

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HALLIBURTON ENERGY SERVICES, INC.,
Petitioner,

v.

U.S. WELL SERVICES, LLC,
Patent Owner.

IPR2021-01065
Patent 9,840,901 B2

Before LYNNE H. BROWNE, GEORGE R. HOSKINS, and
SEAN P. O'HANLON, *Administrative Patent Judges*.

HOSKINS, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Halliburton Energy Services, Inc. (“Petitioner”) filed a Petition (Paper 2, “Pet.”) pursuant to 35 U.S.C. §§ 311–319 to institute an *inter partes* review of U.S. Patent No. 9,840,901 B2 (Ex. 1001, “the ’901 patent”), claims 1–18. The Board instituted the petitioned review (Paper 9, “Institution Decision” or “Inst. Dec.”).

U.S. Well Services, LLC (“Patent Owner”) filed a Patent Owner Response (Paper 13, “PO Resp.”) to oppose the Petition. Petitioner filed a Reply (Paper 18, “Pet. Reply”) to the Patent Owner Response. Patent Owner filed a Sur-reply (Paper 19, “PO Sur-reply”) to the Reply. An oral hearing was held, for which a transcript was entered into the record (Paper 25, “Tr.”).

We have jurisdiction under 35 U.S.C. § 6(b)(4) and § 318(a). This Decision is a final written decision under 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 as to the patentability of claims 1–18 of the ’901 patent. We determine Petitioner has shown by a preponderance of the evidence that claims 1–18 are unpatentable.

II. BACKGROUND

A. *Real Parties-in-Interest and Related Proceedings*

Petitioner identifies itself; Halliburton Company; and Halliburton Holdings LLC, as real parties-in-interest. *See* Pet. 1. Patent Owner identifies itself and ProFrac Holding Corporation as real parties-in-interest. *See* Paper 4, 1; Paper 26.

The parties identify three judicial matters as related to this proceeding. *See* Pet. 1–2; Paper 4, 1.

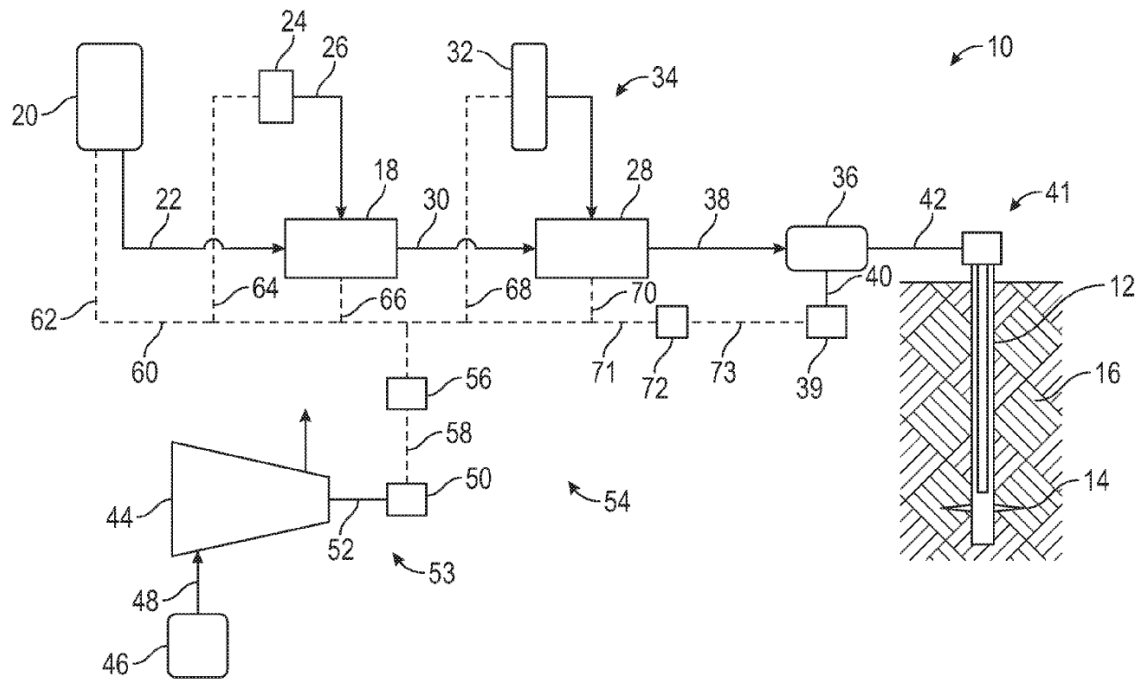
Petitioner has also filed several other IPR proceedings to challenge patents owned by Patent Owner. They are:

Proceeding No.	U.S. Patent No.	Proceeding No.	U.S. Patent No.
IPR2021-01032	9,410,410 B2	IPR2021-01066	10,020,711 B2
IPR2021-01033	8,789,601 B2	IPR2021-01238	10,526,882 B2
IPR2021-01034	10,337,308 B2	IPR2021-01315	9,893,500 B2
IPR2021-01035	9,970,278 B2	IPR2021-01316	10,280,724 B2
IPR2021-01036	9,611,728 B2	IPR2021-01538	10,408,031 B2
IPR2021-01037	9,745,840 B2	IPR2021-01539	10,648,311 B2
IPR2021-01038	10,408,030 B2	IPR2022-00074	10,254,732 B2
IPR2021-01065	9,840,901 B2	IPR2022-00610	10,934,824 B2

B. The '901 Patent

The '901 patent concerns a system for remote monitoring of equipment in a hydraulic fracturing system. *See* Ex. 1001, code (57), 1:19–24. A hydraulic fracturing system pumps fluid into a wellbore at a pressure sufficient to generate fissures in subterranean formations (that is, fracture the formations) surrounding the wellbore, thereby stimulating production of hydrocarbons from the well. *See id.* at 1:25–33.

Figure 1 schematically illustrates various components of a hydraulic fracturing system, and is reproduced below (on the next page):

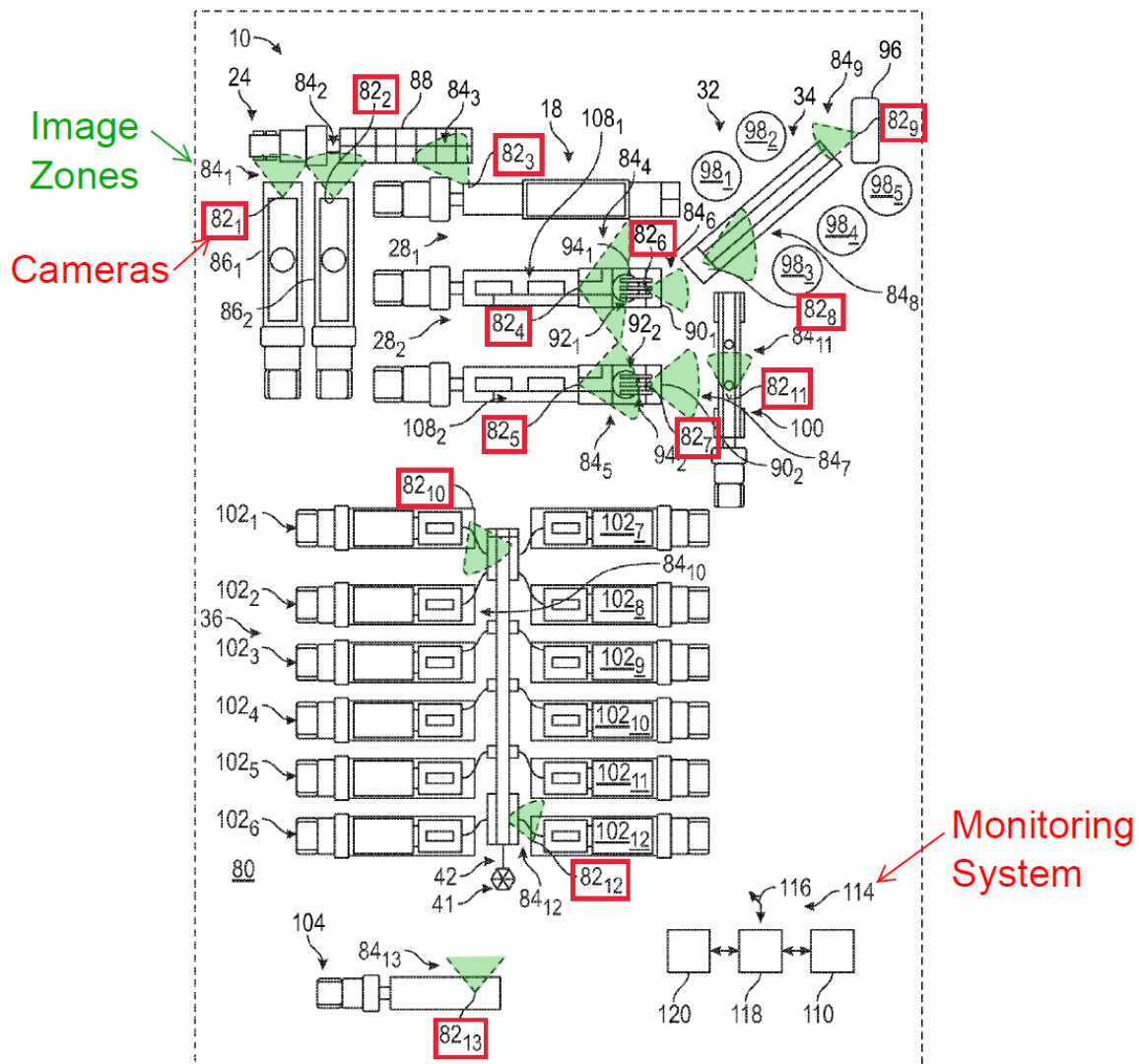


The '901 Patent, Figure 1.

Figure 1 is a schematic illustration of hydraulic fracturing system 10, which pressurizes wellbore 12 to create fractures 14 in subterranean formation 16. *See id.* at 3:50–51, 4:29–32. Hydration unit 18 receives a fluid (such as water) from fluid source 20 via line 22, and receives additives from additive source 24 via line 26, and mixes them together. *See id.* at 4:32–42. Blender unit 28 receives the fluid-additive mixture via line 30, and receives proppant from proppant source 32 via conveyor 34, and blends them together to form a fracturing slurry. *See id.* at 4:42–48. Pump system 36 is powered by motor 39 via connection 40, and receives the fracturing slurry via suction line 38, and pumps the fracturing slurry to wellhead assembly 41 via discharge piping 42. *See id.* at 4:48–51, 4:60–5:2.

All of these system components are powered by electricity, generated by fuel source 46 (such as natural gas), turbine 44, and generator 50, as shown by dotted lines 58, 60, 62, 64, 66, 68, 70, 71, and 73 in Figure 1. *See id.* at 5:10–49.

Figure 2 is reproduced below, with our annotations:



The '901 Patent, Figure 2 (Annotated).

Figure 2 is a plan schematic view of hydraulic fracturing system 10 arranged at well site 80. *See id.* at 5:59–61. System 10 includes thirteen cameras 82₁–82₁₃ (reference numbers annotated with red boxes), each having a respective image zone 84₁–84₁₃ (annotated in green), wherein the cameras are “strategically located about the system 10 in order to capture real time images of designated portions of” system 10. *Id.* at 5:61–67.

Specifically, cameras 82₁ and 82₂ monitor hose connections and booster pumps (not shown) on chemical tankers 86₁ and 86₂. *See id.* at 5:67–6:11. Camera 82₃ monitors chemical tanker 88 for leaks or failed hose connections. *See id.* at 6:11–14. Cameras 82₄ and 82₅ monitor the openings of hoppers 90₁ and 90₂, such that “analyzing data or images captured by cameras 82_{4,5} provides information [in] real time about the level of the slurry mixture within hoppers 90_{1,2} . . . without an operator approaching the hoppers 90_{1,2}.” *Id.* at 6:16–33. Cameras 82₆ and 82₇ monitor hoppers 90₁ and 90₂, such that “analyzing information collected by cameras 82_{6,7} can provide information indicating a level of sand or proppant within hoppers 90_{1,2}, without an operator approaching the hoppers 90_{1,2}.” *Id.*¹ Camera 82₈ monitors proppant conveyor 34 proximate to hoppers 90₁ and 90₂ to observe proppant on the conveyor. *See id.* at 6:34–44. Camera 82₉ monitors the end of conveyor 34 distal from hoppers 90₁ and 90₂ to observe the transfer of proppant from silos 98₁–98₅ to conveyor 34. *See id.* at 6:34–41. Cameras 82₁₀ and 82₁₂ monitor pump trucks 102₁–102₁₂ and discharge piping 42 to observe hoses, fittings, and the general discharge area. *See id.* at 6:63–7:5. Camera 82₁₁ monitors openings in acid tanker 100 to track acid levels in the tanker. *See id.* at 6:44–62. Camera 82₁₃ monitors wellhead assembly 41 and the high pressure zone between pump trucks 102₁–102₁₂ and wellhead assembly 41. *Id.* at 7:7–17.

¹ This passage is somewhat confusing. The correct reading may be that cameras 82₄ and 82₅ monitor *tubs* 94₁ and 94₂ (not hoppers 90₁ and 90₂) to observe the *slurry* level in the tubs, and cameras 82₆ and 82₇ monitor *hoppers* 90₁ and 90₂ to observe the *proppant* level in the hoppers.

Cameras 82₁–82₁₃ are part of monitoring system 114, which also includes monitor 110, communication means 116, controller 118, and human machine interface 120. *See id.* at 7:61–8:4. This permits “remote” monitoring of the various components in system 10 by operating personnel, utilizing “real time images.” *Id.* at 1:21–24, 2:44–48, 3:7–13, 3:20–23, 7:32–36, 7:46–48, 7:58–60, 8:25–27. This enhances the safety of such personnel by: (1) reducing their exposure to hazardous materials used by the system, including silica dust, resin-coated sand, ceramic beads, friction-reducing chemicals, corrosive acids, and biocides (*see id.* at 1:45–2:16, 8:5–10); and (2) reducing the time personnel spend in high pressure areas with the associated risk of explosions and flying shrapnel (*see id.* at 2:17–25, 8:11–14).

In some embodiments, system 10 may be configured for “selectively obtaining images of different hydraulic fracturing components or pump components on a single monitor,” such that “operations personnel can selectively change the image being viewed to that of a separate camera.” *Id.* at 3:32–34, 7:37–47, Fig. 5.

C. The Claims of the '901 Patent

The '901 patent includes eighteen claims, with claims 1 and 13 being independent. *See Ex. 1001*, 8:42–10:37. Illustrative claim 1 is reproduced here:

1. A hydraulic fracturing system for fracturing a subterranean formation comprising:
a pump in communication via pump components with a wellbore that intersects the formation, and that pressurizes fluid in the wellbore, the fluid comprising a fracturing fluid slurry;

hydraulic fracturing system components for making the fracturing fluid slurry; and

a monitoring system that selectively captures and transmits real time images of at least one of the hydraulic fracturing system components or pump components to enable remote monitoring of the at least one of the hydraulic fracturing system components or pump components;

wherein the monitoring system selectively captures and transmits real time images of an opening to a vessel, so that a level within the vessel is discernible in the images.

Id. at 8:42–59.

D. Priority Date of the '901 Patent

The '901 patent asserts priority to two different branches of parent applications. *See* Ex. 1001, codes (60) and (63), 1:4–15. The parties have addressed the propriety of these assertions in their briefs, as we discuss here, considering each of the two branches separately.

1. Priority to U.S. Application Nos. 15/202,085 and 13/679,689 (July 5, 2016 and November 16, 2012)

The '901 patent was filed on October 14, 2016, asserting priority as a continuation-in-part to the July 5, 2016, filing date of U.S. Patent Application No. 15/202,085 (“the '085 Application”), which asserts priority as a continuation to the November 16, 2012, filing date of U.S. Patent Application No. 13/679,689 (“the '689 Application”). *See* Ex. 1001, codes (22) and (63)², 1:4–15.

² The parties agree that the '901 patent's reference to “15/020,085” is a typographical error for “15/202,085.” *See* Pet. 1 n.1; PO Resp. 4 & n.2.

Petitioner argues the '901 patent should not be accorded priority to the filing date of either one of the '085 and '689 Applications. *See* Pet. 5–8; Ex. 1002 ¶¶ 47–50. Patent Owner has not disputed this contention, either before or after institution. *See* Paper 6, 7 (before institution, Patent Owner “used Petitioner’s proposed priority date of October 14, 2016” but “reserve[d] the right to present evidence of an earlier priority date”); PO Resp. 4–24 (after institution, Patent Owner does not address priority to either one of the '085 and '689 Applications); PO Sur-reply 16–20 (same).

In the Institution Decision, we explained why we were persuaded, at that stage of the proceeding, by Petitioner’s argument that the '901 patent should not be accorded priority to the filing date of either one of the '085 and '689 Applications. *See* Inst. Dec. 4–6. We firstly concluded the '901 patent is not entitled to priority to the '085 Application because they do not share any common inventors. *See id.* at 5 (citing 35 U.S.C. § 120; 37 C.F.R. § 1.78(d)(1)). We secondly concluded neither the '085 Application nor the '689 Application has sufficient written description support for independent claims 1 and 13 of the '901 patent. *See id.* at 5–6 (specifying the missing claim limitations). Given Patent Owner’s silence on these two points in its post-institution briefing,³ we now maintain our preliminary conclusions at this final stage of the proceeding.

³ The Patent Owner Response was accompanied by Exhibits 2012 and 2013, which Patent Owner identifies as relating to “Correction of Inventorship.” PO Resp. iv. Exhibit 2012 is a 3-page “Electronic Acknowledgement Receipt” of various materials filed with the Patent Office on March 22, 2022, in connection with U.S. Patent Application No. 15/293,681 (which issued as the '901 patent). *See* Ex. 2012; Ex. 1001, code (21). Exhibit 2013 appears to be the documents listed in Exhibit 2012, including a Request to

Thus, we determine the '901 patent should not be accorded priority to the filing date of either one of the '085 and '689 Applications.

2. *Priority to Provisional Application No. 62/242,566
(October 16, 2015)*

The '901 patent also asserts priority to the October 16, 2015, filing date of Provisional Application No. 62/242,566 (“the Provisional Application”). *See* Ex. 1001, code (60), 1:4–8.

Petitioner argues the '901 patent should not be accorded priority to the filing date of the Provisional Application. *See* Pet. 5–8; Ex. 1002 ¶¶ 47–50. Patent Owner did not dispute this contention before institution. *See* Paper 6, 7 (before institution, Patent Owner “used Petitioner’s proposed priority date of October 14, 2016” but “reserve[d] the right to present evidence of an earlier priority date”). In the Institution Decision, we explained why we were persuaded, at that stage of the proceeding, by Petitioner’s argument because we found the Provisional Application does not include sufficient written description support for independent claims 1 and 13 of the '901 patent. *See* Inst. Dec. 6 (specifying the missing claim limitations).

Patent Owner now argues the '901 patent should be accorded priority to the filing date of the Provisional Application, because the Provisional Application includes sufficient written description support for all claims 1–18 of the '901 patent. *See* PO Resp. 4–24; PO Sur-reply 16–20; Ex. 2016 ¶¶ 54–57. However, Patent Owner does not explain how resolving this

Correct Inventorship seeking to add Joel Broussard as an inventor of the '901 patent. *See* Ex. 2013. However, the Patent Owner Response does not discuss the contents of these Exhibits, or explain their significance in this proceeding. We therefore do not address them further here.

dispute in Patent Owner's favor would affect the patentability issues presented by the Petition. *See, e.g.*, Tr. 23:1–24:3.

In response, Petitioner argues Patent Owner's position on priority is "irrelevant" to the issues presented in this proceeding, because all five of the prior art references cited in the Petition pre-date even the Provisional Application's October 16, 2015, filing date. Pet. Reply 5–6. Petitioner then reiterates that the Provisional Application does not provide written description support for independent claims 1 and 13 of the '901 patent. *See id.* at 6–7.

Upon review of the foregoing, we conclude that we need not decide whether the '901 patent is entitled only to its October 14, 2016, actual filing date (Petitioner's position) or priority to the October 16, 2015, filing date of the Provisional Application (Patent Owner's position). This is because we would reach the same decision concerning the grounds of unpatentability set forth in the Petition, regardless of which is the correct date, for the following reasons.

First, resolution of the priority dispute does not affect whether any of the references cited in the Petition are prior art to the '901 patent. As discussed in Section II.E below, Petitioner contends and Patent Owner does not dispute that all of the Petition's alleged prior art references were published in or before May 2015. That date precedes even Patent Owner's asserted October 2015 priority date, as Patent Owner's counsel agreed during oral argument. *See* Tr. 23:1–24:3. Thus, we need not resolve the parties' priority dispute as to the Provisional Application in order to determine whether the references cited in the Petition are prior art to the '901 patent.

Second, all of Petitioner’s patentability challenges are based on obviousness under 35 U.S.C. § 103. *See* Pet. 26. Pursuant to § 103, obviousness is determined from the timing perspective of “the effective filing date of the claimed invention.” 35 U.S.C. § 103.⁴ However, neither party asserts that there are any changes in the state of the art between October 2015 and October 2016 that might materially affect the obviousness analysis in the present proceeding. Further, we do not independently perceive any such changes, from the evidence presented. Thus, we need not resolve the parties’ priority dispute as to the Provisional Application in order to apply § 103 in this case.

For the foregoing reasons, we need not and we do not reach any conclusions concerning the parties’ priority dispute as to the Provisional Application.

E. Asserted Prior Art and Grounds

Petitioner relies on the following five prior art references, listed in order of publication date alleged by Petitioner. *See* Pet. 11–26.

Name	Reference	Pub. Date	Exhibit No.
Dykstra	US 2008/0236818 A1	Oct. 2008	1007

⁴ The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. § 103 that became effective in March 2013. As discussed in Section II.D.1 above, the ’901 patent is not entitled to priority to the November 2012 filing date of the ’689 Application, and all the other potential filing dates at issue fall after March 2013. Therefore, we apply the AIA version of § 103 here.

Name	Reference	Pub. Date	Exhibit No.
OSHA-Silica	U.S. Dept. of Labor, OSHA-NIOSH, <i>Hazard Alert: Worker Exposure to Silica during Hydraulic Fracturing</i> (DTSEM 6/2012)	June 2012	1010
Coli	US 2012/0255734 A1	Oct. 2012	1008
OSHA-3763	U.S. Dept. of Labor, OSHA, <i>Hydraulic Fracturing and Flowback Hazards Other than Respirable Silica</i> (OSHA 3763-12 2014)	April 2015	1009
Hardin	US 2015/0144336 A1	May 2015	1006

Patent Owner does not challenge Petitioner's publication date contentions for any of these references. We find Petitioner's contentions are supported by a preponderance of the evidence. For Dykstra, Coli, and Hardin, this is a straightforward application of their identified publication dates. *See* Ex. 1007, code (43); Ex. 1008, code (43); Ex. 1006, code (43). For OSHA-Silica and OSHA-3763, Petitioner presents un rebutted evidence in support of their alleged publication dates. *See* Pet. 13–18 (OSHA-Silica), 18–23 (OSHA-3763).

Petitioner relies on the following six grounds of unpatentability, all under 35 U.S.C. § 103. *See* Pet. 26.

Ground	Claim(s) Challenged	References
1	1–18	Hardin
2	1–18	Hardin, OSHA-Silica, OSHA-3763
3	1–18	Dykstra, Hardin
4	4	Hardin, Coli
5	4	Hardin, OSHA-Silica, OSHA-3763, Coli
6	4	Dykstra, Hardin, Coli

F. Testimonial Evidence

Petitioner relies on the proffered expert testimony of Robert A. Durham, Ph.D. (Exs. 1002, 2015). Patent Owner relies on the proffered expert testimony of Mr. Robert Schaaf (Exs. 1042, 2007, 2016).⁵

III. ANALYSIS

A. Statement of Law

Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). Petitioner must prove unpatentability by a preponderance of the evidence. *See* 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

⁵ Exhibit 2007 is Mr. Schaaf’s declaration testimony submitted with Patent Owner’s Preliminary Response (Paper 6). The post-institution Patent Owner Response (Paper 13) does not rely on Exhibit 2007. Therefore, we do not consider Exhibit 2007 in this Decision.

A patent claim is unpatentable 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 of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. *See* 35 U.S.C. § 103; *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective indicia of non-obviousness, if made available in the record.⁶ *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). “While the sequence of these questions might be reordered in any particular case,” *KSR*, 550 U.S. at 407, the Federal Circuit has explained that an obviousness determination can be made only after consideration of all of the *Graham* factors. *See, e.g., Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1360 (Fed. Cir. 2012).

B. Level of Ordinary Skill in the Art

Petitioner contends a person having ordinary skill in the art pertaining to the ’901 patent (“POSITA”) would have either (1) a Bachelor of Science in Mechanical Engineering, Electrical Engineering, Petroleum Engineering or an equivalent field as well as at least two years of academic or industry experience in the oil and gas industry, including well drilling, completion, or production; or (2) at least four years of industry experience in the oil and gas

⁶ In this case, Patent Owner makes a limited argument as to the impact of objective indicia, which we address below.

industry including well drilling, completion, or production. Pet. 10; Ex. 1002 ¶ 54.

Patent Owner “uses Petitioner’s proposed definition of a POSITA.” PO Resp. 24; Ex. 2016 ¶¶ 40–41.

Petitioner’s POSITA formulation stands unrebutted. We also determine it is consistent with the ’901 patent and the prior art of record. We adopt Petitioner’s POSITA formulation in this Decision.

C. Claim Construction

We interpret the ’901 patent claims “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b). This “includ[es] construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *Id.*

We address the claim construction disputes presented by the parties.

1. Claims 1 and 13—“*selectively captures and transmits real time images . . . to enable remote monitoring*”

Claim 1 recites: “a monitoring system that *selectively captures and transmits real time images . . . to enable remote monitoring*” of system components, and “the monitoring system *selectively captures and transmits real time images* of an opening to a vessel, so that a level within the vessel is discernible in the images.” Ex. 1001, 8:50–59 (emphases added). Claim 13 similarly recites “the monitoring system *selectively captures and transmits real time images* of an opening to a vessel, so that a level within the vessel is discernible in the images.” *Id.* at 10:11–14 (emphasis added).

Patent Owner argues “the term ‘selectively’ should be construed because the term is highly context-dependent,” and this term means “having the option to select an image displayed or viewed.” PO Resp. 25–26. Patent Owner asserts the word “selectively” “by itself does not indicate the highly specific activity.” *Id.* at 26 (citing Ex. 2014, a dictionary definition of “selective” as meaning “highly specific in activity or effect”); PO Sur-reply 3–4. Patent Owner argues: “The defining context is found in claim 1 . . . as follows: ‘a monitoring system that selectively captures . . . real time images’ ‘to enable remote monitoring.’” PO Resp. 26 (quoting Ex. 1001, 8:50–53). Patent Owner also argues the ’901 patent “specification further discloses that ‘selectively’ means that the monitoring system may ‘selectively change the image being viewed to that of a separate camera.’” *Id.* at 26–27 (citing Ex. 1001, 7:37–55, Fig. 5).

Petitioner responds that Patent Owner’s claim construction improperly relies on a single embodiment of the ’901 patent to import a limitation into claim 1 from the specification. *See* Pet. Reply 8–9, 14–15 (citing *GE Lighting Sols., LLC v. AgiLight, Inc.*, 750 F.3d 1304, 1309 (Fed. Cir. 2014)). According to Petitioner: “Nothing in the intrinsic record indicates that the patentee desired to limit the term’s meaning to this embodiment (and ignore the additional instances of ‘selectively’ in the specification).” *Id.* at 8. Petitioner asserts Patent Owner’s witness Mr. Schaaf “admits that the plain meaning of [‘selectively’] is broader” than Patent Owner’s proffered construction. *Id.* at 8–9 (citing Ex. 1042, 41:20–25, 36:23–48:22). Petitioner argues we should maintain the construction of “selectively” applied in the Institution Decision, whereby Hardin discloses “selectively capturing and transmitting images because ‘Hardin discloses positioning

cameras at locations of interest to the operators.” *Id.* at 14 (citing Inst. Dec. 22; Ex. 1006 ¶¶ 63, 65, 85).

Patent Owner replies that “the Federal Circuit has emphasized that the specification is always highly relevant and is usually dispositive to claim construction,” and “a claim may be limited to a disclosed embodiment if there is no other way to interpret ambiguous claim language.” PO Sur-reply 3 (citing *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316 (Fed. Cir. 2005); *Chimie v. PPG Indus., Inc.*, 402 F.3d 1371 (Fed. Cir. 2005)). Patent Owner further argues that its “proposed construction does not limit the scope of the claims to a single disclosed embodiment,” but rather “captures the scope of the actual invention by providing context to the word ‘selectively.’” *Id.* at 4 (citing *Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 653 F.3d 1296, 1305 (Fed. Cir. 2011)).

Upon review of the foregoing, we conclude Patent Owner misconstrues the scope of claims 1 and 13, by focusing on whether an operator can “selectively” *display* different real time images on a single monitor. The claims instead require only “selectively” *capturing* and *transmitting* real time images to enable remote monitoring. Ex. 1001, 8:50–59 (claim 1), 10:11–14 (claim 13). Indeed, claims 1 and 13 do not even require a display to view the images. *See id.*; *id.* at 8:60–67 (claim 2 adds “a display” to claim 1). The only description in the claims as to what might be done with the real time images is that they “*enable* remote monitoring of . . . *at least one*” system component (claim 1), including “an opening to a vessel, so that a level within the vessel *is discernable* in the images” (claims 1 and 13). *Id.* at 8:42–59, 9:37–10:14 (emphasis added). Indeed, claim 1 covers capturing images of only “one” system component, if

that component is the “vessel” later recited in claim 1. *Id.* at 8:50–59. Thus, the breadth of the claim language does not support Patent Owner’s narrow claim construction.

We acknowledge that the ’901 patent specification indicates the monitoring system “can include selectively obtaining images of different hydraulic fracturing components or pump components on a single monitor” such that “operations personnel can selectively change the image being viewed to that of a separate camera.” *Id.* at 3:32–34, 7:37–48, Fig. 5. However, the breadth of claims 1 and 13 as discussed above does not support Patent Owner’s position that the claims are limited to this embodiment. Indeed, the ’901 patent expressly refers to this disclosure as pertaining to “certain other embodiments” and as being “one example.” *Id.* at 3:32, 7:37. We must be careful not to read a particular embodiment appearing in the specification into the claim, if the claim language is broader than the embodiment. *See Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1117 (Fed. Cir. 2004) (“particular embodiments appearing in the written description will not be used to limit claim language that has broader effect”); *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993) (“[L]imitations are not to be read into the claims from the specification.”).

For the foregoing reasons, we do not adopt Patent Owner’s construction of claims 1 and 13 as requiring the option to select an image to be displayed or viewed on a monitor. Further, as discussed in Section III.D.2(a)(ii) below, we also find that even if we were to adopt Patent Owner’s narrow claim construction, Hardin discloses that an operator has the option to select an image to be displayed or viewed on a monitor.

2. *Claim 2—“communication means”*

Claim 2 recites: “The hydraulic fracturing system of claim 1, wherein the monitoring system comprises: a camera; a controller; a display; a human machine interface; and *communication means between the camera, controller, human machine interface, and the display.*” Ex. 1001, 8:60–67 (emphasis added).

Petitioner asserts the “communication means” of claim 2 is a means-plus-function limitation subject to 35 U.S.C. § 112(f). *See* Pet. 11; Pet. Reply 7. Petitioner accordingly argues “[t]he [claimed] function is ‘communication’” and “[t]he corresponding structure includes ‘any form of communicating data that represents images, including wireless, hard-wired, or fiber optic material.’” Pet. 11 (citing Ex. 1001, 7:64–67); Ex. 1002 ¶ 56.

Patent Owner responds that the term “communication means” “should be afforded [its] ordinary and customary meaning.” PO Resp. 25.

Petitioner replies that Patent Owner does not dispute that Hardin discloses the “communication means” of claim 2. *See* Pet. Reply 7. Patent Owner’s Sur-reply does not disagree with Petitioner’s characterization. *See, e.g.,* PO Sur-reply 3–9.

Upon review of the foregoing, we conclude that we do not need to construe the “communication means” limitation of claim 2. Patent Owner does not dispute that Hardin discloses the “communication means” regardless of how this term is construed. *See, e.g.,* PO Resp. 40 (relying solely on arguments pertaining to claim 1 in defending claim 2); PO Sur-reply 3–9. Thus, the patentability issues presented for claim 2 do not turn on claim construction. “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) (emphasis added) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

3. *Claims 9 and 18—“silica exposure zone”*

Claim 9 recites: “The hydraulic fracturing system of claim 1, wherein the monitoring system selectively captures and transmits real time images of *a silica exposure zone*.” Ex. 1001, 9:28–30 (emphasis added). Claim 18 also refers to images of “a silica exposure zone.” *Id.* at 10:28–37.

Petitioner asserts the ’901 patent specification identifies several examples of a “silica exposure zone” as recited in claims 9 and 18, including “silos . . . or any other sand storage container, sand conveyor, and dust vacuum system.” Pet. 11 (quoting Ex. 1001, 8:6–11); Ex. 1002 ¶ 57. Patent Owner does not materially disagree. *See* PO Resp. 25 (asserting only that this term “should be afforded [its] ordinary and customary meaning”); Pet. Reply 7; PO Sur-reply 3–4 (claim construction section, not addressing “silica exposure zone”).

Upon review of the foregoing, we agree with Petitioner’s undisputed contention that a “silica exposure zone” as recited in claims 9 and 18 includes at least a sand storage container and a sand conveyor. *See* Ex. 1001, 8:6–11. We do not need to construe claims 9 and 18 any further to resolve the parties’ dispute as to whether Hardin discloses or renders obvious capturing images of a silica exposure zone. *See infra* Sections III.D.5 & III.E; *Realtime Data*, 912 F.3d at 1375.

4. *Other Claim Terms*

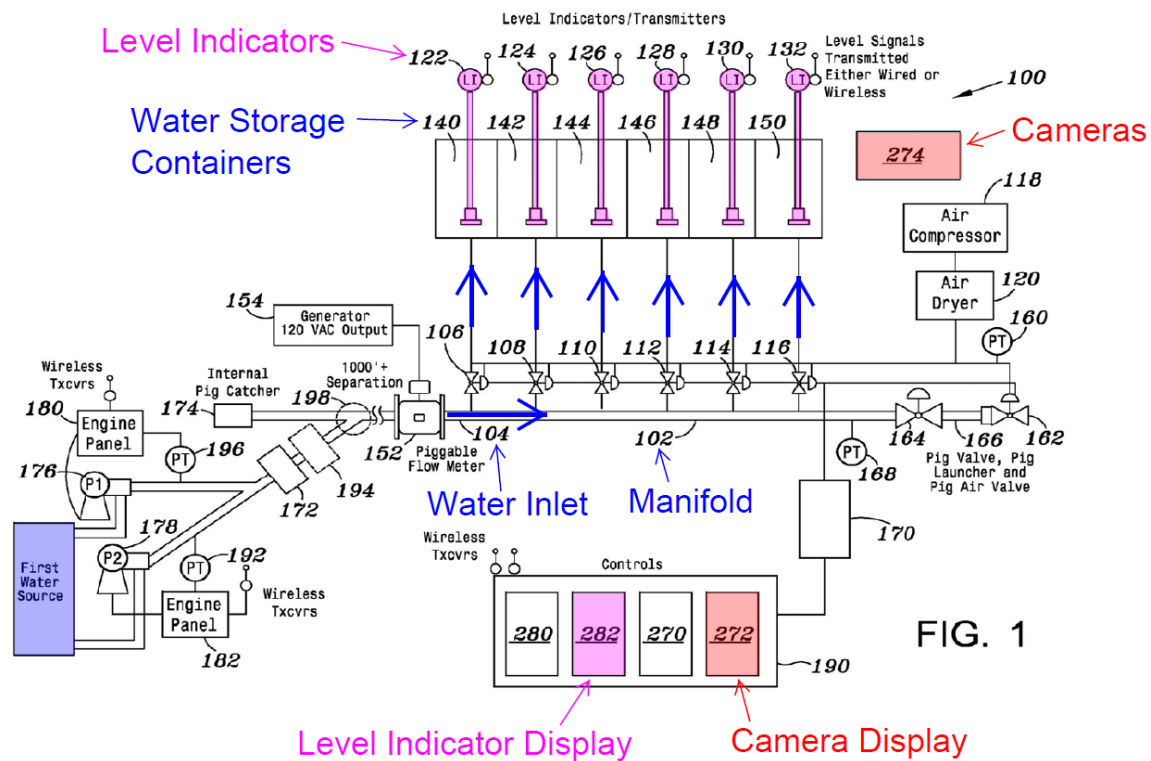
Upon consideration of the entirety of the arguments and evidence presented, we conclude no further explicit construction of any claim term is needed to resolve the issues presented by the arguments and evidence of record. *See Realtime Data*, 912 F.3d at 1375.

D. *Ground One—Obviousness over Hardin*

In Ground One, Petitioner argues claims 1–18 of the '901 patent would have been obvious over Hardin. *See* Pet. 12, 26–56. Patent Owner disagrees. *See* PO Resp. 27–42. We conclude a preponderance of the evidence supports Petitioner's assertions as to all challenged claims. We begin our analysis with a brief summary of Hardin, then we address the parties' contentions as to obviousness, including objective indicia of nonobviousness.

1. *Hardin Summary*

Hardin discloses an automated system for monitoring and controlling a water supply during hydraulic fracturing operations. *See* Ex. 1006, codes (54) and (57). Figure 1 is reproduced below (on the next page), with our annotations:



Hardin, Figure 1 (Annotated).

Figure 1 is a block diagram of automated system 100 for monitoring and controlling the transfer of water during a hydraulic fracturing process. *See id.* ¶¶ 53, 60. As annotated in blue, water is pumped from a first water source (e.g., a lake or a river) to inlet 104, where the water enters manifold 102 to be conveyed to water storage containers 140–150 as automatically controlled by controller 280 operating valves 106–116. *See id.* ¶¶ 6, 8, 60–61. The stored water is then mixed with sand (not shown), and the mixture is used for hydraulic fracturing operations within an oil or gas well (also not shown). *See id.* ¶¶ 2–3, 70. This requires abundant quantities of water to be readily available in containers 140–150, which Hardin’s system 100 seeks to ensure via an automated monitoring and control process. *See id.* ¶¶ 5–8, 60.

As annotated in purple, each water storage container 140–150 includes an associated level indicator 122–132 such as a pressure gauge or a float, which determines the water level in the container. *See id.* ¶¶ 8, 61, 71. Mobile control trailer 190 houses controller 280 which, based on data from level indicators 122–132 and from other sources, automatically controls valves 106–116 and other system components to maintain a sufficient water supply in each container 140–150. *See id.* ¶¶ 8, 27–29, 61–62, 66, 71, 79–80. Trailer 190 additionally houses display 282 to display information concerning the status of system 100, including the respective water levels in containers 140–150 determined by level indicators 122–132, to a human operator of system 100. *See id.* ¶¶ 8, 10, 62, 79; *see also id.* ¶ 103, Fig. 3 (exemplary display 282 “shows the water levels at the various frac water storage containers”); *id.* ¶¶ 106, 108, Fig. 4 (control screen 400 “show[s] water levels of” ten water storage containers 402–420).

As annotated in red, system 100 also includes “a plurality of cameras [274] operable to generate video that can be viewed remotely, the cameras positioned to view one or more” system components. *Id.* ¶¶ 15, 65. For example, cameras 274 may be positioned to view level indicators 122–132 and/or water containers 140–150, “to view water levels.” *Id.* This video data is transmitted to controller 280 to be stored in storage device 270 and displayed on camera display 272 to a human operator of system 100. *See id.* ¶¶ 15, 62–65, 83. Cameras 274 thereby “provide an additional check or verification to the operator.” *Id.* ¶ 63.

2. *Claim 1*

Petitioner provides arguments and evidence, including testimony from Dr. Durham, in support of its contention that claim 1 is unpatentable as having been obvious over Hardin. *See* Pet. 12, 27–38; Ex. 1002 ¶¶ 59, 79–103. Patent Owner provides arguments and evidence in opposition, including testimony from Mr. Schaaf. *See* PO Resp. 27–39; Ex. 2016 ¶¶ 80–108.

We conclude Petitioner’s contentions are supported by a preponderance of the evidence. First, we address Petitioner’s contentions comparing claim 1 with Hardin, and Patent Owner’s opposition to those contentions. Second, we address Petitioner’s contentions as to motivations for modifying Hardin to practice the invention of claim 1, and Patent Owner’s opposition to those contentions. Third, we discuss objective indicia of nonobviousness. Fourth, after weighing all of the arguments and evidence, we reach a conclusion as to obviousness.

(a) Comparison of Claim 1 with Hardin

Petitioner’s Ground One is premised on obviousness, but Petitioner in fact contends that Hardin’s system 100 embodies each and every limitation of claim 1. *See* Pet. 12, 26–38; Ex. 1002 ¶¶ 59, 79–103. In particular, the Petition states “Hardin discloses the preamble” (Pet. 27), and for every limitation “Hardin discloses” it (*id.*) or “Hardin discloses this limitation, or at least renders it obvious” (*id.* at 29, 33, 37). The Petition’s supporting analysis contends Hardin in fact discloses all of the claimed subject matter. *See id.* at 27 (preamble), 27–28 (limitation 1(a)), 29–32 (limitation 1(b)), 33–36 (limitation 1(c)), 37–38 (limitation 1(d)). The Petition nonetheless

alternatively provides motivations for a POSITA to modify Hardin in the event Hardin is found to fall short of claim 1 in several specific regards. *See id.* at 28–29 (limitation 1(a)), 32 (limitation 1(b)), 36–37 (limitation 1(c)), 37–38 (limitation 1(d)).

Patent Owner opposes Petitioner’s contention that Hardin’s system 100 embodies certain aspects of the “monitoring system” in claim 1. *See* PO Resp. 27–39; Ex. 2016 ¶¶ 80–108.

For the following reasons, we find all of Petitioner’s contentions comparing claim 1 with Hardin (both unopposed and opposed) are supported by a preponderance of the evidence.

(i) Petitioner’s Unopposed Contentions

We find Petitioner’s unopposed contentions comparing claim 1 with Hardin are supported by a preponderance of the evidence, as follows.

Assuming the preamble of claim 1 is a limitation, we find Hardin discloses a hydraulic fracturing system for fracturing a subterranean formation. For example, Hardin describes its system 100 as an automated system for monitoring and controlling water transfer for use in a hydraulic fracturing process. *See* Ex. 1006, code (54), ¶¶ 2, 70; Pet. 27; Ex. 1002 ¶ 80. Hardin further describes this process as being used in the oil and gas industry to fracture a geologic formation within an oil or gas well. *See* Ex. 1006 ¶ 3; Pet. 27; Ex. 1002 ¶ 81.

We also find Hardin’s hydraulic fracturing system includes a pump in communication via pump components with the wellbore of the well, which pressurizes a fracturing fluid slurry in the wellbore. In particular, Hardin describes hydraulic fracturing processes as “typically involv[ing] the use of

a high pressure pump, such as a frac pump, to apply a high pressure fluid mixture of water and a proppant, which is often sand . . . down the wellbore of an oil or gas well to fracture or crack the geologic formation.” Ex. 1006 ¶ 3; Pet. 27–28; Ex. 1002 ¶ 82. This mixture of water and sand is a fracturing fluid slurry, as claimed. *See, e.g.*, Ex. 1001, 1:25–44 (“Description of Prior Art” section of the ’901 patent, stating that “[t]he fracturing fluid slurry, whose primary component is usually water, includes proppant (such as sand or ceramic)”).

We further find Hardin’s hydraulic fracturing system includes components for making the fracturing fluid slurry. For example, one such component is water containers 140–150, which store the water that is mixed with sand to make the fracturing fluid slurry. *See* Ex. 1006 ¶¶ 70, 87, 106 (indicating Hardin uses water stored in containers 140–150 to perform a hydraulic fracturing process); *id.* ¶ 5 (“During the hydraulic fracturing process . . . the high pressure pump(s) are used to mix the water with the other chemicals and the proppant, which is normally a specialized sand or ceramic material referred to as ‘frac sand.’”); *id.* ¶ 3 (describing how the mixture of water and sand is used to fracture a geologic formation); Pet. 29–30; Ex. 1002 ¶¶ 85–86.

For the foregoing reasons, we find that the unopposed aspects of Petitioner’s comparison of claim 1 with Hardin are supported by a preponderance of the evidence.

(ii) Petitioner’s Opposed Contentions

Petitioner contends Hardin’s water supply system 100 embodies the “monitoring system” limitations of claim 1. *See* Pet. 33–38; Ex. 1002

¶¶ 91–103. Patent Owner opposes this contention. *See* PO Resp. 27–39; Ex. 2016 ¶¶ 80–108. For the following reasons, we find Petitioner’s contention is supported by a preponderance of the evidence, despite Patent Owner’s opposition.

Petitioner contends Hardin’s system 100 includes a monitoring system that selectively captures and transmits real time images of hydraulic fracturing system components to enable remote monitoring of the components. *See* Pet. 33–38; Ex. 1002 ¶¶ 91–103. Petitioner specifically contends Hardin’s cameras 274 capture real time images of water containers 140–150 and their associated level indicators 122–132, and enable remote monitoring of the containers and level indicators by transmitting the images to mobile control trailer 190 to be viewed by a human operator. *See* Pet. 33–34 (citing Ex. 1006, code (54), Figs. 1–2, ¶¶ 15, 63, 106–112, claim 7); Ex. 1002 ¶¶ 91–93.

Petitioner asserts this monitoring includes “selectively” capturing and transmitting images, as claimed, “[b]y positioning cameras at locations of interest to the operator.” Pet. 34–35 (citing Ex. 1006 ¶¶ 63, 65, 83); Ex. 1002 ¶¶ 94–95. The images also are captured and transmitted in “real time” as claimed, according to Petitioner, because Hardin’s “monitoring system provides real-time control” and also provides “manual control” of the water supply to containers 140–150. Pet. 35–37 (citing Ex. 1006 ¶¶ 5, 7, 43, 63, 67, 72, 74, 88, 90, 118, 124); Ex. 1002 ¶¶ 96–101. Petitioner further contends Hardin’s cameras 274 capture “images of an opening to a vessel, so that a level within the vessel is discernible in the images,” as claimed. *See* Pet. 37–38 (citing Ex. 1006, Figs. 1, 2, and 4, ¶¶ 65, 71, 106–108, claim 7); Ex. 1002 ¶¶ 102–103.

Patent Owner argues Hardin's cameras 274 are not part of a monitoring system that selectively captures and transmits real time images of water containers 140–150 to enable remote monitoring, as recited in claim 1. *See* PO Resp. 27–39; Ex. 2016 ¶¶ 80–108. According to Patent Owner, Hardin's monitoring system relies on level indicators 122–132, not cameras 274, to monitor the water levels inside containers 140–150 in real time and thereby maintain sufficient water levels within system 100. *See* PO Resp. 27–29, 32, 34–36 (citing Ex. 1006 ¶¶ 5, 7, 60–61, 63–64, 67, 74, 124); Ex. 2016 ¶¶ 83–94, 98–102. Patent Owner emphasizes that the claimed system must use *images* for remote monitoring. *See* PO Resp. 29–31 (citing Ex. 1001, Figs. 2 and 6, 5:60–65, 6:25–60, 7:49–55); Ex. 2016 ¶¶ 85–86. According to Patent Owner: “Hardin, in fact, teaches away from the use of cameras to perform monitoring as Hardin is directed to automated monitoring that eliminates ‘human error’” by using level indicators 122–132. PO Resp. 27–28, 31 (citing Ex. 1006 ¶¶ 7, 9); PO Sur-reply 6–7, 8; Ex. 2016 ¶ 87. In Patent Owner's view, Hardin's cameras 274 provide merely “an ‘additional check or [v]erification’ for the operator that the water level sensors of the automated system are functioning properly,” which “is a ‘high level’ check” rather than “a monitoring system that uses images or photographic data” as required by claim 1. PO Resp. 29, 32–33, 36 (quoting Ex. 1006 ¶ 63); Ex. 2016 ¶¶ 87, 98–102. Patent Owner additionally asserts Hardin's cameras 274 do not capture images “*so that a level within the vessel is discernible in the images*” as required by claim 1. PO Resp. 33 (emphasis added); Ex. 2016 ¶¶ 88–94.

Patent Owner further argues Hardin “**fail[s] to teach the ‘selectively captures and transmits’ limitation**” of claim 1. PO Resp. 37 (section

heading); *id.* at 37–39; Ex. 2016 ¶¶ 105–108. This argument is premised on Patent Owner’s claim construction of the term “selectively” as meaning “‘having the option to select’ an image displayed or viewed.” PO Resp. 38; *see supra* Section III.C.1 (claim construction analysis). Patent Owner then asserts “Hardin does not teach a monitoring system that has the option to select an image displayed or viewed” or “selectively change the image being viewed to that of a separate camera,” and instead “merely discloses ‘positioning the cameras at locations of interest to the operator.’” PO Resp. 38, 39 (quoting Ex. 1002 ¶ 94 (citing Ex. 1006 ¶ 83)); Ex. 2016 ¶¶ 107–108.

Petitioner replies that Patent Owner presented similar arguments at the institution stage, and they were rejected in the Institution Decision. *See* Pet. Reply 9–10, 12–13, 14; *see also* Inst. Dec. 21–25 (discussing Patent Owner’s pre-institution arguments concerning the monitoring system limitations). Petitioner also asserts “Hardin’s disclosure of eliminating human error . . . does not meet the standard for teaching away” and Hardin in fact “endorses the use of cameras to ‘visually display images’ and use ‘photographic data’ to ‘monitor the level of fluids within the water tanks.’” Pet. Reply 10–11 (citing *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004); *In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012); Ex. 1002 ¶ 103). Petitioner further contends that “even under [Patent Owner’s] improper construction” of the term “selectively,” Hardin still discloses selectively capturing and transmitting real time images because Hardin provides “the option to select images provided through multiple cameras 274 to be displayed via display 272 and viewed remotely by the operator.” Pet. Reply 15–16 (citing Ex. 1006 ¶ 83).

Patent Owner replies by reiterating arguments from its Patent Owner Response, as discussed above. *See* PO Sur-reply 5–9. Concerning Petitioner’s reliance on the Institution Decision, Patent Owner argues “showing a ‘reasonable likelihood of success’” as to claim 1 “is not showing by a preponderance of evidence that” claim 1 would have been obvious. *Id.* at 7, 9.

Upon review of the foregoing, we find a preponderance of the evidence supports Petitioner’s reliance on Hardin as disclosing the monitoring system limitations of claim 1. First, we find Hardin discloses, as recited in claim 1, a monitoring system that captures and transmits images of hydraulic fracturing system components to enable remote monitoring of the components. Specifically, Hardin’s hydraulic fracturing water supply system 100 includes cameras 274 that are “operable to generate *video that can be viewed remotely*, the cameras positioned to view” various “critical areas or desired locations” within system 100. Ex. 1006, Fig. 1, ¶¶ 15, 63 (emphasis added), claim 7. Cameras 274 provide their images to controller 280 in mobile control trailer 190, to be stored in storage device 270 and displayed to a human operator on camera display 272 for “remote” monitoring per claim 1. *See id.* ¶ 62 (“The controller 280 may reside locally or at a second location, such as in a mobile control trailer 190[.]”), ¶ 63 (“[T]his video information may be provided to the controller 280 . . . and displayed at a camera display 272” to provide “[t]he capability of an operator of the automated system 100 positioned at the mobile command center 190 to remotely view various components of the automated system 100.”), ¶ 64 (“The video from the plurality of

cameras 274 may be stored using a storage device, such as the storage device 270[.]”), ¶ 83 (more of the same).

We agree with Patent Owner’s contention that Hardin’s controller 280 uses data from level indicators 122–132 and other sources, but *not* data from cameras 274, as part of Hardin’s automated process for ensuring containers 140–150 contain a sufficient amount of water to perform Hardin’s hydraulic fracturing operations. *See, e.g.*, Ex. 1006, ¶¶ 8, 28–29, 61–62, 71. However, Hardin further discloses that its camera 274 images may be viewed by a human operator on camera display 272 to “provide *an additional check or verification* to the operator of the operational data of the automated system 100,” including the “water levels” in containers 140–150. Ex. 1006 ¶¶ 63, 65 (emphasis added). This additional check or verification satisfies the claim requirement of a monitoring system that captures images of hydraulic fracturing system components to enable remote monitoring of the components. Claim 1 does not require that the images must be used as a control input to operate the hydraulic fracturing system, as Patent Owner’s arguments suggest that it does.

We similarly disagree with Patent Owner’s position that Hardin’s use of level indicators 122–132 rather than cameras 274 to implement its automated water supply process teaches away from using cameras 274 as monitoring devices. According to Hardin, cameras 274 “provide an additional check or verification” of the data coming from level indicators 122–132. Ex. 1006 ¶¶ 63, 65. This encourages using a combination of level indicators 122–132 and cameras 274 to monitor the water levels in containers 140–150, rather than teaching away from using cameras 274 as monitoring devices. Claim 1 does not require that the

recited “images” are the sole or only monitoring data generated by the hydraulic fracturing system.

Next, we find Hardin’s monitoring system captures images of a vessel opening, so that a level within the vessel is discernible in the images, as recited in claim 1. In particular, Hardin describes how its cameras 274 may be positioned “above” water containers 140–150 “to view water levels.” *Id.* ¶ 65; *see also id.* ¶ 15 (stating cameras 274 may be “positioned to view . . . one or more of the frac water storage containers” 140–150), claim 7 (same). We are persuaded by Dr. Durham’s testimony that: “In order for a camera placed ‘above one or all of the plurality of water containers 140–150 to view water levels,’ as disclosed in Hardin [¶ 65], then the camera must have been placed so it is capturing ‘real time images of an opening to a vessel so that a level within the vessel is discernible in the images’” per claim 1. Ex. 1002 ¶ 102. Mr. Schaaf’s opposing testimony is too conclusory to be persuasive, and fails to address Hardin’s paragraph 65 in any meaningful fashion. *See* Ex. 2016 ¶¶ 88–94. In particular, after acknowledging Dr. Durham’s testimony concerning Hardin’s paragraph 65 (*see id.* ¶ 91), Mr. Schaaf merely states that “in my opinion, Petitioner has mischaracterized Hardin’s disclosure” and “Hardin is silent with regard to a ‘monitoring system that selectively captures and transmits real time images of an opening to a vessel, so that an actual level within the vessel is discernible in the images’” (*id.*).

We find Hardin moreover discloses that its monitoring system “selectively” captures and transmits images, as recited in claim 1, because system operators may position cameras 274 at various locations of interest to the operators. *See* Pet. 34–35 (asserting Hardin satisfies the “selectively” claim requirement “[b]y positioning cameras at locations of interest to the

operator”). In particular, Hardin indicates that “video cameras may be placed adjacent certain critical areas or desired locations” (Ex. 1006 ¶ 63) and “[t]he various cameras of the plurality of cameras 274 may be placed wherever desired in connection with the automated system 100” (*id.* ¶¶ 65, 83). This is sufficient to satisfy the “selectively” term in claim 1. As discussed above in Section III.C.1, we are not persuaded by Patent Owner’s claim construction of this term that would limit the claim to require the option to select different images to be displayed or viewed on Hardin’s camera display 272.

Further, we find that even if we were to adopt Patent Owner’s narrow claim construction, Hardin discloses that the operator has the option to select different images to be displayed or viewed on camera display 272. In particular, Hardin’s system includes “a *plurality* of cameras” to view “one or more” system components, *all* of which send their images to controller 280 to be displayed on camera display 272 to a human operator of system 100. Ex. 1006 ¶¶ 15, 63–65, 83. We agree with Petitioner’s position that these disclosures reflect that the operator of Hardin’s system has the option to select which of the plurality of the images that are gathered by controller 280 is to be shown on camera display 272. *See* Pet. Reply 15.

Finally, we find Hardin’s monitoring system captures and transmits “real time” images to enable remote monitoring, as recited in claim 1. Hardin emphasizes that: “*During the hydraulic fracturing process, the liquid, which is usually water, must be available in abundant quantities*” within containers 140–150 to prevent damage to the expensive high pressure pumps, and to ensure an effective hydraulic fracturing operation and avoid extremely costly repeat operations. *Id.* ¶ 5 (emphasis added). Hardin

reiterates “it is *imperative* that the frac water be available in sufficient quantity *at all times when needed during the hydraulic fracturing process.*” *Id.* (emphasis added); *see also id.* ¶ 7 (referring to “the important process of monitoring and controlling the numerous water levels in the various frac water tanker trailers”). Hardin later describes how its cameras 274 may be positioned “above” water containers 140–150 “to view water levels” (*id.* ¶ 65), to “provide an additional check or verification” of the water levels (*id.* ¶ 63). From these combined disclosures, a person of ordinary skill in the art would appreciate that Hardin contemplates using cameras 274 to implement real time monitoring of the water levels within containers 140–150, to provide an effective additional check or verification as the hydraulic fracturing operation progresses. *See, e.g.,* Ex. 1002 ¶ 98.

(iii) *Conclusion as to Comparing Claim 1 with Hardin*

Based on the foregoing findings as to Petitioner’s undisputed contentions (Section III.D.2(a)(i)) and Petitioner’s disputed contentions (Section III.D.2(a)(ii)), we conclude Hardin discloses each and every limitation of claim 1 as arranged in the claim. We acknowledge Ground One is based on obviousness under 35 U.S.C. § 103, not anticipation under 35 U.S.C. § 102. We discuss Petitioner’s alternative theories of obviousness, proffered in the event it is found that Hardin does not disclose various aspects of the monitoring system limitations in claim 1, in Section III.D.2(b) below.

(b) *Motivations for Modifying Hardin*

For the following reasons, we find that each of Petitioner’s four contentions as to motivations for modifying Hardin to practice the invention of claim 1 are supported by a preponderance of the evidence.

Petitioner firstly contends that, to the extent Hardin does not disclose *a pump* in communication via *pump components* with the wellbore to supply a pressurized fracturing fluid slurry in the wellbore, it would have been obvious to use such a pump and pump components in Hardin’s system based on the general knowledge of a POSITA. *See* Pet. 28–29 (citing Ex. 1002 ¶ 84). We find this contention is supported by a preponderance of the evidence. Specifically, Dr. Durham testifies that high pressure pumps and pump components were “a basic feature of hydraulic fracturing processes” and “in ubiquitous use in the hydraulic fracturing industry” at least by 2012, and cites OSHA-Silica and OSHA-3763 in support. Ex. 1002 ¶ 84 (citing Ex. 1010, 1; Ex. 1009, 16). The evidence of record persuasively supports this testimony. *See* Ex. 1010, 1 (“Hydraulic fracturing . . . is not a new process, but its use has increased significantly in the last 10 years,” and “[i]t involves pumping large volumes of water and sand into a well at high pressure[.]”); Ex. 1009, 15 (referring to the “pump, piping, hose, or fitting” and the “high pressure lines from the pump trucks to the wellhead” within a hydraulic fracturing system).

Petitioner secondly contends that, to the extent Hardin does not disclose *hydraulic fracturing system components* for making a fracturing fluid slurry, it would have been obvious to use such components in Hardin’s system based on the general knowledge of a POSITA. *See* Pet. 32 (citing Ex. 1002 ¶¶ 89–90). We find this contention is supported by a

preponderance of the evidence. Specifically, Dr. Durham testifies that Hardin expressly discloses mixing water and sand together to make a fracturing fluid slurry, and that it would have been obvious to use *blenders* in Hardin’s system to perform this mixing, based in part on OSHA-Silica and OSHA-3763. *See* Ex. 1002 ¶¶ 89–90 (citing Ex. 1006 ¶¶ 3, 22–23, 74; Ex. 1010, 1–2; Ex. 1009, 14). The evidence of record persuasively supports this testimony. *See* Ex. 1006 ¶¶ 3, 8 (stating Hardin’s system is used for “hydraulic fracturing,” which “typically involves” application of “a high pressure fluid mixture of water and a proppant, which is often sand”); Ex. 1010, 2 (“Large quantities of silica sand are used during hydraulic fracturing,” and the sand is “blended with other hydraulic fracturing fluids prior to high pressure injection into the drilling hole” using “blender hoppers”); *id.* (“Water accounts for about 90 percent of the fracturing mixture and sand accounts for about 9.5 percent.”); Ex. 1009, 14 (referring to the “blending of proppants”).

Petitioner thirdly contends that, to the extent Hardin does not disclose capturing and transmitting *real time* images as recited in claim 1, it would have been obvious to do so based on Hardin and the general knowledge of a POSITA. *See* Pet. 35–37 (citing Ex. 1002 ¶¶ 96–101). We find this contention is supported by a preponderance of the evidence. Specifically, Dr. Durham testifies that “Hardin describes the importance of controlling the hydraulic fracturing system in real-time” to ensure that water supply system 100 has stored a sufficient amount of water in containers 140–150. Ex. 1002 ¶ 97 (citing Ex. 1006 ¶¶ 7, 67, 74, 124). This need, according to Dr. Durham, would have motivated a POSITA to capture and transmit camera 274 images in real time, “to ensure proper water levels” and

“provide an ‘additional check or verification’ of such components, and to quickly operate a kill switch in case overflow or hazards develop.” *Id.* ¶ 98; *id.* ¶¶ 99–101 (citing Ex. 1006 ¶¶ 5, 43, 63, 72, 90, 118). We have already discussed in Section III.D.2(a)(ii) above how Hardin emphasizes the importance of maintaining a sufficient supply of water in containers 140–150 during hydraulic fracturing operations, and how Hardin also discloses that monitoring water levels in the containers with cameras 274 can provide an additional check or verification of the water levels in containers 140–150. These disclosures, even if they fall short of actually disclosing the use of real time images, provide ample motivation for using real time images as part of Hardin’s hydraulic fracturing process.

Petitioner fourthly contends that, to the extent Hardin does not disclose capturing images of *an opening to a vessel so a level within the vessel is discernable in the images* as recited in claim 1, it would have been obvious to do so based on the general knowledge of a POSITA. *See* Pet. 37–38 (citing Ex. 1002 ¶¶ 102–103). We find this contention is supported by a preponderance of the evidence. Specifically, Dr. Durham testifies that Hardin discloses using cameras 274 to generate images of water containers 140–150. *See* Ex. 1002 ¶ 102 (citing Ex. 1006 ¶ 65, claim 7). Dr. Durham also points to Hardin’s disclosure of permitting an operator to “visually see at any given moment what the water level is within the corresponding water storage container” as a benefit. *Id.* (quoting Ex. 1006 ¶ 71). Dr. Durham then notes that “[a] POSITA would have known that the containers used to hold fracturing water, such as those disclosed in Hardin, are typically steel ‘frac tanks’” in which “the level within the vessel would be discernible through an opening in the top of the vessel.” *Id.* ¶ 103.

Dr. Durham concludes: “In [Hardin’s containers 140–150], the level within the vessel would be discernible through an opening in the top of the vessel,” and Hardin describes how cameras 274 are “placed ‘above’ the water containers and used ‘to view water levels,’” so “Hardin is disclosing that the camera has been positioned to not only capture the opening of the vessel, but also to capture the fluid level within the viewed vessel.” *Id.* ¶ 103; *see also* Ex. 1006 ¶ 65 (“The various cameras of the plurality of cameras 274 may be placed . . . above one or all of the plurality of water containers 140–150 to view water levels . . .”). These disclosures, even if they fall short of actually disclosing using cameras 274 to capture images of an opening to a vessel to discern a level within the vessel, provide ample motivation for doing so as part of Hardin’s hydraulic fracturing process.

Patent Owner presents a broadside attack on the credibility of Dr. Durham’s testimony, on the basis that it “is replete with conclusions and devoid of evidentiary support.” PO Resp. 56; PO Sur-reply 14–15. In particular, Patent Owner asserts “numerous substantive portions [of Dr. Durham’s declaration (Ex. 1002)] are virtually identical to the Petition, and merely rely on conclusions and not evidence.” PO Resp. 56. We do not agree that Dr. Durham’s testimony is too conclusory to be persuasive. As summarized above, Dr. Durham’s testimony as to obviousness is supported by citations to evidence in the record, and the cited evidence in fact supports his testimony.

Patent Owner also asserts Dr. Durham’s testimony as to motivations for modifying Hardin is legally deficient for failure to “articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness” in order to “avoid hindsight reconstruction by using the patent

in suit as a guide through the maze of prior art references, combining the right references in the right way so as to achieve the result of the claims in suit.” PO Resp. 56–57, 59 (citations omitted); PO Sur-reply 14–15. We disagree. As summarized above, Dr. Durham’s testimony as to obviousness provides the requisite reasoning and evidentiary support to avoid hindsight bias.

Thus, we conclude Petitioner’s contentions as to motivations to modify Hardin to result in the invention of claim 1 are supported by a preponderance of the evidence, and are sufficiently articulated and reasoned to avoid the taint of hindsight reconstruction.

(c) Objective Indicia of Nonobviousness

Patent Owner argues the Petition improperly “failed to address secondary considerations [i.e., objective indicia of nonobviousness] at all,” despite Petitioner’s knowledge when the Petition was filed that the ’901 patent asserts priority to the ’410 patent,⁷ during the prosecution of which Patent Owner advanced objective indicia evidence. PO Resp. 65. Patent Owner asserts this failure to address known objective indicia evidence “makes the Petition deficient” even if the evidence is “not dispositive” of obviousness, and “once a petition is deficient, it is always deficient.” *Id.* at 66 & n.21 (citing 35 U.S.C. § 312(a)(3); 37 C.F.R. § 42.104(b); *ClassCo, Inc. v. Apple, Inc.*, 838 F.3d 1214, 1220 (Fed. Cir. 2016); *In re Huai-Hung Kao*, 639 F.3d 1057, 1067–68 (Fed. Cir. 2011)).

⁷ See Ex. 1037 (U.S. Patent No. 9,410,410 B2). The ’410 patent issued from the ’689 Application, to which the ’910 patent asserts priority as discussed above. See *id.* at code (21); *supra* Section II.D.

Importantly, Patent Owner’s argument is limited to criticizing the Petition for failing to address known objective indicia evidence; Patent Owner does not argue objective indicia in fact support a conclusion of nonobviousness in this case. *See id.* at 65–66.⁸

In response, Petitioner emphasizes that the evidence at issue was presented in connection with the parent ’410 patent, not the ’901 patent. *See* Pet. Reply 27. Petitioner also argues the Board has rejected Patent Owner’s objective indicia argument in the Institution Decision of this proceeding, and in other proceedings, for lack of a nexus to the patent claims at issue in the IPRs. *See id.* at 27–28 (citing Inst. Dec. 66 [sic 27]; IPR2022-00074, Paper 9 at 27–28; IPR2021-01538, Paper 9 at 28). Petitioner further asserts the ’410 patent is prior art to the ’901 patent, despite the latter’s assertion of priority to the former, so any objective indicia evidence presented during prosecution of the ’410 patent “need not be taken into account” here. *Id.* at 28. Petitioner finally asserts Patent Owner cannot meet its burden to demonstrate a nexus between the objective indicia evidence and the ’901 patent claims at issue here, for various reasons. *See id.* at 28–29.

Patent Owner replies by reiterating arguments from its Patent Owner Response, discussed above. *See* PO Sur-reply 2–3, 15–16.

⁸ The Patent Owner Response was accompanied by Exhibit 2010 (a Declaration of Joel Broussard testifying as to potential objective indicia), and Exhibit 2011 (an excerpt from the ’410 patent prosecution history, consisting of Patent Owner’s arguments and evidence relating to objective indicia). However, the Patent Owner Response does not discuss the contents of these Exhibits, or explain their significance in this proceeding. *See, e.g.*, PO Resp. 65–66.

Upon review of the foregoing, we first note that Hardin discloses each and every limitation of claim 1 as arranged in the claim. *See supra* Section III.D.2(a). In this circumstance, Federal Circuit case law is not clear regarding the impact of objective indicia evidence. On one hand, some decisions suggest objective indicia evidence is irrelevant in the obviousness inquiry when a single reference discloses each and every claim limitation. *See, e.g., In re Fracalossi*, 681 F.2d 792, 794 (CCPA 1982) (“That the rejection is here described as one under § 103 is not controlling, *for it is not in this case rebuttable by evidence*” due to lack of novelty (emphasis added)); *In re Wiggins*, 488 F.2d 538, 543–44 (CCPA 1973) (“[E]vidence of commercial success, no matter how striking, could not overcome a rejection of a claim based on its lack of novelty” because “[i]t is simply not relevant or material to that point.”); *Low Temp Indus., Inc. v. Duke Mfg. Co.*, No. 2021-2137, 2021 WL 6124455, at *6 (Fed. Cir. Dec. 28, 2021) (“[T]hat Finegan anticipates all of the Infringed Claims . . . renders LTI’s objective indicia irrelevant as to those claims.”); *Cohesive Techs. Inc. v. Water Corp.*, 543 F.3d 1351, 1376–77 (Fed. Cir. 2008) (Mayer, J. dissenting). On the other hand, other decisions suggest objective indicia evidence must still be considered in the obviousness inquiry when a single reference discloses each and every claim limitation. *See, e.g., Cohesive*, 543 F.3d at 1363–65 (“[O]bviousness requires analysis of secondary considerations of nonobviousness, while secondary considerations are not an element of a claim of anticipation.”); *Fracalossi*, 681 F.2d at 795–96 (Miller, J., concurring).

In the event the first line of Federal Circuit case law is followed, then we need not consider Patent Owner’s objective indicia arguments, because

Hardin discloses each and every limitation of claim 1 as arranged in the claim. A determination of obviousness based on this finding is not improper. *See, e.g., Realtime Data*, 912 F.3d at 1373 (“While Realtime argues that the use of O’Brien as a single anticipatory reference would have been more properly raised under § 102, it is well settled that ‘a disclosure that anticipates under § 102 also renders the claim invalid under § 103, for “anticipation is the epitome of obviousness.”’” (citations omitted)).

In the event the second line of Federal Circuit case law is followed, then we must consider Patent Owner’s objective indicia evidence. We therefore do so here, on the alternative underlying premises that (1) Hardin discloses each and every limitation of claim 1 as set forth in the Petition (*see supra* Section III.D.2(a)); or (2) if Hardin falls short in four specific regards, then Petitioner has established motivations to modify Hardin to result in the invention of claim 1 in these regards (*see supra* Section III.D.2(b)).

Turning then to objective indicia, we reject Patent Owner’s notion that a petitioner is required in the petition to address objective indicia evidence presented during the prosecution history of a parent application, regardless of how such evidence may (or may not) bear upon the claims of the challenged patent. The legal authorities cited by Patent Owner do not support this notion, and we are not aware of any other authority that might support it. In both cases cited by Patent Owner, the patent owner presented objective indicia evidence in the proceeding as being related to the claims challenged in the proceeding. *See ClassCo*, 838 F.3d at 1218 (during an *inter partes* reexamination of an issued patent, the patent owner submitted objective indicia evidence in response to an examiner’s obviousness-based claim rejection); *Kao*, 639 F.3d at 1601–02 (during *ex parte* patent

prosecution, the applicant submitted objective indicia evidence in response to an examiner's obviousness-based claim rejection). By contrast, here, Patent Owner does not assert that the objective indicia evidence from the '410 patent prosecution history in fact does relate to the challenged claims of the '901 patent. *See* PO Resp. 65–66 (asserting only that the Petition is deficient “even if” the objective indicia evidence is “not dispositive”).

It is difficult to justify disregarding an entire Petition for failing to address evidence that even Patent Owner seems to believe is not relevant in this proceeding. *See, e.g.*, Pet. Reply 28–29 (identifying several IPR proceedings in which Patent Owner *has* relied on the objective indicia evidence from the '410 patent prosecution history as demonstrating nonobviousness of other challenged patents). Accepting Patent Owner's position here would, in effect, require future petitioners to scour the prosecution histories of all applications related to the patent being challenged, and address any objective indicia evidence discussed therein, no matter how far afield the respective claims at issue might be. That is an unreasonable burden to impose.

Further, in this case, Patent Owner has done nothing to satisfy its burden to establish a nexus between the objective indicia evidence from the '410 patent prosecution history and the '901 patent claims being challenged here. *See* PO Resp. 1–2, 65–66. “For objective indicia of nonobviousness to be accorded substantial weight, *its proponent* must establish a nexus between the evidence and the merits of the claimed invention.”

Lectrosonics, Inc. v. Zaxcom, Inc., IPR2018-01129, Paper 33, 32 (PTAB Jan. 24, 2020) (precedential) (emphasis added). “[T]he patentee bears the burden of showing that a nexus exists.” *Henny Penny Corp. v. Frymaster*

LLC, 938 F.3d 1324, 1332 (Fed. Cir. 2019) (quoting *WMS Gaming, Inc. v. Int'l Game Tech.*, 184 F.3d 1339, 1359 (Fed. Cir. 1999)).

Indeed, the Institution Decision noted several deficiencies in Patent Owner's argument seeking to establish nexus. *See* Inst. Dec. 25–27. Patent Owner did not, in its post-institution briefing, address those preliminary conclusions, and we maintain them here. We further determine that the objective indicia evidence presented during the '410 patent prosecution history is far afield from the '901 patent claims being challenged here. As we noted when instituting review in a related proceeding: “During prosecution of the '410 patent, the Applicant touted the ‘electric motors . . . powered by natural gas’ or ‘a power grid’ as being the reason for the asserted commercial success of the ‘Clean Fleet’ product.” *Halliburton Energy Services, Inc. v. U.S. Well Services, LLC*, IPR2021-01033, Paper 12, 42 (PTAB Jan. 11, 2022); *see also* Ex. 2011, 9–11 (the portion of the '410 patent prosecution history cited in that decision). By contrast, the claims of the '901 patent at issue here are not limited to require any particular power source, whether it be electricity, natural gas, or something else. Instead, as discussed at length above with respect to claim 1, the claims of the '901 patent focus on an image-based monitoring system, which none of the '410 patent claims address. *See* Ex. 1001, 8:41–10:37 (listing the '901 patent claims at issue here); Ex. 2011, 2–5 (listing the claims at issue during the '410 patent prosecution history). Based on these significant differences between the respective claims at issue, we do not fault Petitioner for choosing not to discuss the '410 patent prosecution history in the Petition challenging the '901 patent.

Finally, in this proceeding, we determined there was good cause to allow additional pre-institution briefing to address Patent Owner's asserted objective indicia evidence. *See* Ex. 1038 (Board's email authorization); Paper 7, 6–10 (Petitioner presenting arguments regarding a lack of nexus); Paper 8, 6–10 (Patent Owner presenting additional arguments regarding objective indicia). To the extent Patent Owner requests that we reconsider our determination that good cause existed to allow the additional briefing, we decline to consider such an untimely request. *See* 37 C.F.R. § 42.71(d) (setting a request for rehearing time limit of 14 days after entry of a non-final decision or a decision to institute a trial).

For all the foregoing reasons, we conclude the Petition is not deficient for failing to consider objective indicia evidence presented during prosecution of the '410 patent.

*(d) The Office's Prior Consideration of Prior Art
During Prosecution of the '901 Patent*

Patent Owner asserts Hardin was already considered by the Office during prosecution of the '901 patent, and OSHA-Silica and OSHA-3763 “are at best cumulative of the previously considered and overcome art”—namely, Hobbs and Bruins. *See* PO Resp. 59–61, 63–65 (citing Ex. 1003, 14, 27–29, 85–102, 160); Ex. 2016 ¶¶ 65–79; Ex. 2002 (Hobbs); Ex. 2004 (Bruins). However, Patent Owner does not specify what effect(s) this prior consideration of prior art by the Office should have in the present Decision. *See* PO Resp. 59–65.

Petitioner responds that Patent Owner's foregoing argument addresses “discretionary denial under [35 U.S.C. § 325(d)]” which is “irrelevant at this stage of the proceeding” because “the Board has already instituted” review.

Pet. Reply 5, 6 n.1. Petitioner also asserts the Institution Decision held “that application of § 325(d) was ‘unwarranted’ because ‘the Petition includes grounds based on combinations of prior art not previously presented to the Office.’” *Id.* at 6 n.1.

Upon review of the foregoing, we acknowledge Patent Owner’s attempt to analogize the prior art presented in the Petition to the prior art considered by the Office during prosecution of the ’901 patent. We nonetheless conclude, despite any such analogies, that Petitioner has demonstrated claim 1 is unpatentable over the prior art cited in the Petition, for the reasons set forth above.

(e) Conclusion Regarding Claim 1

Petitioner has shown by a preponderance of the evidence that claim 1 of the ’901 patent is unpatentable as having been obvious over Hardin, because Hardin discloses each and every claim limitation as arranged in the claim, or alternatively because a person of ordinary skill in the art would have been motivated to modify Hardin to practice the claimed invention. Further, the Petition is not deficient for failing to consider objective indicia evidence presented during the ’410 patent prosecution history.

3. Claim 2

Claim 2 recites:

2. The hydraulic fracturing system of claim 1, wherein the monitoring system comprises:

- a camera;
- a controller;
- a display;
- a human machine interface; and

communication means between the camera, controller, human machine interface, and the display.

Ex. 1001, 8:60–67.

Petitioner contends Hardin discloses the limitations added by claim 2, including cameras 274, controller 280, and display 282 which may be a touchscreen display (i.e., a human machine interface). *See* Pet. 38–39 (citing Ex. 1006, Figs. 1–2 and 4–5, ¶¶ 27, 62–65, claim 30); Ex. 1002 ¶¶ 104–105. Petitioner asserts Hardin discloses the communication means of claim 2, because the camera, controller, human machine interface, and display communicate among each other using “wireless, wired, or a combination of each” such communications. Pet. 39 (citing Ex. 1006 ¶ 79); Ex. 1002 ¶¶ 105–106.

Patent Owner, in a footnote appended to a discussion of several claims including claim 2, asserts “Hardin fails to teach a monitoring system with a ‘human interface device’ such as ‘human machine interface (“HMI”) which can be a keyboard, joystick, panel, or any other device that allows a user to adjust operation or control of what is being viewed on monitor.’” PO Resp. 40 n.6 (quoting Ex. 1001, 7:43–46).

Petitioner replies that Patent Owner’s argument improperly attempts to read a preferred embodiment of the ’901 patent into the human machine interface limitation of claim 2. *See* Pet. Reply 16 (citing *GE Lighting*, 750 F.3d at 1309). Petitioner also asserts that, regardless of how claim 2 is construed in this regard, Hardin discloses a human machine interface as a touchscreen control system because a touchscreen is a panel that allows a user to adjust operation or control of what is being viewed on a monitor, per Patent Owner’s construction. *See id.* at 16–17. Petitioner further notes that

Patent Owner does not dispute Hardin discloses the “communication means” of claim 2. *See id.* at 7.

Patent Owner’s Sur-reply does not address whether Hardin discloses the limitations added by claim 2. *See, e.g.*, PO Sur-reply 5–9.

Upon review of the foregoing, we find Petitioner’s contentions are supported by a preponderance of the evidence, as cited by Petitioner. Particularly concerning the disputed “human machine interface” limitation, Hardin discloses its display 282 is a panel that allows a user to adjust operation or control of various system components. *See* Ex. 1006, Fig. 1, ¶¶ 27, 62 (display 282 “may be implemented as a touchscreen display” to use controller 280); *id.* at Fig. 4, ¶ 106 (describing and illustrating exemplary touchscreen control screen 400). This control includes controlling what is viewed on camera display 272. *See id.* ¶ 63 (controller 280 receives video information from cameras 274 and displays the video information on display 272 to allow the operator to view various components of system 100). Concerning the “communication means” of claim 2, Hardin discloses controller 280 communicates with other components of the monitoring system via “wireless” or “wired” means (*id.* ¶ 79), which Patent Owner does not dispute corresponds to the claimed means (*see* PO Resp. 25).

Thus, we conclude Petitioner has shown by a preponderance of the evidence that claim 2 of the ’901 patent is unpatentable as having been obvious over Hardin.

4. *Claims 3 and 4*

Claims 3 and 4 recite:

3. The hydraulic fracturing system of claim 1, wherein the display comprises a monitor from which the images are viewed.

4. The hydraulic fracturing system of claim 3, wherein the display is disposed within a passenger compartment mounted to a fluid blender, so that the images can be viewed by operations personnel in the passenger compartment.

Ex. 1001, 9:1–7.

Petitioner contends “Hardin discloses” the limitations added by claims 3 and 4, “or at least renders [the limitation of claim 4] obvious.” Pet. 39–43; Ex. 1002 ¶¶ 107–112. Petitioner asserts Hardin’s camera display 272 is a monitor from which images captured by cameras 274 are viewed per claim 3, and display 272 is disposed within a passenger compartment of mobile control trailer 190 which also supports manifold 102 which is a fluid blender per claim 4. Pet. 38–42 (citing Ex. 1006, Figs. 1–2, ¶¶ 27, 45, 62–65, 74, 79, 83, 85, 98–101, claim 30); Ex. 1002 ¶¶ 104–110. Petitioner alternatively argues “Hardin provides an express motivation for a POSITA to mount a passenger compartment (e.g., mobile command center including a display) to a fluid blender, stating that the manifold and mobile command trailer are ‘provided in close proximity’ to each other.” Pet. 42–43 (citing Ex. 1006 ¶ 86); Ex. 1002 ¶ 111.

Patent Owner argues “Hardin does not teach a passenger compartment mounted to a fluid blender” per claim 4, emphasizing the “mounted” claim term. PO Resp. 40. Patent Owner asserts “Petitioner acknowledges” this, due to Petitioner’s alternative modification theory for claim 4. *Id.* Patent Owner then argues “Petitioner fails to provide any demonstrated motivation to combine” as part of Petitioner’s alternative modification theory for claim 4. *Id.* at 40–41 & n.7.

Petitioner's Reply addresses only Petitioner's alternative modification theory for claim 4. *See* Pet. Reply 17–18. Patent Owner's Sur-reply does not address claims 3 and 4 separately from their parent claim 1. *See, e.g.*, PO Sur-reply 5–9.

Upon review of the foregoing, we find Petitioner's contentions are supported by a preponderance of the evidence, as cited by Petitioner. As to claim 3, Hardin discloses display 272 is a monitor on which images captured by cameras 274 can be viewed. *See* Ex. 1006 ¶¶ 63–64. Patent Owner does not dispute this finding.

As to claim 4, we find Hardin discloses display 272 is disposed within a passenger compartment, as claimed. Hardin states controller 280 and display 272 may “*reside . . . in* mobile control trailer 190” and are “*located within* the remote control trailer 190.” Ex. 1006 ¶¶ 62–63, 79, 83 (emphases added); *id.* at Fig. 1 (showing controller 280 and display 272 as “Controls” located within trailer 190).

Hardin further discloses that the passenger compartment is mounted to a fluid blender, as recited in claim 4. In particular, in one embodiment of Hardin: “The mobile command center 190 *may be implemented in a trailer along with the manifold 102 (and a second manifold 310 as shown in FIG. 2).*” *Id.* ¶ 63 (emphasis added). In this embodiment, the mobile command center is also a fluid blender, because it blends water from two different sources. *See id.* ¶ 98 (describing how, although not expressly shown in Figure 2, the system of Figure 2 may be implemented as “a blended automated system” in which “the water from the first water source and the second water source are both provided to the input opening 104 of the manifold 102,” and this system “provides blending within the

manifold 102 such that the blended solution may then be provided to the plurality of frac water storage containers 140–150”).

Thus, based on Hardin’s express disclosure of its hydraulic fracturing system incorporating the added limitations of claims 3 and 4 (i.e., regardless of any alleged deficiencies in Petitioner’s alternative motivations for modifying Hardin with respect to claim 4), we conclude Petitioner has shown by a preponderance of the evidence that these claims of the ’901 patent are unpatentable as having been obvious over Hardin.

5. *Claims 9 and 18*

Claim 9 recites: “The hydraulic fracturing system of claim 1, wherein the monitoring system selectively captures and transmits real time images of a silica exposure zone.” Ex. 1001, 9:28–30. Claim 18 depends from claim 13 and similarly refers to “images of . . . a silica exposure zone” or other hydraulic fracturing system components. *Id.* at 10:29–37.

Petitioner contends Hardin discloses capturing and transmitting real time images of a silica exposure zone, or at least renders this obvious. *See* Pet. 47–50; Ex. 1002 ¶¶ 121–125. Petitioner asserts “[a] POSITA would have understood that the sand in Hardin comprises silica, as it was generally known that ‘silica . . . is a major component of the sand.’” Pet. 47 (citing Ex. 1006 ¶ 3, and quoting Ex. 1010, 1); Ex. 1002 ¶ 121. Petitioner further asserts “it was within general engineering knowledge that there are multiple silica exposure zones on a hydraulic fracturing site[]” such as the site described in Hardin, “including ‘sand storage trailers’ and ‘sand movers.’” Pet. 47–48; Ex. 1002 ¶ 121. Based on this alleged disclosure in Hardin and general engineering knowledge, Petitioner concludes “a POSITA would

have been motivated and with a reasonable expectation of success to capture and transmit images of silica exposure zones” in Hardin per claims 9 and 18, “[f]or similar reasons that a POSITA would have wanted to monitor and capture images of the frac water containers” per claim 1. Pet. 49; Ex. 1002 ¶ 123. Specifically, this “would have achieved the well-known goal ‘to minimize exposures during chemical handling’ by allowing workers to monitor remotely.” Pet. 49 (citing Ex. 1010, 4; Ex. 1009, 11, App. D); Ex. 1002 ¶ 123. Petitioner cites additional motivations as “to visually monitor levels of proppant (including sand),” “to provide an ‘additional check or verification’ of such components, to ensure sufficient supply of [sand] during hydraulic fracturing processes, and to quickly operate a kill switch in case of hazards.” Pet. 49–50 (quoting Ex. 1006 ¶¶ 63, 83, 91); Ex. 1002 ¶¶ 123–125.

Patent Owner argues “Petitioner has failed to show that Hardin teaches a ‘silica exposure zone,’” because “Hardin . . . is only concerned with the level of water within the water storage containers.” PO Resp. 41–42. Patent Owner additionally asserts “[i]t is improper to rely on common sense in this case” to establish obviousness. *Id.* (citing *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361–62 (Fed. Cir. 2016)).

Petitioner replies that the evidence establishes Hardin uses sand which is generally known to include silica. Pet. Reply 18–19 (citing Pet. 11; Ex. 1002 ¶ 121; Ex. 1010; Ex. 1042, 19:7–1 [sic], 21:19–22:4). Petitioner asserts “general engineering knowledge was appropriately applied in the Petition to” establish the obviousness of monitoring Hardin’s “silica exposure zone” remotely with cameras. *Id.* at 19 (citation omitted).

Upon review of the foregoing, we find Petitioner's contentions are supported by a preponderance of the evidence, as cited by Petitioner. First, we find Hardin discloses the silica exposure zone recited in claims 9 and 18, because Hardin describes how its hydraulic fracturing system mixes water with sand to be used for hydraulic fracturing operations within an oil or gas well. *See* Ex. 1006 ¶¶ 2–3, 70. We are persuaded by Dr. Durham's testimony that a POSITA "would have understood that the 'sand' in Hardin comprises silica, as it was well-known that 'silica . . . is a major component of the sand.'" Ex. 1002 ¶ 121 (quoting Ex. 1010, 1). We are also persuaded by Dr. Durham's testimony that a POSITA would have known "there are multiple silica exposure zones on . . . hydraulic fracturing sites" such as Hardin's, including "sand storage trailers" and "sand movers" which would satisfy Petitioner's undisputed claim construction of "silica exposure zone." *Id.* (citing Ex. 1010, 1–2, 7). Thus, Patent Owner's argument that Hardin fails to disclose a silica exposure zone is unavailing.

Second, we determine Petitioner's proffered motivations for modifying Hardin to include cameras that monitor Hardin's silica exposure zone and thereby meet the limitations of claims 9 and 18 are supported by a preponderance of the evidence, and are sufficiently articulated and reasoned to avoid hindsight reconstruction. In particular, we determine a POSITA would have been motivated to do this in order to minimize worker exposure to the silica, which OSHA-Silica demonstrates was a known danger in hydraulic fracturing systems. *See* Ex. 1002 ¶ 123; Ex. 1010, 1 ("Employers must ensure that workers are properly protected from exposure to silica."), 2 (describing why silica exposure "is a concern for workers during hydraulic fracturing"). Indeed, OSHA-Silica states one way to reduce worker

exposure to silica is to “[l]imit . . . the number of workers, and the time workers must spend in areas where dust and silica levels may be elevated, and consider ways to perform dusty operations remotely to completely remove employees from these areas.” *Id.* at 4.

Petitioner’s case for obviousness does not rest upon common sense to supply a missing limitation to arrive at the claimed invention, which *Arendi* (cited by Patent Owner) cautions against doing. Instead, Hardin expressly discloses its system incorporates a silica exposure zone, as discussed above. *See* Ex. 1003 ¶¶ 2–3, 70. Hardin also expressly discloses that “video cameras may be placed adjacent *certain critical areas or desired locations*” such as its water storage containers “to remotely view various components” of the system and thereby “provide an additional check or verification to the operator of the operational data of the automated system.” *Id.* ¶ 63 (emphasis added). Hardin does not expressly disclose that its silica exposure zone is one of the critical areas that might be monitored remotely using Hardin’s cameras, but the motivation for doing this comes from the knowledge of a POSITA, as demonstrated by OSHA-Silica.

Thus, we conclude Petitioner has shown by a preponderance of the evidence that claims 9 and 18 of the ’901 patent are unpatentable as having been obvious over Hardin.

6. *Claims 5–8 and 10–17*

Petitioner provides arguments and evidence, including testimony from Dr. Durham, in support of its contention that claims 5–8 and 10–17 are unpatentable as having been obvious over Hardin. *See* Pet. 43–55; Ex. 1002 ¶¶ 113–137.

In defense of these claims, Patent Owner relies solely on arguments considered above in relation to claim 1. *See, e.g.*, PO Resp. 27–39 (addressing claims 1 and 13 together as a group), 40 (addressing claims 5–8 and 14–17). For the reasons provided in Section III.D.2 above in the context of claim 1, we conclude Patent Owner’s arguments are unavailing.

Concerning independent claim 13, our analysis of claim 1 above applies equally well to the bulk of claim 13. Claim 13 differs from claim 1 most significantly in that the claimed method includes “obtaining images of hydraulic fracturing components *and* pump components,” whereas claim 1 requires obtaining images of “hydraulic fracturing system components *or* pump components.” *Compare* Ex. 1001, 8:42–59 (claim 1, emphasis added), *with id.* at 9:37–10:14 (claim 13, emphasis added).

To address this difference, Petitioner asserts “Hardin obtains images of hydraulic fracturing components for remote viewing,” and “[i]t would have been obvious to do the same for high-pressure pumps and other pumps in [Hardin’s] hydraulic fracturing system.” Pet. 51 (citing Ex. 1006 ¶ 3); Ex. 1002 ¶ 130. In particular, according to Petitioner, this would have been done “to facilitate manual control of the pumps, to provide an ‘additional check or verification’ of the proper functioning of such components, and to quickly operate a kill switch in case of hazards.” Pet. 52 (citing Ex. 1003 ¶¶ 5, 63, 83); Ex. 1002 ¶ 131. We determine these unopposed assertions are supported by a preponderance of the evidence, as cited by Petitioner, and provide a sufficiently articulated motivation to combine to avoid the taint of hindsight reconstruction.

Concerning dependent claims 5–8, 10–12, and 14–17, we find a preponderance of the evidence supports Petitioner’s contentions that

Hardin’s hydraulic fracturing system exhibits the limitations recited in these claims, or that such limitations would have been obvious to implement in Hardin, based on the evidence cited and the reasons provided in the Petition, which we adopt as our own here. *See* Pet. 43–51 (claims 5–8 and 10–12), 53–55 (claims 14–17).

Thus, we conclude Petitioner has shown by a preponderance of the evidence that claims 5–8 and 10–17 of the ’901 patent are unpatentable as having been obvious over Hardin.

E. Ground Two—Obviousness over Hardin, OSHA-Silica, and OSHA-3763

In Ground Two, Petitioner argues claims 1–18 of the ’901 patent would have been obvious over Hardin, OSHA-Silica, and OSHA-3763, which Patent Owner opposes. We conclude a preponderance of the evidence supports Petitioner’s assertions as to all challenged claims. We begin our analysis with brief summaries of OSHA-Silica and OSHA-3763, then we address the parties’ contentions as to obviousness.

1. OSHA-Silica Summary

OSHA-Silica is a brochure entitled as a “HAZARD ALERT” concerning “Worker Exposure to Silica during Hydraulic Fracturing,” published by the Occupational Safety and Health Administration of the U.S. Department of Labor (“OSHA”). Ex. 1010, 1; Pet. List of Exhibits i, 13 (identifying OSHA). OSHA-Silica describes how hydraulic fracturing processes typically “involve[] pumping large volumes of water and sand into a well at high pressure,” during which “[e]mployers must ensure that workers are properly protected from exposure to silica.” Ex. 1010, 1. For

example, employers may: “**Limit the number of workers, and the time workers must spend in areas** where dust and silica levels may be elevated, and **consider ways to perform dusty operations remotely** to completely remove employees from these areas.” *Id.* at 4.

2. OSHA-3763 Summary

OSHA-3763 is a brochure concerning “Hydraulic Fracturing and Flowback Hazards Other than Respirable Silica” published by OSHA. Ex. 1009, cover page. It describes several hazards associated with hydraulic fracturing operations, and provides various strategies to minimize worker exposure to such hazards.

3. Claims 1–18

Petitioner provides arguments and evidence, including testimony from Dr. Durham, in support of its contention that claims 1–18 are unpatentable as having been obvious over Hardin, OSHA-Silica, and OSHA-3763. *See* Pet. 18, 23–24, 56–58; Ex. 1002 ¶¶ 139–144. Patent Owner provides arguments and evidence in opposition. *See* PO Resp. 42–46.

The essential difference between Grounds One and Two is a matter of form. *See, e.g.*, Tr. 13:4–11 (Petitioner’s counsel comparing Grounds One and Two). In Ground One, the motivation to modify Hardin (if needed) arises from the knowledge of a POSITA as evidenced by OSHA-Silica and OSHA-3763. *See* Pet. 28 (referring to “general engineering knowledge” and “the general knowledge of a skilled artisan” as the basis for obviousness); *id.* at 29, 32, 43, 43–44, 47–49, 53 (citing OSHA-Silica and OSHA-3763 as evidencing the general knowledge of a POSITA in various respects). In

Ground Two, by contrast, OSHA-Silica and OSHA-3763 are listed as secondary references to Hardin. *See id.* at 56.

In Ground Two, Petitioner asserts “[a] POSITA would have been motivated to combine basic hydraulic fracturing components” such as “pump components” (claims 1 and 13), a “blender” (claim 4), other units (claim 5), and “acids” (claim 11), into Hardin’s hydraulic fracturing system in light of OSHA-Silica and OSHA-3763. Pet. 56; Ex. 1002 ¶ 140. As motivation, Petitioner asserts OSHA-Silica and OSHA-3763 are both directed to increasing the safety of human operators in the field of hydraulic fracturing, including protecting them from exposure to silica (OSHA-Silica) and from dangers associated with flowback operations (OSHA-3763). *See* Pet. 56–58 (quoting Ex. 1010, 1; Ex. 1009, 1); Ex. 1002 ¶¶ 142–143. Petitioner contends that “[i]n determining where to place the cameras of Hardin, a POSITA would have been motivated to access information on areas potentially hazardous to workers.” Pet. 57 (emphasis added) (citing Ex. 1006 ¶ 63); Ex. 1002 ¶ 142. Petitioner concludes a POSITA would have been expressly motivated by Hardin’s use of sand as a proppant and of flowback water, in combination with the known dangers of exposure to silica per OSHA-Silica and to flowback operations per OSHA-3763, to place cameras in regions of Hardin’s hydraulic fracturing system where silica is present and where flowback operations are performed to enable remote monitoring of such regions and thereby increase worker safety. *See* Pet. 57–58 (citing Ex. 1006 ¶¶ 3, 45); Ex. 1002 ¶¶ 141–143. Petitioner asserts this could have been achieved with a reasonable expectation of success “because the combination merely incorporates well-known hydraulic

fracturing units and well-known materials (e.g., silica and acids).” Pet. 58; Ex. 1002 ¶ 144.

In opposition, Patent Owner firstly reiterates its opposition to Petitioner’s reliance on Hardin in Ground One. *See* PO Resp. 42–43. For the reasons provided in Section III.D above in the context of Ground One, we conclude these arguments are unavailing.

Patent Owner secondly asserts Petitioner’s combination of Hardin with OSHA-Silica and OSHA-3763 “is facially deficient” because Petitioner “failed to articulate an explanation for why a POSITA would have combined the **particular features** of OSHA-Silica and OSHA-3763” with Hardin to reach the inventions of claims 1–18, and Petitioner’s analysis is “divorced from any specific claim limitation.” PO Resp. 43–46 & n.8, 57–58; Sur-reply 2, 10–12. Patent Owner maintains “Petitioner provides no motivation in Hardin for a POSITA to turn to the OSHA publications other than what appears to be a POSITA’s ‘common sense,’” but “it is improper to rely on common sense in this case to provide missing claim elements.” PO Resp. 44 & n.9 (citing *Arendi*, 832 F.3d at 1361–62); PO Sur-reply 10. Concerning Petitioner’s reliance on the known dangers of silica and flowback operations as motivations, Patent Owner argues “merely disclosing ‘sand’ [in Hardin] does not describe the ‘dangers of inhaling silica,’” and “merely disclosing ‘flowback’ [in Hardin] does not disclose flowback hazards or the need to mitigate hazards of flowbacks.” PO Resp. 45.

Petitioner replies that Patent Owner’s “obviousness analysis is improperly rigid in requiring that the references teach ‘particular features’ (or include particular suggestions or motivations).” Pet. Reply 19–20. Petitioner also distinguishes case law cited by Patent Owner on the basis that

the Petition here “provides the *how* (i.e., combining basic hydraulic fracturing components and basic hydraulic fracturing ingredients of OSHA-Silica and OSHA-3763 into the hydraulic fracturing system of Hardin) and *why* (i.e., (i) same field of endeavor, (ii) POSITA’s general knowledge of OSHA as a repository of safety information; and (iii) express motivation to combine).” *Id.* at 20–21 (citing Pet. 56–57). Concerning the express motivations arising from Hardin’s use of sand and flowback operations, Petitioner argues Patent Owner’s opposition “is again too rigid” because a POSITA “‘is also a person of ordinary creativity, not an automaton,’ and the POSITA’s use of some creativity to connect sand with the dangers of inhaling silica and flowback with the dangers of flowback does not defeat a finding of obviousness.” *Id.* at 21 (quoting *KSR*, 550 U.S. at 421).

Upon review of the foregoing arguments and evidence, we conclude a preponderance of the evidence supports Petitioner’s contention that it would have been obvious to modify Hardin’s hydraulic fracturing system to include “pump components” as recited in claims 1 and 13, a “blender” as recited in claims 4 and 5, and “acid” as recited in claim 11, and to use Hardin’s cameras 274 to monitor these system components as well as Hardin’s silica sources.

As to including pump components and a blender in Hardin’s hydraulic fracturing system, we rely on our consideration of these system components in Ground One and claims 1 and 4 above. *See supra* Sections III.D.2(a)(ii) & III.D.4.

As to including acid in Hardin’s fracturing fluid slurry, we find Hardin expressly discloses injecting “a pH controlling agent” into its slurry.

See Ex. 1006 ¶¶ 22–23, 74; Pet. 48–49 (Ground One), 56 (Ground Two, referencing Ground One). We further are persuaded by Dr. Durham’s testimony that it was well known in 2014 and before to use an acid as a pH controlling agent in hydraulic fracturing systems, so a POSITA would have known to use an acid as Hardin’s pH controlling agent. *See* Ex. 1002 ¶ 122; Pet. 48–49. This testimony is supported by OSHA-3763 and OSHA-Silica. *See* Ex. 1009, 11 (identifying “Acids” including hydrochloric acid and hydrofluoric acid as “Frequently Used Hydraulic Fracturing Chemicals” for “pH Adjustment”); Ex. 1010, 2 (“Fracturing fluid is made up of a base fluid, proppant, and chemical additives” wherein the chemical additives may include “acids”).

As to using Hardin’s cameras 274 to monitor the foregoing system components remotely, Hardin expressly discloses that its cameras 274 “may be placed adjacent *certain critical areas or desired locations*” in order “to remotely view various components” of the system and thereby “provide an additional check or verification to the operator of the operational data of the automated system.” Ex. 1006 ¶ 63 (emphasis added). Hardin does not expressly disclose that its critical areas for remote monitoring using cameras include silica exposure zones, pump components, a blender, or acids.

The motivation for remotely monitoring Hardin’s silica exposure zones is the same as articulated above for Ground One and claims 9 and 18. *See supra* Section III.D.5.

The motivation for remotely monitoring the pump components and the blender comes from the need to ensure these components are functioning properly, and the desire to protect human operators from hazards posed by these components. *See* Ex. 1002 ¶¶ 130–131 (Dr. Durham discussing the

“high pressure” employed by hydraulic fracturing system pumps), ¶¶ 141–143 (Dr. Durham discussing the hazards posed by “flowback” in hydraulic fracturing systems). For example, OSHA-3763 refers to “Flowback Hazards” posed by hydraulic fracturing systems, and states “OSHA has determined that additional information concerning hydraulic fracturing and flowback operations hazards should be provided to educate and protect workers.” Ex. 1009, Cover Page, 1.

The motivation for remotely monitoring the acid comes from the desire to protect human operators from hazards posed by acids. *See* Ex. 1002 ¶¶ 122–125 (Dr. Durham discussing the known hazards posed by exposure of personnel to acids used in hydraulic fracturing systems). For example, OSHA-3763 describes “Potential Hazards” arising from exposure to acids as including irritation to the skin, eyes, and lungs, such as chemical burns. Ex. 1009, 11.

Thus, Petitioner’s case for obviousness does not rest upon common sense to supply a missing limitation to arrive at the claimed invention, which *Arendi* (cited by Patent Owner) cautions against doing. Instead, the combination of Hardin, OSHA-Silica, and OSHA-3763 discloses each and every claim limitation—with Hardin disclosing remote monitoring of critical system components, and OSHA-Silica and OSHA-3763 demonstrating the critical need to protect operating personnel from known hazards posed by various hydraulic fracturing systems.

Patent Owner thirdly suggests Petitioner has not established a reasonable expectation of success by “merely showing that each of the elements are individually known.” PO Resp. 45–46. We agree with Petitioner’s position that, although Patent Owner’s argument facially attacks

reasonable expectation of success, the underlying substance actually attacks motivation instead. *See* Pet. Reply 22. We have accordingly addressed Petitioner's requisite motivations above.

We conclude Petitioner has demonstrated by a preponderance of the evidence that claims 1–18 of the '901 patent are unpatentable as having been obvious over Hardin, OSHA-Silica, and OSHA-3763.

F. Ground Three—Obviousness over Dykstra and Hardin

In Ground Three, Petitioner argues claims 1–18 of the '901 patent would have been obvious over Dykstra and Hardin. *See* Pet. 26, 58–77; Pet. Reply 22–24. Patent Owner disagrees. *See* PO Resp. 36–37, 46–51. We have already determined claims 1–18 are unpatentable based on Petitioner's Ground One (obviousness over Hardin) and Ground Two (obviousness over Hardin, OSHA-Silica, and OSHA-3763). *See supra* Sections III.D & III.E. Therefore, we need not, and to conserve the Board's resources we do not, reach Ground Three.

G. Grounds Four to Six—Obviousness additionally over Coli

In Grounds Four to Six, Petitioner argues claim 4 of the '901 patent would have been obvious over each of Grounds One to Three, additionally in view of Coli to address the subject matter added by claim 4 to its parent claims 1 and 3. *See* Pet. 26, 77–81; Pet. Reply 25–26. Patent Owner disagrees. *See* PO Resp. 51–55; PO Sur-reply 12–14. We have already determined claim 4 is unpatentable based on Petitioner's Ground One (obviousness over Hardin) and Ground Two (obviousness over Hardin, OSHA-Silica, and OSHA-3763). *See supra* Sections III.D.3 & III.E.

Therefore, we need not, and to conserve the Board's resources we do not, reach Grounds Four to Six.

IV. SUMMARY OF CONCLUSIONS

In summary, we determine a preponderance of the evidence establishes claims 1–18 of the '901 patent are unpatentable, as shown in the following table:⁹

Claim(s)	35 U.S.C. §	References	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–18	103	Hardin	1–18	
1–18	103	Hardin, OSHA-Silica, OSHA-3763	1–18	
1–18	103	Dykstra, Hardin ¹⁰		
4	103	Hardin, Coli ¹⁰		

⁹ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

¹⁰ We do not reach these asserted grounds to conserve the Board's resources, because we have determined claims 1–18 are unpatentable based on Grounds One and Two. See *supra* Sections III.F & III.G.

4	103	Hardin, OSHA-Silica, OSHA-3763, Coli ¹⁰		
4	103	Dykstra, Hardin, Coli ¹⁰		
Overall Outcome			1–18	

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1–18 of the '901 patent have been proven by a preponderance of the evidence to be unpatentable; and

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

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FOR PETITIONER:

Chad C. Walters
Brandon Chen
Clarke Stavinoha
BAKER BOTTS L.L.P.
chad.walters@bakerbotts.com
brandon.chen@bakerbotts.com
clarke.stavinoha@bakerbotts.com

David J. Tobin
MCDERMOTT WILL & EMERY LLP
dtobin@mwe.com

FOR PATENT OWNER:

B. Todd Patterson
John Allen Yates
Edgar N. Gonzalez
Kyrie K. Cameron
PATTERSON + SHERIDAN LLP
tpatterson@pattersonsheridan.com
jyates@pattersonsheridan.com
egonzalez@pattersonsheridan.com
kcameron@pattersonsheridan.com