

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NABORS DRILLING TECHNOLOGIES USA, INC.,
Petitioner,

v.

MOTIVE DRILLING TECHNOLOGIES, INC.,
Patent Owner.

PGR2022-00055
Patent 11,170,454 B2

Before KEN B. BARRETT, MATTHEW S. MEYERS, and
SEAN P. O'HANLON, *Administrative Patent Judges*.

O'HANLON, *Administrative Patent Judge*.

DECISION
Granting Institution of Post-Grant Review
35 U.S.C. § 324

I. INTRODUCTION

A. Background

Nabors Drilling Technologies USA, Inc. (“Petitioner”) filed a Petition for post-grant review of claims 1–4 and 10–13 (“the challenged claims”) of U.S. Patent No. 11,170,454 B2 (Ex. 1001, “the ’454 patent”). Paper 3 (“Pet.”), 3. Motive Drilling Technologies, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 8 (“Prelim. Resp.”).

We have authority to determine whether to institute a post-grant review. 35 U.S.C. § 324(c) (2018); 37 C.F.R. § 42.4(a). Institution of post-grant review is authorized by statute only when “the information presented in the petition . . . , if such information is not rebutted, would demonstrate that it is more likely than not that at least 1 of the claims challenged in the petition is unpatentable.” 35 U.S.C. § 324(a). “When instituting post-grant review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim.” 37 C.F.R. § 42.208(a)). Having considered the arguments and evidence presented by Petitioner and Patent Owner, we determine that Petitioner has demonstrated that it is more likely than not that it will prevail with respect to at least one challenged claim. Accordingly, we institute post-grant review of the challenged claims of the ’454 patent.

B. Real Parties in Interest

Petitioner identifies itself and Nabors Corporate Services, Inc. as real parties in interest. Pet. 1.

Patent Owner identifies itself, Helmerich & Payne International Drilling Co., Helmerich & Payne Technologies, LLC, and Helmerich & Payne, Inc. as real parties in interest. Paper 5, 2.

C. Related Matters

The parties indicate that the '454 patent is not the subject of any district court proceeding. Pet. 1; Paper 5, 2. The parties note that two related patents—U.S. Patent No. 10,726,506 B2 (“the '506 patent”) and U.S. Patent No. 9,865,022 B2 (“the '022 patent”)—are involved in other proceedings. Pet. 1; Paper 5, 2. Specifically, both the '506 patent and '022 patent are involved in the following district court proceeding:

Nabors Drilling Technologies USA, Inc. v. Helmerich & Payne International Drilling Co., Case. No. 3-20-cv-03126 (N.D. Tex., filed October 14, 2020),

and Petitioner challenges the '506 patent in IPR2022-00289 and the '022 patent in IPR2022-00288. Pet. 1; Paper 5, 2.

D. The Challenged Patent

The '454 patent is titled “Systems and Methods for Drilling a Well.” Ex. 1001, code (54). The '454 patent explains that “[d]rilling a borehole for the extraction of minerals has become an increasingly complicated operation due to the increased depth and complexity of many boreholes, including the complexity added by directional drilling.” *Id.* at 1:39–42. “Drilling is an expensive operation and errors in drilling add to the cost and, in some cases, drilling errors may permanently lower the output of a well for years into the future.” *Id.* at 1:42–45. According to the '454 patent,

Calculating paths for a borehole in a formation is a complex and often difficult to understand process that frequently uses a combination of known factors and estimates. Whether calculating the path prior to the beginning of drilling or attempting to return to a desired path when drilling has gone off course, there are an infinite number of paths from which to choose. Each of these paths has an associated financial cost that is difficult to identify due to the number of factors involved. However, the financial cost of a path is important to the business of drilling and needs to be taken into account.

Id. at 2:29–39. The '454 patent further explains that, by normalizing drilling variables, multiple path options can be evaluated and the path that best satisfies one or more defined parameters can be selected. *Id.* at 2:39–44.

Figure 1 illustrates a drilling environment as is reproduced below.

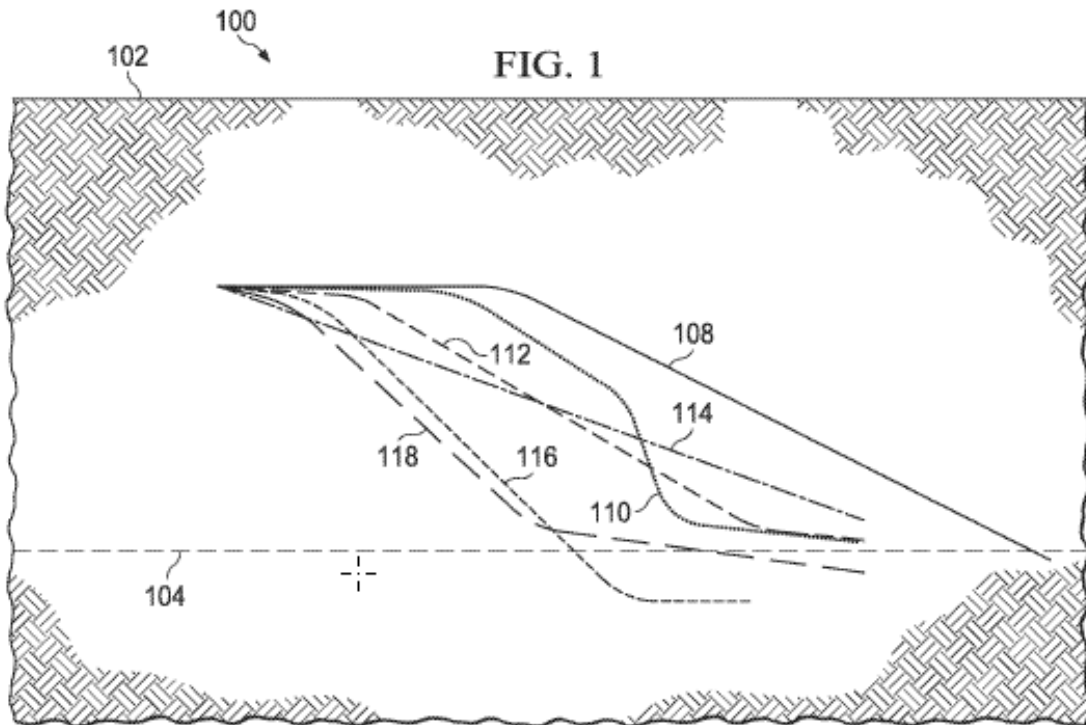


Figure 1 shows drilling environment 100 including formation 102 within which a borehole is being drilled. Ex. 1001, 1:55–57, 2:26–29. Target path 104 represents an optimal path for the borehole, and “paths 108, 110,

112, 114, 116, and 118 illustrate possible convergence paths from a point . . . representing a current or future bottom hole assembly (BHA) location to the target path 104.” *Id.* at 2:45–47, 2:66–3:2.

Figure 4 illustrates a flowchart for identifying the cost of a convergence path and is reproduced below.

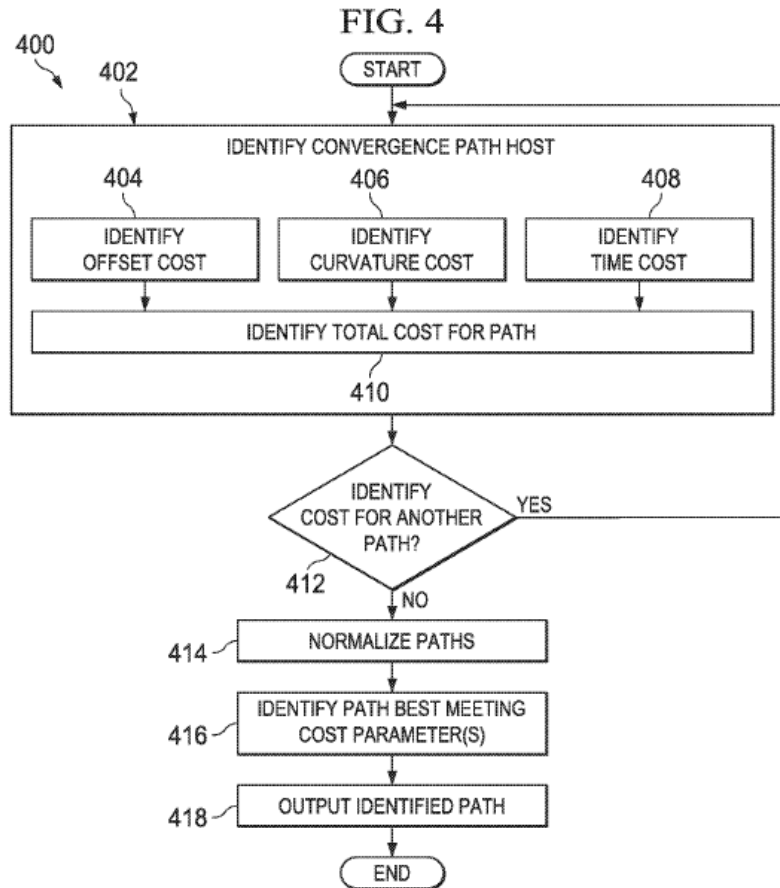


Figure 4 “illustrates a process that may be used to identify the cost of multiple convergence paths and then select one of the paths.” Ex. 1001, 7:20–21. As can be seen in the figure, the total cost of a possible convergence path is based on its offset cost, curvature cost, and time cost. *See id.* at 7:22–24. Offset cost penalizes a path based on distance from the target path (*id.* at 6:59–60, 9:31–34) and is determined by dividing the path

into segments of an identified length, such as a foot, identifying the distance from the target path for each segment, identifying a cost for each segment, such as by using cost curves, and summing the segment costs (*id.* at 9:15–48). Curvature cost penalizes a path for the path’s curvature (which has an impact on friction) (*id.* at 6:60–61, 11:5–10) and is determined by identifying the locations of curvature of the path, including the peak curvature, and assigning a cost to each curvature location (*id.* at 11:39–12:11). Time cost penalizes a path based on the amount of time the path will take (*id.* at 6:62–63) and is determined by identifying the length of the rotation segments and the length and build rate of the sliding segments, identifying a time for each segment based on the projected rate of penetration, and summing the times for each segment (*id.* at 12:17–62). The cost for each path can be normalized for comparison (*id.* at 7:46–48, 8:48–51), and the path with the lowest cost is chosen as the desired convergence path (*id.* at 9:64–67).

E. The Challenged Claims

Petitioner challenges claims 1–4 and 10–13 of the ’454 patent. Pet. 3, 5. Claims 1 and 13 are independent. Claim 1 is illustrative of the challenged claims and is reproduced below with bracketing used by Petitioner and some formatting added.¹

1. A system for drilling a well, the system comprising:
 - [1.1] a processor;
 - [1.2] a memory coupled to the processor, wherein the memory comprises a plurality of instructions executable by the

¹ Claim 1 as presented here as been modified to separate the “updating the well plan” recitation from the “receiving a well plan” recitation.

processor, and wherein the instructions comprise instructions for:

- [1.3] receiving first information comprising a location of a bottom hole assembly (BHA) in a well being drilled and a target path for a wellbore of the well;
- [1.4] responsive to the first information, generating a first set of a plurality of possible convergence paths from the BHA location to the target path;
- [1.5] removing a first possible convergence path from the first set, wherein the first possible convergence path removed comprises an illogical option, wherein the illogical option comprises a path which extends in the wrong direction before converging, thereby generating a second set of a plurality of possible convergence paths;
- [1.6] removing a second possible convergence path from the second set of the plurality of possible convergence paths, wherein the second possible convergence path comprises a violation of a rule, thereby generating a third set of a plurality of possible convergence paths;
- [1.7] selecting a desired convergence path responsive to at least one of: a curvature associated with each of the possible convergence paths in the third set, a time associated with each of the possible convergence paths, and a cost associated with each of the possible convergence paths;
- [1.8] receiving a well plan;
- [1.9] updating the well plan with the desired convergence path; and
- [1.10] sending one or more control signals to a control system to drill in accordance with the updated well plan.

Ex. 1001, 13:24–56.

F. Asserted Grounds of Unpatentability

The Petition relies on the following prior art references:

Name	Reference	Exhibit
Budiman	US 8,892,407 B2, issued November 18, 2014	1005
Pirovolou	US 2010/0185395 A1, published July 22, 2010	1006
Panchal	US 2015/0330209 A1, published November 19, 2015	1011
Downton	US 2011/0031015 A1, published February 10, 2011	1023

Petitioner asserts the following grounds of unpatentability:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–4, 10–13	101 ²	Eligibility
1–4, 11–13	103	Pirovolou, Panchal, Budiman
10	103	Pirovolou, Panchal, Budiman, Downton

Pet. 5. Petitioner submits a declaration of Jerome J. Schubert, Ph.D., PE (Ex. 1003, “Schubert Declaration”) in support of its contentions.

II. ANALYSIS

A. Eligibility for Post-Grant Review

The post-grant review provisions apply to a patent that contains a claim with an effective filing date on or after March 16, 2013. AIA § 6(f)(2)(A). A petition for post-grant review must be filed within nine

² The application resulting in the ’454 patent claims an earliest effective filing date of June 26, 2013, and, thus, is subject to the Leahy-Smith American Invents Act’s (“AIA”), Pub. L. No. 112–29, 125 Stat. 284 (2011), revisions to 35 U.S.C. § 100 *et seq.*

months of the date of the grant of the patent or of the issuance of a reissue patent, as the case may be. 35 U.S.C. § 321(c). Petitioner must certify that these requirements are satisfied. 37 C.F.R. § 42.204(a).

Here, the '454 patent was filed on June 19, 2020, and claims an earliest effective filing date of June 26, 2013. Ex. 1001, codes (22), (60), (63). The '454 patent issued on November 9, 2021 (*id.* at code (45)), and the Petition was filed on August 8, 2022 (Paper 4, 1), within nine months of issuance. Thus, the '454 patent is eligible for post-grant review. *See* Pet. 2–3.

B. Level of Ordinary Skill in the Art

The level of ordinary skill in the art is “a prism or lens” through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). The person of ordinary skill in the art is a hypothetical person presumed to have known the relevant art at the time of the invention. *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). In determining the level of ordinary skill in the art, we may consider certain factors, including: “(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.” *Best Med. Int’l, Inc. v. Elekta Inc.*, 46 F.4th 1346, 1353 (Fed. Cir. 2022) (citations omitted). “The patent’s purpose can also be informative.” *Id.* (citation omitted).

Petitioner contends that a person having ordinary skill in the art at the time of the invention (“POSITA”) would have had “(i) a bachelor’s degree

in mechanical engineering or petroleum engineering, or equivalent training, and (ii) 3-5 years of work experience related to the design, performance, and control of components and systems used in oil and gas exploration and production, including downhole tools used in drilling applications.” Pet. 17 (citing Ex. 1003 ¶¶ 42–46). Petitioner asserts that “[l]ess experience is necessary with additional education” and “less education is necessary with additional work experience.” *Id.*

Patent Owner does not contest Petitioner’s definition or offer a definition of its own. *See generally* Prelim. Resp.

Based on the arguments presented and the cited references, we find Petitioner’s definition of the level of ordinary skill reasonable and, for purposes of this Decision, adopt it as our own.

C. Claim Construction

In a post-grant review, claims are construed using the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b), including construing the claims in accordance with the ordinary and customary meaning of such claims as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.200(b). “[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention” and “after reading the entire patent.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313, 1321 (Fed. Cir. 2005) (en banc). In addition to the specification and prosecution history, we also consider use of the terms in other claims and extrinsic evidence including expert and inventor testimony,

dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Id.* at 1312–17. Usually, the specification is dispositive, and it is the single best guide to the meaning of a disputed term. *Id.* at 1315.

“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) (alteration in original) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Neither party presents arguments for the express construction of any term, instead interpreting the claim terms according to their ordinary and customary meaning. Pet. 18; Prelim. Resp. 15.

For purposes of this Decision, and based on the record before us, we determine that no construction of any term is necessary. We note that this determination does not preclude the parties from arguing their proposed constructions of the claims during trial. Indeed, the parties are hereby given notice that claim construction, in general, is an issue to be addressed at trial. A final determination as to claim construction will be made at the close of the proceeding, after any hearing, based on all the evidence of record.

D. Overview of the Asserted Prior Art

1. Pirovolou

Pirovolou discloses “a method and system for altering a wellbore trajectory while drilling.” Ex. 1006 ¶ 1. Pirovolou recognizes that, “[a]fter drilling commences . . . , it is often realized that the preplanned trajectory will not arrive at the desired target(s) and that the trajectory must be

Figure 3 shows two optional trajectories 28, 30 that extend from position A to target T. Ex. 1006 ¶ 29. These trajectories are based on drilling and formation considerations and production considerations. *Id.* ¶ 35. The optional trajectories may be reviewed based on the operating and drilling limitations. *Id.* In an initial evaluation, it may be determined whether the optional trajectories are within the maximum allowed dog-leg severity. *Id.* In a subsequent evaluation, it may be determined which of the optional trajectories minimizes drag. *Id.* As another example, the subsequent evaluation may determine which of the optional trajectories is within the allowable build rate limitations. *Id.* ¶ 36.

2. Panchal

Panchal discloses “a feedback control system for steering a tool along a [well plan].” Ex. 1011 ¶ 3. One objective of Panchal’s system is to “minimize[e] the deviation of the borehole trajectory during the real-time drilling process from a predefined [well plan].” *Id.* Feasible drilling paths are generated taking a number of factors into consideration, including weights that represent a tradeoff between following the well plan and drilling a smooth borehole and curvature constraints imposed by the capability of the drilling tool. *Id.* ¶¶ 53, 55, 58, 60. Figure 4 illustrates several potential drilling paths and is reproduced below.

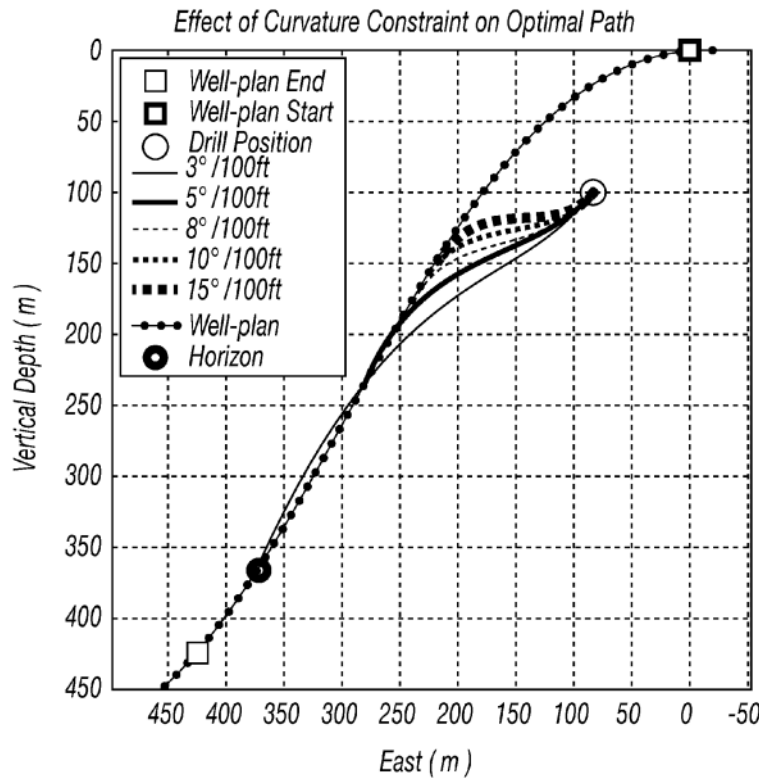


FIG. 4

Figure 4 shows a graph of paths produced from different curvature constraints. *Id.* ¶¶ 11, 55. Panchal discloses,

Given the measured position [of the drilling tool], the measured attitude . . . of the tool, a section of the [well plan] corresponding to the closest point [on the well plan] and a fixed horizon ahead, and knowledge of the curvature capability of the tool . . . , the optimization problem . . . can generate control points . . . to be the optimal path coincident with the position and attitude of the tool to guide the tool back to the [well plan].

Id. ¶ 52. Panchal further explains that “a controller can dynamically generate an optimal trajectory coincident with the real-time measured pose of a drilling tool in order to guide the drilling tool.” *Id.* ¶ 37.

3. *Budiman*

Budiman “relates generally to . . . integrating well trajectory and well development planning processes.” Ex. 1005, 1:15–17. According to the Abstract of Budiman, it describes “[a] robust well trajectory planning and drilling or completion planning system that integrates well trajectory optimization and well development planning optimization so that optimized solutions are generated simultaneously.” *Id.* at code (57). Budiman describes a design phase in which candidate well path parameters are provided for each segment of the well, and the parameters are adjusted to achieve an optimal solution. *Id.* at 5:58–6:2. An “optimization model searches the solution space by adjusting each of the well path parameters and drilling or completion parameters until an optimal, or near-optimal solution is found.” *Id.* at 6:6–10. The optimal solution “is determined by the objective score for the optimality criterion,” which may be “cost, probability of success, total time to drill the well, etc.” *Id.* at 6:4–10.

4. *Downton*

Downton discloses “a system and a method for managing and/or using data for tools in a wellbore.” Ex. 1023 ¶ 1. The system includes “one or more tools located downhole or at the surface with access to data and intelligence to perform actions based on the data,” including “measur[ing] data to adjust drilling operations, tool operations and/or the like without instructions from a surface location.” *Id.* Downton explains that “[d]rilling operations typically require monitoring to determine the trajectory of the borehole. Measurements of drilling conditions, such as, for example, drift of the drill bit, inclination, azimuth and the like, may be necessary for

determining the trajectory of the borehole, especially for directional drilling.” *Id.* ¶ 4. “[A]djustment of the drilling operations in response to accurate real-time information may enable optimization of the drilling process” *Id.* ¶ 5.

E. Asserted Subject Matter Ineligibility

Petitioner argues that the subject matter of the challenged claims is ineligible for patent protection under 35 U.S.C. § 101. Pet. 19–33. In support of its showing, Petitioner relies upon the Schubert Declaration. *Id.* (citing Ex. 1003). We have reviewed the parties’ briefs and the evidence of record. For the reasons discussed below, and based on the record before us, we determine that Petitioner demonstrates that it is more likely than not that it will prevail in showing that at least one challenged claim is ineligible under § 101.

1. Principles of Law

An invention is patent-eligible if it claims a “new and useful process, machine, manufacture, or composition of matter.” 35 U.S.C. § 101. However, the U.S. Supreme Court has long interpreted § 101 to include implicit exceptions: “[l]aws of nature, natural phenomena, and abstract ideas” are not patentable. *E.g., Alice Corp. v. CLS Bank Int’l*, 573 U.S. 208, 216 (2014).

In determining whether a claim falls within an excluded category, we are guided by the Court’s two-step framework, described in *Mayo* and *Alice*. *Alice*, 573 U.S. at 217–18 (citing *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 75–77 (2012)). In accordance with that framework, we first determine what concept the claim is “directed to.” *See Alice*, 573

U.S. at 219 (“On their face, the claims before us are drawn to the concept of intermediated settlement, *i.e.*, the use of a third party to mitigate settlement risk.”); *see also Bilski v. Kappos*, 561 U.S. 593, 611 (2010) (“Claims 1 and 4 in petitioners’ application explain the basic concept of hedging, or protecting against risk.”).

If the claim is “directed to” an abstract idea, we turn to the second step of the *Alice* and *Mayo* framework, where “we must examine the elements of the claim to determine whether it contains an ‘inventive concept’ sufficient to ‘transform’ the claimed abstract idea into a patent-eligible application.” *Alice*, 573 U.S. at 221 (quotation marks omitted). “A claim that recites an abstract idea must include ‘additional features’ to ensure ‘that the [claim] is more than a drafting effort designed to monopolize the [abstract idea].’” *Id.* (alterations in original) (quoting *Mayo*, 566 U.S. at 77). “[M]erely requir[ing] generic computer implementation[] fail[s] to transform that abstract idea into a patent-eligible invention.” *Id.*

In January 2019, the U.S. Patent and Trademark Office (USPTO) published revised guidance on the application of § 101. 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (Jan. 7, 2019) (“2019 Revised Guidance”); *see also October 2019 Update: Subject Matter Eligibility* (the “October 2019 Update”).³ Under the 2019 Revised Guidance, we first look to whether the claim recites:

- (1) any judicial exceptions, including certain groupings of abstract ideas (*i.e.*, mathematical concepts, certain methods of organizing human activity such as a fundamental economic practice, or mental processes) (“Step 2A, Prong One”); and

³ Available at https://www.uspto.gov/sites/default/files/documents/peg_oct_2019_update.pdf.

(2) additional elements that integrate the judicial exception into a practical application (*see* MPEP § 2106.05(a)–(c), (e)–(h) (9th ed. Rev. 08.2017, Jan. 2018)) (“Step 2A, Prong Two”).

2019 Revised Guidance, 84 Fed. Reg. at 52–55.

Only if a claim (1) recites a judicial exception and (2) does not integrate that exception into a practical application, do we then look, under Step 2B, to whether the claim:

(3) adds a specific limitation beyond the judicial exception that is not “well-understood, routine, conventional” in the field (*see* MPEP § 2106.05(d)); or

(4) simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception.

2019 Revised Guidance, 84 Fed. Reg. at 52–56.

2. Independent Claim 1

a. Step 1

This part of the eligibility analysis evaluates whether the claim falls within any statutory category. Claim 1 recites a system for drilling a well comprising a memory and a processor configured to perform a series of steps. The claimed system is a device or set of devices, which is a machine and thus a statutory category of invention.

b. Step 2A, Prong One

This part of the eligibility analysis evaluates whether the claim recites a judicial exception. A claim “recites” a judicial exception when the judicial exception is “set forth” or “described” in the claim. October 2019 Update 1.

Petitioner argues that “the claims recite ‘selecting a desired convergence path’ and further describe the process of selecting a best path

based on standard criteria [an ordinarily skilled artisan] would have used to make that determination.” Pet. 24. Petitioner argues that “[t]his abstract idea most readily falls into the category of ineligible mental processes, but could also be considered a certain method of organizing human activity.” *Id.*

Patent Owner argues that “[t]he Challenged Claims do not recite an abstract idea,” asserting that claim 1 “covers a specific system for drilling a well that addresses particular challenges in drilling operations, not abstract ideas.” Prelim. Resp. 27; *see also id.* at 32 (“The claimed system is directed to a particular system for drilling a well that uses a convergence path to return the drill bit to the target path, which is not an abstract idea.”). According to Patent Owner, “[t]he focus of Claim 1 is on concrete drilling operations and, in particular, on returning the BHA to the target path, not selecting an optimal path in the abstract as Petitioner contends.” *Id.* at 30–31.

Claim 1 recites a system that performs the steps of receiving information (recitations 1.3, 1.8), using received information to generate a set of possible drilling paths (recitation 1.4), removing certain ones of the generated possible paths (recitations 1.5–1.6), selecting a desired one of the generated paths (recitation 1.7), and updating a plan to include the selected path (recitation 1.9). This collection and manipulation of data is similar to the data collection and management concepts that were held to be patent ineligible in previous cases. *See Content Extraction & Transmission LLC v. Wells Fargo Bank*, 776 F.3d 1343, 1345, 1347 (Fed. Cir. 2014); *In re TLI Commc ’ns LLC Patent Litig.*, 823 F.3d 607, 610, 613 (Fed. Cir. 2016); *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1351–54 (Fed. Cir. 2016).

Although the claim enumerates the type of information (i.e., BHA location, target path, and possible convergence paths) that is acquired and analyzed, the Federal Circuit has explained that the mere selection and manipulation of particular information by itself does not make an abstract concept any less abstract. *Elec. Power Grp.*, 830 F.3d at 1353; *Dig. Image Techs., LLC v. Elecs. for Imaging, Inc.*, 758 F.3d 1344, 1351 (Fed. Cir. 2014).

Accordingly, on this record, Petitioner sufficiently shows that the claim recites an abstract idea that falls within the grouping of mental processes. *See Elec. Power Grp.*, 830 F.3d at 1355.

c. Step 2A, Prong Two

This part of the eligibility analysis evaluates whether the claim as a whole integrates the recited judicial exception into a practical application of the exception. This evaluation is performed by (a) identifying whether there are any additional elements recited in the claim beyond the judicial exception, and (b) evaluating those additional elements individually and in combination to determine whether the claim as a whole integrates the exception into a practical application. October 2019 Update 10–12.

Petitioner argues that the “sending one or more control signals to a control system to drill in accordance with the updated well plan” recitation of claim 1 is insignificant post-solution activity because it “merely requires sending an instruction to do something in the future; it does not even require drilling to occur.” Pet. 26–27.

Patent Owner argues that, during prosecution of the application resulting in the ’454 patent, the Examiner found the claims to “integrate any alleged abstract idea recited in Claim 1 into a practical application.” Prelim.

Resp. 36 (citing Ex. 1002, 66). Patent Owner argues that “by pruning the number of paths for which certain calculations must be performed,” “the system for drilling a well in Claim 1 recites additional elements that improve the functioning of a computer and the drilling process itself.” *Id.* at 37.

Patent Owner argues that claim 1 “is actually focused on improving well drilling by selecting *and drilling* a path from the BHA location to the target path.” *Id.* at 38. Patent Owner argues that the “updating” and “sending” recitations “use the alleged judicial exception . . . in a meaningful way by enabling the BHA to return to the target path via the desired convergence path.” *Id.* at 39. Patent Owner likens the “sending” recitation to claim 2 in Example 45 in the Office’s illustrative examples of subject matter eligibility analyses.⁴ *Id.* at 40–41. Patent Owner argues that the Petition does not address the prong two analysis adequately. *Id.* at 41–44.

In addition to the abstract idea, claim 1 recites the additional elements of a processor (recitation 1.1), a memory (recitation 1.2), and sending a control signal (recitation 1.10). The “removing” and “updating” steps identified by Patent Owner (recitations 1.5, 1.6, 1.9) are part of the abstract idea itself, not additional elements beyond the judicial exception. Patent Owner’s arguments, therefore, do not address how the claim integrates the recited judicial exception into a practical application thereof.

The additional elements of the processor and memory are recited at a high level of generality, i.e., as a generic processor performing a generic computer function of processing data. These generic processor and memory recitations are no more than mere instructions to apply the exception using a

⁴ Available at https://www.uspto.gov/sites/default/files/documents/peg_oct_2019_app1.pdf (“Examples”).

generic computer component. *See, e.g., Alice*, 573 U.S. at 221–23.

Accordingly, these additional elements do not integrate the abstract idea into a practical application because they do not impose any meaningful limits on practicing the abstract idea. *See* 2019 Revised Guidance, 84 Fed. Reg. at 55 (stating that a claim element that “merely includes instructions to implement an abstract idea on a computer, or merely uses a computer as a tool to perform an abstract idea,” indicates that the judicial exception is not integrated into a practical application).

The additional element of sending a control signal is merely insignificant post-solution activity that does not show that the judicial exception is integrated into a practical application. *See, e.g., Mayo*, 566 U.S. at 610–11 (“[T]he prohibition against patenting abstract ideas ‘cannot be circumvented by . . . adding ‘insignificant post-solution activity.’” (quoting *Diamond v. Diehr*, 450 U.S. 175, 191–92 (1981))). Contrary to Patent Owner’s contentions (*see* Prelim. Resp. 38), claim 1 does not recite drilling a well. Recitation 1.10 requires sending a control signal but does not require any drilling to occur. Nor does claim 1 recite, for example, any drilling tools or specific actions to perform the alleged drilling.

Based on the current record, we do not agree with Patent Owner’s contention that claim 1 is akin to claim 2 of the Office’s example 45. *See* Prelim. Resp. 40. There, the Office explained that the subject recitation “improves upon previous controllers used in th[e] technical field of injection molding” by controlling the timing of the injection molding process to “avoid[] the technical problems associated with undercure and overcure, which would otherwise negatively affect the cured polyurethane’s strength and wear performance.” Examples 24. Here, however, claim 1 does not

improve upon a controller or other component in the recited system. Nor does claim 1 improve upon a drilling process or solve a technical problem. Rather, the '454 patent purports “to identify multiple possible convergence paths, narrow the identified paths to a single ‘best’ path based on cost, and select that path as the path to be used.” Ex. 1001, 5:47–51. As reflected in claim 1, the '454 patent facilitates the selection of a drilling path, but does not alter the performance of any such drilling.

Considering the judicial exception as well as the additional elements in the claim in combination also fails to integrate the judicial exception into a practical application. Claim 1 does not recite any improvement in the functioning of any computer component or drilling process. Rather, as described above, claim 1 uses conventional computer components to collect and analyze data and to send a control signal based on the result of the data analysis. Such generic data manipulation and computer use is insufficient to evidence a practical application of the judicial exception.

Accordingly, on this record, Petitioner sufficiently shows that the claim fails to integrate the recited judicial exception into a practical application of the exception.

d. Step 2B

This part of the eligibility analysis evaluates whether the claim as a whole amounts to significantly more than the recited exception, i.e., whether any additional element, or combination of additional elements, adds an inventive concept to the claim.

Petitioner argues that the recitation of generating a set of a plurality of possible convergence paths based on BHA location and target information

was a well-understood process prior to the '454 patent. Pet. 28 (citing Ex. 1003 ¶¶ 107–111). Petitioner argues that “it was well-understood, routine, and conventional to use the various criteria recited in the challenged claims when designing an optimal well path.” *Id.* at 29. Petitioner argues that “the claims of the '454 patent . . . merely identify the relevant information to gather and analyze, and then use conventional computer technology to perform that analysis.” *Id.* at 30 (citing Ex. 1003 ¶¶ 102–106). Petitioner argues that “sending a control signal to drill using [the updated] well plan . . . is merely insignificant post-solution activity that amounts to an instruction to ‘apply it.’” *Id.* at 31 (citing Ex. 1003 ¶ 102).

Patent Owner argues that the sequence of “pruning” steps “‘reduces the number of paths for which later calculations are needed,’ which ‘may speed up calculations, thereby providing a performance benefit.’” Prelim. Resp. 44–45 (emphasis omitted) (quoting Ex. 1001, 6:29–31). Patent Owner argues that the “‘pruning’ steps (elements 1.4-1.6) constitute an inventive concept that confers technical benefits.” *Id.* at 45. Patent Owner argues that the Petition fails to consider the claim elements as an ordered combination and, therefore, is deficient. *Id.* at 47.

Initially, we note that the '454 patent refers only to the step of removing illogical options as the “pruning” step, rather than the “generating” and two “removing” steps as asserted by Patent Owner. *See* Ex. 1001, 6:21–34, 6:42–43, 6:50. The two “removing” steps noted by Patent Owner reduce the number of cost considerations that the computer must perform (by increasing the number of other comparisons (regarding illogical options and rule violations)), but do not change the way in which the computer performs the cost analyses. And, as explained above, neither the

“removing” steps nor any other recitation alters the way in which drilling is performed. Moreover, as also noted above, the “generating” and “removing” steps relied upon by Patent Owner are part of the abstract idea itself and, therefore, cannot evidence an inventive concept. *See Berkheimer v. HP Inc.*, 890 F.3d 1369, 1374 (Fed. Cir. 2018) (Moore, J., concurring); *BSG Tech LLC v. BuySeasons, Inc.*, 899 F.3d 1281, 1290–91 (Fed. Cir. 2018).

As noted above, the additional elements of the processor and memory are recited at a high level of generality, i.e., as a generic processor performing a generic computer function of processing data. The ’454 patent also refers to the processor and memory as generic computer components. *See Ex. 1001*, 4:50–5:29. The claim includes the additional recitations of a memory and processor to send a control signal. A memory for storing data and a processor for processing data and sending signals are well-understood, routine, and conventional computer components, which in this claim are recited at a high level of generality and perform generic computer functions (e.g., storing, processing, and transmitting information). *See Ex. 1003* ¶¶ 104–105 (citing *Ex. 1006* ¶ 22, Fig. 2, code (57)). Generic computer components performing generic computer functions, alone, do not amount to significantly more than the abstract idea, as the Supreme Court has explained that “the mere recitation of a generic computer cannot transform a patent-ineligible abstract idea into a patent-eligible invention.” *Alice*, 573 U.S. at 223.

Viewing the limitations in combination also fails to amount to significantly more than the abstract idea. The claimed system seeks to use a processor and memory to generate possible convergence paths, remove

certain ones of the generated possible paths, select a desired one of the generated paths, update a plan to include the selected path, and send a signal, but these functions reflect ordinary usage typically performed by a generic computer, as would be recognized by those of ordinary skill in the field of mining. *See, e.g.,* Ex. 1006 ¶ 22, code (57). The claim here does not invoke any of the considerations that courts have identified as providing significantly more than an exception; the combination of elements is no more than the sum of their parts. Additionally, as the Federal Circuit has explained, claims that do not include a requirement for performing “claimed functions of [data] gathering, analyzing, and [transmitting] by use of anything [other than] conventional, generic technology” fail to provide an inventive concept. *Elec. Power Grp.*, 830 F.3d at 1356.

Accordingly, on this record, Petitioner sufficiently shows that the claim as a whole does not amount to significantly more than the recited exception.

e. Conclusion

For the reasons set forth above, Petitioner has shown that it is more likely than not that claim 1 is unpatentable under 35 U.S.C. § 101.

3. Independent Claim 13

Claim 13 recites a method of using a computer system to perform steps that are substantially the same as steps recited in claim 1. Ex. 1001, 14:63–15:19. Notably, where claim 1 recites removing an illogical possible convergence path and removing a possible convergence path that violates a rule (*id.* at 13:36–47), claim 13 recites removing one possible convergence

path that satisfies one of these requirements (*id.* at 15:5–9). Claim 13 also does not recite a well plan. *Id.* at 14:63–15:19.

The analysis of claim 1 in § II.E.2 above applies to claim 13, and for the reasons provided there, Petitioner has shown that it is more likely than not that claim 13 is unpatentable under 35 U.S.C. § 101.

F. Asserted Obviousness Based on Pirovolou, Panchal, and Budiman

Petitioner argues that claims 1–4 and 11–13 would have been obvious in view of Pirovolou, Panchal, and Budiman. Pet. 34–97. In support of its showing, Petitioner relies upon the Schubert Declaration. *Id.* (citing Ex. 1003). We have reviewed the parties’ briefs and the evidence of record. For the reasons discussed below, and based on the record before us, we determine that Petitioner demonstrates that it is more likely than not that it will prevail in showing that at least one challenged claim would have been obvious in view of the combination of Pirovolou, Panchal, and Budiman.

1. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious before the effective filing date to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level

of skill in the art, and (4) when in evidence, any objective evidence of nonobviousness.⁵ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

2. Status of Panchal as Prior Art

Petitioner argues that Panchal, which was published on November 19, 2015, is entitled to the December 13, 2012, filing date of provisional patent application no. 61/737,015 (“the ’015 application”), presenting tables to assert where the recitations of Panchal claim 1 and the portions of Panchal relied upon in the Petition find support in the ’015 application. Pet. 5–11.

Patent Owner notes that the ’454 patent claims an earliest effective filing date of June 26, 2013, the filing date of provisional patent application no. 61/839,731, and argues, therefore, that “*Panchal* only qualifies as prior art to the ’454 Patent if it is entitled to claim priority to [the ’015 application].” Prelim. Resp. 48. Patent Owner argues that Petitioner has not established support in the ’015 application for the “determining” recitation of Panchal claim 1. *Id.* at 49, 51–54.

Patent Owner’s argument assumes that the ’454 patent is entitled to an earlier filing date than its actual June 19, 2020, filing date. Patent Owner references the earliest claimed priority date, but does not provide a showing of written description support through the claimed priority chain of five applications. *See Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571 (Fed. Cir. 1997) (“In order to gain the benefit of the filing date of an earlier application under 35 U.S.C. § 120, each application in the chain leading back to the earlier application must comply with the written description

⁵ At this stage of the proceeding, the parties have not directed us to any such objective evidence.

requirement of 35 U.S.C. § 112.”). Nor has Patent Owner made the applications to which the ’454 patent claims priority of record in this proceeding. Thus, the current record does not support Patent Owner’s assumption. Notably, Patent Owner recognizes that “[t]here is no presumption that a patent is entitled to the benefit of the filing date of its provisional precursor for prior art purposes.” Prelim. Resp. 49 (citing *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1380 (Fed. Cir. 2015)). The case cited by Patent Owner also makes clear that Patent Owner bears the burden of production to show that the ’454 patent is entitled to an earlier filing date. *Dynamic Drinkware*, 800 F.3d at 1380 (explaining that, after the petitioner met its initial burden of production, “[t]he burden of production then shifted to [Patent Owner] to argue or produce evidence. . . that [an asserted reference] is not prior art because the asserted claims in the [challenged] patent are entitled to the benefit of a filing date (constructive or otherwise) prior to the filing date of [the asserted reference]”). Patent Owner has failed to satisfy its burden.

For completeness, we nonetheless consider the merits of Patent Owner’s arguments regarding Panchal’s effective filing date. As noted by Patent Owner, Petitioner’s burden is to show that the provisional application would enable an ordinarily skilled artisan to practice the claimed invention. *See* Prelim. Resp. 50 (citing *Dynamic Drinkware*, 800 F.3d at 1378). Petitioner’s declarant, Dr. Schubert, testifies that an ordinarily skilled artisan would have been familiar with the art and known how to implement what Panchal discloses. Ex. 1003 ¶ 76 (cited at Pet. 11); *see also id.* ¶¶ 47–69

(discussing the state of the art).⁶ Patent Owner does not offer the testimony of any witness to counter Dr. Schubert’s testimony. We credit this uncontested testimony of Dr. Schubert. *See Icon Health & Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1043 (Fed. Cir. 2017) (“Attorney argument is not evidence.”). Accordingly, for purposes of this Decision, Petitioner provides an adequate showing that Panchal is entitled to the benefit of the December 13, 2012, filing date of the ’015 application.

3. Independent Claim 1

Petitioner relies on Pirovolou to disclose a system substantially as recited in claim 1, and relies on Panchal to teach removing a possible convergence path that comprises an illogical option and on Downton to teach using cost as a consideration in selecting a desired convergence path. Pet. 44–81.

a. Preamble

Claim 1 recites “[a] system for drilling a well.” Ex. 1001, 13:24. Petitioner refers to this recitation as element “1.0” and maps it to Pirovolou’s system for selecting and drilling. Pet. 44 (citing Ex. 1006 ¶ 7, code (57); Ex. 1003 ¶¶ 127–129).

Patent Owner does not contest this aspect of the Petition. *See generally* Prelim. Resp.

⁶ We do not agree with Patent Owner’s characterization of Dr. Schubert’s testimony as conclusory. Prelim. Resp. 53–54 (citing Ex. 1003 (Dr. Schubert’s declaration) ¶ 76 but omitting Dr. Schubert’s citations to Pirovolou and Budiman, and failing to acknowledge Dr. Schubert’s reference to the Background and State of the Art section found earlier in the same declaration).

Pirovolou discloses “a method and system for selecting and drilling along an optimal corrected trajectory.” Ex. 1006 ¶ 7.

Accordingly, for the foregoing reasons and on this record, to the extent the preamble is limiting, Pirovolou supports Petitioner’s contentions.

b. The Processor Recitation

Claim 1 recites “a processor.” Ex. 1001, 13:25. Petitioner refers to this recitation as element “1.1” and maps Pirovolou’s central processing unit (“CPU”) 20 to the recited processor. Pet. 44–45 (citing Ex. 1006 ¶¶ 21–22, Fig. 1; Ex. 1003 ¶¶ 130–132).

Patent Owner does not contest this aspect of the Petition. *See generally* Prelim. Resp.

Pirovolou discloses that its “control system 19 may be a computer-based system having a central processing unit (CPU) 20.” Ex. 1006 ¶ 22.

Accordingly, for the foregoing reasons and on this record, Pirovolou supports Petitioner’s contentions.

c. The Memory Recitation

Claim 1 recites “a memory coupled to the processor, wherein the memory comprises a plurality of instructions executable by the processor.” Ex. 1001, 13:26–29. Petitioner refers to this recitation as element “1.2” and maps memory 22 of Pirovolou’s CPU to the recited memory. Pet. 46–48 (citing Ex. 1006 ¶ 22, Fig. 2, code (57); Ex. 1003 ¶¶ 133–137).

Patent Owner does not contest this aspect of the Petition. *See generally* Prelim. Resp.

Pirovolou discloses that its CPU 20 includes memory 22 that stores instructions to, for example, “analyze the factors or considerations relating

to the optimal [drilling] trajectory and selecting the optimal trajectory.”

Ex. 1006 ¶¶ 22, 30, code (57).

Accordingly, for the foregoing reasons and on this record, Pirovolou supports Petitioner’s contentions.

d. The First Receiving Recitation

Claim 1 recites “receiving first information comprising a location of a bottom hole assembly (BHA) in a well being drilled and a target path for a wellbore of the well.” Ex. 1001, 13:30–32. Petitioner refers to this recitation as element “1.3” and presents two alternate mappings. Pet. 48–53. First, Petitioner argues that Pirovolou discloses receiving BHA location information from its logging-while-drilling and measuring-while-drilling modules, and receiving target path information from its predetermined trajectory, which Petitioner argues is a well plan. *Id.* at 48–50 (citing Ex. 1006 ¶¶ 5–6, 18, 20, 23–24, 27–28, 38–39; Ex. 1003 ¶¶ 140–149). Second, Petitioner argues that Panchal teaches receiving BHA location information from its real-time bit data and receiving target path information from its well plan. *Id.* at 50–53 (citing Ex. 1011 ¶¶ 4, 33, 60, Fig. 4, claim 1; Ex. 1003 ¶¶ 150–153).

Pirovolou discloses that its BHA can include logging-while-drilling and measuring-while-drilling modules that include sensors and measurement devices that obtain downhole information including, for example, orientations and positions. Ex. 1006 ¶ 18. Drilling measurements can include the “location of the drill bit.” *Id.* ¶ 31. Pirovolou further discloses that its system receives, and may update, a well plan that includes an optimal

trajectory for drilling. *Id.* ¶¶ 5–6, 34. The optimal trajectory may be updated based on real-time drilling information. *Id.* ¶ 39.

Accordingly, for the foregoing reasons and on this record, Pirovolou supports Petitioner’s contentions in its first alternative mapping.

Panchal discloses receiving a well plan describing a borehole trajectory and updating the trajectory based on real-time data received from the drilling system. Ex. 1011 ¶ 4. Petitioner argues that it would have been obvious to an ordinarily skilled artisan to modify Pirovolou’s system to receive a predetermined well plan as a combination of known prior art elements in a known manner to yield a predictable result. Pet. 52–53; Ex. 1003 ¶ 153.

Patent Owner argues that the Petition fails to set forth adequate reasoning for combining the teachings of Pirovolou and Panchal. Prelim. Resp. 66–70. Patent Owner argues that the Petition’s premise that drilling “paths must be ‘coincident with the drilling tool’ is based on flawed reasoning” because “[i]f a selected path must be coincident with the pose of the drilling tool, as Petitioner alleges, a path could never turn or correct itself.” *Id.* at 66–67 (citing Pet. 60). Patent Owner argues that Petitioner fails to set forth a reasonable expectation of success in combining the teachings of Pirovolou and Panchal because “Petitioner does not explain *how* to combine [Panchal’s] system that calculates a single optimal path with [Pirovolou’s] system that allegedly discloses calculating multiple paths and then selecting an optimal path.” *Id.* at 68 (citing Pet. 60–61).

Patent Owner misconstrues Petitioner’s arguments. Rather than suggesting that a convergence path must begin and continue in the direction of the drilling tool, Petitioner argues that an ordinarily skilled artisan would

have “eliminate[d] paths that extend away from the target *before converging with the target path*.” Pet. 60 (emphasis added). Thus, we read the Petition to contend that an ordinarily skilled artisan would eliminate possible convergence paths that begin in a direction that is not coincident with the drilling tool. *See, e.g., id.* (“a path that requires a drilling tool to *begin* drilling in a southwest direction cannot be implemented by a drilling tool that is oriented in a due east direction” (emphasis added)).

We also disagree with Patent Owner’s assertion that Petitioner has failed to set forth a reasonable expectation of success in combining the teachings of Pirovolou and Panchal. As Patent Owner notes, Panchal discloses the use of “input constraints,” including “remaining ‘coincident’ with the pose of the drill [string],” and Pirovolou discloses evaluating possible convergence paths based on certain drilling limitations. Prelim. Resp. 68; *see also* Ex. 1006 ¶¶ 34–36; Ex. 1011 ¶ 60. The Petition argues that an ordinarily skilled artisan would have treated Panchal’s constraint (requirement for coincidence) as another limitation in Pirovolou’s system. Pet. 61.

Accordingly, for the foregoing reasons and on this record, Panchal supports Petitioner’s contentions in its second alternative mapping. We determine that Petitioner sets forth reasoning with rational underpinning explaining why a person having ordinary skill in the art would have combined the teachings of Pirovolou and Panchal. *See* Pet. 52–53; Ex. 1003 ¶ 153.

e. The Generating Recitation

Claim 1 recites “responsive to the first information, generating a first set of a plurality of possible convergence paths from the BHA location to the target path.” Ex. 1001, 13:33–35. Petitioner refers to this recitation as element “1.4” and presents two alternate mappings. Pet. 53–58. First, Petitioner argues that Pirovolou identifies numerous possible trajectories from the current BHA location to the target path. *Id.* at 54–55 (citing Ex. 1006 ¶¶ 27–28, 39, Figs. 1, 3; Ex. 1003 ¶¶ 155–161). Second, Petitioner argues that Panchal teaches generating feasible smooth drilling paths based on the measured pose of the drilling tool. *Id.* at 55–58 (citing Ex. 1001 ¶¶ 37, 39, 60, 88–92, Figs. 4, 18; Ex. 1003 ¶¶ 162–166).

Patent Owner does not contest this aspect of the Petition. *See generally* Prelim. Resp.

Pirovolou discloses that “there are nearly an infinite number of paths from the [BHA position] to the target T.” Ex. 1006 ¶ 29; *see also id.* ¶ 28 (discussing “numerous possible trajectories”).

Accordingly, for the foregoing reasons and on this record, Pirovolou supports Petitioner’s contentions in its first alternative mapping.

Panchal discloses “the generation of feasible smooth paths which are coincident with the pose of the drilling tool in order to track back to the [well plan].” Ex. 1011 ¶ 60. Petitioner argues that it would have been obvious to an ordinarily skilled artisan “to modify Pirovolou’s controller to generate these numerous paths . . . to allow for Pirovolou’s selection of the trajectory to be in ‘real-time.’” Pet. 57 (citing Ex. 1006 ¶ 39; Ex. 1003 ¶ 165).

Accordingly, for the foregoing reasons and on this record, Panchal supports Petitioner's contentions in its second alternative mapping. We determine that Petitioner sets forth reasoning with rational underpinning explaining why a person having ordinary skill in the art would have combined the teachings of Pirovolou and Panchal. *See* Pet. 57; Ex. 1003 ¶ 165.

f. The First Removing Recitation

Claim 1 recites “removing a first possible convergence path from the first set, wherein the first possible convergence path removed comprises an illogical option, wherein the illogical option comprises a path which extends in the wrong direction before converging, thereby generating a second set of a plurality of possible convergence paths.” Ex. 1001, 13:36–42. Petitioner refers to this recitation as element “1.5” and argues that “Pirovolou discloses eliminating paths from consideration based on various drilling limitations,” including the elimination of illogical paths “that require a dog-leg that is unachievable with selected equipment.” Pet. 58–59 (citing Ex. 1006 ¶ 32; Ex. 1003 ¶ 168). Petitioner relies on Panchal to teach eliminating paths that extend in the wrong direction. *Id.* at 59–61 (citing Ex. 1011 ¶¶ 37, 60; Ex. 1003 ¶¶ 169–171). Petitioner argues that “Pirovolou discloses or renders obvious selecting an optimal path by first eliminating paths based on certain criteria, and then further eliminating additional possible paths based on additional criteria before selecting an optimal path.” *Id.* at 61–62 (citing Ex. 1006 ¶¶ 34, 38).

Patent Owner argues that “*Pirovolou* teaches eliminating potential paths *before* generating them,” and, thus, “*Pirovolou* fails to disclose or

render obvious ‘*removing* a first possible convergence path *from the first set*,’ where the first set of the plurality of possible convergence paths were already generated.” Prelim. Resp. 58. Rather, according to Patent Owner, “*Pirovolou* . . . preemptively limits the possible trajectories that are generated in the first place.” *Id.* (citing Ex. 1006 ¶ 32). For substantially the same reasons, Patent Owner argues that Pirovolou does not generate a second set of possible convergence paths. *Id.* at 59–66 (arguing, *inter alia*, that “*Pirovolou*’s disclosure focuses on how to *select* the ‘optimal trajectory,’ not on removing potential options”).

Pirovolou discloses that “there are nearly an infinite number of paths” from the tool location to the target path from which “the optimal path” is selected based on various “factors or considerations.” Ex. 1006 ¶ 29; *see also id.* ¶ 28 (discussing “numerous possible trajectories”). “The optimal trajectory may be selected from the possible trajectories by analyzing the data in view of the production considerations and/or the drilling considerations.” *Id.* ¶ 34. The selection may be based on “a hierarchy of the data input as production and drilling considerations.” *Id.* Pirovolou explains that the number of possible trajectories may be reduced in steps: “Possible trajectories may be eliminated by drilling limitations *and further* by the production or drilling considerations.” *Id.* (emphasis added). For example, Pirovolou discloses that possible trajectories can first be reduced based on “dog-leg severity” and the resulting possible trajectories subsequently reduced based on “drag” or “build rate.” *Id.* ¶¶ 35–36. We agree with Petitioner that this reduction of the number of possible trajectories in subsequent steps results in each step generating a set of possible

convergence paths that is reduced by subsequent reduction steps. *See* Pet. 61–62.

Panchal discloses “feasible smooth paths” from the BHA location to the target path are “coincident with the pose of the drilling tool.” Ex. 1011 ¶ 60. Petitioner argues that it would have been obvious “to use the requirement that a path be coincident with the drilling tool, as taught by Panchal, as a ‘drilling limitation’ as taught by Pirovolou to ensure that potential paths are feasible and less complex or costly to implement.” Pet. 60 (citing Ex. 1003 ¶ 171). As an example, Petitioner states that “a path that requires a drilling tool to begin drilling in a southwest direction cannot be implemented by a drilling tool that is oriented in a due east direction.” *Id.* (citing Ex. 1003 ¶ 171).

Accordingly, for the foregoing reasons and on this record, Pirovolou and Panchal support Petitioner’s contentions. We determine that Petitioner sets forth reasoning with rational underpinning explaining why a person having ordinary skill in the art would have combined the teachings of Pirovolou and Panchal. *See* Pet. 60; Ex. 1003 ¶ 171.

g. The Second Removing Recitation

Claim 1 recites “removing a second possible convergence path from the second set of the plurality of possible convergence paths, wherein the second possible convergence path comprises a violation of a rule, thereby generating a third set of a plurality of possible convergence paths.” Ex. 1001, 13:43–47. Petitioner refers to this recitation as element “1.6” and argues that Pirovolou teaches a second step of removing possible

convergence paths based on build rate. Pet. 63–64 (citing Ex. 1006 ¶¶ 32, 34; Ex. 1003 ¶ 176).

Patent Owner argues that the Petition “ignores th[e] particularly claimed sequential process” and “fails to point to any evidence or reasoning for why it would be obvious to perform a second removal step.” Prelim. Resp. 71.

Patent Owner’s arguments are unavailing for the reasons set forth above regarding the First Removing Recitation. As we explained, Pirovolou discloses reducing the number of possible trajectories in distinct steps: “Possible trajectories may be eliminated by drilling limitations *and further* by the production or drilling considerations.” Ex. 1006 ¶ 34 (emphasis added). For example, Pirovolou discloses that possible trajectories can first be reduced based on “dog-leg severity” and the resulting possible trajectories subsequently reduced based on “build rate.” *Id.* ¶¶ 35–36.

Accordingly, for the foregoing reasons and on this record, Pirovolou supports Petitioner’s contentions.

h. The Selecting Recitation

Claim 1 recites “selecting a desired convergence path responsive to at least one of: a curvature associated with each of the possible convergence paths in the third set, a time associated with each of the possible convergence paths, and a cost associated with each of the possible convergence paths.” Ex. 1001, 13:48–52. Petitioner refers to this recitation as element “1.7” and argues that Pirovolou discloses selecting an optimal trajectory of a wellbore based on one or more factors or considerations, including dogleg severity (curvature) and cost. Pet. 65–66 (citing Ex. 1006

¶¶ 28, 38; Ex. 1003 ¶¶ 182–184). Petitioner relies on Budiman to teach drilling time as a criterion to consider when optimizing a well path. *Id.* at 66–70 (citing Ex. 1005, 3:20–27, 4:14–15, 4:19–24, 6:4–6, 6:63–7:24, 11:3–33, claims 19, 22, Figs. 1A, 1B; Ex. 1003 ¶¶ 83, 93, 185–187).

Patent Owner acknowledges that “*Budiman*’s Figure 1B . . . indicates that drilling time influences cost,” but argues that Figure 1B “does not disclose evaluating a path based on drilling time.” Prelim. Resp. 73 (citing Ex. 1005, 7:15–24).

Patent Owner’s argument focuses on Budiman’s disclosure, but the Petition relies on the combined teachings of Budiman and Pirovolou. *See* Pet. 66–70. Petitioner relies on Budiman to teach that “the ‘drilling time’ for a well path impacts the overall cost of drilling that path” (*id.* at 68 (citing Ex. 1005, Fig. 1B)), a fact that Patent Owner concedes to be true (*see* Prelim. Resp. 73). Petitioner relies on this uncontested teaching of Budiman in contending that it would have been obvious to modify Pirovolou’s system to include drilling time as another criterion on which Pirovolou’s selection of the optimal trajectory is based. *See* Pet. 68–69. We additionally note that Pirovolou discloses selecting the optimal path using dog-leg severity (Ex. 1006 ¶¶ 35, 38) and cost (*id.* ¶ 28) as consideration factors, and Budiman discloses selecting an optimal trajectory based on, for example, “total time to drill the well” (Ex. 1005, 6:4–10).

Next, Patent Owner argues that the Petition fails to set forth adequate reasoning for combining the teachings of Pirovolou and Budiman. Prelim. Resp. 74–77. Patent Owner acknowledges that “[d]rilling time is one of many variables that impact cost,” but argues that “the Petition fails to explain why [an ordinarily skilled artisan] would choose to take drilling time

into account over the many other variables that impact cost performance of a drilling operation.” *Id.* at 75–76.

Patent Owner appears to concede that it would have been obvious for an ordinarily skilled artisan to consider a time associated with each possible convergence path when determining which of the possible convergence paths to select as the desired convergence path. *See* Prelim. Resp. 76. That such an artisan may include others of the factors disclosed by Budiman as impacting cost does not dissuade us that, as acknowledged by Patent Owner, it would have been obvious to an ordinarily skilled artisan to consider time in such an evaluation.

Accordingly, for the foregoing reasons and on this record, Pirovolou and Budiman support Petitioner’s contentions. We determine that Petitioner sets forth reasoning with rational underpinning explaining why a person having ordinary skill in the art would have combined the teachings of Pirovolou and Budiman. *See* Pet. 69; Ex. 1003 ¶ 187.

i. The Second Receiving Recitation

Claim 1 recites “receiving a well plan.” Ex. 1001, 13:53. Petitioner refers to this recitation as element “1.8” and presents two alternate mappings. Pet. 71–72. First, Petitioner argues that Pirovolou’s predetermined plan is a received well plan. *Id.* (citing Ex. 1006 ¶¶ 5–6, 28, 39; Ex. 1003 ¶¶ 192–194). Second, Petitioner argues that Panchal teaches receiving a well plan. *Id.* at 72 (citing Ex. 1011 ¶¶ 4, 33; Ex. 1003 ¶¶ 153, 195).

Patent Owner does not contest this aspect of the Petition. *See generally* Prelim. Resp.

Pirovolou discloses that its system receives, and may update, a well plan that includes an optimal trajectory for drilling. Ex. 1006 ¶¶ 5–6, 34.

Accordingly, for the foregoing reasons and on this record, Pirovolou supports Petitioner’s contentions in its first alternative mapping.

Panchal discloses receiving a well plan describing a borehole trajectory and updating the trajectory based on real-time data received from the drilling system. Ex. 1011 ¶ 4. Petitioner argues that it would have been obvious to an ordinarily skilled artisan to modify Pirovolou’s system to receive a predetermined well plan as a combination of known prior art elements in known manner to yield a predictable result. Pet. 72 (citing *id.* at 52–53).

Accordingly, for the foregoing reasons and on this record, Panchal supports Petitioner’s contentions in its second alternative mapping. We determine that Petitioner sets forth reasoning with rational underpinning explaining why a person having ordinary skill in the art would have combined the teachings of Pirovolou and Panchal. *See* Pet. 52–53; Ex. 1003 ¶ 153.

j. The Updating Recitation

Claim 1 recites “updating the well plan with the desired convergence path.” Ex. 1001, 13:53–54. Petitioner refers to this recitation as element “1.9” and argues that Pirovolou discloses editing its well plan to include a corrected trajectory. Pet. 73–74 (citing Ex. 1006 ¶¶ 5–6, 28, 30, 39; Ex. 1003 ¶¶ 198–201).

Patent Owner does not contest this aspect of the Petition. *See generally* Prelim. Resp.

Pirovolou discloses that its system receives, and may update, a well plan that includes an optimal trajectory for drilling. *Id.* ¶¶ 5–6, 34.

Accordingly, for the foregoing reasons and on this record, Pirovolou supports Petitioner’s contentions.

k. The Sending Recitation

Claim 1 recites “sending one or more control signals to a control system to drill in accordance with the updated well plan.” Ex. 1001, 13:55–56. Petitioner refers to this recitation as element “1.10” and argues that Pirovolou discloses this recitation by communicating instructions from controller 19 to BHA 10. Pet. 74–75 (citing Ex. 1006 ¶¶ 18, 21, 24–26, 30, Fig. 1; Ex. 1003 ¶¶ 205–207). Petitioner argues that Pirovolou’s controller 19 may include multiple device in communication, with some such devices being located at the well surface. *Id.* at 76–81 (citing Ex. 1006 ¶¶ 21–22, Fig. 1; Ex. 1003 ¶¶ 202–210).

Patent Owner does not contest this aspect of the Petition. *See generally* Prelim. Resp.

Pirovolou discloses that its “controller 19 may communicate instructions to the BHA 10, for example, to direct the BHA 10 and the drilling of wellbore 2 along the corrected optimal trajectory.” Ex. 1006 ¶ 30.

Accordingly, for the foregoing reasons and on this record, Pirovolou supports Petitioner’s contentions.

l. Conclusion

For the foregoing reasons, we determine that Petitioner has demonstrated that it is more likely than not that it will prevail on its assertion

that claim 1 would have been obvious in view of the combination of Pirovolou, Panchal, and Budiman.

4. Dependent Claims 2–4, 11, and 12

Each of claims 2–4, 11 and 12 depends directly from independent claim 1. Ex. 1001, 13:57–14:2, 14:59–62. The Petition maps these challenged dependent claims to Pirovolou and Panchal. Pet. 88–97. Patent Owner does not challenge separately the arguments and evidence presented for the dependent claims. *See generally* Prelim. Resp. Based on our review of the current record before us, we determine that the information presented in the Petition establishes that it is more likely than not that it will prevail on its assertion that claims 2–4 and 12 would have been obvious in view of the combination of Pirovolou, Panchal, and Budiman.

Claim 11 recites “wherein the processor is located downhole in the well.” Ex. 1001, 14:59–60. As noted above, Petitioner maps Pirovolou’s CPU 20 to the recited processor. Pet. 44–45. Petitioner argues that it would have been obvious to locate the processor downhole in the well. *Id.* at 93–96. Regarding claim 11, however, Petitioner maps “the processor in the BHA modules” to the recited processor and argues that “the BHA would perform the selection of an optimal path using [such] a processor.” *Id.* at 95. However, Petitioner does not appear to explain adequately that the asserted BHA processor is equivalent to the previously relied upon processor of CPU 20. For example, although Petitioner addresses the selecting step, Petitioner does not appear to explain adequately how the asserted BHA processor would include memory comprising instructions to perform the other steps recited in claim 1. Thus, we question whether the Petition has

explained adequately how claim 11 would have been obvious in view of the combination of Pirovolou, Panchal, and Budiman.

5. Independent Claim 13

As noted above, claim 13 recites a method of using a computer system to perform steps that are substantially the same as steps recited in claim 1. Ex. 1001, 14:63–15:19. Notably, where claim 1 recites removing an illogical possible convergence path and removing a possible convergence path that violates a rule (*id.* at 13:36–47), claim 13 recites removing one possible convergence path that satisfies one of these requirements (*id.* at 15:5–9). Claim 13 also does not recite a well plan. *Id.* at 14:63–15:19.

Petitioner relies on its showing made for claim 1 in arguing that claim 13 would have been obvious in view of the combination of Pirovolou, Panchal, and Budiman. Pet. 81–88.

Patent Owner argues that the Petition is deficient regarding claim 13 for the same reasons discussed above regarding claim 1. Prelim. Resp. 77–80.

The analysis of claim 1 in § II.F.3 above applies to claim 13 and, for the reasons provided there, we determine that Petitioner has demonstrated that it is more likely than not that it will prevail on its assertion that claim 13 would have been obvious in view of the combination of Pirovolou, Panchal, and Budiman.

G. Asserted Obviousness Based on Pirovolou, Panchal, Budiman, and Downton

Petitioner argues that claim 10 would have been obvious in view of Pirovolou, Panchal, Budiman, and Downton. Pet. 98–100. In support of its

showing, Petitioner relies upon the Schubert Declaration. *Id.* (citing Ex. 1003). We have reviewed the parties’ briefs and the evidence of record. For the reasons discussed below, and based on the record before us, we determine that Petitioner demonstrates that it is more likely than not that it will prevail in showing that claim 10 would have been obvious in view of the combination of Pirovolou, Panchal, Budiman, and Downton.

Claim 10 depends directly from claim 1 and recites “wherein the instructions for the step of selecting the desired convergence path is responsive to drift associated with each of the plurality of convergence path.” Ex. 1001, 14:55–58. Petitioner argues that Pirovolou discloses selecting an optimal trajectory of a wellbore based on factors or considerations including current and predicted drilling conditions. Pet. 99 (citing Ex. 1006 ¶¶ 30–31). Petitioner relies on Downton to teach that drift of the drill bit is a drilling condition. *Id.* (citing Ex. 1023 ¶ 4; Ex. 1003 ¶ 281).

Patent Owner does not challenge separately the arguments and evidence presented for the dependent claims. *See generally* Prelim. Resp.

As noted above, Pirovolou discloses selecting the optimal path using dog-leg severity (Ex. 1006 ¶¶ 35, 38) and cost (*id.* ¶ 28) as consideration factors. Downton discloses that “[m]easurements of drilling conditions, such as, for example, drift of the drill bit . . . , may be necessary for determining the trajectory of the borehole, especially for directional drilling.” Ex. 1023 ¶ 4. Downton further discloses that “adjustment of the drilling operations in response to accurate real-time information may enable optimization of the drilling process” *Id.* ¶ 5.

Accordingly, for the foregoing reasons and on this record, Pirovolou and Downton support Petitioner's contentions. We determine that Petitioner sets forth reasoning with rational underpinning explaining why a person having ordinary skill in the art would have combined the teachings of Pirovolou and Downton. *See* Pet. 99–100; Ex. 1003 ¶ 282.

For the foregoing reasons, we determine that Petitioner has demonstrated that it is more likely than not that it will prevail on its assertion that claim 10 would have been obvious in view of the combination of Pirovolou, Panchal, Budiman, and Downton.

III. CONCLUSION

For the foregoing reasons, we determine that the information presented establishes that it is more likely than not that Petitioner would prevail in showing that at least one of the challenged claims of the '454 patent is unpatentable. At this preliminary stage, we have not made a final determination with respect to the patentability of the challenged claims or any underlying factual and legal issues. Accordingly, post-grant review is instituted as to all challenged claims and all proposed grounds of unpatentability.

IV. ORDER

Accordingly, it is:

ORDERED that pursuant to 35 U.S.C. § 324(a), a post-grant review of claims 1–4 and 10–13 of the '454 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 324(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which commences on the entry date of this decision.

PGR2022-00055
Patent 11,170,454 B2

For PETITIONER:

David M. O'Dell
Jonathan R. Bowser
Eugene Goryunov
Vera Suarez
Angela M. Oliver
Matthew Beck
HAYNES AND BOONE, LLP
david.odell.ipr@haynesboone.com
jon.bowser.ipr@haynesboone.com
eugene.goryunov.ipr@haynesboone.com
vera.suarez.ipr@haynesboone.com
angela.oliver.ipr@haynesboone.com
matthew.beck.ipr@haynesboone.com

For PATENT OWNER:

Chad C. Walters
Douglas M. Kubehl
Megan LaDriere White
Clarke W. Stavinoha
BAKER BOTTS L.L.P.
chad.walters@bakerbotts.com
doug.kubehl@bakerbotts.com
megan.white@bakerbotts.com
clarke.stavinoha@bakerbotts.com