responds that Petitioner fails to identify differences between the references and the claimed subject matter for a proper obviousness analysis. Prelim. Resp. 11. In Patent Owner’s view, Petitioner argues that Welch 2001 discloses the limitations of independent claims. *Id.* at 14–15 (citing Pet. 19–40). Patent Owner also argues that Petitioner asserts what one of ordinary skill in the art would have understood from Welch 2001. *Id.* at 15–16 (citing Pet. 19–21, 28–36). According to Patent Owner, Petitioner fails to articulate the differences between Welch 2001 and the claims, and that Petitioner conflates anticipation and obviousness because Petitioner apparently argues that Welch 2001 must necessarily include certain limitations. *Id.* at 16–17.

Petitioner does begin arguments for each limitation with “Welch 2001 discloses this limitation,” but Petitioner apparently acknowledges that Welch 2001 does not expressly teach the recitation “based on an expected utility of a measurement” because Petitioner argues one of ordinary skill in the art would have understood Welch 2001’s sampling process is conducted on a similar basis. Pet. 22–24. On the present record, this acknowledgement filled in with the understanding of an ordinarily skilled artisan identifies sufficiently a difference between Welch 2001 and claim 33.

Patent Owner also responds that Petitioner does not identify adequately which reference discloses the limitations of the independent claims. Prelim. Resp. 12. According to Patent Owner, Petitioner relies only on Welch 2001 for each limitation, only refers to Welch 1997 along with Welch 2001 for teaching the preambles of claims 33, 44, and 47, and does

not explain how Welch 1997 combined with Welch 2001 would have rendered obvious the independent claims. *Id.* at 12–14 (citing Pet. 17–21, 22–24, 27–36).

For claim 33, Petitioner makes clear that it is relying only on Welch 2001. *See* Pet. 22–24 (starting arguments for each step with “Welch 2001 discloses this limitation” and citing only to Welch 2001 and supporting testimonial evidence). As pointed out by Patent Owner, Petitioner lists Welch 1997 along Welch 2001 for the preamble, “[a] method” and refers to arguments for the preamble of claim 30. Pet. 22; Prelim. Resp. 13 n.3. Arguments for the preambles of claims 30 and 33 do not cite to any portion of Welch 1997. Pet. 17–18 (citing Ex. 1005 ¶¶ 232–233; Ex. 1007, 9, Fig. 6). Petitioner, thus, is not relying on Welch 1997 for any teachings in its arguments for the preamble and the limitations of claim 33. *See id.* at 22–24.

Based on its asserted motivation to combine, Petitioner apparently relies on Welch 1997 for additional details about Welch 2001’s SCAAT calculations and tracking approach. *See* Pet. 16–17 (arguing that one of ordinary skill in the art “would have understood that the SCAAT calculations performed by the PC use the online configuration measurements as inputs to estimate the HiBall’s pose, and that using these measurements as inputs constitutes ‘configuring the estimate system’” and “would have understood that the SCAAT tracking approach described in Welch 2001 and Welch 1997 updates the sensor state estimate according to the accepted measurement and configuration data from the sensor subsystem”). At this stage, the asserted understandings do not appear relevant to claim 33 or its challenged dependent claims 34–36. *See also id.* at 22–27 (citing only to the ’632 patent, Welch 2001, supporting testimony, and an exhibit that is not

part of the proposed combination). Based on the above, Petitioner apparently intends to rely only on Welch 2001 and supporting testimony for claim 33. *See id.* at 22–24.

Regarding Petitioner’s substantive arguments, Patent Owner responds that Petitioner fails to address “enumerating.” Prelim. Resp. 20–21. Patent Owner argues that the “enumerating functionality is a critical aspect of the invention of claims 33–36” because “it allows a ‘tracking component’ to operate with different numbers and types of sensing elements.” *Id.* at 21 (citing Ex. 1001, 11:20–22).

According to Patent Owner, Petitioner and its declarant offer no explanation of how Welch 2001 discloses enumerating a set of sensing elements and do not even use the word “enumerating.” Prelim. Resp. 21 (citing Pet. 22–23; Ex. 1005 ¶¶ 250–251). Patent Owner also argues that Petitioner does not make clear if the HiBall sensing unit or its multiple sensing lenses are the recited “sensing elements.” *Id.* (citing Pet. 22–23).

Patent Owner contends that Welch 2001 does not describe enumerating either the HiBall sensing units or their lenses. Prelim. Resp. 22. Patent Owner also contends that Welch 2001 does not indicate that the number of HiBall sensors can vary, and that there would be no reason to perform any enumeration of those sensors. *Id.* (citing Pet. 22).

Petitioner does not address expressly “enumerating a set of sensing elements available to a tracking system.” Pet. 22–23. Petitioner, however, does argue that Welch 2001 teaches multiple HiBall sensing units with multiple sensing lens. *See id.* at 22 (citing Ex. 1007, 6, Fig. 6). Petitioner appears to be arguing that, because Welch 2001 has multiple HiBall sensing units with multiple sensing lenses, there is an enumeration of available

sensing units. *See id.*; *see also id.* at 25 (arguing that “the sensing elements in the HiBall system include the HiBall sensors and source LED targets”).

At this stage, Petitioner’s implicit argument is sufficient for institution because Welch 2001 teaches estimating pose from HiBall measurements that are associated with certain views. *See, e.g.*, Ex. 1007, 7 (describing that the HiBall has “26 fields of view that are used to sense widely separated groups of LEDs in the environment”). Patent Owner’s argument regarding “enumerating” raises an issue that would benefit from developing the record further at trial, and possibly a proposed interpretation supported by record evidence that has not yet been presented.

Turning to “generating a sequence of candidates of pairs of sensing elements . . . based on an expected utility of a measurement,” Patent Owner contends that the “expected utility” refers to usefulness of a measurement in estimating pose. Prelim. Resp. 22 (citing Ex. 1001, 19:29–37, 26:20–27:12, 41:20–37). In Patent Owner’s view, Petitioner and its declarant argue in a conclusory manner that one of ordinary skill in the art would have understood Welch 2001’s sampling process is conducted based on the expected utility of a HiBall’s yaw measurement. *Id.* at 22–23 (citing Pet. 24; Ex. 1005 ¶ 254).

At this stage, Petitioner’s arguments regarding “expected utility of a measurement” are sufficient for institution. Pet. 24. Like the dispute regarding “enumerating,” the parties’ arguments present an issue, possibly a claim construction issue, that would benefit from developing the record further.

For the reasons above, on the present record, Petitioner shows a reasonable likelihood of prevailing in its challenge to claim 33.

6. *Dependent Claims 34–36*

Claim 34 depends from claim 33 and recites

further comprising selecting a pair of sensing elements from the sequence of candidates, the selected pair of sensing elements being ready to make a measurement at the time of selection of the pair or at a predefined time after the time of selection of the pair, the selected pair having highest expected utility of a measurement among the sequence of candidates.

Ex. 1001, 48:41–47.

Petitioner argues that Welch 2001 would have rendered obvious claim 34 because Welch 2001 teaches randomly selecting the next view after the estimation system makes a first estimate “in a least-recently-used fashion.” Pet. 24–25 (citing Ex. 1005 ¶¶ 256–257; Ex. 1007, 13).

According to Petitioner, one of ordinary skill in the art “would have understood that the selection of the LED paired with the HiBall view in this manner would have the ‘highest expected utility of a measurement’ among the other possible LED-view pairs because having diverse constraints has utility for generating more accurate pose measurements.” *Id.* at 25 (citing Ex. 1005 ¶ 256).

Patent Owner responds that Petitioner’s reliance on selecting a least recently used LED is not the same as selecting an LED with the highest expected utility, as required by the claim. Prelim. Resp. 23–24 (citing Pet. 25; Ex. 1005 ¶ 256).

At this stage, Petitioner’s arguments for claim 34 are sufficient for institution. Pet. 24. The dispute about “highest expected utility” presents an issue that may require a proposed claim construction from Patent Owner, and, thus, the dispute would benefit from developing the record further.

Claim 35 depends from claim 33 and recites “wherein the set of sensing elements comprises at least one sensor and at least one target, the sensor making a measurement with respect to the target.” Ex. 1001, 48:48–51. Petitioner argues that Welch 2001 teaches sensing elements including the HiBall sensors and LED targets and thus discloses the limitation of claim 35. Pet. 25–26 (citing Ex. 1001, 1:21–24; Ex. 1005 ¶¶ 258–259; Ex. 1007, 6, 13).

Claim 36 depends from claim 35 and recites “wherein the target comprises a natural feature in an environment.” Ex. 1001, 48:52–53. Petitioner contends that Welch 2001 contemplates scaling and evolving the HiBall system “to use ‘natural features’ as targets instead of ‘dense active landmarks’ like the LED ceiling described.” Pet. 26–27 (citing Ex. 1001, 1:54–59; Ex. 1005 ¶¶ 260–261; Ex. 1007, 4–5; Ex. 1014, 36). Patent Owner responds that the HiBall system of Welch 2001 did not use “natural features” as targets. Prelim. Resp. 24 (citing Pet. 26–27; Ex. 1007, 4–5).

At this stage, Petitioner’s arguments for claim 36 are sufficient for institution. Pet. 24. Patent Owner presents an issue that would benefit from developing the record at trial.

Patent Owner also responds that Petitioner fails to incorporate its arguments for the independent claims into the arguments for the dependent claims. Prelim. Resp. 18 (citing Pet. 21–22, 24–27, 30, 36–41). Petitioner’s arguments for claims 34–36, however, rely on arguments made for claim 33. Pet. 24–26. For example, Petitioner’s arguments for the recited pairs of sensing elements of dependent claim 34 build on the same asserted pairs of sensing elements of independent claim 33. *See id.* at 24–25.

Patent Owner also responds that Petitioner fails to show the obviousness of claims 34–36 for the same reasons the Petitioner fails to

show the obviousness of claim 33, from which they depend. Prelim. Resp. 23. For the reasons given above for claim 33, Petitioner sufficiently shows at this stage a reasonable likelihood of prevailing on its challenged that claim 33 would have been obvious. *See* Pet. 22–24.

In view of the above, on the present record, Petitioner’s arguments in view of Patent Owner’s responses show a reasonable likelihood of prevailing on at least one of claims 34–36.

7. Independent Claim 44

Petitioner argues that both Welch 2001 and Welch 1997 disclose “[a] method” for tracking a user’s pose by predicting changes and then correcting predicted changes with measurements. Pet. 27 (citing Ex. 1005 ¶¶ 262–263; Ex. 1008, Abstr., § 3).

For “estimating a calibration parameter of a sensing element that is either a sensor or a target, the sensing element being fixed either to an environment or to an object being tracked,” Petitioner argues that Welch 2001 discloses offline and online calibrations that estimate noise by measuring signal strength and using a Kalman filter. Pet. 28 (citing Ex. 1005 ¶¶ 264–265; Ex. 1007, 9–12). According to Petitioner, estimating the noise constitutes estimating a calibration parameter for a sensing element, the HiBall, and the HiBall is attached to a user or object being tracked. *Id.* (citing Ex. 1005 ¶ 264; Ex. 1007, 4).

For “determining whether the sensing element is the sensor or the target,” Petitioner argues that Welch 2001 would have rendered the limitation obvious because the system of Welch 2001 “inherently knows which sensing element is the sensor or the target, because in all circumstances the sensor is a camera and the target is an LED.” Pet. 28 (citing Ex. 1005 ¶¶ 266–267; Ex. 1007, 5). Petitioner also argues that “[t]he

software used with the HiBall system thus determines which element is which when it triggers an LED target to flash and then takes a measurement from the camera sensor.” *Id.* at 28–29 (citing Ex. 1005 ¶ 266; Ex. 1007, 6)

For “assigning the calibration parameter as a sensor calibration parameter when the sensing element is a sensor,” Petitioner argues that Welch 2001 would have rendered obvious the limitation because “[t]he HiBall pose is based in part on the HiBall measurement noise estimate.” Pet. 29 (citing Ex. 1005 ¶¶ 268–269; Ex. 1007, 11–12). Petitioner also argues that one of ordinary skill in the art “would have understood that the measurement noise estimate would be assigned to the HiBall sensor because it is used to estimate the sensor pose.” *Id.* (citing Ex. 1005 ¶ 268).

For “generating an innovation of a measurement of a target made by the sensing element based in part on the sensor calibration parameter,” Petitioner argues that Welch 2001 would have rendered obvious the limitation because a difference in measurement and pose estimate is used for updating and the HiBall sensor takes the measurement based on a selected LED. Pet. 29 (citing Ex. 1005 ¶¶ 270–271; Ex. 1007, 13). Petitioner also argues that the same “approach can be used to estimate the LED targets’ positions,” and that the ’632 patent explains that “innovation” is a difference between expected and actual measurements. *Id.* at 29–30 (citing Ex. 1001, 15:47–51; Ex. 1007, 13).

a) Patent Owner’s Preliminary Response

Patent Owner responds that Welch 2001 has no need to determine whether a sensing element is a sensor or a target, as required by claim 44. Prelim. Resp. 25. Patent Owner argues that Petitioner asserts in a conclusory manner that the HiBall software makes the required determination when it causes an LED to flash and the argument contradicts

Welch 2001 and Petitioner’s characterization of Welch 2001. *Id.* (citing Pet. 28). According to Patent Owner, Petitioner in other arguments indicates that “the HiBall system is hardcoded to flash LEDs (targets) for detection by HiBall units (sensors), without needing to detect which is which.” *Id.* (citing Pet. 15).

At this stage, Petitioner’s arguments for claim 44 are sufficient for institution. Pet. 27–30. Patent Owner presents a factual dispute regarding whether Welch 2001 teaches the recited determining step and whether the determining step is done by software, as argued by Petitioner, that would be better decided on a full record. Prelim. Resp. 25. As discussed above for claim 33, Patent Owner’s remaining arguments also relevant to claim 44 do not provide a reason for denying institution. *Id.* at 24–25.

Based on the record at this stage, Petitioner shows a reasonable likelihood of prevailing in its challenge to claim 44.

8. *Dependent Claim 45*

Claim 45 depends from claim 44 and recites “assigning the calibration parameter as a target calibration parameter when the sensing element is a target, and generating an innovation of a measurement of the sensing element made by a sensor based in part on the target calibration parameter.” Ex. 1001, 49:58–62.

Petitioner argues that Welch 2001 teaches that “the SCAAT algorithm continually refines LED (target) position estimates as an auto-calibration process” and a measurement from an LED-HiBall pair is compared to a *predicted measurement calculated by the CIB* using calibration parameters. Pet. 30 (citing Ex. 1005 ¶¶ 272–273; Ex. 1007, 8). Petitioner also argues that the difference between the two being used to update pose estimates. *Id.* (citing Ex. 1007, 13). Petitioner, thus, argues that the calibration parameters

of an LED would have been used to generate the recited “innovation of a measurement” for sensor pose estimate. *Id.* (citing Ex. 1005 ¶ 272).

Patent Owner responds that Petitioner fails to show that Welch 2001 and Welch 1997 would have rendered obvious claim 45 because Petitioner fails to show that the same references would have rendered obvious claim 44. Prelim. Resp. 26.

Our views on claim 45 are similar to those for claim 30, which we discussed above and also involves target or estimated values.

9. Independent Claim 47

Claim 47 recites “[a] method of using multiple sensors in a tracking system comprising,” *inter alia*, “maintaining estimates of tracking parameters in the estimation module, including repeatedly passing data based on the estimates of the tracking parameters from the estimation module to one or more of the sensor modules.” Ex. 1001, 49:66–50:23.

For the step quoted above, Petitioner argues that Welch 2001 teaches that “the SCAAT algorithm is a ‘recursive prediction-correction cycle’ that ‘continues in an ongoing fashion,’ wherein the estimate is repeatedly updated based on measurements from the LED-sensor pairs.” Pet. 34 (citing Ex. 1005 ¶ 285; Ex. 1007, 13). Petitioner also argues that “[w]hen the measurement from the LED-sensor pair is compared with the estimate calculated by the PC, the estimate data is passed through the CIB to determine which LED to select for the next measurement,” “[t]he CIB is part of the ‘sensor module’ because it performs the compute functions in connection with the head-mounted HiBall sensors,” and “[t]he CIB acts as the electronics for the HiBall, assessing the estimate data and comparing it to the actual measurements to trigger the next LED to flash for measurement by the HiBall.” *Id.* at 35 (citing Ex. 1005 ¶¶ 286; Ex. 1007, 13).

a) Patent Owner's Preliminary Response

Patent Owner responds that Petitioner's assertions are inconsistent with the disclosures of Welch 2001. Prelim. Resp. 30–31 (citing Pet. 35; Ex.1007, 13).

For similar reasons discussed above for claim 30, Petitioner does not show sufficiently that Welch 2001 teaches “maintaining estimates of tracking parameters in the estimation module, including repeatedly passing data based on the estimates of the tracking parameters from the estimation module to one or more of the sensor modules,” as required by claim 47. Petitioner argues that Welch 2001's PC teaches the “estimation module” and that the LED targets and HiBall sensors teach the “sensor modules.” Pet. 31–33 (citing Ex. 1005 ¶¶ 276–279; Ex. 1007, 6, Fig. 6; Ex. 1008 § 3.1.2)

On the present record, it is not clear that the cited portion of Welch 2001 indicates that “data based on the estimates of the tracking parameters from the estimation module” are passed to the sensor modules. Ex. 1007, 6, 13, Fig. 6. Petitioner asserts that “estimate data is passed through the CIB to determine which LED to select for the next measurement,” but as we read it, Welch 2001 appears to indicate that random selection and time since last measurement, not “estimate data,” influence which LED is flashed for the next measurement “to ensure a diversity of constraints” for the SCAAT algorithm. Ex. 1007, 13 (stating that “[a]t each estimation cycle, the next of the 26 possible views is chosen randomly,” “[o]ne of the candidate LEDs is then chosen in a least-recently-used fashion to ensure a diversity of constraints,” and “[o]nce a particular view and LED have been chosen in this fashion, the CIB (section 4.3) is instructed to flash the LED and take a measurement”).

The present record also does not support sufficiently Petitioner's assertion that the CIB "performs the compute functions in connection with the head-mounted HiBall sensors" and "assess[es] the estimate data and compar[es] it to the actual measurements to trigger the next LED to flash for measurement by the HiBall" (Pet. 35) because Welch 1997 indicates that the PC performs the comparison. Ex. 1008 § 3.1.2 ("We are able to execute the SCAAT filter computations, with the autocalibration computations discussed in the next section, in approximately 100µs on a 200 MHz PC-compatible computer."), § 4.4 ("The SCAAT code runs on a 200 MHz PC-compatible computer with a custom interface board.").

Welch 1997 also indicates that "the compute functions" and "assessing the estimate data and comparing it to the actual measurements" are done by the PC, Petitioner's asserted estimation system. *See* Ex. 1008 §§ 3.1.2, 4.4. Petitioner's declarant in discussing the very next recitation states that "Welch 2001 explains that when the measurement from the LED-sensor pair is *compared with the estimate calculated by the PC*, the sensor data is passed through the CIB so the *comparison can be performed by the PC*." Ex. 1005 ¶ 288 (citing Ex. 1007, 13) (emphases added).

Petitioner's arguments substantially repeat the cited testimonial evidence, which, for the reasons discussed above, appears to conflict with other testimony. *Compare* Pet. 34–35, with Ex. 1005 ¶¶ 285–286, 288. Petitioner's asserted motivation to combine argues what one of ordinary skill in the art would have understood and does not relate clearly to the above-discussed step of claim 47. *See* Pet. 16–17.

Claim 47 also recites "receiving from said one or more sensor modules at the estimation module data based on measurements obtained from the associated sensors, and the data passed to the sensor modules."

Ex. 1001, 50:16–19. Petitioner argues that “the sensor data is passed through the CIB so the comparison can be performed by the PC,” and that “the estimation module ‘receiv[es]’ data from the sensor measurement as well as the data from the estimation process.” Pet. 35 (citing Ex. 1005 ¶¶ 288–289; Ex. 1007, 13).

On the present record, we agree with Patent Owner that Petitioner’s argument does not appear to completely address the recitation “data passed to the sensor modules.” Prelim. Resp. 31–32 (citing Pet. 35).

10. Dependent Claims 48, 49, 51–53, and 59–61

Claims 48, 49, 51–53, and 59–61 depend directly or indirectly from claim 47. Ex. 1001, 50:24–34, 50:38–46, 50:66–51:10. Petitioner argues with citations to record evidence that Welch 2001 and Welch 1997 would have rendered obvious these claims. Pet. 36–41. Patent Owner responds that Petitioner fails to show that these claims would have been rendered obvious for the reasons presented for claim 47. Prelim. Resp. 32. Patent Owner also points out inconsistencies in the arguments for claims 59–61. Prelim. Resp. 32–36. We have already offered our views on claim 47; the other issues identified by Patent Owner would benefit from further development at trial.

E. Asserted Obviousness Based on Welch 2001, Welch 1997, and Welch Thesis

1. Welch Thesis (Ex. 1009)

The Welch Thesis is titled “SCAAT: Incremental Tracking with Incomplete Information.” Ex. 1009, 1. It describes a “new approach [referred to] as *single-constraint-at-a-time* or SCAAT tracking.” *Id.* at Abstr. It also provides “A Simple Hybrid Example” that describes “an

inertial-acoustical hybrid tracking system composed of three accelerometers, three rate gyros, and an acoustical line-of-sight system.” *Id.* at § 2.4.3.

2. *Dependent Claim 50*

Claim 50 depends from claim 47 and recites “wherein providing the estimation module includes providing a module that is configurable to use different sets of sensor modules coupled to it.” Ex. 1001, 50:35–37.

Petitioner argues that Welch 2001 and Welch 1997 do not teach using multiple sensor modules, but that the Welch Thesis explains SCAAT can be used in a hybrid system. Pet. 41 (citing Ex. 1005 ¶¶ 308–309; Ex. 1009 §§ 2.4.3, 7.7). According to Petitioner, one of ordinary skill in the art would have understood that Welch 2001’s PC could be coupled to different sets of sensor modules when implementing the SCAAT algorithm. *Id.* (citing Ex. 1005 ¶ 308). Petitioner’s analysis for claim 50 does not appear to resolve the potential issues we identified above with claim 47.

F. *Asserted Obviousness Based on Welch 2001, Welch 1997, and Harris*

1. *Harris (Ex. 1011)*

Harris “pertains to the general field of object state tracking, and more specifically to the field of spatially distributed multi-sensor object state tracking.” Ex. 1011, 1:13–16. Harris describes Smart Weapon Adjustable Aspect and Ranging Munition local nodes in fusion system architectures that can use various types of filters. *Id.* at 4:39–41, 8:67–9:28, 14:29–50, Figs. 5, 6.

2. *Dependent Claims 54, 55, 57, and 58*

Claims 54, 55, 57, and 58 ultimately depend from independent claim 47. Ex. 1001, 50:47–55, 50:60–65. These claims require the Kalman filter to be a distributed Kalman filter. *See id.*

Petitioner argues with citations to record evidence that Welch 2001, Welch 1997, and Harris teach or suggest all the limitations of claims 54, 55, 57, and 58 and that one of ordinary skill in the art would have combined these references. Pet. 42–47. Patent Owner responds that Petitioner fails to show that the asserted references would have rendered obvious these claims for the reasons asserted for claim 47, from which they depend. Prelim. Resp. 38. Petitioner’s analysis for claims 54, 55, 57, and 58 does not appear to resolve the potential issues we identified above with claim 47.

G. Asserted Obviousness Based on Horton

1. Horton (Ex. 1010)

Horton “relates to tracking systems, particularly to such systems that determine position and orientation of an object in a limited volume using accelerometers.” Ex. 1010, 1:9–11. Reproduced below is Figure 1 of Horton.

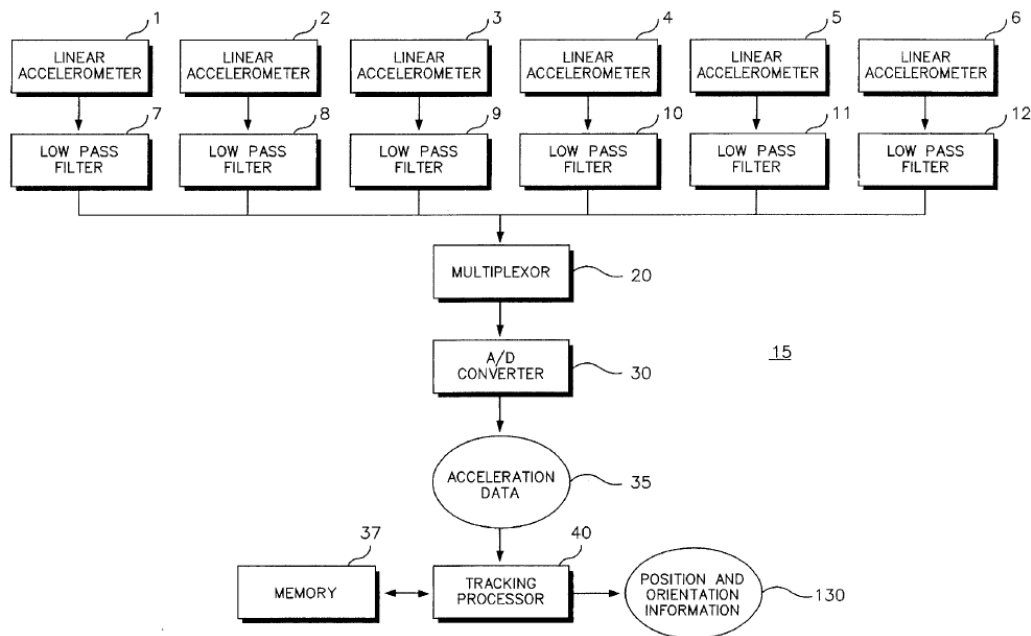


FIGURE 1

Figure 1 “is a simplified block diagram illustrating the components used in the tracking system.” Ex. 1010, 3:3–5, 3:27–28. Conventional

accelerometers 1–6 each measure acceleration in one dimension to track six degrees of freedom of an object. *Id.* at 3:28–30, 3:41–42, 3:63.

Accelerometers 1–6 are coupled to low pass filters 7–12, and their output provides, through multiplexer 20 and analog to digital converter 30, acceleration data 35 for tracking processor 40. *Id.* at 4:5–6, 4:11–15, 4:32, 4:35. Reproduced below is Figure 3 of Horton.

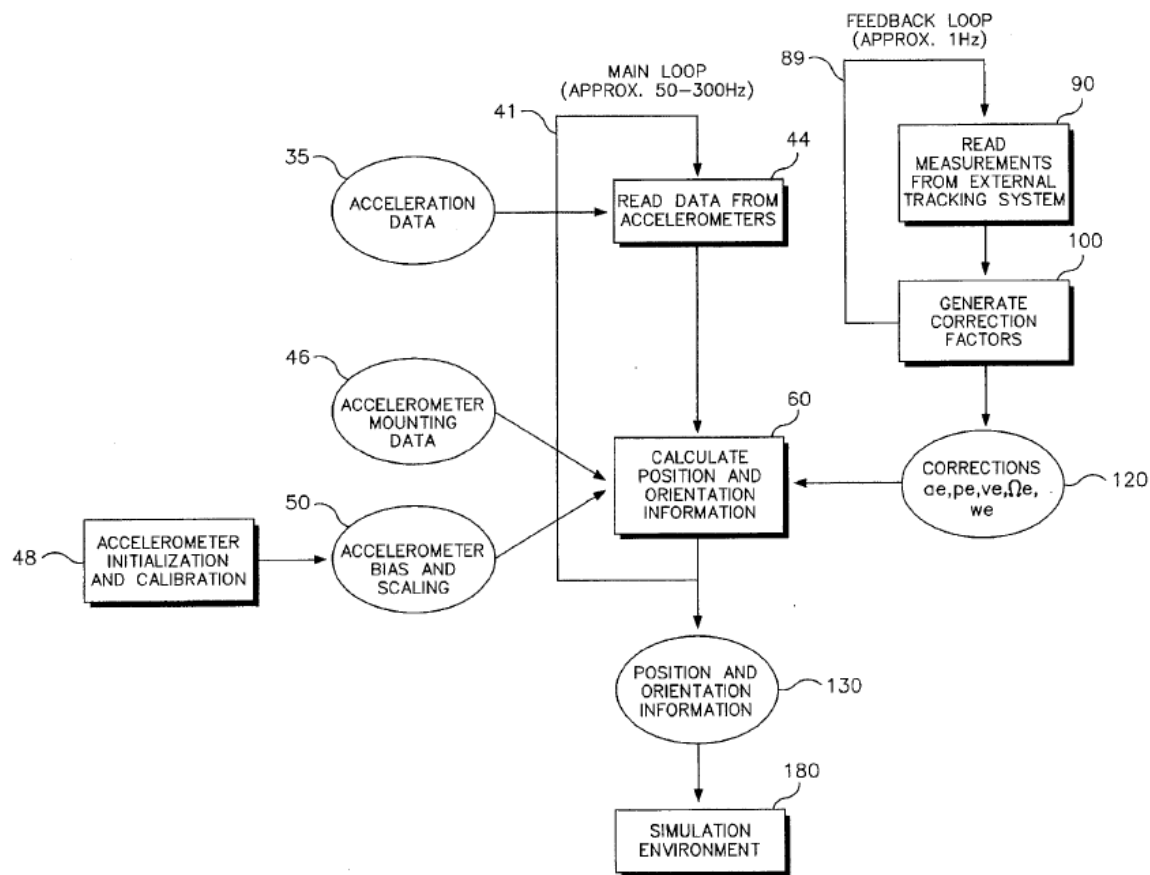


FIGURE 3

Figure 3 “is a simplified flow chart depicting one embodiment of the tracking system.” Ex. 1010, 3:11–12, 5:59. Tracking system 15 is implemented on tracking processor 40 and includes accelerometer initialization and calibration 48 that “is initiated prior to each system use to correct for the bias and scaling factors of the accelerometers due to such

factors as time, temperature, mechanical jarring and the like.” *Id.* at 5:59–64.

“Accelerometers 1–6 are initialized 48 by loading the values of the accelerometer biases which are pre-specified at the factory or obtained from accelerometer specifications.” Ex. 1010, 5:64–67. “Calibration 48 of accelerometers 1–6 is accomplished by running tracking system 15 while the object to be tracked . . . remains stationary.” *Id.* at 5:67–6:3. Feedback filter loop 89 compares calculated position and orientation measurements 130 with known, stationary position and orientation measurement and “uses discrepancies between the two measurements to solve for bias and scaling factors 50 for each accelerometer 1-6.” *Id.* at 6:5–12.

“In main loop 41 tracking processor 40 reads 44 acceleration data 35 from accelerometers 1–6 and calculates 60 position and orientation information 130.” Ex. 1010, 6:25–27. “Feedback loop 89 (also known as a Kalman filter) comprises reading tracking measurements 90 (e.g., position, orientation, and/or velocity) from external tracking system” and “generating 100 correction factors 120.” *Id.* at 6:34–38. “Correction factors 120 are used in calculation 60 of position and orientation information 130.” *Id.* at 6:40–42. “External tracking system 170 is a conventional tracking system using, for example, radar, sonar, infrared, optical, acoustic/ultrasonic, or magnetic tracking technology.” *Id.* at 6:48–51.

2. *Independent Claim 30*

Petitioner argues that Horton discloses the preamble, “[a] sensor module” because Horton describes a system using accelerometers and additional, external tracking sensors. Pet. 48 (citing Ex. 1005 ¶¶ 321–333; Ex. 1010, 3:41–46, 6:48–54). For the recited “sensor interface for communicating with a measurement sensor,” Petitioner argues that Horton

teaches that acceleration data 35 is provided to tracking processor 40, calibration routine 48 provides accelerometer biases, and external tracking sensors provide additional measurements. *Id.* at 48–49 (citing Ex. 1005 ¶¶ 323–325; Ex. 1010, 5:64–6:5, 6:48–54, Fig. 3).

According to Petitioner, “**initialization routine 48** and related data constitute a measurement system for the sensor,” and “main loop 41 and the Kalman Filter (i.e., feedback loop 89) executed by the tracking processor 40 constitutes an ‘estimation system.’” Pet. 49 (citing Ex. 1010, 2:25–30, 2:41–44, 7:56–64). Petitioner contends that one of ordinary skill in the art “would have understood that this coupling of the subsystems through main loop 41 constitutes a ‘sensor interface.’” *Id.* at 50 (citing Ex. 1005 ¶ 324).

For “a communication interface for communication with an estimation system,” Petitioner argues that “the **main loop 41** and the Kalman Filter (i.e., **feedback loop 89**) executed by the tracking processor 40 constitutes an ‘estimation system,’” and “coupling the estimation system with the sensor measurement systems would have been understood to be a ‘communication interface’ wherein the estimation and measurement systems communicate with each other.” Pet. 50 (citing Ex. 1005 ¶¶ 326–327; Ex. 1010, 7:56–64).

For “wherein the sensor module is configured to receive information related to an expected sensor measurement over the communication interface,” Petitioner argues that Horton renders obvious the limitation because Horton teaches loading values of accelerometer biases and mounting data 46 for each accelerometer to determine correction factors 120. Pet. 50–51 (citing Ex. 1005 ¶¶ 328–329; Ex. 1010, 5:37–51, 5:64–67, 6:34–42, 7:6–14, Figs. 3, 4).

For the sensor module being configured to “receive a measurement signal over the sensor interface” and “provide measurement information

based on the measurement signal over the communication interface,”
Petitioner argues that Horton discloses the limitations because Horton teaches reading acceleration data 35, and that reading constitutes receiving a measurement signal over a sensor interface and providing measurement information based on a measurement signal over a communication interface. Pet. 51–53 (citing Ex. 1005 ¶¶ 330–333; Ex. 1010, 6:25–27, Fig. 3).

Patent Owner responds that Horton does not have anything corresponding to the sensor module of claim 30, and that Petitioner does not address which part of Horton corresponds to the claimed sensor module. Prelim. Resp. 43–44 (citing Pet. 48). In its arguments for the preamble, “[a] sensor module,” Petitioner expressly relies on the “tracking system” of Horton. Pet. 48 (citing Ex. 1005 ¶¶ 321–322; Ex. 1010, 3:41–46).

At this stage, this responsive argument does not show that Petitioner fails to demonstrate a reasonable likelihood of prevailing on its challenge to claim 30 based on Horton. During trial, the record would benefit from further evidence and arguments from the parties on this issue of whether one of ordinary skill in the art would have considered Horton’s tracking system to teach a sensor module.

Patent Owner also responds that Petitioner relies on the same coupling of subsystems through main loop 41 for the recited “sensor interface” and “communication interface.” Prelim. Resp. 44–45 (citing Pet. 50). Patent Owner argues that Petitioner’s “mapping undermines a key aspect of the claim: that each sensor module acts as a bridge between the associated measurement sensors and the estimation system.” *Id.* at 44.

On the present record, this responsive argument also does not show that Petitioner fails to demonstrate a reasonable likelihood of prevailing on

its challenge to claim 30 based on Horton. As above, however, the record would benefit from further evidence and arguments on this issue.

Patent Owner further responds that Petitioner appears to rely on Horton's mounting data for "information related to an expected sensor measurement" but such information has "nothing to do with an expected sensor measurement for a particular sensor," especially Horton's accelerometers. Prelim. Resp. 45 (citing Pet. 51; Ex. 1001, 15:44–57, 16:51–56).

This responsive argument in view of the preliminary record does not show that Petitioner fails to demonstrate a reasonable likelihood of prevailing on its challenge to claim 30 based on Horton. The argument raises an issue of whether one of ordinary skill in the art would have considered "locations and directions of the mounted accelerometers" to teach "information related to an expected sensor measurement," as argued by Petitioner. Pet. 51. It also depends on the scope of the recitation "information related to an expected sensor measurement."

Patent Owner additionally responds that Petitioner argues that reading in and providing acceleration data to main loop 41 teaches the required "measurement signal" and "measurement information based on the measurement signal" but the claim recites the signal and information separately. Prelim. Resp. 45–46 (citing Pet. 52–53). Patent Owner contends that Petitioner is reading out the separately required input and output of the claimed sensor module. *Id.* at 46.

This responsive argument also does not show that Petitioner fails to demonstrate a reasonable likelihood of prevailing on its challenge to claim 30 based on Horton. It depends on adopting a certain view of the claim that is not yet supported by the preliminary record.

3. Dependent Claims 31 and 32

Claims 31 and 32 depend directly from claim 30. Ex. 1001, 48:18–25. Petitioner argues with citations to the record that Horton would have rendered obvious these claims. Pet. 53–55. Patent Owner responds that Petitioner fails to show that claims 31 and 32 would have been rendered obvious for the same reasons asserted for claim 30. Prelim. Resp. 46. At this preliminary stage, Petitioner shows a reasonable likelihood of prevailing on at least of claims 31 and 32 in its obviousness challenge based on Horton.

4. Independent Claim 33

Petitioner argues that Horton discloses “[a] method” that includes “enumerating a set of sensing elements available to a tracking system that includes an estimation subsystem that estimates a position or orientation of an object.” Pet. 56 (citing Ex. 1005 ¶¶ 340–342; Ex. 1010, code (54), 2:15–17, 2:25–30, 2:41–44, 3:41–51, 6:48–54, 7:56–64). Petitioner specifically argues that Horton teaches accelerometers and additional tracking sensors and teaches a tracking processor that would constitute an “estimation subsystem.” *Id.* (citing Ex. 1005 ¶¶ 341–342; Ex. 1010, 2:25–30, 2:41–44, 3:41–51, 6:48–54, 7:56–64).

For “providing parameters specific to the set of sensing elements to the tracking system to enable the estimation subsystem to be configured based on the parameters specific to the set of sensing elements,” Petitioner argues that Horton teaches loading accelerometer biases, using mounting data for correction factors 120, and calibrating the accelerometers when the tracked object is stationary. Pet. 57 (citing Ex. 1005 ¶¶ 343–345; Ex. 1010, 5:64–6:11, 6:34–42). Petitioner contends that the data collected in the calibration process teaches “parameters specific to the set of sensing elements to the tracking system.” *Id.* (citing Ex. 1010, Fig. 3)

For “generating a sequence of candidates of pairs of sensing elements selected from the set of sensing elements, the sequence based on an expected utility of a measurement associated with said elements to the estimation subsystem,” Petitioner argues that “Horton explains that selecting two accelerometers in the system would be used to track the object in one-dimensional space,” and “the ‘expected utility’ of measurement from these two sensors would be for one-dimensional tracking (i.e., updating the state) as the object moves.” Pet. 57–58 (citing Ex. 1005 ¶¶ 346–347; Ex. 1010, 3:49–51). Petitioner also argues that one of ordinary skill in the art “would have understood that two accelerometers at a time could be selected in the system to track the object in one dimension at a time in accordance with the estimation of that measurement by the tracking processor/estimation subsystem.” *Id.* at 58.

a) Patent Owner’s Preliminary Response

Patent Owner responds that Petitioner cites to a portion of Horton that fails to suggest “generating a sequence of candidates of pairs of sensing elements,” as required by claim 33, and describes a system with only two accelerometers for tracking an object in one-dimensional space. Prelim. Resp. 48 (citing Pet. 57; Ex. 1010, 3:49–51). Patent Owner also responds that Petitioner’s asserted “‘expected utility’ of measurement” is “one-dimensional tracking,” but the ’632 patent and its claims are referring to quantitative utility. *Id.* at 48–49 (citing Pet 57–58; Ex. 1010, 26:20–43). Patent Owner further responds that Petitioner provides no citation to support that one of ordinary skill in the art would have understood that two accelerometers could be selected to track an object in one-dimension. *Id.* at 49. In Patent Owner’s view, Horton does not disclose any “systems that permit two out of a larger number of accelerometers to be chosen.” *Id.*

For the generating step, Petitioner contends that the ordinarily skilled artisan “would have understood that two accelerometers at a time could be selected in the system to track the object in one dimension,” which apparently acknowledges that Horton does not expressly teach or suggest “generating a sequence of candidates of pairs of sensing elements,” as required by claim 33. Pet. 58. Petitioner cites to a portion of Horton that states “[f]ewer accelerometers (e.g., four) could be used to track the object, for example, in a two-dimensional space or one-dimensional space (e.g., two accelerometers).” Pet. 57–58; Ex. 1010, 3:49–51. On the present record, the cited statement alone does not appear to teach or suggest “generating a sequence of candidates of pairs of sensing elements.” Prelim. Resp. 48; Ex. 1010, 3:49–51. Thus, based on the above, we agree with Patent Owner that Horton does not appear to teach any “systems that permit two out of a larger number of accelerometers to be chosen.” Prelim. Resp. 49.

As for support regarding the generating step and the asserted understanding of the ordinarily skilled artisan, Petitioner cites declarant testimony for the step. Pet. 57–58 (citing Ex. 1005 ¶¶ 346–347). The Petition largely repeats the cited testimony. *Compare id.*, with Ex. 1005 ¶¶ 346–347. The cited testimony also does not include support or further explanation why one of ordinary skill in the art “would have understood that two accelerometers at a time could be selected in the system to track the object in one dimension at a time in accordance with the estimation of that measurement by the tracking processor (estimation subsystem).” *Id.* ¶ 346. This issue would benefit from further development.

5. *Independent Claim 47*

Petitioner argues that Horton’s teachings of two to six accelerometers along with additional tracking sensors disclose the preamble, “[a] method of

using multiple sensors in a tracking system.” Pet. 58 (citing Ex. 1005 ¶¶ 348–349; Ex. 1010, 3:41–51, 6:48–54). For “providing an estimation module,” Petitioner argues that Horton teaches the limitation because “the **main loop 41** and the Kalman Filter (i.e., **feedback loop 89**) executed by the tracking processor 40 constitutes an ‘estimation system’ within the overall system because they are used for estimating the tracked object’s pose.” *Id.* (citing Ex. 1005 ¶¶ 350–351; Ex. 1010, 7:56–64).

For “coupling one or more sensor modules to the estimation module, each associated with a different set of one or more sensors,” Petitioner argues that Horton teaches coupling accelerometers to the tracking processor “through main loop 41” and comparing calculated and known measurements to solve for bias and scaling factors. Pet. 59 (citing Ex. 1005 ¶¶ 352–353; Ex. 1010, 6:5–11). Petitioner also argues that one of ordinary skill in the art “would have understood that main loop 41 of the sensor subsystem includes coupling one or more sensor modules to the estimation module, associated with each accelerometer.” *Id.* (citing Ex. 1005 ¶ 353; Ex. 1010, 7:6–7, Fig. 4).

For “configuring the tracking system,” Petitioner contends that Horton teaches comparing calculated and known measurements to solve for bias and scaling factors and main loop 41 is repeated multiple times to calibrate the system. Pet. 59 (citing Ex. 1005 ¶¶ 355–356; Ex. 1010, 6:5–13). For the configuring step including “providing configuration information from each of the sensor modules to the estimation module regarding the characteristics of the sensors associated with the sensor module,” Petitioner contends that Horton teaches calibrating its accelerometers by collecting pose data while the tracked object is stationary and incorporating that data into the Kalman filter. *Id.* at 60 (citing Ex. 1005 ¶¶ 357–358; Ex. 1010, 5:64–6:11).

According to Petitioner, the “data collected in this calibration process constitutes ‘configuration information.’” *Id.* Petitioner also argues that Horton teaches loading “accelerometer biases which are pre-specified at the factory or obtained from accelerometer specifications” and would also constitute “configuration information . . . regarding the characteristics of the sensors.” *Id.* (citing Ex. 1010, 5:64–67).

For the configuring step including “configuring the estimation module using the provided configuration information,” Petitioner argues that Horton teaches the tracking processor comparing pose data from the calibration with known measurements and using any discrepancies to solve for bias and scaling factors and repeating the main loop to calibrate the system. Pet. 60 (citing Ex. 1005 ¶¶ 359–360; Ex. 1010, 6:5–13).

For “maintaining estimates of tracking parameters in the estimation module,” Petitioner contends that Horton teaches repeatedly updating its pose estimate by reading acceleration data 35 and then calculating position and orientation information 130 and also using the known measurements from the calibration process. Pet. 61 (citing Ex. 1005 ¶¶ 361–362; Ex. 1010, 5:64–6:11, 6:25–27).

For the maintaining step “including repeatedly passing data based on the estimates of the tracking parameters from the estimation module to one or more of the sensor modules,” Petitioner argues that Horton teaches that the asserted estimation module and sensor module are coupled at main loop 41 and that one of ordinary skill in the art “would have understood that this overlap between the two modules would involve passing data based on the tracking parameter estimates (i.e. the bias and scaling factors that are set based on the tracking parameters) to main loop 41 to calculate position and

orientation information for the tracked object (as shown at 60).” Pet. 61–62 (citing Ex. 1005 ¶¶ 363–364; Ex. 1010, Fig. 3).

For the maintaining step including repeatedly “receiving from said one or more sensor modules at the estimation module data based on measurements obtained from the associated sensors, and the data passed to the sensor modules,” Petitioner argues that Horton teaches that, during calibration, collecting accelerometer data while the tracked object is stationary and using that data in the tracking processor to calculate position and orientation in main loop 41. Pet. 62–63 (citing Ex. 1005 ¶¶ 365–366; Ex. 1010, 5:64–6:5, Fig. 3).

For the maintaining step including repeatedly “combining the data received from said one or more sensor modules and the estimates of the tracking parameters in the estimation module to update the tracking parameters,” Petitioner argues that Horton teaches its tracking processor 40 in main loop 41 reading acceleration data 35 from the asserted sensor module and calculating position and orientation information 130 based on corrections from the asserted estimation module to update the tracking parameters in the asserted estimation module. Pet. 63 (citing Ex. 1005 ¶¶ 367–368; Ex. 1010, 6:25–27, Fig. 3).

a) Patent Owner’s Preliminary Response

Patent Owner responds that Petitioner’s asserted sensor module conflicts with its testimonial evidence which indicates that the accelerometers teach the claimed sensor modules. Prelim. Resp. 53–54 (citing Pet. 61–62; Ex. 1005 ¶ 353).

For the coupling step of claim 47, Petitioner’s declarant states that the ordinarily skilled artisan “would have understood that the main loop 41 of the sensor subsystem includes coupling one or more sensor modules

(accelerometers) to the estimation module (tracking processor).” Ex. 1005 ¶ 353. For the passing limitation, Petitioner argues that the sensor module is shown in an annotated Figure 3 of Horton reproduced below.

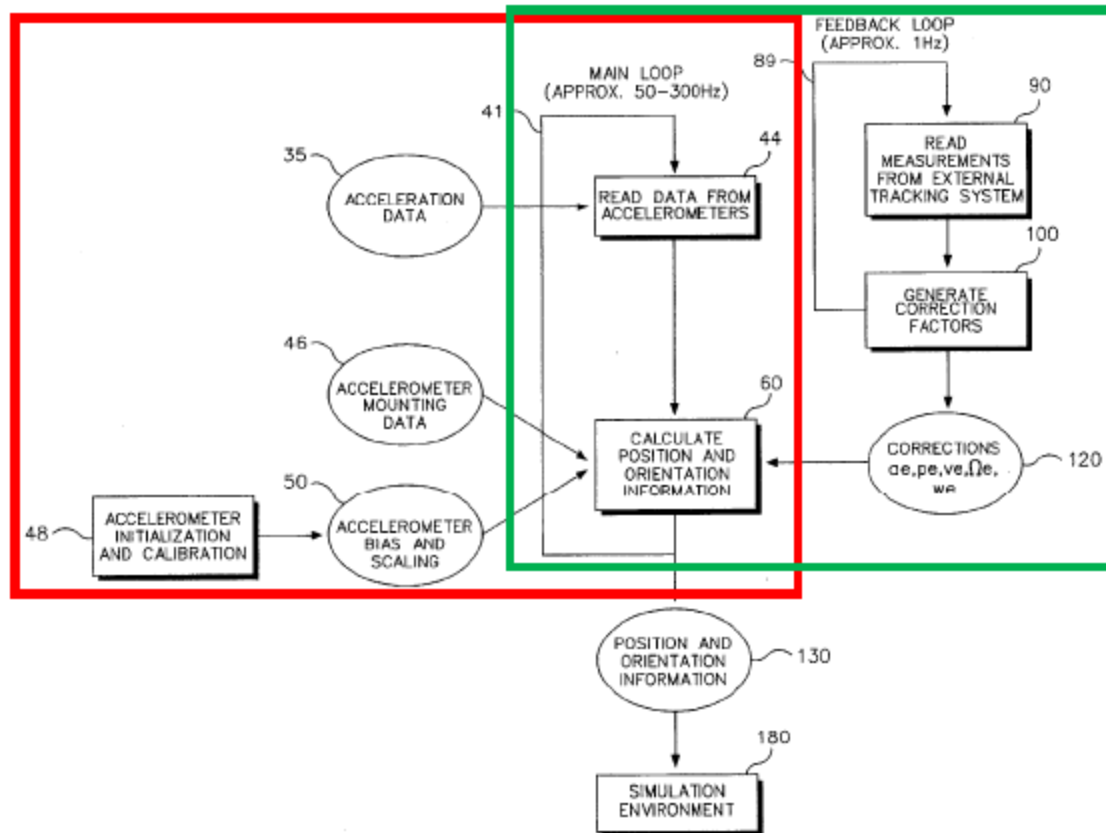


FIGURE 3

Figure 3 of Horton “is a simplified flow chart depicting one embodiment of the tracking system,” and Petitioner annotates the figure with a red outline for the sensor module and a green outline for the estimation module. Pet. 61–62; Ex. 1010, 3:11–12, 5:59; *see also* Pet. 49 (providing the same annotated figure to argue that it shows the measurement sensor and estimation system of claim 30). Figure 3 shows tracking system 15 implemented on tracking processor 40. Ex. 1010, 5:59–64. On the present record, we agree with Patent Owner that Petitioner’s arguments for claim 47 do not appear to be consistent with its testimonial evidence regarding what in Horton teaches the recited “sensor module” and “estimation module.” In

particular, a portion of the testimony indicates that the accelerometers teach sensor modules, and that tracking processor 40 teaches the estimation module, but Petitioner argues that parts of tracking system 15 implemented on tracking processor 40 teach the sensor modules and estimation module. Pet. 61–62; Ex. 1005 ¶ 353.

For the maintaining step “including repeatedly passing data based on the estimates of the tracking parameters from the estimation module to one or more of the sensor modules,” Patent Owner responds that Petitioner relies on a portion of Horton that teaches passing bias and scaling factors from the asserted sensor module to the asserted estimation module, but the claim recites “passing data based on the estimates of the tracking parameters *from the estimation module to one or more of the sensor modules.*” Prelim. Resp. 54 (citing Ex. 1010, 5:64–67, 7:7–8).

For this passing step, Petitioner argues that one of ordinary skill in the art “would have understood that this overlap between the two modules would involve passing data based on the tracking parameter estimates (i.e. the bias and scaling factors that are set based on the tracking parameters) to main loop 41 to calculate position and orientation information for the tracked object (as shown at 60).” Pet. 61–62 (citing Ex. 1005 ¶¶ 363–364; Ex. 1010, Fig. 3).

Petitioner’s argument appears to be contending that Horton teaches sending bias and scaling factors “to main loop 41 to calculate position and orientation information” and, thus, arguing that data is passed to the estimation module, as pointed out by Patent Owner. Prelim. Resp. 54. Petitioner, however, shows in its annotated Figure 3 that main loop 41 can be part of its asserted “sensor module.” See Pet. 49, 62. Elsewhere, Petitioner argues that initialization routine 48 and related data, but not main

loop 41, “constitute a measurement system for the sensor.” *Id.* at 49. This issue regarding main loop 41, and how it fits into Petitioner’s asserted “sensor module,” in addition to what in Horton teaches the “sensor module,” would benefit from further development at trial.

Patent Owner also responds that Petitioner fails to address the limitation “data passed to the sensor modules.” Prelim. Resp. 54–55 (citing Pet. 62–63). In Patent Owner’s view, Petitioner argues that the “tracking processor accepts and uses” “data for the tracked object while stationary” but fails to argue that such data is based on “data passed to the sensor modules.” *Id.* at 55 (citing Pet. 62–63).

We agree with Patent Owner that Petitioner’s arguments do not appear to address “data passed to the sensor modules.” Pet. 62–63 (citing Ex. 1005 ¶¶ 365–366; Ex. 1010, 5:64–6:6, Fig. 3). Petitioner relies on Horton’s teachings regarding data collected while the tracked object is stationary and the tracking processor accepting that data. *See id.* Petitioner does not further address any data being “passed to the sensor modules,” either the accelerometers or the sensor module shown in annotated Figure 3 of Horton. *See id.*

6. Dependent Claims 50–53 and 59–61

Claims 50–53 and 59–61 depend directly or indirectly from claim 47. Ex. 1001, 50:35–46, 50:66–51:10. Petitioner argues with citations to record evidence that Horton would have rendered obvious these claims. Pet. 63–66. Patent Owner responds that Petitioner fails to show that these claims would have been rendered obvious for the reasons presented for claim 47. Prelim. Resp. 55.

Petitioner’s analysis for claims 50–53 and 59–61 does not appear to resolve the potential issues we identified above with claim 47. Patent Owner

also identifies additional issues in the arguments for claims 50 and 59. Prelim. Resp. 56–59. The identified issues would benefit from further development at trial.

H. Asserted Obviousness Based on Horton and Welch 1997

1. Claims 34–36

Claims 34–36 depend ultimately from independent claim 33. Ex. 1001, 48:41–53. Claims 34 and 35 recite further limitations regarding selecting a pair of sensing elements, and claim 36 requires a target to comprise a natural feature in an environment. *See id.*

Petitioner argues with citations to record evidence that Horton and Welch 1997 teach or suggest all the limitations of claims 34–36 and that one of ordinary skill in the art would have combined these references. Pet. 66–69. Patent Owner responds that Welch 1997 does not address the purported flaws identified for claim 33 and the proposed combination would not have rendered obvious claims 34–36. Prelim. Resp. 59–62.

Based on the preliminary record, for the reasons given above for claim 33, Petitioner does not sufficiently show that Horton and Welch 1997 would have rendered obvious claims 34–36.

I. Asserted Obviousness Based on Horton and Harris

1. Claims 54, 55, 57, and 58

Claims 54, 55, 57, and 58 ultimately depend from independent claim 47. Ex. 1001, 50:47–55, 50:60–65. These claims require the Kalman filter to be a distributed Kalman filter. *See id.*

Petitioner argues with citations to record evidence that Horton and Harris teach or suggest all the limitations of claims 54, 55, 57, and 58 and that one of ordinary skill in the art would have combined these references. Pet. 69–74. Patent Owner responds that Petitioner fails to show that the

asserted references would have rendered obvious these claims for the reasons asserted for claim 47, from which it depends. Prelim. Resp. 62–63. Petitioner’s analysis for claims 50–53 and 59–61 does not appear to resolve the potential issues we identified above with claim 47.

IV. CONCLUSION

After considering the evidence and arguments presented in the Petition and the cited evidence, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing in proving that at least one of claims 30–36, 44, 45, 47–55, and 57–61 of the ’632 patent is unpatentable, and thus, we institute an *inter partes* review of all challenged claims on all presented challenges. *SAS*, 138 S. Ct. at 1359–60.

At this stage of the proceeding, the Board has not made a final determination as to the patentability of any challenged claim or any underlying factual and legal issues.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 30–36, 44, 45, 47–55, and 57–61 of U.S. Patent No. 6,922,632 B2 is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of U.S. Patent No. 6,922,632 B2 shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

IPR2022-01305
Patent 6,922,632 B2

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