UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
WACO DIVISION

Halliburton Energy Services, Inc., Halliburton US Technologies, Inc., Halliburton Group Technologies, Inc., Plaintiffs, v. U.S. Well Services, LLC, Profrac Holding Corp., Defendants.	Case No. 6:22-cv-00906-ADA-DTG **JURY TRIAL DEMANDED** Related to 6:21-CV-00367-ADA-DTG

PLAINTIFFS U.S. WELL SERVICES, LLC'S AND PROFRAC HOLDING CORP.'S PRELIMINARY INVALIDITY CONTENTIONS

Pursuant to the Court's Order Governing Proceedings–Patent Cases and the Parties' Agreed Proposed Scheduling Order (Dkt. 20), Defendants U.S. Well Services, LLC ("USWS"), Profrac Holding Corp. ("Profrac") (collectively "Defendants") respectfully serve the following Preliminary Invalidity Contentions against Halliburton Energy Services, Inc. ("Halliburton"), Halliburton U.S. Technologies, Inc. ("Halliburton Technologies"), and Halliburton Group Technologies, Inc. ("HGTI") (collectively, "Halliburton Plaintiffs"). These contentions set forth Defendants' Preliminary Invalidity Contentions with respect to the claims identified in Halliburton Plaintiffs Preliminary Infringement Contentions against Defendants served on November 21, 2022, as further limited by Halliburton's First Amended Complaint for Patent Infringement (Dkt. 24). Defendants' Preliminary Invalidity Contentions demonstrate the invalidity of the claims asserted by Halliburton Plaintiffs of the following asserted patents: U.S. Patent 7,836,949 ("the '949 Patent"), U.S. Patent No. 7,574,325 ("the '325 Patent"), U.S. Patent No. 7,841,394 ("the '394 Patent"), U.S. Patent No. 11,035,213 ("the '213 Patent"), U.S. Patent No. 11,085,282 ("the '282

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Patent"), U.S. Patent No. 11,373,058 ("the '058 Patent"), and U.S. Patent No. 11,377,943 ("the '943 Patent") (collectively, the "Asserted Patents").

Defendants provide these Preliminary Invalidity Contentions subject to the reservations of rights below. For instance, Defendants reserve the right to amend and/or supplement these Preliminary Invalidity Contentions in accordance with the Court's Standing Orders, the Federal Rules of Civil Procedure, and as discovery begins in this matter.

In accordance with the Order and the Parties' Agreed Scheduling order, Defendants serve herewith accompanying charts in the form of A1-A4, B1-B5, C1-C7, D1-D5, E1-E3, F1-F5, and G1-G7 which each set forth where in the prior art references each element of each Asserted Claim of each Asserted Patent is found. Additionally, Defendants herein identify the limitations of the Asserted Claims that Defendants contend are indefinite or lack written description under 35 U.S.C. § 112 or are directed to ineligible subject matter under 35 U.S.C. § 101.

I. INTRODUCTORY STATEMENT

A. Asserted Claims and Asserted Patents

At the time of service of these Preliminary Invalidity Contentions, Halliburton and Halliburton Technologies assert the following claims against Defendants:

Asserted Patent	Asserted Claims	Asserted Priority Date
U.S. Patent No. 7,836,949 ("the '949 Patent")	Claims 1-14	Oct. 27, 2005
U.S. Patent No. 7,574,325 ("the '325 Patent")	Claims 1-22	Dec. 21, 2005
U.S. Patent No. 7,841,394 ("the '394 Patent")	Claims 1-19, 21-27	Aug. 5, 2005
U.S. Patent No. 11,035,213 ("the '213 Patent")	Claims 1-20	Feb. 26, 2019
U.S. Patent No. 11,085,282 ("the '282 Patent")	Claims 1-20	Aug. 25, 2016

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Asserted Patent	Asserted Claims	Asserted Priority Date
U.S. Patent No. 11,373,058 ("the '058 Patent")	Claims 1-20	Apr. 30, 2019
U.S. Patent No. 11,377,943 ("the '943 Patent")	Claims 1-20	July 12, 2019

These claims are collectively referred to as "the Asserted Claims." As set forth in the charts accompanying Defendants' Preliminary Invalidity Contentions, the Asserted Claims are neither novel nor non-obvious in view of the state of the prior art and the understanding of a person of ordinary skill in the art at the time of the alleged invention claimed in each Asserted Patent. The Asserted Claims are further invalid for lack of written description, lack of enablement, and/or indefiniteness under 35 U.S.C. § 112, and/or for being directed toward ineligible subject matter under 35 U.S.C. § 101, as further explained herein.

Consistent with the Court's Order, Defendants hereby: (1) set forth in the form of a chart where in the prior art references each element of the Asserted Claims are found, (2) identifies any limitations Defendants contend are indefinite or lack written description under Section 112, and (3) identify the claims Defendants contend are directed to ineligible subject matter under Section 101. Additionally, Defendants produce herewith a copy of each prior art reference identified in these Preliminary Invalidity Contentions and technical documents sufficient to show the operation of the "Accused Products" identified by Halliburton Plaintiffs in their preliminary infringement contentions.

B. Reservation of Rights

The invalidity contentions provided herein are preliminary in nature and subject to revisions as provided in the Court's Order Governing Proceedings–Patent Cases, the Federal Rules of Civil Procedure, and/or any Order of this Court. These Preliminary Invalidity Contentions are based on Defendants' current knowledge, understanding, and belief as to the facts and information

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available at this time, and are subject to further revisions as additional information becomes available to Defendants. Defendants reserve the right to amend or supplement these contentions and the accompanying document production should Halliburton Plaintiffs: (1) provide any information that it failed to provide with its preliminary infringement contentions; (2) amend its preliminary infringement contentions in any way; or (3) attempt to rely upon any information at trial, in a hearing, or during a deposition, which it failed to provide with its preliminary infringement contentions.

At this point in the proceedings, only limited discovery has occurred. Defendants therefore reserve the right to amend its preliminary invalidity contentions in view of any relevant information, including additional internal or third-party prior art, that is produced during discovery. Specifically, Defendants reserve the right to revise, amend, and/or supplement the information provided herein, including identifying, charting, and relying on additional prior art activities or references, consistent with the Court's Order, the Local Rules, and the Federal Rules of Civil Procedure.

Finally, consistent with the Court's Order and the Parties' Agreed Scheduling Order, Defendants further reserve their right to revise, amend, and/or supplement these Preliminary Invalidity Contentions after the Court has construed the disputed terms. Accordingly, given that the Court has not yet construed the scope and meaning of any of the Asserted Claims, nothing in these Preliminary Invalidity Contentions should be taken as any express or implied admission by Defendants as to the meaning, definiteness, or adequacy of the written description, support for, or enablement of any claim asserted by Halliburton Plaintiffs. As mentioned above, these Preliminary Invalidity Contentions are based on Defendants' current knowledge and

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understanding of the Asserted Claims in the context in which they are asserted by Halliburton Plaintiffs in their preliminary infringement contentions.

II. PRELIMINARY INVALIDITY CONTENTIONS

A. Identification of Each Item of Prior Art

In accordance with this Court's Standing Order Governing Procedures—Patent Cases, Defendants identify each item of prior art that anticipates and/or renders obvious each of the Asserted Claims of the Asserted Patents under 35 U.S.C. §§ 102 and 103 in Table 1 and Table 2 below. Moreover, Defendants attached herewith representative charts, which provide, in detail, where the elements of each Asserted Claim of the Asserted Patents are found in a respective piece of prior art.

In each chart attached to these Preliminary Invalidity Contentions, Defendants have endeavored to identify relevant, representative portions of the references that disclose the elements of each of the Asserted Claims. In an effort to focus the issues, Defendants identify only exemplary portions of the cited references. The identification of only exemplary portions of each reference does not necessarily mean there are no other portions of a reference that teach the element of each asserted claim. Furthermore, the lack of a citation for an element of an asserted claim should not be deemed an admission that the element is not disclosed in, is not inherent in, or is not obvious in light of, a reference. It should be recognized that a person of ordinary skill in the art is deemed to have generally read a prior art reference as a whole and in the context of other publications and literature.

Accordingly, Defendants reserve the right to rely upon other unidentified portions of the prior art references and on other publications and expert testimony as to the knowledge of a person of ordinary skill in the art to provide context, as an aid to understanding and interpreting the portions of the art, or to establish how or why a person of ordinary skill in the art would have been

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motivated to modify or combine certain elements of the cited references to reach the claimed invention of the Asserted Claims. In addition, Defendants reserve the right to rely upon applicable industry standards and prior art cited in the file histories of the Asserted Patents, and any related U.S. and foreign patent applications as invalidating references or to show the state of the art at the time of the alleged invention.

1. Identification of Prior Art That Anticipates One or More Asserted Claims of Each Asserted Patents

In Table 1 below, Defendants provide a list of prior art references that anticipate, and thus invalidate, one or more of the Asserted Claims of each Asserted Patent. Each anticipatory reference identified in Table 1 corresponds to a claim chart to these Preliminary Invalidity Contentions that outlines specific examples of where each limitation of an Asserted Claim of an Asserted Patent is found in said reference. To the extent Halliburton Plaintiffs contend that a particular reference does not expressly anticipate an Asserted Claim of an Asserted Patent, Defendants reserve the right to rely on any other prior art referenced identified herein, or any non-identified reference to teach said limitation. Moreover, Defendants further reserve the right to rely on other references identified herein, and/or additional unidentified prior art that, when combined with other portions of the anticipatory reference, would render each and every limitation of an Asserted Claim of an Asserted Patent obvious in light of the prior art, as discussed in greater detail below. Defendants expressly reserve the right to rely on the combination of any one or more pieces of prior art identified herein with any other prior art reference.

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Table 1 Anticipatory References under 35 U.S.C. § 102				
Exhibit No.	**Prior Art Title (with Country of Origin)**	**Date of Issue or Publication**	**Priority Date**	**Patentee/Author**
Asserted Halliburton Patent: U.S. Patent No. 7,836,949				
A2 (NPL)	Field-Applied Computerized Tracking System: A Practical Approach to On-Site Quality Control	June 17, 1991		BJ Services; Society of Petroleum Engineers
A3	CA 2,306,590	October 27, 2000	April 26, 2000	Vicknair et al.
A4	U.S. Patent No. 5,365,435	November 15, 1994	February 19, 1993	Stephenson
Asserted Halliburton Patent: U.S. Patent No. 7,574,325				
B1	U.S. Patent No. 6,755,261	June 29, 2004	March 7, 2002	Koederitz
B2	U.S. Patent No. 7,318,488	January 15, 2008	April 19, 2002	Hutchinson
B3	A Probabilistic Reasoning Tool for Circulation Monitoring Based on Flow Measurements	October 3, 1999		Mansure et al.
B4	U.S. Patent No. 6,484,816	November 26, 2002	January 26, 2002	Koederitz
Asserted Halliburton Patent: U.S. Patent No. 7,841,394				
C3	U.S. Patent No. 4,305,463	December 15, 1981	October 31, 1970	Zakiewicz
Asserted Halliburton Patent: U.S. Patent No. 11,035,213				
D1	US Patent No. 10,247,182	April 2, 2019	February 4, 2016	Zhang
D2	Pat. Pub. No. US 2022/0003229A1	January 6, 2022	November 5, 2018	Mu
D3	US Patent No. 4,374,544	September 19, 1980	February 22, 1983	Westerman
D4	US Patent No. 11,365,617	June 21, 2022	January 24, 2017	Haustveit
Asserted Halliburton Patent: U.S. Patent No. 11,085,282				
E1	U.S. Patent No. 10,415,562	September, 17, 2019	December 19, 2015	Kajita
E2	U.S. Patent No. 10,247,182	April 2, 2019	February 4, 2016	Zhang

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Table 1 Anticipatory References under 35 U.S.C. § 102				
Exhibit No.	**Prior Art Title (with Country of Origin)**	**Date of Issue or Publication**	**Priority Date**	**Patentee/Author**
Asserted Halliburton Patent: U.S. Patent No. 11,373,058				
F1	U.S. Patent No. 8,849,639	September 30, 2014	September 17, 2010	Brown et al.
F2	Patent App. Pub. No. 10,787,887	September 29, 2020	August 8, 2016	Pankaj et al.
F3	Patent App. Pub. No. US 11,098,561	August 24, 2021	June 21, 2019	Martysevich et al.
F4	U.S. Patent No. 11,306,572	April 19, 2022	July 12, 2019	Ruhle et al.
F5	U.S. Patent No. 10,408,021	September 10, 2019	October 18, 2013	Dykstra et al.
Asserted Halliburton Patent: U.S. Patent No. 11,377,943				
G1	Patent App. Pub. No. U.S. 2016/0326853	November 10, 2016	May 8, 2015	Fredd et al.

2. Identification of Prior Art That Renders One or More Asserted Claims of Each Asserted Patent Obvious

In Table 2 below, Defendants provide a list of prior art references, each of which, either alone or in combination, render one or more of the Asserted Claims of each Asserted Patent obvious under 35 U.S.C. § 103. Similar to the anticipatory references of Table 1, each reference identified in Table 2 corresponds to a claim chart to these Preliminary Invalidity Contentions that outlines specific examples of where each limitation of an Asserted Claim of an Asserted Patent is found in said reference. Accordingly, each identified reference may, either alone or in combination with another reference identified in Table 1 or Table 2, render one or more Asserted Claims of an Asserted Patent obvious in light of the references' teachings. As will be further discussed herein, one of ordinary skill in the art would be motivated to combine each of these references to reach the claimed invention embodied by the Asserted Claims of each Asserted Patent. For example, a person of ordinary skill the art would be motivated to combine or modify any of the references listed in Table 2 so as arrive at one of the limitations of an Asserted Claim of an Asserted Patent.

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As further discussed herein with respect to the specific combinations of one or more references, such a motivation can be found in the prior art references themselves, or may be presumed based on the knowledge of a person of ordinary skill in the art at the time of the invention.

Table 2 Obviousness References				
Exhibit No.	**Prior Art Title (with Country of Origin)**	**Date of Issue or Publication**	**Priority Date**	**Patentee/Author**
Asserted Halliburton Patent: U.S. Patent No. 7,836,949				
A1 (NPL)	Fracturing Process Control and Automation, Phase 1	March 10, 1998		Halliburton Services; Society of Petroleum Engineers
A1 (NPL)	Fracturing Process Control and Automation, Phase 2	July 11, 1993		Halliburton Services; Society of Petroleum Engineers
A2 (NPL)	Field-Applied Computerized Tracking System: A Practical Approach to On-Site Quality Control	June 17, 1991		BJ Services; Society of Petroleum Engineers
A3	CA 2,306,590	October 27, 2000	April 26, 2000	Vicknair et al.
A4	U.S. Patent No. 5,365,435	November 15, 1994	February 19, 1993	Stephenson
Asserted Halliburton Patent: U.S. Patent No. 7,574,325				
B1	U.S. Patent No. 6,755,261	June 29, 2004	March 7, 2002	Koederitz
B2	U.S. Patent No. 7,318,488	January 15, 2008	April 19, 2002	Hutchinson
B3 (NPL)	A Probabilistic Reasoning Tool for Circulation Monitoring Based on Flow Measurements	October 3, 1999		Mansure et al.
B4	U.S. Patent No. 6,484,816	November 26, 2002	January 26, 2001	Koederitz
B5	U.S. Patent 5,442,562	August 15, 1995	December 10, 1993	Hopkins et al.
Asserted Halliburton Patent: U.S. Patent No. 7,841,394				
C1	U.S. Patent No. 4,683,950	August 4, 1987	May 22, 1981	Lessi
C2	U.S. Patent No. 4,397,353	August 9, 1983	June 11, 1982	Lacy

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Table 2 Obviousness References				
Exhibit No.	**Prior Art Title (with Country of Origin)**	**Date of Issue or Publication**	**Priority Date**	**Patentee/Author**
C3	U.S. Patent No. 4,305,463	December 15, 1981	October 31, 1970	Zakiewicz
C4	U.S. Patent No. 6,644,844	November 11, 2003	February 21, 2003	Neal
C5	U.S. Patent No. 4,209,278	June 24, 1980	December 22, 1978	Cooper
C6	U.S. Patent No. 5,515,920	May 14, 1996	October 27, 1994	Luk
C7	U.S. Patent No. 4,715,721	December 29, 1987	July 19, 1985	Walker
Asserted Halliburton Patent: U.S. Patent No. 11,035,213				
D1	US Patent No. 10,247,182	April 2, 2019	February 4, 2016	Zhang
D2	Pat. Pub. No. US 2022/0003229A1	January 6, 2022	November 5, 2018	Mu
D3	US Patent No. 4,374,544	September 19, 1980	February 22, 1983	Westerman
D4	US Patent No. 11,365,617	June 21, 2022	January 24, 2017	Haustveit
D5	US Patent No. 9,297,250	March 29, 2016	March 14, 2013	Dusterhoft
Asserted Halliburton Patent: U.S. Patent No. 11,085,282				
E1	U.S. Patent No. 10,415,562	September, 17, 2019	December 19, 2015	Kajita
E2	U.S. Patent No. 10,247,182	April 2, 2019	February 4, 2016	Zhang
E3	Patent App. Pub. No. US 2021/0396113A1	December 23, 2021	November 15, 2016	Conners
Asserted Halliburton Patent: U.S. Patent No. 11,373,058				
F1	U.S. Patent No. 8,849,639	September 30, 2014	September 17, 2010	Brown et al.
F2	Patent App. Pub. No. 10,787,887	September 29, 2020	August 8, 2016	Pankaj et al.
F3	Patent App. Pub. No. US 11,098,561	August 24, 2021	June 21, 2019	Martysevich et al.
F4	U.S. Patent No. 11,306,572	April 19, 2022	July 12, 2019	Ruhle et al.
F5	U.S. Patent No. 10,408,021	September 10, 2019	October 18, 2013	Dykstra et al.

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Table 2 Obviousness References				
Exhibit No.	**Prior Art Title (with Country of Origin)**	**Date of Issue or Publication**	**Priority Date**	**Patentee/Author**
Asserted Halliburton Patent: U.S. Patent No. 11,377,943				
G1	Patent App. Pub. No. U.S. 2016/0326853	November 10, 2016	May 8, 2015	Fredd et al.
G2	Patent App. Pub. No. U.S. 2011/0048695	March 3, 2011	November 3, 2010	Cherewyk et al.
G3	Patent App. Pub. No. U.S. 2014/0352968	December 4, 2014	June 3, 2013	Pitcher et al.
G4	Patent App. Pub. No. U.S. 2019/0249527	August 15, 2019	February 9, 2018	Kraynek
G5	U.S. Patent No. 7,845,413	December 7, 2010	May 29, 2007	Shampine et al.
G6	Patent App. Pub. No. U.S. 2015/0176387	June 25, 2015	December 19, 2014	Wutherich et al.
G7	Patent App. Pub. No. U.S. 2015/0176387	February 10, 2011	December 6, 2009	Demong et al.

To the extent Halliburton Plaintiffs contend that a particular reference does not include a limitation of an Asserted Claim of an Asserted Patent, Defendants reserve the right to rely on any other identified reference to teach said limitation. Moreover, Defendants further reserve the right to rely on other references identified herein, and/or additional unidentified prior art that, when combined with other portions of the anticipatory reference, would render each and every limitation of an Asserted Claim of an Asserted Patent obvious in light of the prior art. Specifically, Defendants expressly reserve the right to rely on the combination of any one or more pieces of prior art identified herein with any other prior art reference.

1. Prior Art System Under 35 U.S.C. §§ 102(a), (b), (g)

Defendants identify the systems disclosed in the patents and publications listed above as prior art. Additionally, Defendants' identify the following products and systems, including, software, hardware, methods, and processes, as prior art that may anticipate or render obvious the Asserted Patents.

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On information and belief, each product and/or system: (i) was known or used in this country before the alleged invention of the claimed subject matter of the Asserted Patents, (ii) was in public use and/or on sale in this country more than one year before the filing date of the application for the Asserted Patents; or (iii) was made in this country prior to the alleged invention of the claimed subject matter of the Asserted Patents by another inventor who had not abandoned, suppressed or concealed it.

Seller / Purchaser / User
Stewart & Stevenson Power Products, LLC
Gardner Denver Energy Products
Kirby Distribution & Services, Inc.
Forum Energy Technologies, Inc.
Dragon Products, Ltd
ST9 Gas and Oil LLC
TEC Systems Group
ProPetro Holding Corp.
Schlumberger Omnes Inc.
Surefire Industries
Baker Hughes Inc.
Lime Instruments, LLC

Discovery has not yet opened. Defendants will provide further identification of the above systems and any other systems Defendants learn about through discovery ("the Prior Art Systems"), including constituent hardware, methods, and processes, as prior art that may anticipate or render obvious the Asserted Claims of the Asserted Patents, as such information becomes available. Defendants reserve the right to amend and supplement these contentions to provide disclosures based on further investigation of and as they acquire additional information about these systems.

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B. Anticipation and/or Obviousness of Each Element

1. Invalidity Based on Anticipation under 35 U.S.C. § 102

A claim may be invalid as lacking novelty, *i.e.*, it is anticipated, under one of the provisions of 35 U.S.C. § 102(b). A patent claim is anticipated if a single prior art reference discloses all the essential limitations of the claim. *Hybritech, Inc. v. Monoclonal Antibodies, Inc*., 802 F.2d 1367, 1379 (Fed. Cir. 1986), *cert. denied,* 480 U.S. 947 (1987). The single reference need not "expressly" set forth information corresponding to each limitation of the claim to anticipate. *Structural Rubber Prods. Co. v. Park Rubber Co*., 749 F.2d 707, 716 (Fed. Cir. 1984). Rather, "[a] prior art reference anticipates a patent claim if the reference discloses either expressly or inherently, all of the limitations of the claim." *EMI Grp. N. Am. v. Cypress Semiconductor Corp*., 268 F.3d 1342, 1350 (Fed. Cir. 2001). Thus, "a prior art reference may anticipate without disclosing a feature of the claimed invention if that missing characteristic is necessarily present, or inherent, in the single anticipating reference." *SmithKline Beecham Corp. v. Apotex Corp.*, 403 F.3d 1331, 1343 (Fed. Cir. 2005) (natural results flowing from the operation of prior art are inherent) (citing *Schering Corp. v. Geneva Pharm., Inc*., 339 F.3d 1373, 1377 (Fed. Cir. 2003)).

Depending on the Court's construction of the Asserted Claims for each Asserted Patent, including whether the preamble of each Asserted Claim is or is not limiting in nature, the prior art references mentioned in Table 1 above render one or more of the Asserted Claims of each Asserted Patent invalid under 35 U.S.C. § 102, as the Asserted Claims are anticipated by the disclosure of each and every element in one or more of the identified prior art references. As mentioned, the charts accompanying these Preliminary Invalidity Contentions set forth how the Asserted Claims of the Asserted patents are not novel in light of the references in Table 1.

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2. Invalidity Based on Obviousness

A claim may also be invalid for failing to meet the standards of "nonobviousness" under 35 U.S.C. § 103. An invention is not patentable if the differences between the claimed invention and the prior art are such that the subject matter of the claimed invention as a whole would have been obvious, at the time the invention was made, to a person having ordinary skill in the art. 35 U.S.C. § 103. There are four factual issues underlying the ultimate legal question of whether claimed subject matter would have been obvious to one of ordinary skill in the art at the time the invention was made: (1) the scope and content of the prior art; (2) the differences between the prior art and the claimed invention; (3) the level of ordinary skill at the time the invention was made; and (4) secondary or "objective" considerations. *See Graham v. John Deere Co*., 383 U.S. 1, 17-18, (1966); *Ortho-McNeil Pharm., Inc. v. Mylan Labs*., Inc., 520 F.3d 1358, 1365 (Fed. Cir. 2008) (referring to secondary considerations as "objective criteria" and "objective indicia").

In *KSR Int'l Co v. Teleflex Inc.*, 550 U.S. 398 (2007), the U.S. Supreme Court rejected the Federal Circuit's rigid "teaching, suggestion, or motivation" requirement in favor of a flexible, functional approach in which an explicit finding of a "motivation" to combine prior art references is not required to establish obviousness. The Supreme Court held that it is sufficient that a combination of elements was "obvious to try" holding that "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known option within his or her technical grasp." *Id.* at 421; *see also DyStar Textilfarben GmbH v. C.H. Patrick Co.*, 464 F.3d 1368, 1360 (Fed. Cir. 2006); *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1161 (Fed. Cir. 2007).

Moreover, a single prior art reference can establish obviousness where the differences between the disclosures within the reference and the claimed invention would have been obvious

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to one of ordinary skill in the art. For example, "[c]ombining two embodiments disclosed adjacent to each other in a prior art patent does not require a leap of inventiveness." *Boston Scientific Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982, 991 (Fed. Cir. 2009). Additionally, where an individual reference is cited with respect to fewer than all limitations of an Asserted Claim, Defendants contend that the reference may render obvious the claim under 35 U.S.C. § 103 by itself in view of the knowledge of a person of ordinary skill in the art or in view of admitted prior art in the Asserted Patents.

Accordingly, each of the references described in Table 2, alone or in combination with any one or more of the other listed references, render one or more of the Asserted Claims of the Asserted Patents invalid under 35 U.S.C. § 103. To the extent Halliburton contends that an embodiment within a particular item of prior art does not fully disclose all the limitations or elements of an Asserted Claim, Defendants reserve the right to rely on other embodiments in that prior art reference, or information presumably known to one of ordinary skill in the art, to show single reference obviousness under 35 U.S.C. § 103.

a. Motivation for Combining Identified Prior Art References

In addition to the information contained in charts accompanying these Preliminary Invalidity Contentions, Defendants hereby identify exemplary motivations and reasons that a person of ordinary skill in the art would combine the cited prior art to reach each element of the Asserted Claims for each of the Asserted Patents. As shown below, the motivations to combine prior art references are generally provided by or suggested by the prior art references themselves. Defendants reserve the right to rely on additional motivations to combine, either those further taught in the references or that one of ordinary skill in the art would understand as being present in the prior art. Accordingly, the motivations to combine discussed below should not be taken as

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an exclusive list of motivations that one of ordinary skill in the art would have to combine the references identified herein.Non-patent literature titled "Fracturing Process Control and Automation, Phase 1 and Phase 2 by Halliburton Services ("*Halliburton Services*") discloses, for example, "[t]o support work such as this, pumping and blending equipment must have the capability to (1) continuously and accurately blend a number of liquid and dry additives into the fracturing base fluid, (2) measure progress of the fluid, and (3) record the entire treatment on a time base." *Phase 1*, Introduction. *Halliburton Services* further discloses that the "[g]eneral design goals for the project to automate and remotely control the fracturing process were to (1) improve execution of complex job design, (2) significantly improve quality control of chemical blends, (3) reduce operational cost, (4) improve safety, (5) provide for changes in job design during progress of the operation, and (6) improve documentation of the processes." *Phase 1*, Introduction. Accordingly, a person of ordinary skill in the art ("POSITA") would look to the teachings of *Halliburton Services* for, at least, its solutions directed to creating a well treatment fluid used for a fracturing operation, improve execution of operating a well treatment fluid system, improve quality control of chemical blends, reduce operational costs, improve safety, provide for changes in job design during the operation, and improve documentation of the process. A POSITA would be motivated to look to *Halliburton Services* and its teachings for combining with *BJ Services, Vicknair,* and/or *Stephenson* for monitoring and controlling oilfield equipment systems.

Non-patent literature titled "Field-Applied Computerized Tracking System: A Practical Approach to On-Site Quality Control" by BJ Services ("*BJ Services*") discloses, for example, "[a]utomation and monitoring of modern hydraulic fracturing treatments demand a unique approach incorporating intelligent data acquisition and control equipment." *BJ Services,* Summary. *BJ Services* further discloses "[m]icroprocessor-based monitoring, control, and

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recording equipment provides an efficient, high-speed method of processing, adjusting, transmitting, displaying, and recording all the data necessary to ensure a quality treatment." *Id*. at Introduction. *BJ Services* teaches that such automation and monitoring of said equipment can be used in the context of sand blenders, water systems, and pumping systems, and may provide virtual "displays" of the recorded data. *Id*. at Stimulation Treatment Vehicle; Computer Controlled Blender; Downhole Pressure Calculations; and FIGS. 3-6. Accordingly, a POSITA would look to the teachings of *BJ Services* for, at least, its solutions to improve the operator's control of a well treatment fluid being delivered to the wellbore by accurately measuring the changes in the fluid, controlling the mixture of sand and other proppants into the water-based fluid, provide a visual display of recorded equipment and fluid measurements, and measuring general system measurements and levels. A POSITA would be motivated to look to *BJ Services* and its teachings for combining with *Halliburton Services, Vicknair,* and/or *Stephenson* for monitoring and controlling oilfield equipment systems.

Canada Patent No. CA 2,306,590 to Vicknair et al. ("*Vicknair*") discloses a wireless network "to interrelate individual mobile nodes, and having the capability of automatically establishing and/or modifying functionality of a network in response to the characteristics and/or identity of the nodes connected to the network at a given time." *Vicknair*, Abstract.

> In an exemplary embodiment, the WLAN 100 may be configured with nodes that are operable to perform a well-fracturing function. In this application, the base 106 is a treating van, which is the van from which the job is monitored and controlled. The treating van communicates with "nodes," which would likely include pump trucks and other vehicles required for this particular function. For example, other nodes may include a "liquid additive module," "blender modules,"or "gel pumps." When operating at a job site, a truck (or node), would register with the treating van when entering the coverage area of the WLAN.

Vicknair, Pg. 19: 7-13. Accordingly, a POSITA would look to the teachings of *Vicknair* for, at least, its solutions to improve the operator's control of a well treatment fluid being delivered to the

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wellbore by accurately monitoring and controlling all aspects of the hydraulic fracturing operation through central processing. A POSITA would be motivated to look to *Vicknair* and its teachings for combining with *Halliburton Services, BJ Services, and/or Stephenson* for monitoring and controlling oilfield equipment systems.

U.S. Patent No. 5,365,435 to Stephenson ("Stephenson") discloses,

> A system and method for determining, particularly quantitatively, a mixing efficiency of a mixing system, wherein a fracturing fluid, cement or other mixture is produced at an oil or gas well site, utilizes a mathematical model from which an ideal output characteristic is determined based on actual operating conditions obtained from the mixing system. The ideal output characteristic is compared to an actual output characteristic, and adjustments to the mixing system or an automatic control thereof can be made in response.

Stephenson, Abstract. Accordingly, a POSITA would look to the teachings of *Stephenson* for, at least, its solutions to improve the operator's control of a well treatment fluid being delivered to the wellbore by accurately monitoring, mathematically modeling, and automatically controlling all aspects of the hydraulic fracturing operation. A POSITA would be motivated to look to *Stephenson* and its teachings for combining with *Halliburton Services, BJ Services,* and/or *Vicknair* for monitoring and controlling oilfield equipment systems.

U.S. Patent No. 6,755,261 to Koederitz ("*Koederitz*") discloses, for example,

> [a] control system is provided to monitor one or more selected drilling parameters and provide automated control to reduce the fluid circulation rate to a selected value while circulating a kick out of a well based on the monitored parameters. The control system may monitor selected pressures, pump rates, choke position, pit volumes in the mud system, alarm conditions, lost circulation detectors, bit nozzle plugging detectors, choke washout detectors, mud-gas separation system operation, and/or sensor failure.

Koederitz, 6:1-10. Further, *Koederitz* discloses that the control system may be used to monitor the oilfield system and provide the operator with "[a]n improved method and system for more accurately and reliably controlling well fluid circulation rate when circulating a kick out of a well." *Id*. at 3:55-58. Accordingly, a POSITA would look to the teachings of *Koederitz* for, at least, its

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teachings of controlling and monitoring a number of operational factors in an oilfield equipment system to prevent hazardous well-site conditions or events, such as, but not limited to wellbore "kicks." A POSITA would be motivated to look to *Koederitz* and its teachings for combining with *Hutchinson, Mansure, Koederitz 816,* and/or *Hopkins* for automated monitoring and control of oilfield equipment systems.

U.S. Patent No. 7,318,488 to Hutchinson ("*Hutchinson*") discloses, for example,

> [a] method for classifying data measured during drilling operations at a wellbore includes determining a first difference between values of a selected measured parameter between a first time and a second time and assigning a value of a measured parameter to an enhanced data value set when the first difference falls below selected thresholds.

Hutchinson, Abstract. *Hutchinson* further discloses that "[i]t is desirable to have a method for discriminating data on the basis of drilling operating parameters and mode of motion such that data recorded under preferred drilling conditions may be selectively identified for analysis." *Id*. at 3:20-24. Accordingly, a POSITA would look to the teachings of *Hutchinson* for, at least, its teachings of using measurement data to monitor and analyze the operation of equipment at a well-site. A POSITA would be motivated to look to *Koederitz* and its teachings for combining with *Koederitz, Mansure, Koederitz 816,* and/or *Hopkins* for automated monitoring and control of oilfield equipment systems.

Non-patent literature titled "A Probabilistic Reasoning Tool for Circulation Monitoring Based on Flow Measurements" by Mansure et al. ("*Mansure*") discloses, for example,

> [t]he system is called the Circulation Monitoring System (CMS) and will be useful for detecting, characterizing, and quantifying lost circulation, fluid influx, gas/steam kicks, loss of mud pump efficiency, washouts, plugged nozzles, and sensor problems. Data from the outflow meter, pump-stroke counter, inflow meter, pit volume indicator, standpipe pressure sensor, and other sensors are processed by a Kalman filter and examined for deviations from expected patterns.

Mansure, Abstract. *Mansure* discloses that,

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> "CMS receives and analyzes data from the mud logger information system in real time. It provides timely notification of problems . . . CMS, There are several advantages to using Kalman filters for real-time circulation monitoring . . . Kalman filters are adaptive, allowing them to adjust their state estimates as conditions change downhole. This is a critical advantage for real-time monitoring systems such as CMS…"

Id. at Circulation Monitoring System. Accordingly, a POSITA would look to the teachings of *Mansure* for, at least, its teachings of a Circulation Monitoring System for measuring and analyzing data from the different fracturing operation equipment at a well-site. Additionally, a POSITA would look to the teachings of *Mansure* for its teachings of monitoring conditions in real-time. Further, a POSITA would be motivated to look to *Mansure* and its teachings for combining with *Koederitz, Hutchinson, Koederitz 816,* and/or *Hopkins* for automated monitoring and control of oilfield equipment systems.

U.S. Patent No. 6,484,816 to Koederitz ("*Koederitz '816*") discloses, for example, a system for monitoring and controlling and oilfield equipment system, such as a well bore fluid pressure control system, wherein "one or more sensors may be interconnected with the controller to sense well bore pressure conditions and/or pumping conditions. Statistical process control (SPC) techniques may also be employed to enhance process control by the controller." *Koederitz '816*, Abstract. Accordingly, a POSITA would understand that the method and system of *Koederitz '816* discloses a monitoring system for oilfield equipment systems wherein signals from three or more equipment systems are monitored and compared using known SPC techniques to provide warnings or other necessary indications upon the receipt of inconsistent signals. Further, a POSITA would be motivated to look to *Koederitz '816* and its teachings for combining with *Koederitz, Hutchinson, Mansure,* and/or *Hopkins* to accomplish monitoring and controlling an oilfield equipment system.

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U.S. Patent No. 5,442,562 to Hopkins et al. ("*Hopkins*") discloses, for example, a process control for multivariate analysis. For example, *Hopkins* discloses Statistical Process Control ("SPC") for a system, such as a manufacturing process, wherein the SPC performs multivariate analysis on data representing a plurality of process and/or product variables collected during operations of the process. *Hopkins*, Abstract. Although not specific to the oilfield, a POSITA would understand that the SPC of *Hopkins* that performs multivariate analysis for three or more differing subsystems by "transforming" data, would be equally applicable to three or more "oilfield equipment related" subsystems. Accordingly, a POSITA looks to *Hopkins* and its teachings for combining with *Koederitz, Hutchinson, Mansure,* and/or *Koederitz '816* to accomplish monitoring and controlling an oilfield equipment system.

U.S. Patent No. 4,683,950 to Lessi ("*Lessi*") discloses, for example, "injecting a pressurized fluid into at least two injection wells." *Lessi*, claim 1. *Lessi* further discloses simultaneously injecting hydraulic fluid into two wells. *See id.*, 3:30-34. "This hydraulic fluid is supplied from pumps 13 and 14 connected with the surface apparatuses 15 and 16 equipping the wells 1 and 2." *Id.* at 3:22-23. Accordingly, a POSITA would look to the teachings of *Lessi* for, at least, its solutions to simultaneously pump fluids to a first well and a second well utilizing connections between the wells and the well operations factory. Accordingly, a POSITA looks to *Lessi* and its teachings for combining with *Zakiewicz*, *Lacy*, *Neal*, *Cooper*, *Luk*, and *Walker* to improve the scavenging of the geological formations.

U.S. Patent No. 4,397,353 to Lacy ("*Lacy*") discloses, for example, a method of delivering two different fluids down a wellbore. *See Lacy*, Abstract. The first treatment fluid may be a high grad material such as fracturing fluid or a propping agent. *See id.* at 2:3-11. The second treatment may be a low grade material such as water admixed with a barrier forming material. *See id*. *Lacy*

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further discloses methods of simultaneously pumping the high grade and low grade fluids into the well formations. *See id.* at 4-5:66-16. Accordingly, a POSITA would look to the teachings of *Lacy* for, at least, its solutions to simultaneously pump a first and a second fluid with different compositions. Accordingly, a POSITA looks to *Lacy* and its teachings for combining with *Lessi*, *Neal*, *Zakiewicz*, *Cooper*, *Luk*, and *Walker* to increase production of the wellbores.

U.S. Patent No. 4,305,463 to Zakiewicz ("*Zakiewicz*") discloses, for example, injecting flushing and carrying medium into "a series of injection wells." *See Zakiewicz*, 7:15-23. *Zakiewicz* further discloses several methods of "crude exploitation" including "cold and hot waterflooding; steam soaking and steam driving; cold and hot gas pressurizing (squeezing); and cold gas and wet chemical 'softening'." *See id.* at 1:40-44. *Zakiewicz* also discloses utilizing a manifold to deliver the activating agents to the wells. *See id.* at 4:64-68. *Zakiewicz* continues that "various conventional chemical reagents" may be injected into either well 9 or well 10. *See id.* at 8:53-68. Accordingly, a POSITA would look to the teachings of *Zakiewicz* for, at least, its solutions to manufacture steam, pump a well stimulation fluid, connect the wells to the well operations factory, and simultaneously flow one chemical composition to a first well and a different chemical composition to a second well. Accordingly, a POSITA looks to *Zakiewicz* and its teachings for combining with *Lessi*, *Neal*, *Lacy*, *Cooper*, *Luk*, and *Walker* to improve recovery factors of the wellbores.

U.S. Patent No. 6,644,844 to Neal et al. ("*Neal*") discloses, for example, "an improved blender apparatus useable in well stimulation processes." *Neal*, Abstract. *Neal* continues "that the blender 100 can also be supported on skids or mounted on marine vessels for offshore use." *Id.* at 2:33-41. *Neal* also discloses "[t]he slurry delivery system 118 also includes an upper discharge manifold 152, a lower discharge manifold 154 and a pair of discharge headers 156 a,

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156 b." *Id.* at 5:11-23. Accordingly, a POSITA would look to the teachings of *Neal* for, at least, its solutions to manufacture a proppant solution, pump a well stimulation fluid, connect the wells to the well operations factory, and locate the system on a boat. Accordingly, a POSITA looks to *Neal* and its teachings for combining with *Lessi*, *Lacy*, *Zakiewicz*, *Cooper*, *Luk*, and *Walker* to improve blending operations in a hydraulic fracturing environment.

U.S. Patent No. 4,209,278 to Cooper et al. ("*Cooper*") discloses, for example, "[a] land vehicle for use as a blender for the mixing of dry, particulate, and liquid materials comprising a chassis having an articulated frame thereon . . . ." *Cooper*, Abstract. Cooper further discloses "[t]o move the articulated frame 100 with respect to the truck chassis 10 a telescopic, double acting, hydraulic cylinder 115 is installed having the end of a rod portion 116 secured to a cross-member 14 of the truck chassis 10 while the end portion 117 of the cylinder housing is secured to a cross-member 107 of the first frame portion 101." *Id.* at 3:11-20. *Cooper* states "[t]he second translatable, rotable frame portion 102 also comprises a manifold 208 which is interconnected with the blender tub 203 to supply various liquid material to the blender tub 203 during the operation thereof." *Id.* at 4:6-16. Accordingly, a POSITA would look to the teachings of *Cooper* for, at least, its solutions to manufacture a proppant solution, pump a well stimulation fluid, connect the wells to the well operations factory, and locate the system on a boat. Accordingly, a POSITA looks to *Cooper* and its teachings for combining with *Lessi*, *Lacy*, *Zakiewicz*, *Neal*, *Luk*, and *Walker* for an improved blender truck in a hydraulic fracturing environment.

U.S. Patent No. 5,515,920 to Luk et al. ("*Luk*") discloses, for example, "a method of fracturing an underground formation" comprising a first stream and a second stream. *See Luk*, Abstract. Further, Luk discloses that the streams may have different concentrations of proppant. *See id.* at claim 23. *Luk* continues that the proppant and other chemicals are stored in storage

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vessels prior to blending. *See id.* at 6:26-40. Accordingly, a POSITA would look to the teachings of *Luk* for, at least, its solutions to manufacture a proppant solution, pump a well stimulation fluid, connect the wells to the well operations factory, simultaneously flow one chemical composition in a first stream and a different chemical composition in a second stream, and provide housing for the operations. Accordingly, a POSITA looks to *Luk* and its teachings for combining with *Lessi*, *Lacy*, *Zakiewicz*, *Neal*, *Cooper*, and *Walker* for improved methods of proppant delivery in hydraulic fracturing operations.

U.S. Patent No. 4,715,721 to Walker et al. ("*Walker*") discloses, for example, an "integrated system provides storage, conveying and metering facilities from a fixed assembly of equipment simultaneously and commonly transportable." *Walker*, 2:18-28. *Walker* continues that the outputs are communicated via a discharge manifold mounted on the deck of a vessel. *Id.* at 9-10:65-7 and FIGS. 1-2. Storage bins are utilized to contain proppant and other chemicals. *Id.* at 4-6:43-2. *Walker* also discloses, "part of the storage portion 36 is a housing 98 located on the tier defined by the upper structure of the skid frameworks containing the additive tanks 62-78." *Id.* at 5:17-24. Accordingly, a POSITA would look to the teachings of *Walker* for, at least, its solutions to manufacture a proppant solution, connect the wells to the well operations factory, locate the system on a boat, and provide housing for the system. Accordingly, a POSITA looks to *Walker* and its teachings for combining with *Lessi*, *Lacy*, *Zakiewicz*, *Neal*, *Cooper*, and *Luk* for improved hydraulic fracturing transportation systems.

For instance, US Patent No. 10,247,182 to Zhang ("*Zhang*") discloses, for example, "A pumping system for use in a well stimulation application includes a pump controlled by a controller, the controller operating to monitor operation of the pump." *Zhang*, Abstract. "The present disclosure is applicable to pumps used for hydraulic fracturing or well stimulation

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applications." *Id*. at 6:16-17. *Zhang* further teaches monitoring disposition of the fluid, stating that the emission measurements on the site "an input sensor 138 and an output sensor 140 respectively monitor the flow rate, temperature, composition, pressure and/or viscosity of the inlet and outlet streams of stimulation fluid provided to, and also provided from, the pump 116." *Id*. at 4:16-20. *Zhang* further teaches,

> [a] block diagram for a control system 400 in accordance with the disclosure is shown in FIG. 6. The control system 400 may be operating as a set of computer executable instructions within the electronic controller 130 (FIG. 1), or in another similarly disposed controller that is associated with a well stimulation system such as the system 100. The control system 400 receives information and signals indicative of the operating state of the system and automatically determines whether cavitation in the pump is likely to be present such that an automatic change, adjustment or mitigation can be undertaken to avoid the presence of the cavitation, by adjusting various operating parameters of the well stimulation system operation. In the illustrated embodiment, a signal indicative of pump inlet pressure 402, and also a signal indicative of pump speed 404, are provided to an inlet block 406, but it should be appreciated that additional or different parameters may be provided depending on the requirements of each system.

Id. at 6:36-54. Accordingly, a person of ordinary skill in the art ("POSITA") would look to the teachings of *Zhang* for, at least, its solutions to monitoring and receiving measurements associated with the wellbore treatment operation. Further, a POSITA would look to *Zhang* and its teachings for combining with *Mu*, *Westerman*, *Haustveit*, and *Dusterhoft* to accomplish a wellbore fracturing operation with multiple flow rates and pressures due to *Mu*, *Westerman*, *Haustveit*, and *Dusterhoft* all being directed to this as shown below.

> Additionally, Pat. Pub. No. US 2022/0003229A1 to Mu ("*Mu*") discloses, for example,
>
> "[a]s shown, the method 2000 includes a utilization block 2010 for utilizing a controller in communication with a fracturing pump fleet that is to operate at a desired overall rate and/or pressure for at least a portion of a fracturing job; a commencement block 2012 for commencing operation of each of the pumps according to a first load using the controller and information related to operations specifications of each pump of the fleet of pumps; a reception block 2014 for receiving real-time data on the performance and/or the operation of each of the pumps using a plurality of sensors; a comparison block 2016 for comparing the

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> real-time data for each pump, directly and/or indirectly, to one or more predetermined thresholds for each pump.

Mu at Para [0287]. *Mu* further teaches,

> The control system 220 can use a predicted pressure per the block 232, a pressure threshold per the block 234, and a treating pressure versus pumping rate curve per the block 240 to automatically control pump rate per the block 236. As shown, the pumping rate adjustment block 236 can output an appropriate control signal (e.g., command, etc.) to cause one or more of the pumps 205 to adjust pumping rate.

Id. at Para [0080]. *Mu* further teaches,

> The pumping rate adjustment block 236 can determine if the predicted pressure per the block 232 is approaching the pressure threshold per the block 234; where, if it is determined that it is approaching the pressure threshold, the pumping rate adjustment block 236 can determine a pumping rate from the treating pressure vs pumping rate curve 240 that aims to maintain the pressure below the pressure threshold. The control system 220 can then control the one or more pumps 205 to get a new pumping rate (e.g., where it is determined that adjustment is desired).

Id. at Para [0090]. Accordingly, a person of ordinary skill in the art ("POSITA") would look to the teachings of *Mu* for, at least, its solutions to adjusting the injection rate, and comparing the measurements of the wellbore treatment operation and adjusting the operational constraints to maintain the net treating pressure. Further, a POSITA would look to *Mu* and its teachings for combining with *Zhang*, *Westerman*, *Haustveit*, and *Dusterhoft* to accomplish a wellbore fracturing operation with multiple flow rates and pressures due to *Zhang*, *Westerman*, *Haustveit*, and *Dusterhoft* all being directed to this as shown above and below respectively.

Additionally, US Patent No. 4,374,544 to Westerman ("*Westerman*") discloses, for example,

> [a] signal 22 representing the bottomhole pressure measured by the bottomhole pressure sensor is transmitted to a pressure processor 23 which places the signal in a form compatible with the internal circuits of the controller 7. The output of pressure processor 23 is transmitted to a pressure subtracter 25. The pressure subtracter 25 compares the measured bottomhole pressure to a preset pressure value 24. The pressure subtracter 25 then determines the difference between the actual bottomhole pressure and the preset pressure value and transmits that difference to the error arbiter 30.

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Westerman at 2:62-3:4. *Westerman* further teaches,

> "This is a method and apparatus for controlling the injection of fluid into an underground formation which continually measures the bottomhole pressure adjacent said underground formation during injection of said fluid and maintains the rate of injection so that the bottomhole pressure does not exceed a selected pressure or stays within a preset range. In a preferred embodiment means are provided to maintain both the rate of injection and the measured downhole pressure within preset ranges.....

Id. at 1:26-50. *Westerman* further teaches, "injecting said fluid through said wellbore into said formation." *Id.* at Claim 1. Accordingly, a person of ordinary skill in the art ("POSITA") would look to the teachings of *Westerman* for, at least, its solutions to establishing a net treating pressure, and operational constraints and injecting the fluid into the wellbore. Further, a POSITA would look to *Westerman* and its teachings for combining with *Zhang*, *Mu*, *Haustveit*, and *Dusterhoft* to accomplish a wellbore fracturing operation with multiple flow rates and pressures due to *Zhang*, *Mu*, *Haustveit*, and *Dusterhoft* all being directed to this as shown above and below respectively.

Additionally, US Patent No. 11,365,617 to Haustveit ("*Haustveit*") discloses, for example

> [i]n another implementation of the present disclosure, a method of controlling fracturing of a subterranean formation using a computing system is provided. The method includes receiving, at the computing system, first pressure data corresponding to a first well extending through the subterranean formation. Based on the first pressure data, the computing system calculates a first rate of pressure change. The computing system then receives second pressure data corresponding to the first well during pumping of a fracturing fluid at a first rate into a second well extending through the subterranean formation and poroelastically couplable to the first well. The computing system then calculates a second rate of pressure change based on the second pressure data and identifies a difference between the second rate of pressure change and the first rate of pressure change. The computing system then determines a second pumping rate, different from the first rate, based on the difference between the rates of pressure change.

Haustveit at 2:11-28. *Haustveit* further teaches,

> [i]n certain implementations, control of fracturing operations may be achieved, at least in part, by a computing system adapted to receive and process data collected from the monitor well. The computing system may be communicatively coupled to equipment for performing a fracturing operation such that the computing system

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> may modify one or more operational parameters of the equipment in response to the received data.

Id. at 7:4-11. *Haustveit* further teaches,

> [w]hen the observed difference between the dynamically measured rate of pressure change and the base line rate of pressure change exceeds the predetermined threshold, an operation 310 changes the flow rate of fracturing fluid into the active well 120. In certain implementations, the flow rate is decreased to a lower flow rate, including no flow, for a predetermined period of time. In such implementations, the previously injected fluid may be permitted to flow from the active well into a tank or other storage system. In still other embodiments, the flow rate may be increased. In addition to changing the flow rate of fracturing fluid into the active well 120, an operation 311 to modify characteristics of the fracturing fluid may be carried out.

Id. at 17:22-34. Accordingly, a person of ordinary skill in the art ("POSITA") would look to the teachings of *Haustveit* for, at least, its solutions to establishing a net treating pressure, and operational constraints and comparing the pressure to change the flow rate. Further, a POSITA would look to *Haustveit* and its teachings for combining with *Zhang*, *Mu*, *Westerman*, and *Dusterhoft* to accomplish a wellbore fracturing operation with multiple flow rates and pressures due to *Zhang*, *Mu*, *Westerman*, and *Dusterhoft* all being directed to this as shown above and below respectively.

Additionally, US Patent No. 9,297,250 to Dusterhoft ("*Dusterhoft*") discloses, for example

> [i]n some implementations, a target net treating pressure is determined. The target net treating pressure can refer to an optimal, favorable, or otherwise designated value or range of values of net treating pressure. In the context of an injection treatment, the net treating pressure indicates the extent to which the fluid pressure applied to the subterranean rock (e.g., the bottom hole treating pressure) exceeds the rock closure stress (e.g., the minimum horizontal rock stress). As such, a target net treating pressure may indicate a desired net treating pressure to be applied to the rock formation by an injection treatment. The actual net treating pressure can be observed during the injection treatment, and the fluid injection can be modified (e.g., by increasing or decreasing fluid pressure) when the actual net treating pressure falls outside (above or below) the target range.

Dusterhoft at 2:39-53. *Dusterhoft* further teaches,

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> [a]djustments of the actual net treating pressure can be made based on the comparison result as whether to increase or reduce the actual net treating pressure. In some implementations, the adjustments can include modifying one or more injection parameters (e.g., pumping pressure, adding diversion materials, change proppant size, proppant type, proppant concentration, etc.) instantaneously.

Id. at 16:45-51. *Dusterhoft* further teaches, "[a]s another example, during completion, a Diagnostic Fracture Injection Test (DFIT) can be performed to evaluate the real leak off rates to validate the assumed values used during the treatment design and modify the pumping schedule (e.g., injection rate, fluid type, proppant type, proppant concentration, diverter, etc.) as necessary." *Id.* at 16:31-36. Accordingly, a person of ordinary skill in the art ("POSITA") would look to the teachings of *Dusterhoft* for, at least, its solutions to establishing a net treating pressure, and changing the pressure via operational constraints such as injection rate. Further, A POSITA would look to *Dusterhoft* and its teachings for combining with *Zhang*, *Mu*, *Westerman*, and *Haustveit* to accomplish a wellbore fracturing operation with multiple flow rates and pressures due to *Zhang*, *Mu*, *Westerman*, and *Haustveit* all being directed to this as shown above and below respectively.

Furthermore, U.S. Patent No. 10,415,562 to Kajita ("*Kajita*") discloses, for example,

> The present disclosure further provides various embodiments of systems and/or methods for an adaptive, learning-based approach for controlling various portions of the wellsite system 100, including the pump units 200 described above. An implementation of such system may comprise a control system 300, such as may be operable to monitor and/or control operations of the pump units 200, including fluid flow rate generated by the pump units 200. FIG. 4 is a schematic view of a portion of an example implementation of the control system 300 according to one or more aspects of the present disclosure. The following description refers to FIGS. 1-4, collectively.

Kajita at 10:29-40. *Kajita* further teaches,

> [t]he pump unit 200 may comprise one of more flow rate sensors 203 fluidly coupled with or along the fluid outlets 235 in a manner permitting monitoring of a fluid flow rate of the fluid flowing through the fluid outlets 235. Each flow sensor 203 may be or comprise a flow meter operable to measure the volumetric and/or mass flow rate of the fluid discharged from the pump unit 200 and may be operable to generate signals or information indicative of the flow rate of the fluid discharged from the pump unit 200. The pump unit 200 may further comprise a pressure sensor

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> 205 disposed in association with the fluid section 210 in a manner permitting the sensing of fluid pressure at the fluid outlets 235. For example, the pressure sensor 205 may extend through one or more of the cover plates 242 or other portions of the corresponding pump housing 216 to monitor pressure within the fluid outlet cavity 234 and, thus, the fluid outlets 235 and the corresponding outlet conduits 144.

Kajita at 22:10-26. Accordingly, a person of ordinary skill in the art ("POSITA") would look to the teachings of *Kajita* for, at least, its solutions to starting the pump, monitoring the pressure, and calculating the rate of change. Further, A POSITA would look to *Kajita* and its teachings for combining with *Zhang* and *Conners* to accomplish a wellbore fracturing operation with a first flow rate and changing to a second flow rate due to *Zhang* and *Conners* being directed to this as shown above and below respectively.

Additionally, US Patent No. 4,374,544 to Zhang ("*Zhang*") discloses, for example,

> [a] pumping system for use in a well stimulation application includes a pump controlled by a controller, the controller operating to monitor operation of the pump and determine when cavitation is present or imminent in the pump. When cavitation is present, the controller automatically adjusts an operating condition of the pump reduce pump speed or increase a fluid pressure at the pump inlet.

Zhang at Abstract. *Zhang further* teaches,

> In the diagram of FIG. 1, the controller 130 is connected with or otherwise associated with and configured to exchange information with various sensors and actuators controlling operation of the system 100. More specifically, in the illustrated embodiment, the controller 130 is associated with the power unit 122 via a communication line 132. The communication line 132 may assume any appropriate form of communication of analog and/or digital information and command signals between the power unit 122 and the controller 130 to effect the selective control and monitoring of various parameters controlling the operation of the power unit 122. The controller 130 is further associated with the transmission 126 via a communication line 134, and with the mixer 106 via a communication line 136. An input sensor 138 and an output sensor 140 respectively monitor the flow rate, temperature, composition, pressure and/or viscosity of the inlet and outlet streams of stimulation fluid provided to, and also provided from, the pump 116.

Id. at 4:3-21. Accordingly, a person of ordinary skill in the art ("POSITA") would look to the teachings of *Zhang* for, at least, its solutions to monitoring injection properties and determining a

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second flow rate. Further, A POSITA would look to *Zhang* and its teachings for combining with *Kajita* and *Conners* to accomplish a wellbore fracturing operation with a first flow rate and changing to a second flow rate due to *Kajita* and *Conners* being directed to this as shown above and below respectively.

Additionally, Pat. App. Pub. No. US 2021/0396113A1 to Conners ("*Conners*") discloses, for example,

> [f]urther discussed herein is a non-transient computer-readable medium including instructions that, when executed by one or more processors, causes the one or more processors to perform a method, the method comprising: placing a first wellbore in the subterranean formation; injecting the fluid through the first wellbore into the subterranean formation at an injection rate of R1, wherein R1 is varied with time or fixed; injecting the fluid through the first wellbore into the subterranean formation at an injection rate of R2 for a duration of time D1, wherein R2 is varied with time or fixed and R2 is in the range of 5%-50% of the max of injection rate R1; injecting the fluid through the first wellbore into the subterranean formation at an injection rate of R3, wherein R3 is varied with time or fixed and wherein the max of injection rate R3 is no less than 150% of the minimum of injection rate R2.

Conners at Para. [0024]. *Conners* also teaches For example, '113 patent application, [0110],

> Also disclosed herein is a non-transient computer-readable medium including instructions that, when executed by one or more processors, causes the one or more processors to perform a method, the method comprising: placing a first wellbore in the subterranean formation; injecting the fluid through the first wellbore into the subterranean formation at an injection rate of R1, wherein R1 is varied with time or fixed, subsequently injecting the fluid through the first wellbore into the subterranean formation at an injection rate of R2 for a duration of time D1, wherein R2 is varied with time or fixed and R2 is in the range of 5%-50% of the max of injection rate R1; subsequently injecting the fluid through the first wellbore into the subterranean formation at an injection rate of R3, wherein R3 is varied with time or fixed and wherein the max of injection rate R3 is greater than 150% of the minimum of injection rate R2.

Id. at Para. [0110]. Accordingly, a person of ordinary skill in the art ("POSITA") would look to the teachings of *Conners* for, at least, its solutions to increasing or decreasing the flow rate depending on the monitored injection property. Further, A POSITA would look to *Conners* and its teachings for combining with *Kajita* and *Zhang* to accomplish a wellbore fracturing operation

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with a first flow rate and changing to a second flow rate due to *Kajita* and *Zhang* being directed to this as shown above and below respectively.

U.S. Patent No. 8,849,639 to Brown et al. ("*Brown*") discloses a system for modeling and controlling wellsite operations such as hydraulic fracturing (i.e. stimulation) operations. For example, "the systems and methods described below are also applicable to many different reservoir and subsurface operations, including (besides the aforementioned exploration and production operations for natural gas and other hydrocarbons); storage of natural gas, *hydraulic fracturing* and matrix stimulation to increase reservoir production." *Brown*, col. 3:11-17. Accordingly, a POSITA would look to the teachings of *Brown* for, at least, its methods for modeling and controlling a hydraulic fracturing job. Further, a POSITA would be motivated to look to *Brown* and its teachings for combining with *Pankaj*, *Martysevich*, *Ruhle*, and/or *Dykstra* to accomplish efficient methods for modeling and controlling a hydraulic fracturing job.

U.S. Patent No. 10,787,887 to Pankaj et al. ("*Pankaj*") discloses a system for modeling and controlling wellsite operations such as hydraulic fracturing. For example,

> At the wellsite, measured wellsite data, such as borehole imaging logs, evaluating seismic measurements, ant tracking, sonic measurements, geological measurements, etc., may be used to determine the fracture parameters, such as natural fracture density, spacing and azimuth. Upon running the complex fracture model simulation, the fracture modeling is complete. In order to obtain the dynamic nature of the earth, a reservoir simulation may be performed using numerical analysis. From the reservoir simulation, production parameters (e.g., gas rate, oil rate, water rate, and wellhead pressures) as the well produces post stimulation can be determined.

Pankaj, col. 20:65 – col. 21:9. Accordingly, a POSITA would look to the teachings of *Pankaj* for, at least, its methods for modeling and controlling a hydraulic fracturing job. Further, a POSITA would be motivated to look to *Pankaj* and its teachings for combining with *Brown*, *Martysevich*, *Ruhle*, and/or *Dykstra* to accomplish efficient methods for modeling and controlling a hydraulic fracturing job.

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U.S. Patent No. 11,098,561 to Martysevich et al. ("*Martysevich*") discloses, for example,

> The disclosure improves the analysis of the hydraulic fracturing (HF) break down process of a well system. The analysis can use as inputs collected HF data such as the HF fluid pressure, HF fluid flow rate, and HF fluid composition over one or more time intervals. In some aspects, the perforation parameters and stratigraphic well placement can also be used as inputs. The analysis can also use as inputs the HF model inputs that were used in collecting the HF data. The analysis can determine an effectiveness parameter of the received inputs. HF model inputs can be selected that would best fit a HF job plan goal for the current well system. In some aspects, the HF model inputs can be communicated to a well system controller of the current well system to further direct HF job plan operations.

Martysevich, Abstract. Accordingly, a POSITA would look to the teachings of *Martysevich* for, at least, its methods for modeling and controlling a hydraulic fracturing job. Further, a POSITA would be motivated to look to *Martysevich* and its teachings for combining with *Brown*, *Pankaj*, *Ruhle*, and/or *Dykstra* to accomplish efficient methods for modeling and controlling a hydraulic fracturing job.

US Patent No. 11,306,572 to Ruhle et al. ("*Ruhle*") discloses, for example, systems and methods for modeling and controlling a hydraulic fracturing job. *Ruhle*, Abstract. *Ruhle* discloses "either or both surface diagnostics data and subsurface diagnostics data…ecan be used to train/retrain the fracturing completion model" *Id*. at 29:36-39. *Ruhle* discloses "surface diagnostics data can be gathered by applicable sensors, equipment, and surface monitoring technique, associated with hydraulic fracturing." *Id*. at 22:65-23:1. *Ruhle* further discloses "the fracturing completion plan can be a new/replacement fracturing completion plan that can be implemented to replace a current fracturing completion plan." *Id*. at 27:32-35. Finally, *Ruhle* discloses "once a fracturing completion plan is selected from the plurality of possible fracturing completion plans, then the method can include facilitating performance of the fracture completion job according to the selected fracturing completion plan." *Id*. at 29:4-9. Accordingly, a POSITA would look to the teachings of *Ruhle* for, at least, its methods for modeling and controlling a

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hydraulic fracturing job. Further,a POSITA would be motivated to look to *Ruhle* and its teachings for combining with *Brown*, *Pankaj*, *Martysevich*, and/or *Dykstra* to accomplish efficient methods for modeling and controlling a hydraulic fracturing job.

U.S. Patent No. 10,408,021 to Dykstra et al. ("*Dykstra*") discloses, for example,

> The present disclosure describes, generally, illustrative systems and methods for managing production of subterranean reservoirs, including upstream production systems. In one general implementation of the present disclosure, a computer-implemented method for managing a hydraulic fracturing operation includes receiving a selection of a proxy model that represents a first principles model of a hydraulic fracturing operation, the proxy model including at least one property of a plurality of properties of the first principles model associated with the hydraulic fracturing operation; simulating the selected proxy model to generate a modeled output based on the property; and determining, based on the modeled output, at least one of a value of a control setpoint for hydraulic fracturing operation equipment or a value of a variable manipulated by a control system communicably coupled to the hydraulic fracturing operation equipment.

Dykstra, col. 1:61 – col. 2:9. Accordingly, a POSITA would look to the teachings of *Dykstra* for, at least, its methods for modeling and controlling a hydraulic fracturing job. Further, a POSITA would be motivated to look to *Dykstra* and its teachings for combining with *Brown*, *Pankaj*, *Martysevich*, and/or *Ruhle* to accomplish efficient methods for modeling and controlling a hydraulic fracturing job.

Patent App. Pub. No. U.S. 2016/0326853 to Fredd et al. ("*Fredd*") discloses, for example, "providing a plurality of cased wellbores penetrating the subterranean formation, wherein the plurality of cased wellbores are fluidly connected with a common fracturing fluid source." *Fredd*, claim 16. *Fredd* further discloses that "the treatment fluid delivery rate could vary for each wellbore, and be specifically tailored for each, such as 18 barrels per minute for a first wellbore . . . ." *Id.* at [0018]. "In some instances, modeling may be conducted in conjunction with the treatment. Some modeling steps may include acquiring subterranean formation layer geomechanical properties from well completion and reservoir data for the subterranean formation,

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and a natural fracture network description for the subterranean formation." *Id.* at [0038]. *Fredd* continues "A result of the design for the treating the subterranean formation is then made, the treatment carried out, and adjustment to the treatment design made if the result is not satisfactory." *Id.* *Fredd* discloses "wellbore casings 214 and 216 may then be perforated to create fluid passageways 234 and 236 adjacent formation areas 230 and 232." *Id.* at [0030]. Accordingly, a POSITA would look to the teachings of *Fredd* for, at least, its solutions to selecting a pump of known operating pump capacity, fluidly connecting a pump to a common pumping source, each wellbore having at least one perforation, configuring the wellbores based on the known rate range, and concurrently providing fracturing fluid to fracture the perforation. Accordingly, a POSITA looks to *Fredd* and its teachings for combining with *Cherewyk*, *Pitcher*, *Kraynek*, *Shampine*, *Wutherich*, and *Demong* for enhancing fluid production in multiple wellbore stimulation.

Patent App. Pub. No. U.S. 2011/0048695 to Cherewyk et al. ("*Cherewyk*") discloses, for example, "a large common manifold has been employed to connect a fracturing fluid inlet selectively to one or more of the wellheads of the multiple wells." *Cherewyk*, [0003]. *Cherewyk* continues "[t]hus, multiple wells can be stimulated simultaneously with multiple trains of pumpers and manifolds." *Id.* *Cherewyk* further discloses "[t]he fracturing fluid F with proppant P and the proppant slurry PS are mixed at the wellheads 14 to a final concentration or design load of proppant P for delivery to the wells 16." *Id.* at [0067]. Accordingly, a POSITA would look to the teachings of *Cherewyk* for, at least, its solutions to fluidly connecting a pump to a common pumping source. Accordingly, a POSITA looks to *Cherewyk* and its teachings for combining with *Fredd*, *Pitcher*, *Kraynek*, *Shampine*, *Wutherich*, and *Demong* for more cost effective and robust methods for delivery of stimulation fluids to multiple wells.

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Patent App. Pub. No. U.S. 2014/0352968 to Pitcher et al. ("*Pitcher*") discloses, for example, "simultaneously fracturing multiple wells" which may include "output valves to independently control flow of fracturing fluid from the manifold to each of multiple wells." *See Pitcher*, Abstract. *Pitcher* further discloses,

> a desired amount of fracturing spear fluid (e.g., fifty barrels) can be provided to each well 12 and 14 simultaneously, such as by opening an input valve 56 to allow the spear fluid to enter the manifold 44 and opening output valves 48 such that equal amounts of the spear fluid enters each well.

Id. at [0034]. *Pitcher* further recites "fracturing processes typically include injecting a fracturing fluid—often a mixture or slurry including sand and water—into the well to increase the well's pressure and form the man-made fractures." *Id.* at [0003]. Accordingly, a POSITA would look to the teachings of *Pitcher* for, at least, its solutions selecting a pump of known operating pump capacity, fluidly connecting a pump to a common pumping source, configuring the wellbores based on the known rate range, and concurrently providing fracturing fluid to fracture the perforation. Accordingly, a POSITA looks to *Pitcher* and its teachings for combining with *Fredd*, *Cherewyk*, *Kraynek*, *Shampine*, *Wutherich*, and *Demong* for method of simultaneously fracturing multiple wells.

Patent App. Pub. No. U.S. 2019/0249527 to Kraynek ("*Kraynek*") discloses, for example, "[b]y applying simultaneous hydraulic pressure to both wellbores, at least one curved fracture trajectory will be caused to be transmitted from each wellbore . . . ." *Kraynek*, [0003]. *Kraynek* further discloses "[a] hydraulic fracture may be formed by injecting a fracturing fluid into a wellbore with a high enough pressure through the well bore's perforations." *Id.* at [0037]. *Kraynek* continues "the method 600 includes creating 602 a fracture network in a target formation by simultaneously pressurizing the target formation on opposing sides with hydraulic fracturing liquid through different wells creating a series of fractures . . . ." *Id.* at [0070]. Accordingly, a POSITA

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would look to the teachings of *Kraynek* for, at least, its solutions to each wellbore having at least one perforation and concurrently providing fracturing fluid to fracture the perforation. Accordingly, a POSITA looks to *Kraynek* and its teachings for combining with *Fredd*, *Cherewyk*, *Pitcher*, *Shampine*, *Wutherich*, and *Demong* for method of simultaneously fracturing multiple wells.

U.S. Patent No. 7,845,413 to Shampine et al. ("*Shampine*") discloses, for example, "if it is estimated that the well pressure and the required flow rate are 6000 psi (pounds per square inch) and 68 BPM (Barrels Per Minute), then the pump system 200 would need to supply 10,000 hydraulic horsepower to the fracturing fluid (i.e., 6000*68/40.8)." *Shampine*, 4:1-8. *Shampine* further discloses "the clean side pumps 1201 are shown remotely located from, and supplying a clean fluid to, the wellbores 1222 and 1222' of both a first well 1220 and a second well 1220'." *Id.* at 3-4:65-8. Accordingly, a POSITA would look to the teachings of *Shampine* for, at least, its solutions to selecting a pump of known operating pump capacity, fluidly connecting a pump to a common pumping source, configuring the wellbores based on the known rate range, and concurrently providing fracturing fluid to fracture the perforation. Accordingly, a POSITA looks to *Shampine* and its teachings for combining with *Fredd*, *Cherewyk*, *Pitcher*, *Kraynek*, *Wutherich*, and *Demong* for methods of decreasing erosion in pumps.

Patent App. Pub. No. U.S. 2015/0176387 to Wutherich ("*Wutherich*") discloses, for example, "hydraulically fracturing a geological formation disposed on the wellbore based" on a calculated flow rate of a pumping operation of a hydraullic fracturing process. *See Wutherich*, [0003]. Additionally, "a hydraulic fracturing plan may be determined based on the flow rate of each perforation." *Id.* at [0039]. *Wutherich* also discloses "a proppant, as known in the art, may be pumped into the fractures (700) to prevent the fractures (700) from sealing." *Id.* at [0063].

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Accordingly, a POSITA would look to the teachings of *Wutherich* for, at least, its solutions to selecting a pump of known operating pump capacity, fluidly connecting a pump to a common pumping source, each wellbore having at least one perforation, configuring the wellbores based on the known rate range, and concurrently providing fracturing fluid to fracture the perforation. Accordingly, a POSITA looks to *Wutherich* and its teachings for combining with *Fredd*, *Cherewyk*, *Pitcher*, *Kraynek*, *Shampine*, and *Demong* for methods of hydraulically fracturing wells.

Patent App. Pub. No. U.S. 2015/0176387 to Demong et al. ("*Demong*") discloses, for example, a system for "distributing fluid to a plurality of wellbores drilled from a common pad includes at least two fluid conduits extending between the wellbores." *Demong* at [0012]. *Demong* continues "[t]he fluid may be hydraulic fracturing fluid, for example, water or breakable gel having sand or ceramic particles as proppant." *Id.* at [0029]. *Demong* further discloses "the flow lines 14, 15 and the manifold lines 24, 26 may each include an erosion sensor 44 downstream of the bend in the flow lines 14, 15 or the coupling 20, respectively, or other places in the flow path as required." *Id.* at [0026]. Accordingly, a POSITA would look to the teachings of *Demong* for, at least, its solutions to fluidly connecting a pump to a common pumping source, each wellbore having at least one perforation, and concurrently providing fracturing fluid to fracture the perforation. Accordingly, a POSITA looks to *Demong* and its teachings for combining with *Fredd*, *Cherewyk*, *Pitcher*, *Kraynek*, *Shampine*, and *Wutherich* for methods of controlling distribution of treatment fluid to multiple wells.

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b. Identification of Specific Combinations of References

To narrow the issues, Defendants provide a preliminary identification of the specific combination of references that invalidate one or more of the Asserted Claims for each of the Asserted Patents under 35 U.S.C. § 103.

The following combinations of references are merely examples of obvious combinations that a person of ordinary skill in the art would combine to reach the inventions embodied by each of the Asserted Claims of the Asserted Patents. Nothing within these Preliminary Invalidity Contentions, including the enumerated combinations discussed below, should be taken as any sort of concession that these would be the only combinations that one of ordinary skill in the art would use to meet the claim limitations. Indeed, Defendants contend that any of the cited references for each of the Asserted Patents would be combined by a person of ordinary skill in the art to reach the invention of the Asserted Claims.

For at least the reasons described herein, it would have been obvious to one of ordinary skill in the art to combine any number of the prior art references, with specific regard to those discussed below, to meet the limitations of the Asserted Claims. As such, Defendants' inclusion of exemplary references, in view of the factors and motivations identified in the preceding paragraphs, do not preclude Defendants from identifying other invalidating combinations as appropriate.

Obviousness Prior Art Combinations: '949 Patent

Defendants contend that it would have been obvious for one of ordinary skill in the art to combine any one of to meet all of the elements of one or more of Asserted Claims 1-14 of the '949 Patent.

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For instance, one of ordinary skill in the art would combine *Halliburton Services* with *BJ Services* to teach all of the limitations of the Asserted Claims of the ’949 Patent. Similarly, one of ordinary skill in the art would combine the reference of *BJ Services* with *Vicknair* and/or *Stephenson*.. Furthermore, one of ordinary skill in the art would combine to teach all of the limitations of the Asserted Claims of the ’949 Patent. Additionally, one of ordinary skill in the art would combine *Vicknair* with *Stephenson*, to teach all of the limitations of the Asserted Claims of the ’949 Patent.

Obviousness Prior Art Combinations: ’325 Patent

Defendants contend that it would have been obvious for one of ordinary skill in the art to combine any one of to meet all of the elements of one or more of Asserted Claims 1-22 of the ’325 Patent. For instance, one of ordinary skill in the art would combine *Koederitz* with *Hutchinson and Mansure* and/or *Hopkins* to teach all of the limitations of the Asserted Claims of the ’325 Patent. Furthermore, one of ordinary skill in the art would combine *Koederitz 816* with *Hutchinson* and *Mansure* and/or *Hopkins* to teach all of the limitations of the Asserted Claims of the ’325 Patent. Additionally, one of ordinary skill in the art would combine *Koederitz* with *Koederitz 816* and *Mansure* and/or *Hopkins* to teach all of the limitations of the Asserted Claims of the ’325 Patent.

Obviousness Prior Art Combinations: ’394 Patent

Defendants contend that it would have been obvious for one of ordinary skill in the art to combine any one of *Lessi* (chart C1), *Lacy* (chart C2), *Zakiewicz* (chart C3), *Neal* (chart C4), *Cooper* (chart C5), *Luk* (chart C6), and/or *Walker* (chart C7) to meet all of the elements of one or more of Asserted Claims 1-19, 21-27 of the ’394 Patent.

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For instance, one of ordinary skill in the art would combine *Zakiewicz* with any one of *Lessi*, *Lacy*, *Neal*, *Cooper*, *Luk*, and/or *Walker* to teach all of the limitations of the Asserted Claims of the ’394 Patent. Similarly, one of ordinary skill in the art would combine *Lessi* with *Lacy*, and *Neal*, *Cooper*, *Luk*, *Zakiewicz*, and/or *Walker* to teach all of the limitations of the Asserted Claims of the ’394 Patent. Similarly, one of ordinary skill in the art would combine *Luk* with *Lessi*, and *Neal*, *Cooper*, Zakiewicz, and/or *Walker*. Additionally, one of ordinary skill in the art would combine *Cooper* with *Walker*, and *Luk*, *Lessi*, *Zakiewicz*, and/or *Neal*. Additionally, one of ordinary skill in the art would combine *Luk* with *Walker*, and *Cooper*, *Lessi*, *Zakiewicz*, and/or *Neil*.

Obviousness Prior Art Combinations: ’213 Patent

SWS contends that it would have been obvious for one of ordinary skill in the art to combine any one of *Zhang* (chart D1), *Mu* (chart D2), *Westerman* (chart D3), *Haustveit* (chart D4), and/or *Dusterhoft* (chart D5) to meet all of the elements of one or more of Asserted Claims 1-20 of the ’213 Patent.

For instance, one of ordinary skill in the art would combine *Zhang* with *Mu*, *Westerman*, *Haustveit* and/or *Dusterhoft* to teach all of the limitations of the Asserted Claims of the ’213 Patent. Furthermore, one of ordinary skill in the art would combine: *Mu* with *Zhang*, *Westerman*, *Haustveit*, and/or *Dusterhoft* to teach all of the limitations of the Asserted Claims of the ’213 Patent. Additionally, one of ordinary skill in the art would combine: *Westerman* with *Zhang*, *Mu*, *Haustveit*, and/or *Dusterhoft* to teach all of the limitations of the Asserted Claims of the ’213 Patent. Additionally, one of ordinary skill in the art would combine: *Haustveit* with *Zhang*, *Mu*, *Westerman*, and/or *Dusterhoft* to teach all of the limitations of the Asserted Claims of the ’213

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Patent. Additionally, one of ordinary skill in the art would combine: *Zhang*, *Mu*, or *Westerman* with *Dusterhoft* to teach all of the limitations of the Asserted Claims of the ’213 Patent.

Obviousness Prior Art Combinations: ’282 Patent

Defendants contend that it would have been obvious for one of ordinary skill in the art to combine any one of *Kajita* (chart E1), *Zhang* (chart E2), and/or *Conners* (chart E3) to meet all of the elements of one or more of Asserted Claims 1-20 of the ’282 Patent.

For instance, one of ordinary skill in the art would combine *Kajita* with *Zhang*, and/or *Conners* to teach all of the limitations of the Asserted Claims of the ’282 Patent. Similarly, one of ordinary skill in the art would combine *Conners* with *Kajita* and/or *Zhang* to teach all of the limitations of the Asserted Claims of the ’282 Patent. Additionally, one of ordinary skill in the art would combine *Zhang* with, *Kajita* and/or *Conners* to teach all of the limitations of the Asserted Claims of the ’282 Patent.

Obviousness Prior Art Combinations: ’058 Patent

Defendants contend that it would have been obvious for one of ordinary skill in the art to combine any one of to meet all of the elements of one or more of Asserted Claims 1-20 of the ’058 Patent.

For instance, one of ordinary skill in the art would combine *Brown* with *Pankaj*, *Martysevich*, *Ruhle*, and/or *Dykstra* to teach all of the limitations of the Asserted Claims of the ’058 Patent. Similarly, one of ordinary skill in the art would combine *Pankaj* with *Brown* and/or *Dykstra* to teach all of the limitations of the Asserted Claims of the ’058 Patent. Additionally, one of ordinary skill in the art would combine *Martysevich* with *Ruhle* and/or *Dykstra* to teach all of the limitations of the Asserted Claims of the ’058 Patent.

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Obviousness Prior Art Combinations: ’943 Patent

Defendants contend that it would have been obvious for one of ordinary skill in the art to combine any one of *Fredd* (chart G1), *Cherewyk* (chart G2), *Pitcher* (chart G3), *Kraynek* (chart G4), *Shampine* (chart G5), *Wutherich* (chart G6), and/or *Demong* (chart G7) to meet all of the elements of one or more of the Asserted Claims 1-20 of the ’943 Patent.

For instance, one of ordinary skill in the art would combine *Fredd* with any one of *Cherewyk*, *Pitcher*, *Kraynek*, *Shampine*, *Wutherich*, and/or *Demong* to teach all of the limitations of the Asserted Claims of the ’943 Patent. Additionally, one of ordinary skill in the art would combine *Pitcher* with *Fredd*, and *Cherewyk*, *Pitcher*, *Kraynek*, *Shampine*, *Wutherich*, and/or *Demong* to teach all of the limitations of the Asserted Claims of the ’943 Patent. Similarly, one of ordinary skill in the art would combine *Pitcher* with *Kraynek*, and *Cherewyk*, *Pitcher*, *Fredd*, *Shampine*, *Wutherich*, and/or *Demong* to teach all of the limitations of the Asserted Claims of the ‘943 Patent. Additionally, one might combine *Shampine* with *Fredd* or *Kraynek* to teach all of the limitations of the Asserted Claims of the ’943 Patent. Similarly, one might combine *Shampine* with *Fredd*, and *Cherewyk*, *Pitcher*, *Kraynek*, *Wutherich*, and/or *Demong* to teach all of the limitations of the Asserted Claims of the ’943 Patent. Similarly, one might combine *Shampine* with *Kraynek*, and *Cherewyk*, *Pitcher*, *Fredd*, *Wutherich*, and/or *Demong* to teach all of the limitations of the Asserted Claims of the ’943 Patent. Additionally, one might combine *Wutherich* with *Demong*, and *Fredd*, *Pitcher*, *Kraynek*, and/or *Shampine* to teach all of the limitations of the Asserted Claims of the ’943 Patent.

c. Secondary Considerations

Defendants further contend that an analysis of secondary considerations supports the view that each Asserted Claim of each Asserted Patent is obvious. Secondary considerations are factors

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that the court evaluates as objective indicia of obviousness or nonobviousness of an alleged invention, and include: (1) commercial success of the claimed subject matter; (2) long felt but unresolved needs; (3) failure of others; (4) teaching away from the claimed subject matter by the prior art; (5) copying or acclamation by others; and (6) skepticism of experts. *See, e.g.*, *Ruiz v. A.B. Chance Co.*, 357 1270, 1274 (Fed. Cir. 2004); *Ecolochem, Inc. v. Southern Cal. Edison Co.*, 227 F.3d 1361, 1379 (Fed. Cir. 2000).

At this time, Halliburton Plaintiffs have offered no argument or evidence of secondary considerations of non-obviousness to rebut. Defendants reserve the right to supplement these Preliminary Invalidity Contentions with evidence, including expert testimony, in accordance with the Court's orders governing patent cases, the Parties' Agreed Scheduling Order, and the Federal Rules of Civil Procedure, and as discovery continues in this matter.

C. Other Invalidity Grounds

1. Ineligible Subject Matter Under 35 U.S.C. § 101

To determine whether a patent claims ineligible subject matter, the court is to engage in a two-step process. First, the court is to determine whether the claims at issue are directed to one of the patent-ineligible concepts – laws of nature, natural phenomena, and abstract ideas. *Alice Corp. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2355 (2014). Both the Federal Circuit and the Supreme Court have found it sufficient to compare the claims at issue to those claims already found to be directed to an abstract idea in previous cases. *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1334 (Fed. Cir. 2016).

If the claims at issue are found to recite an abstract idea, the court must proceed to step two, where it analyzes whether the claims recite "additional features" that embody an "inventive concept." *Alice*, 134 S. Ct. at 2357. That is, the court must consider the elements of each claim

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both individually and as an ordered combination to determine whether the additional elements transform the nature of the claim into a patent-eligible application. *Id*. The additional features must be more than well-understood, routine, conventional activities. *Mayo Collaborative Servs. v. Prometheus Labs, Inc.*, 132 S. Ct. 1289, 1298 (2012).

With respect to the Asserted Claims of the Asserted Patents, Defendants contend that, at least, Claims 1-22 of the '325 Patent and/or Claims 1-14 of the '949 Patent are invalid because they are directed towards ineligible subject matter under 35 U.S.C. § 101, as contextualized by the *Alice/Mayo* framework. For instance the identified claims are all directed towards an abstract idea, and the claims fail to recite any "additional features" that "embody the invention concept" of the subject matter in the claims. Accordingly, the identified claims of the '325 Patent and '949 Patent are invalid for being directed to ineligible subject matter.

2. Indefiniteness Under 35 U.S.C. § 112, Paragraph 2

Section 112 requires that the specification "conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." 35 U.S.C. § 112, ¶ 2. As the Supreme Court has stated, this Section 112 requires that the "claims, viewed in light of the specification and the prosecution history, inform those skilled in the art about the scope of the invention with reasonable certainty." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 910 (2014).

Accordingly, Defendants identify the following terms of the Asserted Claim that are indefinite for failure to inform those skilled in the art about the scope of the invention with the requisite amount of reasonable certainty to render the term definite in Table 3 below. For instance, Defendants contend that the specification and prosecution history of each of the Asserted Patents fails to, at least, sufficiently define, describe, or discuss the identified terms, or provide inconsistent

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or ambiguous terms to a degree that one of ordinary skill in the art would not be able to understand the scope of the claimed invention. Accordingly, the Asserted Claims that contain the follow terms, as well as those that depend from those claims, are invalid for indefiniteness.

Table 3 Indefinite Terms	
Indefinite Term(s)	**Asserted Claim Nos.**
U.S. Patent No. 7,836,949	
"virtual rate control system"	Claims 1, and 8
"a proportionality constant associated with the virtual rate control"	Claims 2 and 9
U.S. Patent No. 7,841,394	
"centralized well operations"	Claims 1, 24, 25, 26, and 27
"manufactures"	Claims 1, 23, 24, 25, 26, and 27
"well operations factory"	Claims 1, 23, 24, 25, 26, and 27
U.S. Patent No. 11,377,943	
"rate range"	Claims 1, 11, and 20
U.S. Patent No. RE 46,725	
"pre-gel storage unit"	Claims 83-86, 89, 91, and 92
"hydrate"	Claims 83 and 89
U.S. Patent No. 11,085,282	
"injection property"	Claims 1, 2, 3, 4, and 5.

3. Lack of Enablement and/or Written Description Under 35 U.S.C. § 112, Paragraph 1

The disclosure of the Asserted Patents fails to satisfy the requirements of 35 U.S.C. § 112, ¶1 because it fails to provide an adequate written description of the claimed inventions embodied by one or more of the Asserted Claims. Section 112 requires that a patent specification "contain a written description … of the manner and process of making and using [the invention] in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same." 35 U.S.C. § 112, ¶1. To

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fulfill that written description requirement, "the patent specification must describe an invention in sufficient detail that one skilled in the art can clearly conclude that the inventor invented what is claimed." *Kao Corp. v. Unilever US, Inc.*, 441 F.3d 963, 967-68 (Fed. Cir. 2006); *LizardTech, Inc. v. Earth Res. Mapping, Inc.*, 424 F.3d 1336, 1345 (Fed. Cir. 2005).

Accordingly, in Table 4 below, Defendants identify the following terms of the Asserted Patents that lack enablement or a sufficient written description to render the claims definite.

Table 4
Terms with Lack of Enablement or Written Description

Indefinite Term(s)	Asserted Claim Nos.
U.S. Patent No. 7,836,949	
"virtual rate control system"	Claims 1, and 8
"a proportionality constant associated with the virtual rate control"	Claims 2 and 9
U.S. Patent No. 7,574,325	
"which node"	Claim 18
U.S. Patent No. 7,841,394	
"centralized well operations"	Claims 1, 24, 25, 26, and 27
"manufactures"	Claims 1, 23, 24, 25, 26, and 27
"well operations factory"	Claims 1, 23, 24, 25, 26, and 27
"not to the second well"	Claims 1, 25, and 27
"not to the first well"	Claims 1, 25, and 27
"different compositions"	Claims 1, 24, 25, and 26
"third connection"	Claims 16 and 17
"fourth connection"	Claims 18 and 19
"on a boat"	Claim 20
U.S. Patent No. 11,377,943	
"eight pounds of solids per gallon of liquid"	Claims 4 and 14
"a proportion at which the solids-laden fluid stream is admixed with the liquid-phase-only fluid stream is less	Claims 6 and 16

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Table 4 Terms with Lack of Enablement or Written Description	
Indefinite Term(s)	**Asserted Claim Nos.**
than (i) 1-to-2, (ii) 1-to-3, (iii) 1-to-4, or (iv) 1-to-5"	
U.S. Patent No. 11,085,282	
"injection property"	Claims 1, 2, 3, 4, and 5.

4. On-Sale Bar Under 35 U.S.C. § 102

The on-sale bar of 35 U.S.C. § 102(b) (AIA § 102(a)(1)) precludes patent protection for any invention that was "on sale" in this country more than one year prior to the filing of a patent application. *Pfaff v. Wells Electronics, Inc.*, 525 U.S. 55, 67-68 (1998); *see also Quest Integrity USA, LLC v. Cokebusters USA, Inc.*, 924 F.3d 1220, 1227 (Fed. Cir. 2019) ("The on-sale bar seeks to prevent '[a]ny attempt to use [the claimed invention] for a profit, and not by way of experiment,' for more than one year before filing for a patent application.") (citing *Pfaff*, 525 U.S. at 65). The on-sale bar applies when (1) the product included in a commercial offer for sale and (2) the invention is ready for patenting. *Pfaff*, 525 U.S. at 67; *see also GS CleanTech Corp. v. Adkins Energy, LLC*, 951 F.3d 1310, 1324 (Fed. Cir. 2020). Accordingly, when both conditions are met, an inventor will lose his right to a patent. *Pfaff*, 525 U.S. at 65.

As mentioned, discovery has barely begun for this dispute and, therefore, Defendants' prior art investigation, including any investigation into the alleged prior sale of any invention embodied by the Asserted Claims of one or more of the Asserted Patents, is not yet complete. Accordingly, Defendants expressly reserve the right to supplement these Preliminary Invalidity Contentions with additional items of prior art under 35 U.S.C. §§ 102(a), (b), (e), and/or (g) located during the course of discovery or further investigation.

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III. PRODUCTION ACCOMPANYING DEFENDANTS' PRELIMINARY INVALIDITY CONTENTIONS

Pursuant to the Court's Order Governing Proceedings–Patent Case and the Parties' Agreed Proposed Scheduling Order (Dkt. 20) for this case, Defendants have produced or will produce or make available for inspection and copying concurrently with its Preliminary Invalidity Contentions the following:

- Technical documents sufficient to show the operation of Defendants' Accused Products, previously produced as: USWS0009901-USWS0021112.
- A copy of certain prior art referenced in its Preliminary Invalidity Contentions were previously produced as: USWS0021390-USWS00221397, USWS0021398-USWS0021411, USWS0021784-USWS0021813, HAL-USWS043318-HAL-USWS043342, and HAL-USWS034132-HAL-USWS034148.
- A copy of each item of prior art referenced in its Preliminary Invalidity Contentions were previously produced as: USWS90X-0003781-USWS90X-0005389.

Dated: January 17, 2023

Respectfully submitted,

By: /s/ *John A. Yates*

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CERTIFICATE OF SERVICE

I hereby certify that on January 17, 2023, a true and correct copy of the foregoing document was electronically filed with the Clerk of Court using the CM/ECF system, which will send notifications of such filing to all counsel of record.

/s/ John A. Yates
John A. Yates

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