

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ABB INC.,
Petitioner

v.

ROBOTICVISIONTECH, INC.,
Patent Owner

Case IPR2023-01426
U.S. Patent No. 8,095,237

PATENT OWNER'S PRELIMINARY RESPONSE

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Patent Trial and Appeal Board
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EXHIBIT LIST

Exhibit No.	Description
2001	Declaration of Thomas Kurfess, Ph.D.
2002	Redline Comparison of Petition (Paper 1) to EX1003 (Expert Declaration of Seth Hutchinson)
2003	Defendant's Initial Invalidity Contentions
2004	U.S. Patent No. 6,816,755 to Habibi <i>et al.</i> ("the '755 patent")
2005	<i>Curriculum Vitae</i> of Thomas Kurfess, Ph.D.
2006	Rizzi A., et al., "Preliminary Experiments in Spatial Juggling," International Symposium on Experimental Robotics (1991), 17 pages.
2007	"Navigation of a Mobile Robot using Mono-Vision and Mono-Audition," <i>IEEE International Conference on Systems, Man, and Cybernetics</i> (1999), pp. 686-91.
2008	Henry, N., "Understanding Robot Coordinate Frames and Points," SolisPLC, accessible at https://www.solisplc.com/tutorials/robot-coordinate-frames-and-points (last accessed December 22, 2023)
2009	Stevenson, K., "Breaking the Toolhead Barrier with MedUSA," Fabbaloo.com, accessible at https://www.fabbaloo.com/news/breaking-the-toolhead-barrier-with-medusa (last accessed December 27, 2023)
2010	"Robots Combine for Faster Metal 3D Printing," MedUSA Video, accessible at https://www.youtube.com/watch?v=FR5X0t7-g6M (last accessed January 2, 2024)
2011	Liu, B., et al., "A Rapid Coordinate Transformation Method Applied in Industrial Robot Calibration Based on Characteristic Line Coincidence," <i>Sensors</i> , vol. 16, no. 2 (2016), 16 pages.

Exhibit No.	Description
2012	Xi, F., et al., “Framework on robotic percussive riveting for aircraft assembly automation,” <i>Advances in Manufacturing</i> , vol. 1 (2013), pp. 112-22.
2013	Roth, M., et al., “A Real-time World Model for Multi-Robot Teams with High-Latency Communication,” <i>Proceedings of the 2003 IEEE/RSJ International Conference on Intelligent Robots and Systems</i> (2003), pp. 2494-99.
2014	Zhao, G., “Construction of Vision-based Manipulation System for 3D Industrial Objects,” <i>Proceedings of the 2009 IEEE International Conference on Robotics and Biomimetics</i> (2009), pp. 1051-56.

I. INTRODUCTION

U.S. Patent No. 8,095,237 (“the ’237 patent”) provides novel techniques for robotic manipulation of objects using a standard camera, whether the object is stationary or moving. EX1001, 1:47–59. The Office thoroughly evaluated the ’237 patent during prosecution, ultimately agreeing that the extensively considered prior art failed to teach the claimed features, including the claimed determination of “an object space-to-camera space transformation for the target object.”¹ EX1002, 945, 957.

Here, Petitioner fails to establish that the prior art presented in the Petition teaches the features that the Patent Office previously found patentable. Petitioner, in fact, concedes that Corke (the Petition’s primary reference) does not teach an “object space-to-camera space transformation,” which is recited in every independent claim of the ’237 patent. Yet, Petitioner provides no reason why a person of ordinary skill in the art (“POSITA”) would have modified Corke to determine such a transformation—or even to employ an “object space” at all. Corke’s techniques are fundamentally different from those disclosed in the ’237 patent, relying on a fixed “world” coordinate system for guidance of a robot rather

¹ Consistent with the Petition, underlines are used to denote claim language unless otherwise noted.

than an “object space” that moves with an object. As Patent Owner’s expert Dr. Kurfess explains, a POSITA would not have modified Corke to employ an “object space” because doing so would increase required computation and adversely impact precision. *See* EX2001, ¶¶54–56.

Petitioner’s expert, Dr. Hutchinson, does not fill the Petition’s gaps, merely repeating the Petition’s conclusory assertions without providing any evidence to corroborate those assertions. In fact, the unsupported, conclusory grounds of Dr. Hutchinson’s declaration are nearly word-for-word identical to those of the Petition. *See* EX2002, 0060-0217 (comparing the Petition to Dr. Hutchinson’s declaration). Petitioner, therefore, cannot establish a reasonable likelihood that any challenged claim is unpatentable.

Aside from the merits, the Board should discretionarily deny the Petition in view of the parallel district-court litigation. The parties have already invested significant effort and resources into the parallel litigation, Petitioner asserts the same art and invalidity grounds in the parallel litigation as it does here, and Petitioner has not filed any stipulation to reduce duplicate effort across tribunals. Compounding these facts, the parallel district-court litigation includes three patents, two of which Petitioner has not filed IPR Petitions against and is now time barred from doing so. Given that Petitioner asserts the same art and invalidity grounds against all three patents, institution of trial in this proceeding will not

simplify the issues tried in district court, while increasing the chances of conflicting decisions.

Accordingly, the Board should deny institution for both substantive and discretionary reasons.

II. THE '237 PATENT

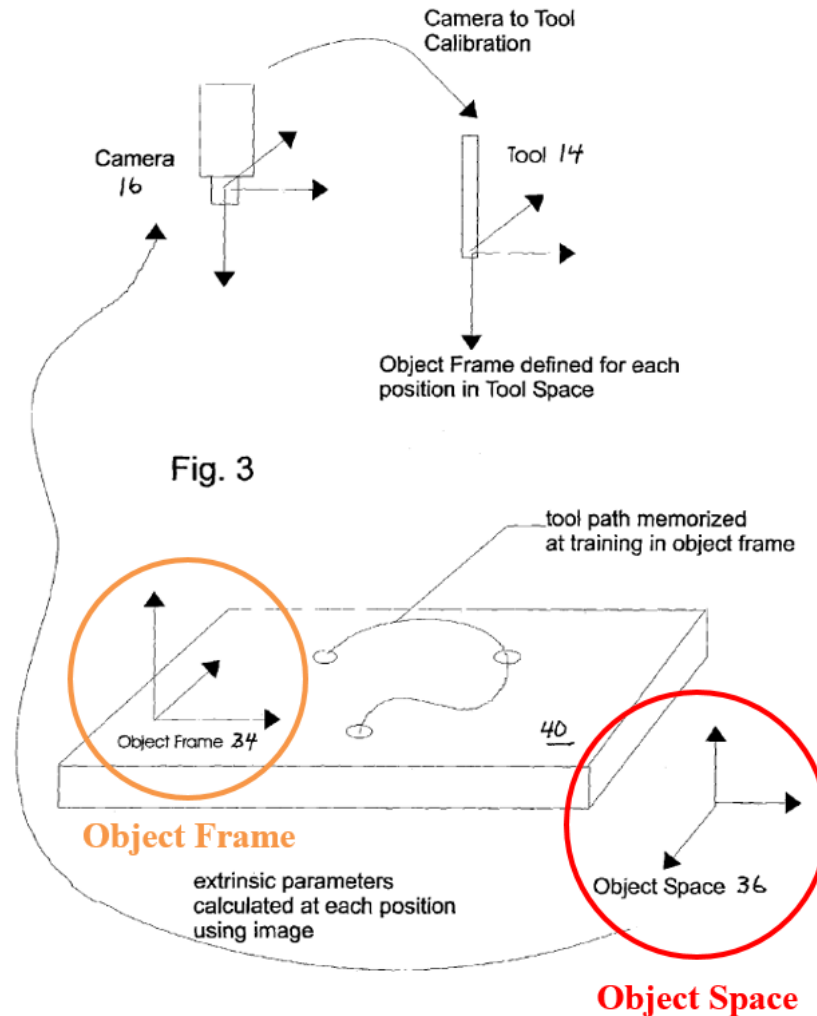
A. The '237 patent discloses novel techniques for robotic manipulation of objects with variable position and orientation.

The '237 patent is directed to “three-dimensional object location and guidance to allow robotic manipulation of an object with variable position and orientation.” EX1001, Abstract. The patent explains that prior “camera systems [] have used laser triangulation which involves expensive specialized sensors, must be rigidly packaged to maintain geometric relationships, require sophisticated inter-tool calibration methods and tend to be susceptible to damage or misalignment when operating in industrial environments.” *Id.* at 1:32–37. The '237 patent thus provides techniques for enabling robotic manipulation of objects “using only standard video camera equipment.” *Id.* at 1:47–52.

The '237 patent discloses both a “calibration process” for “calibrating the sensor array to provide a Robot–Eye Calibration,” and a “[t]eaching” process for teaching features of an object and enabling robotic manipulation of the object. EX1001, 1:56–2:21, 3:36–41, 5:14–45, FIG. 5 (exemplary calibration process),

FIGs. 6–7 (exemplary teaching processes). These calibration and teaching processes are reflected in the '237 patent claims, including claims 1 and 2.

To carry out the disclosed robotic manipulation techniques, the '237 patent defines specific coordinate spaces and frames as part of its processes. EX1001, 3:1–34; EX2001, ¶33. Of significance, the patent defines a three-dimensional “Object Space” that is “a reference frame defined with respect to, and therefore rigid to, the object,” and an “Object Frame” that is “a reference frame defined with respect to a point on, and therefore rigid to, the object.” *Id.* at 3:25–28. These concepts are illustrated, for example, in Figure 3 of the '237 patent.



EX1001, FIG. 3 (annotated).

The '237 patent explains that the “Object Space is defined such that it is identical to the Training Space but is rigid to the object and moves with the object.” EX1001, 5:29–31. “Also an Object Frame will be defined with a constant relationship to the object, in a position selected by the user.” *Id.* at 5:32–33. Then, for the robot to “find this frame position, the transformation from Object Space to Camera Space is used, then from Camera Space to Tool Space.” *Id.* at 5:37–40. As Dr. Kurfess explains, by defining and employing a coordinate space and frame

rigid to the object, the '237 patent enables “teaching robots and handling of objects by robots in three dimensions” using at least one camera, where “[t]he objects need not be fixtured and can be placed anywhere within the workspace of the robot.” *Id.* at 7:50–8:10; EX2001, ¶¶34–35. In other words, a robot is able to manipulate multiple objects and interact with multiple points on those objects in a consistent manner, without needing to account for variations in the position or orientation of objects in the robot’s working area. EX2001, ¶¶35–36.

B. Claim Construction

All claim terms must be given their ordinary and customary meaning as understood by a POSITA at the time of the invention in light of the specification and the patent’s prosecution history. 37 C.F.R. § 42.100(b); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–1313 (Fed. Cir. 2005) (en banc).

For purposes of the Petition, Petitioner asserts that the term “object space” means “a reference frame defined with respect to, and therefore rigid to, the object,” and the term “training space” means “a reference frame defined with respect to a point on the calibration template, and aligned to its main axis.” Pet., 8 (citing EX1001, 3:3–34). Patent Owner takes no position as to the proper construction of these terms. But for purposes of this Preliminary Response, Patent Owner applies Petitioner’s definitions of these terms.

Patent Owner takes no position as to the proper construction of the “means for” elements recited in claims 20–28 for purposes of this Preliminary Response. *See* Pet., 8 (citing EX1001, 13:41–14:65). None of Patent Owner’s arguments rely on any particular construction of these claim elements, and the Board does not need to determine the proper construction at this preliminary stage. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy”); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co., Ltd.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

III. DR. HUTCHINSON’S DECLARATION SHOULD BE ACCORDED NO WEIGHT BECAUSE IT MERELY REPEATS—VERBATIM—THE PETITION’S CONCLUSORY ASSERTIONS.

The Petition relies exclusively upon the testimony of its expert, Dr. Hutchinson, for the knowledge of a POSITA at the time of the ’237 patent. *See, e.g.,* Pet., 16, 18, 19, 20, 22, 25, 28, 29, 30, 31, 32, 33, 36, 39, 40, 42, 47, 49, 51, 53, 54, 55, 58, 59, 60, 61, 63, 72, 78 (relying on EX1003 to assert that “[a] POSITA would have understood...” or “[a] POSITA would have found it obvious...”). The Board, however, should accord no weight to Dr. Hutchinson’s declaration for two reasons: (1) Dr. Hutchinson’s declaration merely repeats—verbatim—the Petition’s assertions for which it is offered to support, providing no

analysis or explanation; and (2) Dr. Hutchinson provides no evidence to corroborate his opinions, giving his opinions of zero probative value.

First, Dr. Hutchinson’s opinions with respect to the presented grounds of unpatentability are no more than a copy-paste of the Petition’s grounds. *See* EX2002, 0060–0217 (providing a redline comparison of the Petition (Paper 1) to Dr. Hutchinson’s declaration (EX1003) using Microsoft Word, which illustrates no substantive differences between the Petition’s grounds and Dr. Hutchinson’s opinions). The Board has consistently accorded little or no weight to testimony that merely repeats the arguments presented in the Petition. *See Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 at 15 (P.T.A.B. Aug. 24, 2022) (holding that testimony that “merely repeats, *verbatim*, the conclusory assertion for which it is offered to support ... is entitled to little weight.”) (emphasis in original); *Wowza Media Sys., LLC v. Adobe Sys. Inc.*, IPR2013-00054, Paper 16 at 4 (P.T.A.B. July 13, 2013) (according little weight to a declaration that “appeared, for the most part, simply to track and repeat the arguments for unpatentability presented in the Petition.”).

Second, Dr. Hutchinson provides no corroborating evidence to support his opinions, adding only superfluous statements such as “in my opinion” *Compare, e.g.*, Pet., 19–20, with EX1003, ¶112; *see also* EX2002, 0060–0217. The Board and the Federal Circuit have consistently held that testimony lacking any

supporting evidence—as is the case here—is entitled to no weight. 37 C.F.R.

§ 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”); *Finnigan Corp. v. Int’l Trade Comm’n*, 180 F.3d 1354, 1366 (Fed. Cir. 1999) (“The law has long looked with disfavor upon invalidating patents on the basis of mere testimonial evidence absent other evidence that corroborates that testimony.”); *American Simmental Ass’n v. Leachman Cattle of Col., LLC*, PGR2015-00005, Paper 52 at 23 (P.T.A.B. June 13, 2016) (“[C]orroboation is required of any witness whose testimony alone is asserted to invalidate a patent.”) (citing *Finnegan*, 180 F.3d at 1369); *Upjohn Co. v. Mova Pharm. Corp.*, 225 F.3d 1306, 1311 (Fed. Cir. 2000) (“Lack of factual support for expert opinion going to factual determinations, however, may render the testimony of little probative value in a validity determination.”); *Nobel Biocare Servs. AG v. Intradent USA, Inc.*, 903 F.3d 1365, 1377 (Fed. Cir. 2018) (requiring corroboration of testimony to invalidate a patent in an IPR).

Accordingly, the Board should accord no weight to Dr. Hutchinson’s *ipse dixit* declaration and look critically upon statements in the Petition relying on Dr. Hutchinson for support.

**IV. GROUND 1: THE CITED REFERENCES DO NOT RENDER
OBVIOUS INDEPENDENT CLAIMS 1, 20, AND 25.**

A. The Petition fails to demonstrate that Corke teaches “determining an object space-to-camera space transformation,” as recited in the independent claims.

Independent claim 1 recites, “determining by a processor an object space-to-camera space transformation.” EX1001, Claim 1. Independent claims 20 and 25 similarly recite, “determining an object space-to-camera space transformation.” *Id.* at Claims 20, 25. As explained above, the inventors of the ’237 patent recognized that the use of a defined “object space” simplifies “handling of objects by robots in three dimensions” using at least one camera, where “[t]he objects need not be fixtured and can be placed anywhere within the workspace of the robot.” *Id.* at 7:50–8:10; EX2001, ¶¶34–36. Particularly, the ’237 patent discloses “training the intended operation path [of the robot] relative to the ‘Object Frame,’” which allows the robot to manipulate multiple objects in the same way, regardless of variations in the position or orientation of the objects. *Id.* at 10:38–42; *see also id.* at 5:65–67 (the “‘Object Frame’ inside ‘Object Space’ is defined to be used for teaching the intended operation path” of the robot). As Dr. Kurfess explains, the use of an “object space” to guide a robot manipulator, as claimed in the ’237 patent, is fundamentally different from the use of a fixed “world” coordinate system for guidance—as in Corke—which relies on the absolute positions of the robot and object within the world. EX2001, ¶¶35–36. These techniques are particularly

useful for certain industrial object handling and high-speed manufacturing applications, in contrast to Corke, which is not directed to high-speed manufacturing. *Id.* at ¶35.

Petitioner alleges that “[a] POSITA would have understood that determining the target’s pose with respect to the camera [in Corke] is equivalent to the claimed step of determining the object space-to-camera space transformation.” Pet., 18. Petitioner’s theory fails for at least three reasons. *First*, Corke’s techniques rely on determining an object’s pose in a world coordinate system—not an “object space” as claimed—and Petitioner fails to provide *any* reason why a POSITA would have modified Corke to meet the claims. Indeed, there are significant reasons why one would not. *Second*, Petitioner fails to show where Corke teaches an “object space” as defined in the patent: “a reference frame defined with respect to, *and therefore rigid to*, the object.” EX1001, 3:25–26.² *Third*, even if Corke had taught the claimed “object space,” Petitioner fails to show that Corke’s purported “3D relative pose of an object,” Pet., 22 (citing EX1004, 159), is determined by an “object space-to-camera space transformation.”

² Emphasis added unless otherwise noted.

For each of these reasons, Petitioner cannot establish a reasonable likelihood that Corke renders obvious the claimed “object space-to-camera space transformation.” The Board should, therefore, deny institution.

- 1. Corke’s techniques rely on a world coordinate system—not an “object space” as claimed—and Petitioner fails to provide *any* reason why a POSITA would have modified Corke to meet the claims.**

The Petition alleges that the independent claims of the ’237 patent are obvious over a single reference, Corke (EX1004). Pet., 5. “[I]n appropriate circumstances, a patent can be obvious in light of a single prior art reference if it would have been obvious to modify that reference to arrive at the patented invention.” *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016). However, it is blackletter law that when an element is not taught by the prior art, “there must be a showing of a suggestion or motivation to modify the teachings of that reference to the claimed invention in order to support the obviousness conclusion.” *SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp.*, 225 F.3d 1349, 1356 (Fed. Cir. 2000). Here, Petitioner concedes that Corke does not teach the claimed “object space-to-camera space” transformation (Pet., 20) but provides no reason why a POSITA would have modified Corke to reach the claimed invention. And there are good reasons why a POSITA would *not* have modified Corke in this way. Petitioner, therefore, cannot establish obviousness of the challenged claims.

Specifically, the '237 patent distinguishes between “3D (x,y,z) *world* coordinates,” which are independent of any particular object, and “a coordinate system rigid to the *object* (‘Object Space’).” *Compare* EX1001, 2:1–4, 3:25–26 *with* EX1001, 4:6–13. As Petitioner acknowledges, the '237 patent separately defines “Object Space” as “a reference frame defined with respect to, and therefore rigid to, the object.” EX1001, 3:25–26; Pet., 8, 17.

Petitioner asserts that “Corke teaches an algorithm that uses the position of features from a single image to determine the object space-to-camera space transformation for the target object based at least in part on a position of at least some of the located features.” Pet., 19 (underlining in original). Petitioner’s theory relies on Corke’s “camera calibration matrix, **C**,” for Corke’s alleged teaching of an “object space-to-camera space transformation.” Pet., 19–20. Specifically, Petitioner asserts that “Corke teaches methods for determining matrix **C** using the position of multiple features in a single image.” *Id.*

Petitioner acknowledges, however, that Corke’s matrix **C** does not represent, and is not used to determine, an “object space-to-camera space transformation”; rather, Corke’s matrix **C** relates “3-D *world* coordinates and their corresponding 2-D image coordinates as seen by the computer.” Pet. 19 (citing EX1004, 138). Rather, recognizing that Corke does not explicitly disclose an “object space-to-camera space transformation,” Petitioner asserts, “[a] POSITA would have

understood that *if* the 3D coordinates are specified with respect to the object space, then the camera pose obtained by Corke’s algorithm is defined with respect to the object space, and therefore determines the object space-to-camera space transformation.” Pet., 20. That is the Petitioner’s *entire* analysis with respect to modifying Corke—Petitioner fails to provide any reason or support for why a POSITA would have sought to modify Corke to specify Corke’s 3-D world coordinates “with respect to the object space.” *Id.* Petitioner thus cannot meet the basic requirements for establishing obviousness. *SIBIA Neurosciences*, 225 F.3d at 1356.

Corke’s techniques never employ or require an “object space” as defined by the ’237 patent. EX2001, ¶¶44, 46–50. Instead, Corke’s techniques employ a world coordinate system independent from any object. EX1004, 137–39; EX2001, ¶¶40–42, 44–46. Corke denotes the origin of its world coordinate system with a “0,” explaining, for example, that “ ${}^0T_c$ ” represents the “camera position in world coordinates.” EX1004, 137. Corke’s techniques then relate “3-D *world* coordinates”—not coordinates in an “object space”—to “2-D image coordinates.” EX1004, 138, 143 (“The homogeneous camera calibration matrix, **C**, contains information about the position of the camera with respect to the world coordinate frame”); EX2001, ¶¶42, 44.

Petitioner does not dispute that Corke’s “3-D world coordinates” do not provide the claimed “object space.” Pet., 20. Instead, as noted above, Petitioner merely asserts that “*if* the 3D coordinates are specified with respect to the object space, then the camera pose obtained by Corke’s algorithm is defined with respect to the object space, and therefore determines the object space-to-camera space transformation.” Pet., 20. At the outset, this conclusory assertion that relies on *if* a POSA did something, even if true, cannot establish obviousness of the challenged claims. It is well established that “obviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.” *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (emphasis in original); *see also Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 993–94 (Fed. Cir. 2017). Thus, that a POSITA *could* specify “the 3D coordinates ... with respect to the object space,” Pet., 20, is insufficient to establish obviousness.

Putting aside Petitioner’s use of the word “if,” Petitioner still fails to provide any reason why a POSITA would have modified Corke. Again, the sum total of Petitioner’s modification analysis is the same “if” language quoted above. Even had Petitioner asserted that a POSITA *could* have modified to Corke, Petitioner never explains or establishes *why* a POSITA would have done so.

Petitioner's expert, Dr. Hutchinson, does not cure the Petition's failings.

EX1003, ¶112. Dr. Hutchinson merely repeats the same assertion, utilizing the same *if* language made in the Petition, without providing any further explanation, analysis, or, most importantly, evidence. *Compare* Pet., 20, *with* EX1003, ¶112. And, as discussed above, the Board has repeatedly held that testimony that “merely repeats, *verbatim*, the conclusory assertion for which it is offered to support ... is entitled to little weight.” *Xerox*, IPR2022-00624, Paper 9 at 15 (emphasis in original); 37 C.F.R. § 42.65(a); *TQ Delta, LLC v. CISCO Sys., Inc.*, 942 F.3d 1352, 1361 (Fed. Cir. 2019) (rejecting “obviousness determinations based on conclusory and unsupported expert testimony” because “crediting such testimony risks allowing the challenger to use the challenged patent as a roadmap to reconstruct the claimed invention using disparate elements from the prior art”). Therefore, Petitioner cannot meet its burden to establish obviousness with respect to “determining an object space-to-camera space transformation,” as recited in the independent claims. *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (“[T]he expedited nature of IPRs bring with it an obligation for petitioners to make their case in their petition to institute.”).

Moreover, as explained by Patent Owner's expert, Dr. Kurfess, there is no need to employ an “object space” in the context of Corke's techniques, and a POSITA would not have sought to do so. EX2001, ¶¶47–61. Corke provides

techniques for enabling robotic vision using fixed “3-D world coordinates.”

EX1004, 138; EX2001, ¶¶47–48. For instance, Corke provides an example of “visual servoing” in which “[t]hree robot DOF [(degrees of freedom)] are controlled by image features so as to keep the camera at a constant height vertically above a target rotating on a turntable,” as illustrated in Corke’s Figure 8.15. EX1004, 282–83.

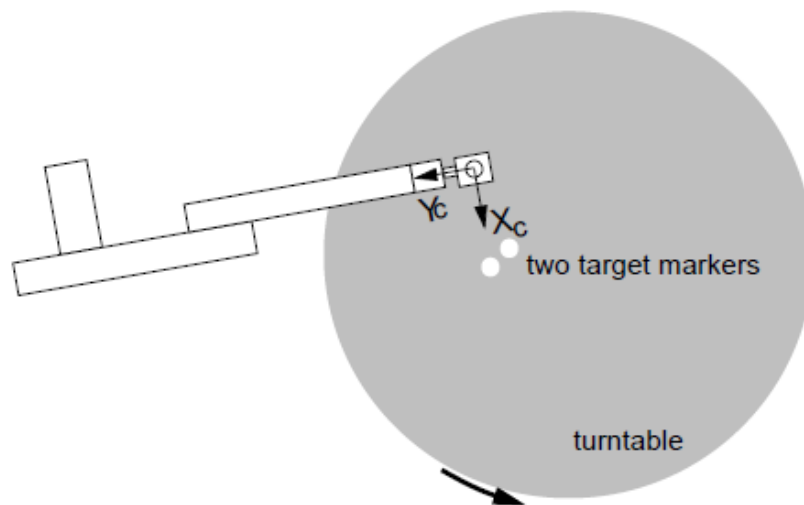


Figure 8.15: Plan view of the experimental setup for translational visual servoing.

EX1004, 283 (FIG. 8.15).

As Corke explains, “[t]he camera coordinate frame can be determined ... which provides the *camera pose in world coordinates* allowing the *target position in world coordinates* to be estimated.” EX1004, 283; EX2001, ¶¶49–50. As Dr. Kurfess explains, a turntable as described in Corke can be used to allow multiple robots positioned around the turntable to operate upon the same object. EX2001, ¶51. Maintaining operations using a world coordinate system, as in

Corke's example, allows multiple robots to work in a shared, common space, simplifying communication between robots and reducing any chance of collision.

Id. at ¶¶51, 53. Corke also discloses other applications that benefit from the use of a fixed world coordinate system, including applications in which one or more objects are constantly moving, such as “robotic ping-pong [and] juggling.”

EX1004, 151; EX2001, ¶¶52–53.

Similarly, for an object that remains stationary, the use of an independent world coordinate system is sufficient to enable robotic vision. EX2001, ¶54. There is no need to define a separate “object space,” which would require additional computations that can adversely impact the precision of the robot—none of which are discussed in Corke—when Corke already defines a matrix **C** for transforming points in world space to camera space (EX1004, 138) and when the position of the object can be represented in world coordinates. EX2001, ¶¶54–56. Such techniques discussed in Corke are particularly useful, for example, when operating on a large object or in the assembly of multiple stationary parts, where a world coordinate system captures positions of and relationships between the parts and different points on a part. *Id.* at ¶¶57–60.

Accordingly, Petitioner has not established that Corke renders obvious the claimed “object space-to-camera space transformation.” Petitioner's unsupported, hindsight-driven assertions should be rejected.

2. Petitioner fails to show where Corke teaches an “object space” as defined in the patent: a reference frame defined with respect to, and therefore rigid to, the object.

Under Petitioner’s own interpretation, the claimed “object space” must be “a reference frame defined *with respect to, and therefore rigid to, the object.*”

EX1001, 3:25–26; Pet., 8 (acknowledging this definition), 17 (“The ’237 Patent provides that ‘object space’ is a 3D coordinate frame ‘defined with respect to a point on, and therefore rigid to, the object.’”). The ’237 patent further explains the meaning of “rigid to” in this definition, providing that the “[o]bject Space” “is rigid to the object *and moves with the object.*” EX1001, 5:29–31. In other words, as an object moves through world space, its world space coordinates change, but it does not move through object space—it brings the object space coordinate system with it. The “object space” system of the ’237 patent thus uses a different coordinate system, and implicates different algorithms and computations, than the world space coordinate system of the cited prior art. EX2001, ¶¶44–45, 54–60.

Although Petitioner acknowledges this requirement of the claimed “object space,” nowhere does Petitioner address where Corke teaches an object space that is “rigid to” the object. *See* Pet., 17–22 (acknowledging the patent definition but failing to address this requirement anywhere in the Petition grounds). For this reason alone, Petitioner cannot establish obviousness of the challenged claims. 37 C.F.R. § 42.104(b)(4) (“The petition must specify where each element of the claim

is found in the prior art patents or printed publications relied upon.”); *Intelligent Bio-Sys.*, 821 F.3d at 1369.

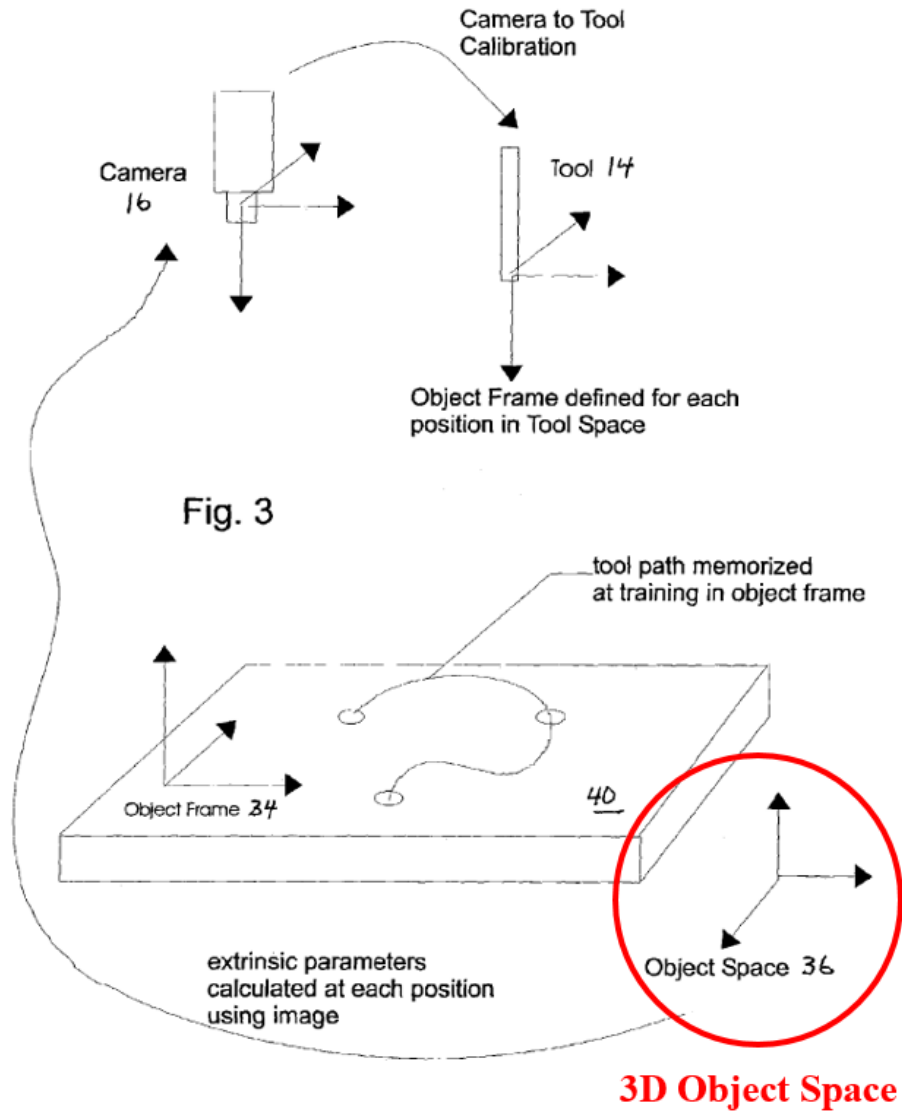
Moreover, Petitioner provides no reason why a POSITA would have sought to make Corke’s 3D coordinate space rigid to and move with the object. *See* Pet., 17–22. As explained above, Corke defines a camera calibration matrix **C** that allows a point in 3D world space to be translated to camera space. *See* Section IV.A.1; EX1004, 138. Employing an additional object space is illogical given what Corke actually discloses and, at a minimum, attempting to use an additional object space would require maintenance of an additional coordinate frame, as well as its relationship to the initial position as the object moves. EX2001, ¶¶54–56 (explaining that use of an “object space” in Corke would require additional computations and adversely impact precision of the robot). Indeed, as discussed above, Corke provides examples of visual control for moving objects using world space coordinates—explicitly *without* maintaining a separate object space. EX1004, 282–83 (discussing a “target rotating on a turntable” and “allowing the target position *in world coordinates* to be estimated”); EX2001, ¶¶49–50. Petitioner has not provided any reason why a POSITA would have sought to modify Corke’s teachings. Pet., 17–22.

Accordingly, because Petitioner does not explain where Corke’s techniques employ or require an “object space” under Petitioner’s *own definition*, the Board should deny institution.

3. Petitioner fails to show that Corke’s purported “3D relative pose of an object” is determined by an “object space-to-camera space transformation” as claimed.

In addition to the reasons provided above, the Petition fails for a third reason: Petitioner has not shown that Corke’s purported “3D relative pose of an object,” EX1004, 159, is determined by an “object space-to-camera space transformation.” Specifically, Petitioner states: “Corke explains that to ‘determine the 3D relative pose of an object...from 2D image coordinates,’ ‘additional information is needed.’” Pet., 21 (citing EX1004, 159). Petitioner then alleges that the determination of the “3D relative pose of an object” meets the claimed “object space-to-camera space transformation for the target object.” *Id.* at 22.

But the claims require determining “an object space-to-camera space transformation.” EX1001, Claims 1, 20, 25. As Petitioner acknowledges, “[t]he ’237 Patent provides that ‘object space’ is a *3D coordinate frame*” Pet., 17 (citing EX1001, 3:1–34). This three-dimensional object space is illustrated, for example, in Figure 1 of the ’237 patent:



EX1001, FIG. 3 (annotated).

In contrast, as Petitioner again acknowledges, Corke discloses “determin[ing] the 3D relative pose of an object ... *from 2D image plane coordinates*,” EX1004, 159—not from a three-dimensional “object space.” And neither Petitioner nor its expert provide any explanation as to how Corke’s “2D image plane coordinates,” *id.*, map to the claimed “object space.” Pet., 22;

EX1003, ¶114. Petitioner’s unsupported, conclusory assertion, therefore, directly contradicts Corke’s disclosure and should be rejected. *See Intelligent Bio-Sys.*, 821 F.3d at 1369 (“[T]he expedited nature of IPRs bring with it an obligation for petitioners to make their case in their petition to institute.”).

B. The Petition fails to demonstrate that Corke teaches determining “an object space-to-camera space transformation for the target object based at least in part on a position of at least some of the located features,” as recited in the independent claims.

Claim 1 also requires, “determining by a processor an object space-to-camera space transformation for the target object based at least in part on a position of at least some of the located features [of the target object]” EX1001, Claim 1. Claims 20 and 25 similarly require, “determining an object space-to-camera space transformation based at least in part on a position of at least some of the located features [of the target object].” *Id.* at Claims 20, 25.

Petitioner inconsistently and illogically points to two different aspects of Corke to meet different portions of the claimed “determining by a processor an object space-to-camera space transformation for the target object based at least in part on a position of at least some of the located features.” On one hand, Petitioner alleges that “determining the target’s pose with respect to the camera,” which occurs *after* camera calibration, “is equivalent to the claimed step of determining the object space-to-camera space transformation.” Pet., 18. On the other hand, Petitioner points to “determining [camera calibration] matrix C,” which occurs

during camera calibration, to meet the “based at least in part on a position of at least some of the located features” portion of the claim element. Pet., 20. For clarity, Petitioner’s assertions are shown in the table below:

Portion of Claim Element	Petitioner’s Position
<u>determining by a processor an object space-to-camera space transformation for the target object...</u>	Pointing to Corke’s operation <i>after</i> camera calibration: “A POSITA would have understood that determining the target’s pose with respect to the camera is equivalent to the claimed step of <u>determining the object space-to-camera space transformation</u>.” Pet., 18. “A POSITA would have understood that Corke teaches an algorithm ... to determine the ‘3D relative pose of an object’ (<u>object space-to-camera space transformation for the target object</u>).” <i>Id.</i> at 22 (citing EX1004, 153, 159–60).
<u>...based at least in part on a position of at least some of the located features</u>	Pointing to Corke’s operation <i>during</i> camera calibration: “Corke teaches an <u>algorithm</u> that uses the position of features from a <u>single image</u> to determine the <u>object space-to-camera space transformation for the target object based at least in part on a position of at least some of the located features</u>.” <i>Id.</i> at 19 (citing EX1004, 138). “Corke teaches methods for determining [camera calibration] matrix C using the

	position of multiple features in a single image.” <i>Id.</i> at 20 (citing EX1004, 139–42).
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Petitioner’s positions are inconsistent with the claim language, in which the phrase “based at least in part on a position of at least some of the located features” is a specific requirement regarding *how* the “object space-to-camera space transformation for the target object” must be determined. As explained below, Petitioner’s argument makes no sense temporally or logically because the claimed transformation needs to be based at least in part on features located in the “target object,” but the “target object” is not present in Corke when the camera is being calibrated; it comes into play only afterwards. Thus, Petitioner fails to show that this claimed element is present in Corke, fails to explain how the two disparate passages describing two different embodiments in two different chapters could logically be combined to arrive at the element, and fails to provide any apparent reason or motivation to combine those disparate passages in the first place.

For starters, the ’237 patent claims expressly differentiate between a “calibration object” used for “calibrating the camera,” and a “target object” that the robot manipulates *after* calibration. *See, e.g.*, EX1001, Claim 20 (reciting both a “calibration object” and a “target object”); *see also id.* at 2:53-56 (“FIG. 1 shows a robot ... designed to manipulate a part or target object”). Importantly, the “located

features” used to determine the “object space-to-camera space transformation” must be features of “the target object”—that is, the object manipulated by the robot *after* calibration. Petitioner, however, does not (and cannot) point to any passage in Corke in which the features of the object to be manipulated are used to determine any such transformation. Instead, Petitioner points to Corke’s camera *calibration* algorithm, which is temporally and logically prior to, does not use, and has nothing to do with, any located features of a “target object.” Pet., 19–20 (citing EX1004, 138).

Petitioner specifically asserts that “Corke teaches methods for *determining [camera calibration] matrix C using the position of multiple features* in a single image.” Pet., 20 (citing EX1004, 139–42: “Camera *calibration* techniques”) (emphasis in bold in original). But those multiple features are not for any object to be manipulated; they are on a distinct object that Corke calls a “calibration target,” which may be either a “[c]hart[] with coplanar points” or a more complex “calibration frame.” EX1004, 139, 141. In contrast, for the “target object,” Petitioner points to Corke’s disclosure of an object that the robot operates upon *after* calibration. Pet., 14 (citing EX1004, 152–53 (“The word target will be used to refer to the object of interest, that is, the object which will be tracked.”)).

In Corke, therefore, the features of the purported “target object”—that is, the object manipulated by the robot—are *not* used to determine Corke’s “camera

calibration matrix.” Pet., 20; EX1004, 138. That calibration matrix is determined using a distinct “calibration target” before any “target object” is present. EX1004, 139–41 (discussing Corke’s camera calibration techniques). That is, Corke’s “camera calibration” techniques discussed in Chapter 4, which use a “calibration target” (*id.* at 139), happen earlier in time than, and are a prerequisite to, Corke’s “visual servoing” techniques discussed in Chapter 5, which use an “object of interest” that is manipulated by a robot. EX1004, 152; *see also id.* at 151 (“visual servoing” refers to “how visual features may be used to guide a robot manipulator.”). Simply put, Corke does not disclose that its camera calibration techniques use, in any way, features extracted from “object[s] of interest” operated upon by the robot because the calibration is complete before the “object[s] of interest” ever come into play.

Petitioner does not even attempt to explain how a skilled artisan could plausibly integrate the calibration algorithm from Chapter 4 with the servoing algorithm from Chapter 5 to arrive at a system in which “an object space-to-camera space transformation for the target object” is “based at least in part on a position of at least some of the located features” of the target object. Nor does Petitioner proffer any reason why a skilled artisan would be motivated to attempt such an illogical integration of the two distinct embodiments (carrying out two distinct functions) in the first place. *See Abiomed, Inc. v. Maquet Cardiovascular, LLC*,

IPR2017-01204 & IPR2017-01205, Paper 9 at 8–12 (P.T.A.B. Oct. 23, 2017)

(“Petitioner also fails to provide a sufficient rationale to combine the teachings of [the prior art’s] different embodiments. Petitioner simply fails to explain sufficiently why one skilled in the art would have found it obvious to combine those teachings.”). Petitioner thus cannot establish its own proffered theory—that that the claimed determination of “an object space-to-camera space transformation based at least in part on a position of at least some of the located features” is rendered obvious by Corke’s determination of camera calibration matrix **C**. Pet., 20.

For these additional reasons, the Board should deny institution.

V. GROUND 2: PETITIONER HAS NOT ESTABLISHED A MOTIVATION TO COMBINE CORKE AND WEI-I.

Petitioner alleges that Corke in view of Wei-I (EX1005) renders obvious claims 5, 12–16, and 21–24 of the ’237 patent. Pet., 56. But Petitioner’s alleged motivation to combine Corke and Wei-I is conclusory and insufficient to establish obviousness.

In particular, Petitioner asserts that “[a] POSITA would have understood that Wei-I discloses a streamlined way to perform the calibration required by Corke” because “Wei-I discloses a way for a system to self-calibrate (using a teaching object) for each of the intrinsic, extrinsic, and hand-eye calibration requirements of Corke.” Pet., 58. Petitioner, however, provides no explanation of how Wei-I’s

supposed self-calibration differs from Corke’s calibration techniques, or how they would be used to “streamline” the calibration process of Corke. *Id.* at 58–59. *See ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1328 (Fed. Cir. 2012) (holding that a motivation asserting that “you wanted to build something better,” “[y]ou wanted a system that was more efficient, cheaper, or you wanted a system that had more features” is insufficient “to support a determination of obviousness”).

For example, Petitioner asserts, “[w]hereas Corke requires use of a ‘target object’ for calibration, Wei-I performs self-calibration using a teaching object of the type a robot will manipulate during calibration.” Pet., 58–59.³ But Wei-I makes no mention of a “teaching object” in the provided citation, nor does Wei-I disclose that its techniques require the use of a “teaching object of the type a robot will manipulate during calibration.” *Id.* (citing EX1005, 1). Even if it had, Petitioner does not explain how Wei-I’s purported “teaching object” provides an improvement over the “target object” used by Corke, as Petitioner asserts. Pet., 58–

³ Petitioner argues that claims 5 and 12 recite “using a teaching object of the type a robot will manipulate during calibration.” Pet., 59–60. Patent Owner takes no position on this assertion but, regardless, Petitioner has not shown the claims are unpatentable even under its own interpretation.

59.

As with Ground 1, Dr. Hutchinson repeats—almost word-for-word—the conclusory reasons to combine presented in the Petition. *Compare* Pet., 58–59, with EX1003, ¶¶211–13; *see also* EX2002, 0171–0173. *Xerox*, IPR2022-00624, Paper 9 at 15; 37 C.F.R. § 42.65(a). Dr. Hutchinson, again, cites no additional evidence to corroborate his assertions. *See TQ Delta*, 942 F.3d at 1361 (rejecting “obviousness determinations based on conclusory and unsupported expert testimony” because “crediting such testimony risks allowing the challenger to use the challenged patent as a roadmap to reconstruct the claimed invention using disparate elements from the prior art”).

VI. THE BOARD SHOULD DENY THE PETITION IN VIEW OF THE PARALLEL DISTRICT-COURT LITIGATION.

In *Apple Inc. v. Fintiv, Inc.*, the Board articulated six nonexclusive factors for determining whether to institute an AIA post-grant proceeding where there is parallel district-court litigation. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (P.T.A.B. Mar. 20, 2020) (“*Fintiv*”). On June 21, 2022, Director Vidal issued a Memorandum re: Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (“*Fintiv* Memo”) clarifying the procedure that the Board should follow when evaluating the six *Fintiv* factors. Here, the Board should exercise its discretion to deny the Petition because (1)

Fintiv factors one through five support discretionary denial; and (2) the Petition does not provide a compelling, meritorious challenge (*Fintiv* factor six).

Fintiv factor one: As Petitioner notes, no stay has been requested in the parallel litigation, and there is no indication that the court would grant in the event this proceeding were instituted. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 15 at 12 (P.T.A.B. May 13, 2020) (“*Fintiv II*”) (in similar circumstances finding that “[t]his factor does not weigh for or against discretionary denial”).

Moreover, the parallel district-court proceeding is in front of Judge Gregory Williams of the District of Delaware. EX1013, 14. Judge Williams has explained that he is not inclined to grant a stay when “the issues before the PTAB are not the only defenses asserted by Defendants” and the case has moved beyond its earliest stages, as is the case here. *See CAO Lighting, Inc. v. Gen. Elec. Co.*, No. CV 20-681-GBW, 2022 WL 17752270, at *2 (D. Del. Dec. 19, 2022). As indicated in Defendant’s initial invalidity contentions, Defendant asserts numerous defenses under 35 U.S.C. §§ 101, 102, 103, and 112, beyond what is at issue in this IPR. *See* EX2003. This factor, therefore, should weigh in favor of discretionary denial.

Fintiv factor two: Trial in the parallel litigation is scheduled to begin April 21, 2025. EX1013, 16. If trial were instituted in this proceeding, a Final Written Decision would be due around the same time (April 4, 2025). This factor thus should weigh in favor of discretionary denial, or, at a minimum, should “implicate

other factors ... such as the resources that have been invested in the parallel proceeding.” *Fintiv*, 9.

Fintiv factor three: Petitioner asserts that “[t]he Related Litigation is in its initial stages, and the investment in it has been minimal.” Pet., 80. Not true. The parties have been litigating for almost a year and a half. The parallel district-court litigation has moved far beyond its initial stages, and the parties will have made a significant investment in the case by the projected institution date. Specifically, the parties have exchanged initial infringement and invalidity contentions, document production and interrogatory responses are well underway, and all claim construction briefing will be completed prior to April 4, 2024, the date by which an institution decision is due here. EX1013, 15. Additionally, fact discovery is set to close a mere two months after the institution decision. *Id.* at 16. Thus, depositions of the parties’ witnesses are likely to begin prior to an institution decision in this proceeding. These facts weigh at least “somewhat in favor of discretionary denial.” *Fintiv II*, 14.

Moreover, Petitioner waited until the very last day it was allowed to file its petition—exactly one year after being served with a complaint—and provides no explanation as to its filing delay. Pet., 80 (discussing *Fintiv* factor three); 35 U.S.C. § 315(b). This fact weighs heavily in favor of discretionary denial. *Fintiv*, 11–12

(“If, however, the evidence shows that the petitioner did not file the petition expeditiously, ... these facts have favored denial.”).

Fintiv factor four: *Fintiv* factor four weighs heavily in favor of discretionary denial. “Fintiv factor four looks at the overlap between the issues raised in the IPR petition and in the parallel proceeding in order to evaluate ‘concerns of inefficiency and the possibility of conflicting decisions.’” *Fintiv* Memo, 7; *Fintiv*, 12. Aside from noting the estoppel provisions of 35 U.S.C. § 315(e)(2), Petitioner has not provided a *Sotera* stipulation stating that it will not, in the parallel litigation, pursue the same grounds as in the Petition or any grounds that could have reasonably been raised in the petition. Pet., 80. Petitioner, in fact, has not provided any stipulation that would reduce overlap between the issues in this proceeding and the parallel district-court litigation. *Id.*

Petitioner includes the same prior art in the parallel litigation as in its Petition, as indicated in its initial invalidity contentions from the parallel litigation. EX2003, 10, 12 (including the same Corke and Wei references asserted in this Petition), 13, 20–23 (alleging that Corke and Wei either anticipate or render obvious the “Asserted Claims of the Patents-in-Suit”). Indeed, in its invalidity contentions, Petitioner has explicitly incorporated-by-reference the Petition and all supporting material. *Id.* at 5. This fact alone weighs heavily in favor of denial. *Fintiv* Memo, 7 (“If the petition includes the same or substantially the same claims,

grounds, arguments, and evidence as presented in the parallel proceeding, this fact has favored denial.”); *Fintiv*, 12.

The concerns of *Fintiv* factor four are further compounded by the other patents involved in the parallel litigation. The parallel litigation involves three patents—U.S. Patent Nos. 8,095,237 (“the ’237 patent”), 6,816,755 (“the ’755 patent”), and 7,336,814 (“the ’814 patent”). EX2003, 1. The ’237 patent involved in this proceeding is a continuation-in-part of the ’755 patent, and both contain similar claimed subject matter. *Compare* EX1001, Claims 1–2, *with* EX2004, Claim 1. Indeed, Petitioner asserts in its initial invalidity contentions that “[t]he Asserted Claims of the ’237 Patent *are not patentably distinct* from the claims of the ’755 Patent.” EX2003, 44.

Although Petitioner filed this Petition against the ’237 patent, no IPR petition was filed against the ’755 patent (and Petitioner is now barred from doing so). Petitioner has also asserted the same prior art presented in this Petition against the ’755 patent, as indicated in its initial invalidity contentions. *See* EX2003, 7–13. Because the estoppel provisions of 35 U.S.C. § 315(e)(2) apply only to the patent claims involved in an IPR and there is no indication that any collateral estoppel would apply, the same or similar invalidity issues will likely be tried in the parallel litigation *regardless of a final decision here*.

The “concerns of inefficiency and the possibility of conflicting decisions” emphasized by *Fintiv* factor four, *Fintiv* Memo, 7, therefore, will not be mitigated by a decision in this proceeding. Factor four thus strongly weighs in favor of discretionary denial.

Fintiv factor five: As Petitioner notes, Petitioner is the defendant in the parallel district-court litigation. *See* EX1011. This factor, therefore, weighs in favor of discretionary denial. *Fintiv II*, 15.

Fintiv factor six: Director Vidal’s *Fintiv* Memo explains that “[c]ompelling, meritorious challenges are those in which the evidence, if unrebutted in trial, would plainly lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence.” *Fintiv* Memo, 4. As explained in the arguments above, for a number of claim elements the Petition presents conclusory, attorney argument that lacks evidentiary support. *See* Section IV. This lack of evidence is exemplified by Dr. Hutchinson’s declaration, which provides no additional analysis of or corroborating evidence for the assertions made in the Petition. *See* Section III. Factor six therefore favors denial of institution. *Fintiv*, 15.

* * *

At bottom, the same invalidity issues will be tried in district court around the same time that a Final Written Decision is due here. Institution of trial, therefore, would not provide a “quick and cost-effective alternative[] to litigation,” causing

duplicate effort and costs for both parties. *Fintiv* Memo, 3 (citing H.R. Rep. No. 112–98, pt. 1, at 48). The Board should thus exercise its discretion to deny the Petition in view of the parallel litigation.

VII. CONCLUSION

For at least the foregoing reasons, the Board should deny institution of this proceeding.

Respectfully submitted,

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**CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATION,
TYPEFACE REQUIREMENTS, AND TYPE STYLE REQUIREMENTS**

1. This Patent Owner's Preliminary Response complies with the type-volume limitation of 14,000 words, comprising 7,466 words, excluding the parts exempted by 37 C.F.R. § 42.24(a)(1).

2. This Patent Owner's Preliminary Response complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word 2016 in 14-point Times New Roman.

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that the foregoing **PATENT OWNER'S PRELIMINARY RESPONSE** and Exhibits 2001-2014 were served electronically via e-mail on January 4, 2024, in their entireties on the following counsel of record for Petitioner:

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