

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SHENZHEN TUOZHU TECHNOLOGY CO. LTD.,
Petitioner,

v.

STRATASYS, INC.,
Patent Owner.

IPR2025-00585
Patent 11,167,464 B2

Before MITCHELL G. WEATHERLY, CHRISTOPHER L. OGDEN, and
LILAN REN, *Administrative Patent Judges*.

REN, *Administrative Patent Judge*.

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

I. INTRODUCTION

Shenzhen Tuozhu Technology Co., Ltd. (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1–6 and 10–19 (“the challenged claims”) of U.S. Patent No. 11,167,464 (Ex. 1001, “the ’464 patent”). Paper 2 (“Pet.”). Petitioner filed a declaration of Dr. Michael Hickner (Ex. 1003) in support of the Petition. Stratasy, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 8 (“Prelim. Resp.”).

We have authority to determine whether to institute an *inter partes* review. See 35 U.S.C. § 314 (2024); 37 C.F.R. § 42.4(a) (2024). Institution of an *inter partes* review requires that “the information presented in the petition . . . and any response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a). For the reasons set forth below, we determine that the scope of claim 1 is ambiguous and that there is not a reasonable likelihood that Petitioner will prevail with respect to at least one challenged claim, and we deny *inter partes* review.¹

II. BACKGROUND

A. *Real Parties in Interest*

Petitioner identifies itself as a real party in interest, and notes that Bambulab Limited, Shanghai Lunkuo Technology Co. Ltd., Tuozhu Technology Limited, and Bambulab USA Inc. are potential real parties in interest. Pet. 78. Patent Owner identifies itself and Stratasy Ltd. as real parties in interest. Paper 4, 2 (Patent Owner Mandatory Notices).

¹ The case was referred to the Board panel to consider the merits and non-discretionary considerations. Paper 10, 2.

B. Related Matters

Petitioner indicates that the '464 patent is involved in *Stratasys, Inc. v. Shenzhen Tuo Zhu Technology Co. Ltd.*, No. 2:24-cv-00645 (E.D. Tex.) which has been consolidated with No. 2:24-cv-00644 (E.D. Tex.) involving the same parties. Pet. 79; *see also* Paper 4, 2. Both parties indicate that the '464 patent is also involved in Civil Action No. 1:24-cv-01511, which is pending in the U.S. District Court for the Western District of Texas, Austin Division. Pet. 79; *see also* Paper 4, 2. Petitioner also states that the parties are involved in IPR2025-00257, IPR2025-00311, IPR2025-00321, IPR2025-00354, IPR2025-00531, and IPR2025-00532 whereas Patent Owner states that the parties are additionally involved in IPR2025-00438 and IPR2025-00611. Pet. 79; Paper 4, 2.

C. The '464 Patent

The '464 patent, titled “Tagged Build Material For Three-Dimensional Printing,” relates to “three-dimensional printers [which] use build material of various type and configuration to print three-dimensional objects.” Ex. 1001, code (54), 1:18–20. “In order to properly process the build material through the three-dimensional printer extruder for the fabrication of an object, the three-dimensional printer controller may need at least a basic set of characteristics of the build material to determine operation.” *Id.* at 1:20–34. To obtain these characteristics, the '464 patent provides that “[a] supply of build material such as a spool or cartridge is instrumented with a data tag that includes information about the build material. A three-dimensional printer can read the information from the tag and determine how to use the build material during fabrication of a three-dimensional object.” *Id.* at 1:31–35.

In particular, the '464 patent provides a process which “can dramatically simplify use of a three-dimensional printer by automating those aspects of printer configuration that depend on the type of build material being used.” *Id.* at 22:26–29. As a result, “a user may simply load a build material [sic] from a suitably instrumented container and select an object to print without specifying various configuration details that might otherwise be required.” *Id.* at 22:29–33. Figure 6 reproduced below is a flowchart of such a process:

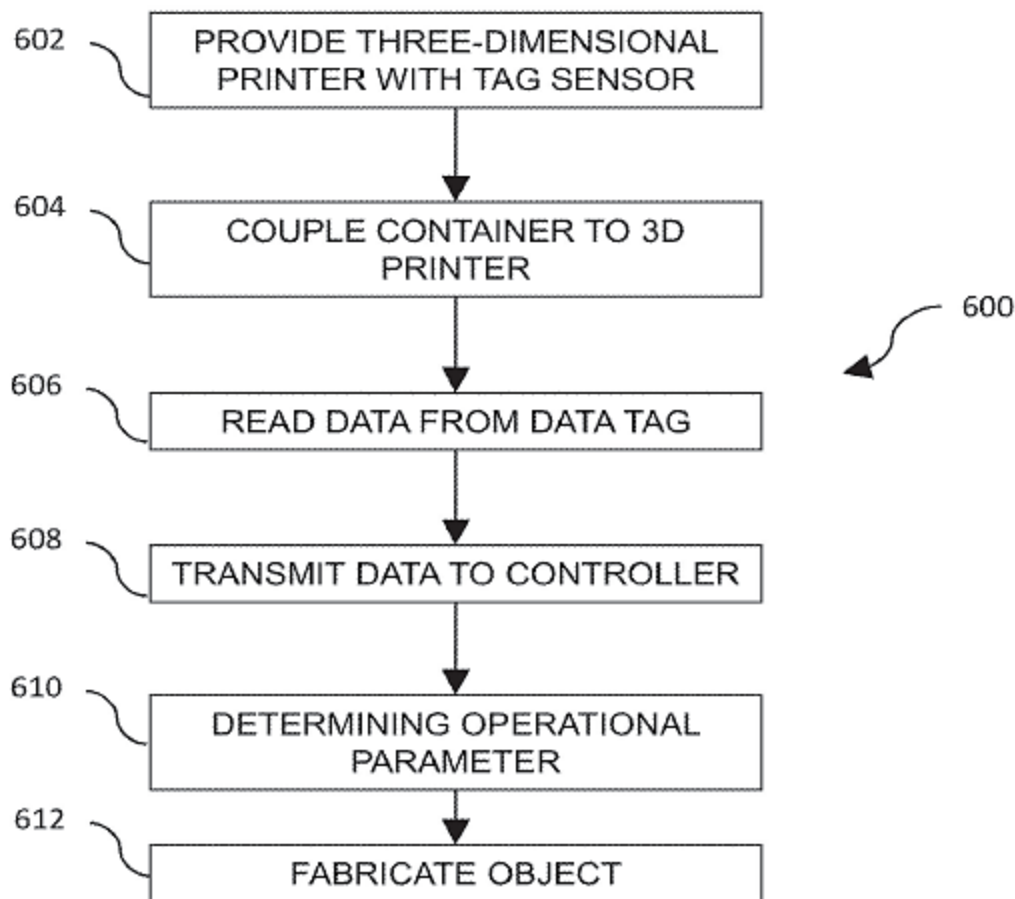


Fig. 6

As Figure 6 illustrates, step 602 includes “providing a three-dimensional printer with a controller and a tag sensor.” Ex. 1001, 20:66–67. Step 604 includes “coupling a container with a data tag to the three-dimensional printer.” *Id.* at 21:7–8. Such a “data tag may be a radio frequency identification (RFID) tag” and the like which “may store information about the build material such as a property of the build material in the container.” *Id.* at 21:9–15. The stored information may include “mechanical or structural properties of the build material, thermal properties of the build material (including phase change data), aesthetic properties of the build material, or any other properties useful for determining operational parameters.” *Id.* at 21:18–22.

Upon reading the data from the data tag at step 606 and transmitting the data from the tag sensor to the controller at step 608, “determining an operational parameter for the fabrication of an object by the three-dimensional printer based on data from the data tag” takes place at step 610. *Id.* at 21:41–47, 21:53–55. Such parameters may include “an extruder temperature, a feed rate, a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, an extruder movement speed, and a cooling requirement.” *Id.* at 21:60–63. “In one embodiment, the controller may make the determination of operational parameters using only the data from the data tag” *Id.* at 15:26–29. “For example, the data tag 304 may explicitly specify an extruder temperature and the controller may use the extruder temperature as an operational parameter” *Id.* at 15:28–31. Alternatively, the data tag “may identify a type of build material and the controller may calculate a suitable extruder temperature based on the type. Similarly, the controller may calculate other operational parameters such as build platform temperature,

feed rate, cooling parameters, build chamber heating parameters, and so forth.” *Id.* at 15:31–36. Lastly, “[a]s shown in step 612, the method 600 may include fabricating an object while using the operational parameter(s) to control operation of a three-dimensional printer.” *Id.* at 22:23–26.

The ’464 patent further provides that “the determination of operational parameters may include preliminary diagnostic tests such as whether the diameter of the build material, size of a build material pellet, build material fluid viscosity, or the like is appropriate for the three-dimensional printer.” *Id.* at 15:54–58.

D. Illustrative Claim

Of the challenged claims, claims 1, 12, and 19 are independent. Claim 1, reproduced below with bracketed reference numerals corresponding to those used by Petitioner, is illustrative of the claimed subject matter.

1. [p] A method comprising:
 - [a] reading data from a tag included on a supply of a build material using a tag sensor in communication with a controller of a three-dimensional printer, the data including at least one property of the build material;
 - [b] determining an operational parameter of a fabrication process using the three-dimensional printer based upon the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement;
 - [c] performing a diagnostic test to determine whether the operational parameter is suitable for the three-dimensional printer; and
 - [d] when the operational parameter is suitable for the three dimensional printer according to the diagnostic test, controlling operation of the three-dimensional printer during the fabrication process with the controller

according to the operational parameter to fabricate an object with the three-dimensional printer.

Ex. 1001, 23:33–53; see Pet. v (providing Petitioner’s claim identifiers).

E. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability:

Ground	Claim(s) Challenged	35 U.S.C. § ²	Reference(s)/Basis
1A	1, 4, 5, 11–17	103	Dahlin, ³ Menchik ⁴
1B	2, 3, 6, 10, 18, 19	103	Dahlin, Menchik, Loughran ⁵
2	1–6, 10–15, 17–19	103	Loughran, Toshiki ⁶

Pet. 1.

² The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. §102 and § 103, effective March 16, 2013. Because the actual filing date of the application for the ’464 patent was after that date but the ’464 patent claims priority to an earlier provisional application (filed on October 29, 2012) and Petitioner argues that the ’464 patent is not entitled to the earlier priority data, we refer to both the pre-AIA and AIA versions of §§ 102 and 103 when applicable.

³ Dahlin, US 6,022,207, issued Feb. 8, 2000, filed Jan. 26, 1998 (Ex. 1011). Petitioner contends that Dahlin is prior art to the ’464 patent under pre-AIA 35 U.S.C. § 102(a) and AIA § 102(a)(1). Pet. 2.

⁴ Menchik, US 2006/0127153 A1, published June 15, 2006, filed Nov. 12, 2003 (Ex. 1009). Petitioner contends that Menchik is prior art to the ’464 patent under pre-AIA 35 U.S.C. § 102(a) and AIA § 102(a)(1). Pet. 2.

⁵ Loughran, US 2006/0091199 A1, published May 4, 2006, filed Oct. 29, 2004 (Ex. 1004). Petitioner contends that Loughran is prior art to the ’464 patent under pre-AIA 35 U.S.C. § 102(a) and AIA § 102(a)(1). Pet. 2.

⁶ Toshiki, JP 2013067018A, published Apr. 18, 2013, filed Sept. 20, 2011 (Ex. 1024). Petitioner contends that Toshiki is prior art to the ’464 patent under AIA § 102(a)(1). Pet. 2. Petitioner states that the English translation is certified. Ex. 1024, 103.

III. ANALYSIS

A. *Legal Standards*

A patent claim is unpatentable under 35 U.S.C. § 103 if “the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” The question of obviousness is resolved based on underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when presented, objective evidence of obviousness or nonobviousness, i.e., secondary considerations.⁷ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

The obviousness inquiry typically requires an analysis of “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”)). A patent claim “is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *Id.* In particular, “[a]lthough the *KSR* test is flexible, the Board ‘must still be careful not to allow hindsight reconstruction of references . . . without any explanation as to *how* or *why* the references would be combined to produce the claimed invention.’” *TriVascular, Inc. v. Samuels*, 812 F.3d

⁷ Neither party presents evidence or arguments regarding objective evidence of non-obviousness. See Pet.; Prelim. Resp.

1056, 1066 (Fed. Cir. 2016) (alteration in original) (quoting *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1368 (Fed. Cir. 2012) (emphases added)).

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3)); *see also* *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016). Therefore, to prevail in an *inter partes* review, Petitioner must explain how the proposed combinations of prior art would have rendered the challenged claims unpatentable. At this preliminary stage, we determine whether the information presented in the Petition shows there is a reasonable likelihood that Petitioner would prevail in establishing that at least one of the challenged claims would have been obvious over the proposed combinations of prior art. *See* 35 U.S.C. § 314(a).

B. Level of Ordinary Skill in the Art

Determining whether an invention would have been obvious under 35 U.S.C. § 103 requires resolving the level of ordinary skill in the pertinent art at the relevant time. *Graham*, 383 U.S. at 17. The person of ordinary skill in the art is a hypothetical person who knows the relevant art. *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). Factors in determining the level of ordinary skill in the art include the types of problems encountered in the art, the sophistication of the technology, and educational level of active workers in the field. *Id.* One or more factors may predominate. *Id.*

Petitioner contends that a person of ordinary skill in the art in the field in the relevant time frame would have had “(1) at least a bachelor’s degree in Mechanical Engineering, Computer Engineering, Chemical Engineering,

Materials Science, or a related field, and (2) at least two years of research or industry experience in 3D printing or materials used for 3D printing.” Pet. 5 (citing Ex. 1003 ¶ 20). Petitioner also contends that “[a]dditional experience could substitute for a formal degree or formal training (and vice versa).” *Id.* (citing the same).

Patent Owner contends that an ordinarily skilled artisan “would have had a bachelor’s degree in Mechanical Engineering, Computer Engineering, Electrical Engineering, Chemical Engineering, Materials Science, or a comparable field and at least two years of experience related to 3D printing, with additional experience potentially being a substitute for a formal degree or training (and vice versa).” Prelim. Resp. 12.

For purposes of this decision, we adopt Petitioner’s definition of the level of ordinary skill in the art as it appears unopposed and consistent with the disclosures of the ’464 patent and the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

C. Claim Construction

In an *inter partes* review, we apply the same claim construction standard as would be used by a district court to construe a claim in a civil action involving the validity or infringement of a patent. 37 C.F.R. § 42.100(b). Under that standard, claim terms are given their ordinary and customary meaning, as would have been understood by a person of ordinary skill in the art at the time of the invention, in light of the language of the claims, the specification, and the prosecution history of record. *Id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–19 (Fed. Cir. 2005) (en banc); *Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1365–66 (Fed. Cir. 2012). “The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the

controversy.” *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (quoting *Vivid Techs., Inc. v. Am. Sci. Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

At this stage of the proceeding, neither party contends that any formal claim construction is necessary. See Pet. 5–6 (“Petitioner submits that no claim terms require a formal construction for purposes of evaluating the prior art and resolving issues this proceeding.”); Prelim. Resp. 13 (“For the purposes of this Preliminary Response, Patent Owner submits that the Board does not need to construe any claim terms in any particular way to conclude that the Petition is deficient and thus institution of review is not warranted.”). After reviewing the parties’ respective arguments and the evidence currently before us, however, we discern a need to expressly construe at least one term as discussed below to resolve the controversy at this stage of the proceeding.

1. *Claim element 1c: “performing a diagnostic test to determine whether the operational parameter is suitable for the three-dimensional printer”*

Claim element 1c requires “performing a diagnostic test to determine whether the operational parameter is suitable for the three-dimensional printer.” The prosecution history of the ’464 patent shows that claim 1 as originally filed recites only the “reading,” “determining,” and “controlling” steps or claim elements 1a, 1b, and 1d of claim 1 as issued. Ex. 1002, 63 (prosecution history of Application No. 16/796,122 or the “’122 application” which was issued as the ’464 patent). Claim 10 as originally filed, which did recite a “performing” step substantially similar to claim element 1c, was cancelled after the originally filed claim 1 was amended to incorporate the “performing” step in originally filed claim 10. *Id.* at 135, 136, 139. This

amendment to claim 1 eventually resulted in the claim being issued without further amendment. *See id.* at 176 (filing terminal disclaimer in response to obviousness type double patenting rejection), 183 (showing claim 1 without further amendment), 195 (Notice of Allowability).

In the applicant's remarks accompanying the amendment adding element 1c to claim 1, the applicant states that "[t]he claim amendments find support in at least ¶¶ [0067] and [0077] of the as-filed Specification" and that "[n]o new matter is added." *Id.* at 139. The applicant additionally provides that originally filed claim 1 is amended as such "to be sure that the operational parameter is compatible with the three-dimensional printer" and provides the following quote from paragraph 69 of the specification as support "to clarify this inventive concept":

[T]he determination of operational parameters may include preliminary diagnostic tests such as whether the diameter of the build material, size of a build material pellet, build material fluid viscosity, or the like is appropriate for the three-dimensional printer 306. Additional diagnostic test may be performed such as whether the correct build material 312 is provided on the supply 302, whether the correct color or color lot build material 312 is on the supply, or any other appropriate preliminary diagnostic build material test used to determine, as a threshold matter, whether a desired fabrication can be performed with the supply 302.

Id. at 139–140 (alteration in original). The '122 application was issued as the '464 patent without further claim amendment. *See id.* at 148–224.

Other than the claim language itself, the only portion that mentions the phrase "diagnostic test" is paragraph 69 of the '122 application quoted

above⁸ which is column 15, lines 54–64 of the ’464 patent (“the diagnostic test passage”). *Compare id.* at 51, with Ex. 1001, 15:54–64; *see also* Ex. 1002, 139–140 (quoting paragraph 69 of the ’122 application in support of the amendment which led to claim 1 at issue here). The diagnostic test passage describes performing “preliminary diagnostic tests” as a possible mechanism for “the determination of operational parameters.” Ex. 1001, 15:54–55. The diagnostic test passage further provides these preliminary diagnostic tests may include a “preliminary diagnostic build material test” “to determine . . . whether a desired fabrication can be performed with the supply 302.” *Id.* at 15:62–65.

The ’464 patent distinguishes and contrasts build material property data from operational parameters. Whereas build material property data “may characterize at least one property of the build material” and may include “other characteristic information appropriate for a three-dimensional printer,” an “operational parameter” “may be at least one of an extruder temperature, a feed rate, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement” or “an authorization to print.” *Id.* at 14:61–15:4, 15:16–25, 22:2–3.

⁸ As noted *supra*, the applicant also cites paragraphs 67 and 77 as support. Paragraph 67 provides, in relevant part, that “the controller may make the determination of operational parameters using the material identification number stored on the data tag,” and paragraph 77 provides, in relevant part, that “data tag 304 may encode ordering information, such as information on how to purchase replacement build material, or information including an identifier of a suitable replacement container (with build material).” Ex. 1002, 50–51, 54. Neither paragraph mentions the term “a diagnostic test” or “test.”

The operational parameters may be determined using preliminary diagnostic tests of the build material. *See id.* at 15:54–58 (“[T]he determination of operational parameters may include preliminary diagnostic tests such as whether the diameter of the build material . . . is appropriate for the three-dimensional printer . . .”). The preliminary diagnostic tests are performed to determine whether build material property such as “the diameter of the build material,” the “size of a build material pellet,” and “build material fluid viscosity” are “appropriate for the three-dimensional printer.” *Id.* at 15:54–58. Other build material attributes such as “whether the correct build material 312 is provided on the supply 302” or “whether the correct color or color lot build material 312 is on the supply” may also be subjected to the diagnostic testing. *Id.* at 15:59–63. The ’464 patent specifies that the diameter, color, “color lot number,” and viscosity of the build material (which may be subjected to the diagnostic build material test), are properties of the build material. *Id.* at 14:57–15:3 (“[T]he tag sensor 310 may be configured to automatically read data from the data tag 304 regarding the supply 302 of build material 312. The data may characterize at least one property of the build material 312. For example, characteristic data stored on the data tag 304 may include at least one of . . . a build material diameter, . . . a build material color, . . . a build material color lot number, . . . a build material viscosity . . .”).

. The diagnostic test passage states that ““[t]he determination of operational parameters may include preliminary diagnostic tests such as whether the diameter of the build material . . . is appropriate for the three-dimensional printer” (*id.* at 15:54–58) indicating the diagnostic test of the build material property is part of the determination of an operational parameter. As we explain in the previous paragraphs, the ’464 patent

distinguishes and contrasts build material property from operational parameters. The diagnostic test passage therefore only describes a diagnostic test of the build material property but does not describe a subsequent diagnostic test to assess whether an operational parameter is suitable for the printer. Based solely on the diagnostic test passage and the prosecution history, a possible interpretation may be that the operational parameter determination in claim element 1b encompasses the diagnostic testing in claim element 1c. That is, “performing a diagnostic test to determine whether the operational parameter is suitable for the three-dimensional printer” in claim element 1c is subsumed as part of “determining an operational parameter of a fabrication process using the three-dimensional printer based upon the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement” in claim element 1b.

Contrary to the interpretation that the operational parameter determination in claim element 1b encompasses the diagnostic testing in claim element 1c, the plain language of claim 1 requires two distinctive steps: determining an operational parameter in 1b; followed by performing a diagnostic test in 1c. Consistent with the specification, the plain language of the claim also requires the operational parameter to be determined based on “at least one property of the build material.” *See id.* at 15:12–17 (describing a controller that receives build material property data “to determine at least one operational parameter for the three-dimensional printer 306 based on at least one characteristic of the build material 312 for the fabrication of an object”). The ’464 patent provides an embodiment that a controller “may make the determination of operational parameters using only the data from

the data tag 304” as well as “other operational parameter[s] that might be usefully determined by the controller from the data stored by the data tag 304.” *Id.* at 15:23–28; *see also id.* at 21:9–22 (“[T]he data tag may store information about the build material such as the property of the build material in the container. . . . [T]he data may include information about mechanical or structural properties of the build material, . . . or any other properties useful for determining operational parameters.”), 21:58–67 (“[B]ased upon the type of build material, the controller may determine a variety of parameters such as an extruder temperature, a feed rate, a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, . . . and a cooling requirement. More generally, any parameter . . . might usefully be determined with reference to the type of material and/or other information available on the data tag.”). Only after the operational parameter is determined in claim element 1b is it possible “to determine whether the operational parameter is suitable for the three-dimensional printer” as recited in claim element 1c.

The plain language of the claim and the ’464 patent in its entirety, therefore, offer conflicting interpretations as to whether claim element 1b encompasses claim element 1c such that the recited “determining” and “performing” steps are in fact one and the same. The scope of claim element 1c “performing a diagnostic test to determine whether the operational parameter is suitable for the three-dimensional printer” is therefore ambiguous as to whether the recited “diagnostic test” is the same as that performed for “the determination of operational parameters.” *See id.* at 15:54–55.

Moreover, if the recited “diagnostic test to determine whether the operational parameter is suitable for the” printer is the same as that performed for “the determination of operational parameters,” the scope of claim element 1c is further ambiguous because it is unclear why it is a separate step from claim element 1b which already determines the operational parameters based on both (1) data read by the tag included with the supply of the build material and (2) requirements of the 3D printing task such as temperature, infill, rafting, and support-structure requirements. On the other hand, if the recited “diagnostic test to determine whether the operational parameter is suitable for the” printer is different from that “the determination of operational parameters” of element 1b, the scope of claim element 1c remains ambiguous as to what “performing [the] diagnostic test” entails (whether it is a testing of the operational parameters, a testing of the build material data which is used to determine the operational parameters, or a testing of the printer itself, etc.). We are unable to discern any way in which the specification of the ’464 patent resolves this ambiguity. The ’464 patent only states that it is the “diagnostic build material test” that is performed “to determine . . . whether a desired fabrication can be performed with the supply 302” and that a preliminary diagnostic test is performed to determine the operational parameter. *Id.* at 15:54–55 (“[T]he determination of operational parameters may include preliminary diagnostic tests . . .”), 15:62–65.

2. Conclusion Based on Claim Construction

“[D]etermination of the patentability of a claim on the presented prior-art grounds” may be “rendered impossible because of the indefiniteness of an essential claim limitation.” *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 813 (Fed. Cir. 2021) (citing *Samsung Electronics America, Inc. v. Prisia*

Eng'g Corp., 948 F.3d 1342, 1353 (Fed. Cir. 2020)). Because the scope of claim 1 is ambiguous, we deny institution on this basis.

Alternatively, for the reasons below, we deny institution on the additional basis that Petitioner has not established a reasonable likelihood of prevailing on any of the asserted grounds of unpatentability, based on our best understanding of the ambiguous claim language. For this analysis, we assume, based on the plain language of the claims, that the “diagnostic test” of claim element 1c is distinct from the step of “determining an operational parameter” in 1b.

In other words, even though claim element 1b already requires selecting an operational parameter that is “based on” the tag-sensor data recited in claim element 1a, we assume, for this decision that claim element 1c requires a distinct diagnostic test (not involving the same determination made in 1b) for determining whether the operational parameter is suitable for the printing job.

D. Earliest Effective Filing Date

The '464 patent claims priority to an application filed on October 28, 2013. Ex. 1001, code (63). The '464 patent also claims priority to provisional application No. 61/719,874 (the “provisional application” or the “'874 provisional”), which was filed on October 29, 2012. *Id.* at code (60). Petitioner argues that the provisional application does not provide written description support for the challenged claims and that the '464 patent is therefore only entitled to a priority date of October 28, 2013. Pet. 7–8.

Petitioner argues that the provisional application mentions the phrase “diagnostic test” but “does not adequately provide written description support for performing a diagnostic test to determine whether the operational parameter is suitable for the three-dimensional printer” required by claim

element 1c and claim element 1d which requires the result of the diagnostic test in claim element 1c. *Id.* at 8. Specifically, the provisional application discloses performing “preliminary diagnostic tests such as whether the diameter of the build material is appropriate for the three-dimensional printer.” Ex. 1022 ¶ 28 (cited in Pet. 8). Petitioner argues that “the diameter of the build material” is not an operational parameter but rather “data describing the build material.” Pet. 8. The provisional application also discloses a “selection of defaults for tool instructions such as a build platform temperature, extrusion temperature, and so forth, any of which may be selected according to the properties of the build material and/or the characteristics of the three-dimensional printer.” Ex. 1022 ¶ 28 (cited in Pet. 8). Petitioner argues that the provisional application does not disclose “performing a diagnostic test on [such] ‘tool instructions’” and therefore does not provide written description support for claim elements 1c and 1d. Pet. 8.

Patent Owner, on the other hand, argues that “Petitioner demands the exact words of the claim appear in the earlier filing” and “Petitioner fails to appreciate and address numerous interrelated disclosures in the provisional application that support the claim elements.” Prelim. Resp. 37. Patent Owner cites paragraph 28 of the provisional application for the disclosure that “diagnostic test may be performed to determine whether a selected default is appropriate for the three-dimensional printer.” *Id.* at 38 (citing Ex. 1022 ¶ 28). Patent Owner argues that “a variety of diagnostic tests may be performed that may be based upon sensors that permit determinations concerning the ability of the three-dimensional printer to execute a print job.” *Id.* (citing Ex. 1022 ¶¶ 87–89). Patent Owner reasons that “the provisional application supports performing a diagnostic test to determine

whether the operational parameter is suitable for the three-dimensional printer” because “numerous additional disclosures in the provisional application show that it determines the operational parameter based upon the data read from the tag when certain materials are to be used or provided.” *Id.*

“It is elementary patent law that a patent application is entitled to the benefit of the filing date of an earlier filed application only if the disclosure of the earlier application provides support for the claims of the later application, as required by 35 U.S.C. § 112.” *PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1306 (Fed. Cir. 2008); *see also Research Corps. Techs. v. Microsoft Corp.*, 627 F.3d 859, 871–72 (Fed. Cir. 2010) (holding that claims of the later-filed application, which were not limited to a “blue noise mask,” were “not entitled to claim the benefit of their parent applications’ filing dates”); *ICU Med., Inc. v. Alaris Med. Sys.*, 558 F.3d 1368, 1377–78 (Fed. Cir. 2009) (holding that “spikeless” claims “added years later during prosecution” were not supported by the specification which “describe[d] only medical valves with spikes”); *Tronzo v. Biomet, Inc.*, 156 F.3d 1154, 1158–60 (Fed. Cir. 1998) (holding the generic shaped cup claims of the later-filed child application were not entitled to the filing date of the parent application that “disclosed only a trapezoidal cup and nothing more”). “To satisfy the written description requirement the disclosure of the prior application must convey with reasonable clarity to those skilled in the art that, as of the filing date sought, [the inventor] was in possession of the invention.” *PowerOasis*, 522 F.3d at 1306 (emphasis omitted; alteration in original). The sufficiency of written description support is based on “an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art.”

Ariad Pharm., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc).

“In an *inter partes* review, the burden of persuasion is on the petitioner to prove ‘unpatentability by a preponderance of the evidence,’ . . . and that burden never shifts to the patentee.” *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (quoting 35 U.S.C. § 316(e)). The burden of production can shift to the patentee, however (*see id.* at 1379), where it is “warranted because the patentee affirmatively seeks to establish a proposition not relied on by the patent challenger and not a necessary predicate for the unpatentability claim asserted—effectively an affirmative defense.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1376 (Fed. Cir. 2016).

In this case, having considered the parties’ respective arguments and the cited evidence, we are persuaded that Petitioner has sufficiently shown for purposes of institution that claim element 1c lacks written description support in the provisional application.

Claim element 1c requires “performing a diagnostic test to determine whether the operational parameter is suitable for the three-dimensional printer.” Paragraph 28 of the provisional application discloses performing “preliminary diagnostic tests such as whether the diameter of the build material is appropriate for the three-dimensional printer.” Ex. 1022 ¶ 28 (cited in Prelim. Resp. 38). The provisional application also discloses a “selection of defaults for tool instructions such as a build platform temperature, extrusion temperature, and so forth, any of which may be selected according to the properties of the build material and/or the characteristics of the three-dimensional printer.” *Id.* (cited in Prelim. Resp. 38). This paragraph of the provisional application therefore discloses: (1) a

diagnostic test to determine “whether the diameter of the build material is appropriate for the three-dimensional printer”; and (2) a selection of certain default tool instructions. *See id.* Patent Owner does not contest Petitioner’s contention that “the diameter of the build material” is not an operating parameter but rather “data describing the build material.” *Compare* Pet. 8, *with* Prelim. Resp. 33–40, 35 (acknowledging that diameter is “data describing the build material”). Patent Owner acknowledges that this paragraph discloses “defaults for tool instructions . . . may be selected according to the properties of the build material” but concludes, without adequate explanation, that the same paragraph also discloses “a diagnostic test may be performed to determine whether the operational parameter is appropriate for the three-dimensional printer.” Prelim. Resp. 37–38 (citing paragraph 28 of the provisional application).

Patent Owner also argues that other portions of the provisional disclose “a variety of diagnostic tests may be performed that may be based upon sensors that permit determinations concerning the ability of the three-dimensional printer to execute a print job.” Prelim. Resp. 38 (citing Ex. 1022 ¶¶ 87–89). These paragraphs describe “evaluating an availability of the three-dimensional printer for the print job” “based upon a signal from any of the sensors associated with the three-dimensional printer.” Ex. 1022 ¶ 87. For example, “if a thermal sensor detects that a print head is not at a suitable temperature (or is not responding correctly to a heating command), the printer may not be ready and a corresponding evaluation may be provided.” *Id.* ¶ 88. To the extent that these paragraphs disclose an evaluation of printer availability based on print head temperature, the record before us shows that the print head temperature is detected by “a thermal sensor” (*id.*) instead of based on tag data for the build material. Patent

Owner does not specifically contest Petitioner’s contention that “[d]etermining that ‘a print head is not at a suitable temperature (or is not responding correctly to a heating command)’ is not a test of whether the print head temperature, determined based on the tag data, is suitable for the printer.” *Compare* Pet. 9, with Prelim. Resp. 37–38.

We determine, based on the record before us, that Petitioner has adequately established that the provisional application does not provide written description support for claim 1, in particular claim element 1c, as it is currently written.⁹ Accordingly, we agree with Petitioner that the earliest possible priority date of the ’464 patent is October 28, 2013, for purposes of this decision. The Toshiki reference is therefore prior art under AIA § 102(a)(1) as Petitioner contends for the purpose of this decision. *See* Pet. 2; *see also* FN 6. Dahlin, Menchik, and Loughran are prior art under the applicable AIA provisions for the purpose of this decision. *See* FN 3–5.

E. Alleged Obviousness Over Dahlin and Menchik (Ground 1A)

Petitioner alleges that claims 1, 4, 5, and 11–17 of the ’464 patent would have been obvious over Dahlin and Menchik. Pet. 10–39. Patent Owner contends in response that there is no motivation to combine the

⁹ Petitioner also argues that “nowhere does the ’874 Provisional disclose that the ‘amount of build material required for the print job’ is determined based on the tag data” and therefore that the ’874 Provisional does not provide written description support for claim element 1b. Pet. 9. Because we determine that claim element 1c lacks written description support in the provisional application, we need not address Petitioner’s argument that element 1b also lacks written description support.

references and that the proposed combination does not teach various claim elements. Prelim. Resp. 16–27.¹⁰

As explained in more detail below, having considered the arguments and evidence before us at this preliminary stage, we find that the current record does not establish a reasonable likelihood that Petitioner would prevail on claim 1 in this asserted ground of unpatentability.

1. *Dahlin*

Dahlin, titled “Rapid Prototyping System with Filament Supply Spool Monitoring,” describes “a rapid prototyping system for forming three-dimensional objects.” Ex. 1011, code (54), 1:7–8. Dahlin states that “it is desirable for the control system of the rapid prototyping system to keep track of the amount of modeling material remaining in a cassette or on a spool” as well as “for the control system to know the type of modeling material that is on the cassette or spool, and the proper extrusion parameters for dispensing the material.” *Id.* at 1:41–47. Dahlin accordingly describes “a filament spool and a filament supplied rapid prototyping system that provides a circuit for monitoring data concerning the filament on the filament spool” as well as “[a]n electronically readable and writeable memory device that provides data to the control system.” *Id.* at 1:48–50, 1:61–64. “The memory device serves as an electronic tag which informs the control system” of data such as “the proper extrusion parameters for dispensing the material.” *Id.* at 1:54–56.

¹⁰ The Preliminary Response generally italicizes the names of the references. *See generally* Prelim. Resp. Unless otherwise noted, our quotations of the Preliminary Response do not reproduce such italicization of reference names.

In one embodiment, Dahlin describes a rapid prototyping system having a modeling filament spool as well as support filament spool. *Id.* at 2:63, 3:8–9. “IO card 94 monitors data concerning modeling material filament spool 42 through communications with a modeling drybox processor board 116.” *Id.* at 5:1–3. “CPU 92 receives the modeling filament data from IO card 94. At the outset of a job, the CPU 92 will calculate whether a spool 42 or 56 contains enough filament to complete the job” and notifies an operator “either that the filament is adequate to complete the job, or that the filament spool will need replacement and reloading during the process.” *Id.* at 5:26–32.

2. *Menchik*

Menchik, titled “Three-Dimensional Object Printing,” describes a “method to monitor, compute, and control building material Supply in a 3D printing system.” Ex. 1009, code (54), ¶ 47. Such a method includes a step where “the status of the building material in the one or more cartridges may be measured by respective sensors” followed by computation of “various parameters of the materials within the various cartridges” by “utilizing the data provided by . . . respective memory chips attached to the respective cartridge.” *Id.* ¶ 47. Menchik describes a memory chip “or other suitable data storage device” which may “store and/or record information relating to the material stored within cartridge” such as “the type of building material in the cartridge bag,” “the materials color, manufacturing date, optimal operation parameters (e.g., recommended jetting temperature), optimum building parameters (e.g., for building or support), and material parameters (e.g., viscosity and Surface tension at the recommended temperature etc.) etc.” *Id.* ¶ 35.

The method in Menchik may also “compute . . . the amount of modeling material, support liquid, or combination of modeling and supporting materials required for printing a given three-dimensional object” as well as “supply parameters for material in each cartridge” “based on the materials required for printing a given object.” *Id.* ¶¶ 48, 49. “[D]ata relating to the object to be printed, such as print data, CAD data, control data, etc.” may be used for these computations and “data relating to the material type, properties, etc.” may be stored. *Id.* ¶ 47.

3. *Reasons to Combine & Reasonable Expectation of Success*

Patent Owner disagrees with Petitioner’s contention that there is motivation to combine Dahlin and Menchik with a reasonable expectation of success. *Compare* Prelim. Resp. 16–20, *with* Pet. 14–17. As our analysis shows below, even if we assume, *arguendo*, that there is motivation and a reasonable expectation of success in combining the teachings of Dahlin and Menchik in the manner argued by Petitioner, the combined teachings do not teach or suggest every claim element.

4. *Analysis of Independent Claim 1*

Among the various claim elements that Patent Owner contends are missing from the combined prior art teaching, we focus on claim element 1b, which recites “determining an operational parameter of a fabrication process using the three-dimensional printer based upon the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement,” because the subsequent steps/claim elements are predicated on carrying out claim element 1b.

Petitioner first argues that Dahlin alone teaches or suggests this claim element because “the EEPROM board 120 serves as ‘an electronic tag with a

variety of functions’ to communicate information about the filament of material to the control system 90” and such information may include both “the type of material” as well as “the proper extrusion parameters for dispensing the material.” Pet. 23–24 (citing Ex. 1011, 1:40–58, 5:11–12). Petitioner thus contends that it is within the ordinary skill use “Dahlin’s control system 90 . . . to determine such operational parameters by simply reading them from the electronic tag and to fabricate objects using those proper extrusion parameters for that particular filament material.” *Id.* at 24 (citing Ex. 1011, 4:30–5:53; Ex. 1003 ¶ 56).

Petitioner’s arguments do not establish a reasonable likelihood that Dahlin teaches or suggests claim element 1b. In Petitioner’s analysis of claim element 1c (whose implementation is predicated on the “operational parameter” determined in claim element 1b), Petitioner argues that the “operational parameter specifying a support structure requirement” is “the amount of support filament required for completing the job.” Pet. 29. Moreover, Petitioner’s analysis of claim element 1c is solely based on the “operational parameter specifying a support structure requirement” (*id.*) and not on any “extrusion parameters” (*id.* at 24). Petitioner’s own arguments therefore do not show that there is a reasonable likelihood that Dahlin alone teaches or suggests claim element 1b.

Petitioner next argues that a skilled artisan

would have also been motivated to implement Dahlin’s system in a manner that employs Menchik’s suggestion (e.g., the memory device storing optimal operation parameters, optimum building parameters, material parameters, and building material information, and the controller computing material and supply parameters including the amount of material required for printing a given object) to thereby enable Dahlin’s system to determine the amount of support material required for printing a

given object (operational parameter) based on building material information stored in its tag.

Pet. 25 (citing Ex. 1003 ¶ 57). Petitioner argues that Figure 6 of Menchik shows a printer controller computing “the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object.” *Id.* Petitioner argues that Menchik teaches a memory chip that “stores a greater variety of ‘information relating to the material stored within cartridge 250.’” *Id.* at 26 (quoting Ex. 1009 ¶ 35). Petitioner argues that the combined teachings of Dahlin and Menchik would have used “data from the electronic tag (e.g., building material information)” to determine an operational parameter which includes “the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object.” *Id.* at 27.

Patent Owner argues that Petitioner acknowledges “‘the amount of material required for printing a given object’ . . . is not stored or based on information stored in the memory device.” Prelim. Resp. 22 (citing Pet. 25). Patent Owner argues that “the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object” in Menchik (which Petitioner contends are operational parameters) are calculated based on “data relating to the object to be printed, such as print data, CAD data, control data” rather than build material data read from the electronic tag. *Id.* at 22–23 (citing Ex. 1009 ¶¶ 47, 48).

We are persuaded by Patent Owner’s arguments, which are supported by the record before us. Figure 6 of Menchik describes the following process: at block 105, data regarding “the status of the building material”

“may be transmitted to a printer controller;” at block 610, the controller computes “various parameters of the materials” such as color and amount using the data transmitted at block 105, the printer may also “utilize data relating to the object to be printed, such as print data, CAD data, control data, etc.”; and subsequently at block 615, “the printer controller may compute . . . the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object.” Ex. 1009 ¶¶ 47, 48.

Menchik does not clearly explain what data is used to compute “the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object.” *Id.* ¶ 48.¹¹ Menchik, however, clearly states that the “building material information” which Petitioner contends is “data read from the electronic tag” (Pet. 27) is used to compute “parameters of the material” such as “color.” Ex. 1009 ¶ 48. Moreover, Menchik teaches to “store data relating to the material type, properties, etc.” but does not mention storing “the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object.” *Id.* ¶¶ 47, 48. The record before us therefore lacks any teaching or suggestion that “the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object” (which Petitioner contends are

¹¹ We note, based on the current record before us, Patent Owner’s argument that such data is calculated based on “data relating to the object to be printed, such as print data, CAD data, control data” is not an unreasonable understanding of Menchik’s teaching. See Ex. 1009 ¶¶ 47, 48.

operational parameters) are determined “based upon the data [that includes at least one property of the building material]” as claim element 1b requires.

Petitioner further argues that, based on Dahlin’s teaching to “notif[y] the operator . . . if the amount of filament on the spool is insufficient to create a desired object,” “CPU 92 also determines the amount of modeling and support filament required for completing the job in order to ‘calculate whether a spool 42 or 56 contains enough filament to complete the job.’” Pet. 27–28 (citing Ex. 1011, 1:64–2:2, 5:26–37). Petitioner specifies that “the amount of support filament required for completing the job is an operational parameter specifying a support structure requirement” that claim element 1b requires. *Id.* at 28. Patent Owner, on the other hand, argues that such support filament amount is not calculated based on build material data because “Dahlin’s filament spool contains information about the filament or material itself and not information about objects to be built.” Prelim. Resp. 23. Based on the current record, we are persuaded by Patent Owner that the record does not sufficiently establish that Dahlin’s support material amount is calculated based on build material property data. We therefore find that Petitioner has not sufficiently established “the amount of support filament required for completing the job” (Pet. 28) is determined “based upon the data [that includes at least one property of the building material]” as claim element 1b requires.

Lastly, Petitioner argues that a skilled artisan

would have been motivated to implement Dahlin’s system in a manner that employs Menchik’s suggestion (e.g., the controller computing the amount of support material required for printing a given 3D object) to thereby enable Dahlin’s system to determine the amount of support filament required for completing the job (an operational parameter specifying a

support structure requirement) in order to “calculate whether a spool . . . 56 contains enough filament to complete the job.”

Pet. 28.

Patent Owner argues that “Petitioner again fails to explain why the amount of support filament required for completing a job is based on the data from the spool of material.” Prelim. Resp. 24. As we note *supra*, the record before us does not clearly show that Menchik teaches or suggests that “the amount of support filament required for completing the job” (which Petitioner contends is “an operational parameter specifying a support structure requirement” (Pet. 28)) is calculated based on build material property data. We are persuaded by Patent Owner that Petitioner has not sufficiently established that “the amount of support filament required for completing the job” is determined “based upon the data [that includes at least one property of the building material]” as claim element 1b requires.

5. *Conclusion Regarding Independent Claim 1 (Ground 1A)*

We determine that Petitioner has not established, based on the current record, that the combined teachings of Dahlin and Menchik teach claim element 1b “determining an operational parameter of a fabrication process using the three-dimensional printer based upon the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement.” Because claim elements 1c and 1d are both predicated on the determination of the operational parameter in claim element 1b, Petitioner has not established, based on the current record, that the combined teachings of Dahlin and Menchik teach these subsequent claim elements.

For these reasons and others set forth above, we find that Petitioner has not sufficiently demonstrated, based on the current record, that the combination of Dahlin and Menchik teaches each of the limitations of claim 1 and that the information presented in the Petition does not demonstrate a reasonable likelihood that claim 1 is unpatentable under 35 U.S.C. § 103 over that combination.

6. Conclusion Regarding Remaining Claims (Ground 1A)

Because claims 4, 5, and 11 depend from independent claim 1, we find that Petitioner has not sufficiently demonstrated, based on the current record, that the combination of Dahlin and Menchik teaches each of the limitations of these dependent claims and that the information presented in the Petition does not demonstrate a reasonable likelihood that these dependent claims are unpatentable under 35 U.S.C. § 103 over that combination.

Independent claim 12 recites substantially identical claim elements as claim 1. For example, Petitioner's analysis of claim element 12d is based, in part, on the analysis of claim elements 1b and 1c. Pet. 35. For these reasons and others set forth above with regard to claim 1, we find that Petitioner does not sufficiently demonstrate, based on the current record, that the combination of Dahlin and Menchik teaches each of the limitations of independent claim 12 and claims 13–17 which depend from claim 12. Accordingly, we conclude that the information presented in the Petition does not demonstrate a reasonable likelihood that claims 12–17 are unpatentable under 35 U.S.C. § 103 over that combination.

*F. Alleged Obviousness Over Dahlin, Menchik, and Loughran
(Ground 1B)*

Petitioner alleges claims 2, 3, 6, 10, 18, and 19 of the '464 patent would have been obvious over Dahlin, Menchik, and Loughran. Pet. 47–75. Because claims 2, 3, 6 and 10 depend from claim 1 and claim 18 depends from claim 12, we find that Petitioner has not sufficiently demonstrated, based on the current record, that the combination of Dahlin, Menchik, and Loughran teaches each of the limitations of these dependent claims and that the information presented in the Petition does not demonstrate a reasonable likelihood that these dependent claims are unpatentable under 35 U.S.C. § 103 over that combination.

Independent claim 19 recites substantially identical claim elements as claim 1. For example, Petitioner's analysis of claim element 19d is based, in part, on the analysis of claim elements 1b. Pet. 47. For these reasons and others set forth above with regard to claim 1, we find that Petitioner has not sufficiently demonstrated, based on the current record, that the combination of Dahlin, Menchik, and Loughran teaches each of the limitations of claim 19. Accordingly, we conclude that the information presented in the Petition does not demonstrate a reasonable likelihood that claim 19 is unpatentable under 35 U.S.C. § 103 over that combination.

G. Alleged Obviousness Over Loughran and Toshiki (Ground 2)

Petitioner alleges claims 1–6, 10–15, and 17–19 of the '464 patent would have been obvious over Loughran and Toshiki. Pet. 47–75. Patent Owner contends in response that there is no motivation to combine the references and that the proposed combination does not teach various claim elements. Prelim. Resp. 42–51.

Having considered the arguments and evidence before us, we find, for the reasons explained below, that the record does not establish a reasonable likelihood that Petitioner would prevail on claim 1, in this asserted ground of unpatentability.

1. *Loughran*

Loughran, titled “Retrieving Information on Material Used in Solid Freeform Fabrication,” describes certain solid freeform fabrication or SFF systems and “material 112 from which physical objects can be fabricated” at the SFF system. Ex. 1004, code (54), ¶ 20. The SFF system includes “tag 114 [which] may be a bar code tag having a bar code encoding the unique material identifier of the material 112.” *Id.* ¶ 21. The SFF system “is able to recognize the material 112 being introduced thereinto” “[b]ased on the material identifier of the tag 114.” *Id.* ¶ 20.

Loughran also describes “a material information server, in which the SFF systems are able to retrieve information regarding materials from the material information server.” *Id.* ¶ 5. The SFF system may request and retrieve information regarding material 112 from the material information server “based on the unique material identifier with which the material 112 is associated.” *Id.* ¶ 22. Such retrieved information “may include material data sheet (MDS) information regarding the material 112, including safety, storage, and other information that is more pertinent to the users of” the SFF system. *Id.* ¶ 25. “Thus, the information retrieved from the material information server 108 regarding the material 112 may be both information on which basis the second SFF system 104 dynamically adjusts its own parameters for fabricating physical objects from the material 112, as well as information intended for user education.” *Id.* Loughran specifies:

These parameters may include the operating temperature that the second SFF system 104 needs to achieve to melt the material, the temperature that the second SFF system 104 needs to maintain to store the material, the length of time to wait after one layer of the material has been fabricated before processing the next layer, and so on.

Id.

2. *Toshiki*

Toshiki, titled “Three-Dimensional Modeling Device and Modeling System,” provides a device having, among other components, “modeling estimation unit 204 [that] calculates . . . an estimated amount of modeling material to be used in the modeling process 223, on the basis of the modeling data 221.” Ex. 1024, code (54), ¶ 95. “The estimated amount of modeling materials used is made up of an estimated amount of model material M used and an estimated amount of support material S used, each of which is calculated on the basis of the modeling data.” *Id.* ¶ 90. “The modeling data includes shape information indicating the three-dimensional shape of a modeling object” as well as “modeling parameters such as . . . the thickness of the modeling material layer [and the] scanning speed” as well as “the type of modeling material.” *Id.* ¶ 29; *see also id.* ¶ 85.

The device in Toshiki also includes “remaining amount detecting unit” which detects “remaining amount of support material S in each support material cartridge.” *Id.* ¶ 109. “The tank replacement determining unit 406 determines whether or not the modeling material storage tank needs to be replaced while performing model processing on the basis of the remaining amount detected by the remaining amount detecting unit 405, and outputs the determination result to the display unit 122.” *Id.* ¶ 110. “The determination of whether or not the tank needs to be replaced is made by comparing the current remaining amount of the model material M and the

support material S with the cumulative amount of the modeling material to be used in model processing.” *Id.* “[A] cumulative usage amount is calculated on the basis of the modeling data by adding up the estimated usage amount of the model material M and the support material S required to form each slice layer and the estimated usage amount in the purging process.” *Id.* ¶ 90.

3. *Reasons to Combine & Reasonable Expectation of Success*

Patent Owner disagrees with Petitioner’s contention that there is motivation to combine Loughran and Toshiki with a reasonable expectation of success. *Compare* Prelim. Resp. 40–41, *with* Pet. 50–52. As our analysis shows below, even if we assume, *arguendo*, that there is a reasonable expectation of success in combining the teachings of Loughran and Toshiki in the manner argued by Petitioner, the combined teachings do not teach or suggest every claim element.

4. *Analysis of Independent Claim 1*

Among the various claim elements that Patent Owner contends are missing from the combined prior art teaching, we again focus on claim element 1b, which recites “determining an operational parameter of a fabrication process using the three-dimensional printer based upon the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement,” because the subsequent steps/claim elements are derived from the performance of claim element 1b.

Petitioner argues that Loughran teaches a “material identifier from the tag 114 of the material container 110” and retrieves information such as “extract parameters regarding the material 112” “based on the material

identifier.” Pet. 58–59 (citing various portions of Ex. 1004). Petitioner argues that Loughran teaches parameters such as “operating temperature that the [fabrication system] needs to achieve to melt the material, the temperature that the [fabrication system] needs to maintain to store the material, the length of time to wait after one layer of the material has been fabricated before processing the next layer, and so on.” *Id.* at 59. Petitioner argues that a skilled artisan would have understood these parameters “are operational parameters of a fabrication process and are retrieved based on the material identification number (tag data including at least one property of the build material).” *Id.* (citing Ex. 1003 ¶ 107).

Petitioner’s arguments do not establish a reasonable likelihood that Loughran teaches or suggests claim element 1b. In Petitioner’s analysis of claim element 1c (whose implementation is predicated on the “operational parameter” determined from claim element 1b), Petitioner argues that the “operational parameter specifying a support structure requirement” is “the amount of support material to be used in the modeling process.” Pet. 63. Moreover, Petitioner’s analysis of claim element 1c is solely based on the “operational parameter specifying a support structure requirement.” *Id.* at 61–63. Petitioner does not establish that the parameters in Loughran (“operating temperature that the [fabrication system] needs to achieve to melt the material, the temperature that the [fabrication system] needs to maintain to store the material, the length of time to wait after one layer of the material has been fabricated before processing the next layer, and so on” (*id.* at 59)) are subsequently subjected to the diagnostic test in claim element 1c. *See id.* at 61–63. Petitioner’s own arguments therefore do not show that there is a reasonable likelihood that Loughran alone teaches or suggests claim element 1b.

Petitioner next argues that Toshiki teaches calculating an estimated amount of support material “on the basis of modeling data including modeling parameters such as the thickness of the modeling material layer and the scanning speed.” Pet. 60. Based on this teaching as well as the teachings of Loughran described *supra*, Petitioner argues that a skilled artisan “would have been motivated to implement Loughran so that the [fabrication system] also determines the amount of model material and support material to be used in the modeling process based on modeling parameters that are retrieved using the material identification number.” *Id.* Petitioner further argues that a skilled artisan “would have understood that the amount of support material to be used in the modeling process is an operational parameter specifying a support structure requirement and is determined based on modeling parameters that are retrieved using the material identification number (tag data including at least one property of the build material).” *Id.* at 60–61.

Patent Owner argues that neither Petitioner nor Petitioner’s technical declarant “explain[s] the rationale that underpins this obviousness theory.” Prelim. Resp. 44. Patent Owner argues that “Petitioner does not explain why information specific to model generation, as opposed to information specific to the material, would be stored and retrieved from Loughran’s material information server 108 using a material identifier, as opposed to a model identifier.” *Id.* (emphases omitted).

We are persuaded by Patent Owner that Petitioner has not established a reasonable likelihood that the combined teachings of Loughran and Toshiki teach or suggest claim element 1b. Petitioner specifies that “the amount of material to be used in the modeling process is an operational parameter specifying a support structure requirement” as claim 1b requires.

Pet. 60. Petitioner acknowledges that Toshiki estimates such “amount of modeling material used” based on modeling data such as “the thickness of the modeling material layer and the scanning speed.” *Id.* (citing various portions of Ex. 1024).

Based on the contention that “the material identification number” is the “tag data including at least one property of the build material” that claim 1b requires (Pet. 60–61), Petitioner argues that “the amount of material to be used in the modeling process” is determined based on “the material identification number” by using the “modeling parameters that are retrieved using the material identification number.” *Id.* Petitioner, however, does not clearly establish that a skilled artisan would have used Loughran’s “material identifier” unique for the build material (Ex. 1004 ¶ 20) to retrieve Toshiki’s modeling data that are not necessarily related to the build material such as “the thickness of the modeling material layer and the scanning speed.” See Pet. 59 (stating that Toshiki estimates “the amount of modeling material used” based on modeling data such as “the thickness of the modeling material layer and the scanning speed”). Petitioner’s assertion that a skilled artisan “would have found it obvious to implement Loughran’s parameters that are retrieved based on the material identification number to include modeling parameters such as the type of modeling material, the thickness of the modeling material layer, and the scanning speed, as suggested by Toshiki” does not explain why Toshiki suggests that “the type of modeling material” may be used to estimate “the amount of material used in the modeling process.” *Id.* at 56 (citing Ex. 1003 ¶ 108 which essentially repeats Petitioner’s analysis). Petitioner’s analysis therefore does not reasonably establish that “the amount of material to be used in the modeling process” in

Toshiki is determined based on “the material identification number” in Loughran to meet the requirement of claim 1b.

5. Conclusion Regarding Independent Claim 1 (Ground 2)

We determine that Petitioner has not established, based on the current record, that the combined teachings of Loughran and Toshiki teach claim element 1b “determining an operational parameter of a fabrication process using the three-dimensional printer based upon the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement.” Because claim elements 1c and 1d are both predicated on the determination of the operational parameter in claim element 1b, Petitioner has not established, based on the current record, that the combined teachings of Loughran and Toshiki teach or suggest these subsequent claim elements.

For these reasons and others set forth above, we find that Petitioner has not sufficiently demonstrated, based on the current record, that the combination of Loughran and Toshiki teaches each of the limitations of claim 1. Accordingly, we conclude that the information presented in the Petition does not demonstrate a reasonable likelihood that claim 1 is unpatentable under 35 U.S.C. § 103 over that combination.

6. Conclusion Regarding Remaining Claims (Ground 2)

As we note *supra*, independent claims 12 and 19 recite substantially identical claim elements as claim 1. For example, Petitioner’s analysis of claim element 12d is based, in part, on the analysis of claim elements 1b and 1c, Pet. 72–73, whereas Petitioner’s analysis of claim elements 19b and 19d are based, in part, on the analysis of claim elements 1b, *id.* at 74.

For these reasons and others set forth above with regard to claim 1, we find that Petitioner has not sufficiently demonstrated, based on the current record, that the combination of Loughran and Toshiki teaches each of the limitations of claim 1's dependent claims and independent claims 12 and 19 and their respective dependent claims. Accordingly, we conclude that the information presented in the Petition does not demonstrate a reasonable likelihood that claims 2–6, 10–15, and 17–19 are unpatentable under 35 U.S.C. § 103 over that combination.

IV. CONCLUSION

After considering the evidence and arguments presented in the Petition, we determine Petitioner has not established a reasonable likelihood of prevailing on its assertion that at least one claim of the '464 patent is unpatentable, and we deny institute an *inter partes* review on the challenged claims and on the grounds presented in the Petition. *See* 37 C.F.R. § 42.108(a).

V. ORDER

For the reasons given, it is ORDERED that the Petition is *denied* and no trial is instituted.

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