

UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD

PGR2023-00023

U.S. PATENT NO. 11,373,058 B2

PROFRAC HOLDING CORPORATION
and U.S. WELL SERVICES, LLC,
Petitioners,
v.

HALLIBURTON ENERGY SERVICES, INC.,
Patent Owner.

Deposition of
ROBERT DURHAM, Ph.D.
Thursday, May 2, 2024
9:28 a.m. Central

Court Stenographer:
Myrina A. Kleinschmidt, RMR, CRR, CRC

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18
19 ALSO PRESENT:

20 Sarah Kleinschmidt

21 TRIAL TECHNICIAN

22 * * * * *

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C O N T E N T S

DEPONENT: ROBERT DURHAM, Ph.D.	PAGE
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E X H I B I T S

EXHIBIT	DESCRIPTION	PAGE
Exhibit 1001	Unite States Patent 11,373,058 B2. 15 pgs.	18
Exhibit 1005	United States Patent Application Publication. Pub. No.: US 2018/0230782 A1. Pankaj et al. 29 pgs.	46
Exhibit 1046	Wikipedia page on "Reservoir modeling." 4 pgs.	23

1	Exhibit 1047	Nexus User Guide.	25
2		276 pgs.	
3	Exhibit 2013	Declaration of	18
4		Dr. Robert A. Durham.	
5		109 pgs.	

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1 DEPOSITION, held pursuant to
2 NOTICE OF TAKING DEPOSITION, and held with
3 the understanding of counsel that all parties
4 are appearing remotely via the Zoom remote
5 platform. By participating in this
6 deposition, counsel have agreed to the oath
7 being administered remotely and the testimony
8 being transcribed remotely by the court
9 stenographer regardless of the locale of the
10 deponent.

11 WHEREUPON, the following proceedings
12 were duly had:

13 TRIAL TECHNICIAN: Okay. We are
14 now on the record. My name is Sarah
15 Kleinschmidt, and I'm a trial technician with
16 Twin West Reporting. Today's date is
17 May 2nd, 2024, and the time is 9:29 a.m.
18 Central time.

19 This is the deposition of
20 Dr. Robert Durham and is being held in the
21 matter of Profrac Holding Corporation and
22 U.S. Well Services, LLC, versus Halliburton

1 Energy Services, Incorporated.

2 By participating in this
3 deposition, all parties have agreed to our
4 court reporter administering the oath and
5 transcribing the testimony remotely.

6 Will counsel please identify
7 themselves for the record and who they
8 represent, after which our court reporter
9 will administer the oath.

10 MR. FERGUSON: This is Brian
11 Ferguson. I'm with Winston & Strawn. We
12 represent the petitioners, Profrac and U.S.
13 Well.

14 MR. WALTERS: And this is Chad
15 Walters for Baker Botts -- with Baker Botts,
16 and we represent patent owner Halliburton.

17 (WHEREUPON, the oath was
18 administered by the court stenographer.)

19 WITNESS RESPONSE: I do.

20 ROBERT DURHAM, Ph.D.,
21 a witness in the above-entitled proceedings,
22 after having been first duly sworn,

1 testified under oath as follows:

2 EXAMINATION

3 BY MR. FERGUSON:

4 Q. Good morning, Dr. Durham.

5 A. Good morning.

6 Q. Can you hear me okay?

7 A. Yes.

8 Q. Could you please state your full name
9 and address for the record.

10 A. Robert Allan, A-l-l-a-n, Durham. And
11 the lab is 17350 East Highway 64, Bixby,
12 B-i-x-b-y, Oklahoma 74008.

13 MR. FERGUSON: I'll ask Sarah to
14 pull up what we have identified as the Notice
15 of Deposition.

16 BY MR. FERGUSON:

17 Q. And I just want to confirm that
18 you're here today in response to that Notice of
19 Deposition.

20 TRIAL TECHNICIAN: All right.
21 And just to confirm, we're not going to mark
22 this as an exhibit, correct?

1 MR. FERGUSON: That's right.

2 TRIAL TECHNICIAN: Okay. Thank
3 you.

4 BY MR. FERGUSON:

5 Q. Can you see that okay, Doctor?

6 A. Yes.

7 Q. And you're here today in response to
8 this Notice of Deposition; is that right?

9 A. Yes.

10 Q. You've been deposed before, right?

11 A. Yes, sir.

12 Q. About how many times, do you know?

13 A. Over a hundred.

14 Q. So you know the routine. I'll just
15 ask that you please give verbal answers to all
16 questions. And please wait for me to finish a
17 question before you give any answer. If a
18 question I ask is unclear to you, feel free to ask
19 for clarification.

20 And we can take a break any time that
21 you wish. I would just ask that if we have a
22 pending question, you answer the question before

1 we take the break. Is that okay?

2 A. Yes, sir.

3 Q. Okay. Do you have any papers in
4 front of you?

5 A. Yes. I have a notebook.

6 Q. And what's in the notebook?

7 A. A clean copy of my declaration, the
8 '058 patent, Pankaj reference, the Payne
9 reference, Dawson, Lecerf, Klumpen, and
10 Dr. Nikolaou's declaration.

11 Q. And there is no writing on any of
12 those documents; is that accurate?

13 A. That's correct.

14 Q. Okay. And you have submitted a
15 declaration in connection with this PGR
16 proceeding, right?

17 A. Yes, sir.

18 Q. And that's Exhibit 2013. You say you
19 have a copy of it there?

20 A. Yes. That's correct. And I do have
21 a copy.

22 Q. Okay. And is Exhibit 2013, then, a

1 copy of the declaration that you submitted?

2 A. Yes, it is.

3 Q. Just so we're working from the same
4 document, is your signature on page 94?

5 A. Yes, sir, it is.

6 Q. Great. Sitting here today, is there
7 anything that you would like to change in this
8 declaration or make any corrections to?

9 A. No. There were a couple of typos,
10 but they're insignificant.

11 Q. Okay. About how many hours did you
12 spend preparing this declaration?

13 A. Oh, I have no way of knowing.

14 Q. Do you submit invoices for your work?

15 A. Yes, sir.

16 Q. Would your invoice reflect how many
17 hours you spent?

18 A. Yes.

19 Q. Okay. Did you meet with anyone to
20 prepare for today's deposition?

21 A. Yes, sir.

22 Q. And who did you meet with?

1 A. I met with counsel from Baker Botts
2 yesterday for about four hours. I would say three
3 or four hours.

4 Q. Who was the counsel?

5 A. Mr. Walters and Mr. Stavinoha.

6 Q. If we can look at paragraph 17 in
7 your declaration, this is a list of materials and
8 exhibits that you considered in preparing the
9 declaration; is that accurate?

10 A. Yes, it is.

11 Q. And did you consider any other
12 documents besides those that are listed in
13 paragraph 17 in preparing this declaration?

14 A. No, sir. No other documents.

15 Q. Did you review the institution
16 decision that the Patent Trial and Appeal Board
17 issued in this proceeding?

18 A. Yes. I do recall that I did. Should
19 be on the list. If not, I just missed it.

20 Q. Okay. And your CV is included in
21 this declaration as well; is that right? And
22 that's on page 96 of the PDF, of the document.

1 A. Yes, sir. That's -- yes, sir, that's
2 correct. Starts on page 96.

3 Q. Okay. And so this represents your
4 educational history, work history. It includes
5 publications that you authored or co-authored; is
6 that right?

7 A. Yes, sir. That's correct.

8 Q. So you have an electrical engineering
9 degree, a B.S., from the University of Tulsa; is
10 that right?

11 A. Yes, sir. That's correct.

12 Q. What year did you receive that?

13 A. 1992.

14 Q. Okay. And then you received a
15 Master's of engineering from the University of
16 Tulsa as well; is that right?

17 A. Yes, sir. That's correct.

18 Q. And when was that?

19 A. 1997.

20 Q. Okay. And then you have a Ph.D. from
21 Kennedy-Western University. When did you receive
22 that?

1 A. 2004.

2 Q. And what's the subject matter of the
3 Ph.D. you received?

4 A. Engineering management.

5 Q. It's my understanding that
6 Kennedy-Western University changed its name to
7 Warren National University. Is that right? Do
8 you know that?

9 A. I've heard something about that, yes.
10 I think that took place after I was finished.

11 Q. Okay. And neither Kennedy-Western
12 University nor Warren National University exist
13 today; is that right?

14 A. That's my understanding, yes.

15 Q. And do you know when Warren National
16 University ceased operations?

17 A. No, sir. It was sometime after I was
18 finished.

19 Q. Okay. And at least one reason that
20 Warren National University no longer exists is
21 because it was not granted accreditation by the
22 Higher Learning Commission; is that accurate?

1 A. I don't know that, sir.

2 Q. So you have no knowledge of what
3 ended up happening to Kennedy-Western University
4 after you received your degree; is that fair?

5 A. That's fair.

6 Q. Okay. In your declaration, you
7 indicated that you're a principal of a company
8 called Pedocs Inc. That's P-e-d-o-c-s; is that
9 right?

10 A. Yes, sir.

11 Q. And you indicated that's an oil and
12 gas production company; is that accurate?

13 A. Yes, sir.

14 Q. When I looked at your CV, I could not
15 see any reference to Pedocs anywhere in it. And
16 is there a reason for that?

17 A. No, sir. It's not work experience, I
18 guess. That's the reason it's not on there.

19 Q. What do you mean it's not work
20 experience?

21 A. Well, I'm a principal. I operate the
22 company, but I'm not an employee, if you will.

1 Q. So it's fair to say you don't do any
2 work for Pedocs?

3 A. Oh, I do quite a bit of work. I run
4 the office, I do studies, I work in the field when
5 necessary, but I just didn't consider it work
6 experience past what's there. No reason it's not
7 on there. It just never made it.

8 Q. Okay. Are you a member of the
9 Society of Petroleum Engineers?

10 A. Yes, sir.

11 Q. I didn't see any reference to that in
12 your CV either. Did I miss it? You have --

13 A. Well, you're pointing out all the --

14 Q. -- a membership -- I'm sorry. Go
15 ahead. My fault.

16 A. You're pointing out all the things I
17 need to update on my CV, obviously. I've been
18 diligent -- I'd take the publications and kind of
19 ignored everything else for the past 15 years.

20 Q. How long have you been a member of
21 the Society of Petroleum Engineers?

22 A. Off and on since 2000. There's been

1 times I've let it lapse, but it was 2000.

2 Q. I guess this raises the question,
3 then, the CV that's attached to your declaration,
4 when was the last time it was updated?

5 A. The publications get updated when I
6 have a new publication, but it looks like I
7 haven't done anything else to it since at least
8 '22. Let's see. Let me look at this. Yes,
9 that's correct.

10 Q. Have you ever published a paper for
11 the Society of Petroleum Engineers?

12 A. No, sir.

13 Q. Looking at your list of publications
14 in the CV, you had no publications directed to
15 optimization methods for well stimulation design;
16 is that fair?

17 A. That's fair.

18 Q. And you have no publications directed
19 to the fracture geometry in well formations; is
20 that accurate?

21 A. Yes, sir. That's correct. But let
22 me check one thing.

1 Q. Sure.

2 A. (Reviewing.) Yes, sir. That's
3 correct.

4 Q. And I saw no publications directed to
5 hydraulic fracturing treatments. Is that fair?

6 A. Yes, sir, that's fair.

7 Q. Have you ever heard of something
8 called digital oil fields?

9 A. Yes. I've heard the name.

10 Q. Just generally, what's your
11 understanding of digital oil fields?

12 A. Just generally, very broadly, I
13 haven't prepared an opinion on that. Generally,
14 very broadly, it's computerization and, to the
15 extent possible, automation of oil and gas
16 operations.

17 Q. And you have no publications directed
18 to digital oil fields; is that fair?

19 A. That's fair. Not directly directed
20 toward them.

21 MR. FERGUSON: I'll ask Sarah to
22 pull up Exhibit 1001, which is U.S. patent

1 11,373,058.

2 (Exhibit Number 1001 was
3 introduced at this time.)

4 MR. WALTERS: Counsel, could I
5 ask the court reporter to drop that in the
6 chat as well so I can have it electronically?

7 TRIAL TECHNICIAN: Yes.

8 MR. FERGUSON: Sure.

9 TRIAL TECHNICIAN: Well,
10 actually, if it's okay, send a link to the
11 chat where all the exhibits that are
12 introduced will be available.

13 MR. WALTERS: Okay.

14 TRIAL TECHNICIAN: Let me grab
15 that.

16 MR. FERGUSON: So, Sarah, can
17 you include Exhibit 2013, which was
18 Dr. Durham's declaration as well?

19 TRIAL TECHNICIAN: Yes. And for
20 the record, let's officially mark
21 Exhibit 2013.

22 (Exhibit Number 2013 was

1 introduced at this time.)

2 MR. FERGUSON: Good. Thank you.

3 TRIAL TECHNICIAN: Let me know
4 if you have issues accessing that document --
5 or that link, I mean.

6 MR. WALTERS: Okay. I've got it
7 here. Thank you.

8 BY MR. FERGUSON:

9 Q. You've read the '058 patent before,
10 yes?

11 A. Yes, sir.

12 Q. Were you able to understand its
13 content?

14 A. Yes, sir.

15 MR. WALTERS: Counsel, I think
16 she may have put up Exhibit 1011 instead of
17 1001.

18 MR. FERGUSON: Oh. Yep. You're
19 right.

20 TRIAL TECHNICIAN: Apologies.
21 We'll mark Exhibit 1001.

22 MR. FERGUSON: There we go.

1 TRIAL TECHNICIAN: And I'll fix
2 that in the link. Thank you.

3 BY MR. FERGUSON:

4 Q. Okay. So looking at 1001, can we ask
5 you to take a look at column 2, lines 38 to 41.

6 A. Okay.

7 MR. FERGUSON: Actually, Sarah,
8 there are columns after the pictures, so go
9 through the pictures. Right. There we go.
10 And then -- nope. It's column 2, sorry, and
11 it's lines 38 to 41. Good. Okay. That's
12 fine.

13 BY MR. FERGUSON:

14 Q. So looking at that particular
15 sentence, it says, "The responsive sensor data may
16 be used to select a pre-defined representative
17 system model for stage and/or well treatment
18 schedules (e.g., treatment sequences,
19 compositions, etc.)." Do you see that sentence?

20 A. Yes, sir.

21 Q. So prior to reviewing the '058
22 patent, did you have any experience with models

1 used for well treatment schedules in the oil and
2 gas industry?

3 A. Models used for well treatment
4 schedules, I knew they existed, but I had not
5 worked with them personally.

6 Q. Okay.

7 A. Models of formations, we use those
8 regularly in reservoir analysis.

9 Q. Okay. So the type of system models
10 identified in the '058 patent would generally be
11 generated through use of computer software; would
12 you agree with that?

13 A. Generally, today, yes, sir. That
14 would be correct.

15 Q. Are you aware of some of the
16 currently commercially available software programs
17 for well performance modeling or simulation?

18 A. I'm generally aware of them, yes,
19 sir.

20 Q. Are you able to name any, sitting
21 here today?

22 A. Yes, sir. Eclipse, UFM, Mangrove. I

1 can name those off the top of my head.

2 Q. Have you ever heard of FracCADE,
3 F-r-a-c-C-A-D-E?

4 A. I can't recall whether I have or not.

5 Q. You performed consulting work in this
6 matter on behalf of Halliburton; is that fair?

7 A. Yes, sir. That's correct.

8 Q. You've performed consulting work for
9 Halliburton in other proceedings as well, right?

10 A. Yes, sir. That's correct.

11 Q. Are you aware of any of Halliburton's
12 commercially available well modeling or simulation
13 software?

14 MR. WALTERS: Objection. Form.

15 A. I have seen some of those software
16 packages available. I haven't worked with them in
17 any depth, as we've talked about.

18 BY MR. FERGUSON:

19 Q. Okay. The application, the patent
20 application, for the '058 patent was filed on
21 September 17th, 2019. And do you agree that well
22 modeling software was in use in the oil and gas

1 industry for many years before that filing date?

2 A. I can agree that well modeling
3 software was in use before that filing date. I
4 don't have a back-end number on when that was.

5 Q. Fair enough. Are you aware that
6 Wikipedia has a web page devoted to reservoir
7 modeling before the '058 patent application was
8 filed?

9 A. No.

10 MR. FERGUSON: I'm going to ask
11 Sarah to pull up and mark Exhibit 1046.

12 (Exhibit Number 1046 was
13 introduced at this time.)

14 BY MR. FERGUSON:

15 Q. Dr. Durham, have you ever used the
16 Internet Archive or the Wayback Machine?

17 A. Yes, sir, I have.

18 Q. Okay. And do you understand that it
19 captures websites as they existed as of a
20 particular date in time?

21 A. Generally speaking, yes, sir. That's
22 correct? I think I...

1 Q. So I'll represent to you that
2 Exhibit 1046 is a capture from the Internet
3 Archive dated April 1st, 2019, from Wikipedia, and
4 it's the Wikipedia page directed towards reservoir
5 modeling. Do you see that?

6 A. Yes, sir.

7 Q. So if we can blow up the first
8 sentence, I'll just read it into the record. It
9 says, "In the oil and gas industry, reservoir
10 modeling involves the construction of a computer
11 model of a petroleum reservoir, for the purposes
12 of improving estimation of reserves and making
13 decisions regarding the development of the field,
14 predicting future production, placing additional
15 wells, and evaluating alternative reservoir
16 management scenarios."

17 Do you have any reason to doubt the
18 accuracy of that sentence as it existed in April
19 of 2019?

20 A. Having never seen this document
21 before, I haven't reviewed it in context, but
22 taking that sentence by itself and alone, it makes

1 sense. I had certainly done reservoir modeling
2 prior to April 1st, 2019.

3 Q. Have you ever heard of a product
4 called Nexus offered by Halliburton Landmark
5 Software & Services?

6 A. Yes, sir. I've heard the name.

7 MR. FERGUSON: Okay. I'll ask
8 Sarah to pull up Exhibit 1047.

9 (Exhibit Number 1047 was
10 introduced at this time.)

11 BY MR. FERGUSON:

12 Q. Okay. I'll represent to you,
13 Dr. Durham, that this is a document called the
14 Nexus User Guide from Halliburton Landmark
15 Software & Services. You can see at the bottom
16 there it's dated December 2009. And I just
17 located this through a Google search. Do you know
18 what Nexus is?

19 A. No. I haven't studied it in depth to
20 prepare an opinion on that.

21 MR. FERGUSON: Okay. If we
22 could just flip to page 9 of that document.

1 BY MR. FERGUSON:

2 Q. Yes. I'll give you a moment to read
3 that.

4 A. (Reviewing.)

5 Q. Do you see it references that "Nexus
6 delivers a significant speed increase over older
7 simulators while enabling true integrated asset
8 management by providing the ability to model
9 subsurface reservoir systems simultaneously with
10 surface facilities"? And it goes on.

11 A. I see that sentence, yes, sir.

12 Q. Based on your understanding of what
13 Nexus was, is that your understanding of the
14 functionality of Nexus, among other things?

15 A. No. I don't have a -- I don't have
16 an opinion on the functionality of Nexus.

17 Q. Okay.

18 A. I would need to study that in some
19 depth.

20 Q. You'll at least -- do you see that it
21 indicates that it allows the ability to model
22 subsurface reservoir systems?

1 A. Yes, sir.

2 Q. And do you have any reason to doubt
3 that this user guide was in existence as of
4 December 2009, as of the date on it?

5 A. I just don't have an opinion on that.

6 Q. Okay. Fair enough.

7 Dr. Durham, in the oil and gas
8 industry, do you know what the acronym ISIP stands
9 for?

10 A. That acronym is not at my fingertips.
11 No, sir.

12 Q. Have you ever heard of instantaneous
13 shut-in pressure in the context of the oil and gas
14 industry?

15 A. Yes, sir. I don't know that I had
16 heard that acronym in some time. Yes, I'm
17 familiar with instantaneous shut-in pressures.

18 Q. Do you agree that instantaneous
19 shut-in pressure is considered to be the minimum
20 pressure required to hold open a fracture in a
21 well formation? Does that sound accurate?

22 A. That's generally accurate. Yes, sir.

1 Q. Okay. Have you heard of the
2 Environmental Protection Agency?

3 A. Yes, sir.

4 Q. Do you know if the Environmental
5 Protection Agency provides guidelines or rules for
6 conducting fracturing operations in the U.S.?

7 A. I've seen some. Yes, sir.

8 MR. FERGUSON: I'd like to go
9 back -- we can take that down. And I'd like
10 to go back to Exhibit 1001. So that's the
11 '058 patent. And if we could go to the last
12 page -- second-to-last page. Sorry.

13 And if we could just -- Sarah,
14 if you could go down in the first column, at
15 the bottom there's the paragraph that says,
16 "What is claimed is." Just pull up that to
17 the bottom. Perfect.

18 BY MR. FERGUSON:

19 Q. Can you see that okay, Dr. Durham?

20 A. Yes, sir.

21 Q. This is claim 1 of the '058 patent in
22 its entirety. Is that your understanding?

1 A. Yes, it is.

2 Q. Okay. I want to focus for a bit on
3 what I think the parties have identified as the
4 first limitation in the claim, which is the
5 generating a sequence of stimuli limitation.
6 You're aware of that limitation, right?

7 A. Yes, sir. The limitation that begins
8 with generating a sequence of stimuli, yes, sir.

9 Q. We'll just read in the entire
10 limitation to the record. It's "generating a
11 sequence of stimuli for application to a well
12 environment, the sequence of stimuli comprising
13 one or more of particulate concentrations,
14 chemical concentrations, or a pump rate control.
15 Did I read that accurately?

16 A. Yes, sir.

17 Q. So we'll come back to that, but I
18 want to have you look now at paragraph 64 of your
19 declaration, please.

20 MR. FERGUSON: So that's
21 Exhibit 2013, paragraph 64.

22 A. Okay.

1 BY MR. FERGUSON:

2 Q. I'll give you a minute to take a look
3 at that paragraph to refresh your memory.

4 A. Sure. (Reviewing.) Okay.

5 Q. So there you indicate that "The '058
6 Patent describes the sequence of stimuli as a
7 series of events that are generated in advance of
8 the actual stimulation and then applied to a well
9 environment"; is that accurate?

10 A. Yes, sir.

11 MR. FERGUSON: Okay. And now
12 let's look at paragraph 66 in particular.
13 We'll just focus on the top of that.

14 BY MR. FERGUSON:

15 Q. In the second sentence, you indicate
16 that a plain reading of this claim limitation
17 "requires that a sequence of stimuli be generated
18 before it is applied to a well environment." Do
19 you see that?

20 A. Yes, sir.

21 Q. And in that sentence, the reference
22 to "this limitation" is the claim limitation that

1 we looked at before the sequence of stimuli
2 limitation; is that fair?

3 A. Yes, sir.

4 Q. Just so I have a better understanding
5 of this, what do you mean that the sequence of
6 stimuli must be generated before it is applied to
7 a well environment?

8 A. What I mean to say and I go on to
9 explain in paragraph 67 and 68 that it's a
10 predetermined pattern of stimuli determined before
11 application to the well environment. It must
12 be -- it has to be generated before the sequence
13 is applied. In other words, it's not adjusting on
14 the fly.

15 Q. So I was just going to ask that. So
16 it's different from generating a sequence of
17 stimuli on the fly, in your opinion?

18 A. Right. The sequence may include
19 modifications to the stimuli, but the plan may
20 include steps, if you will. In fact, it does, but
21 it's not -- this claim limitation is not talking
22 about adjusting on the fly.

1 Q. Okay. And is that how you evaluated
2 the prior art that you looked at when considering
3 whether the prior art disclosed the sequence of
4 stimuli limitation?

5 A. That understanding of the term
6 "sequence of stimuli" certainly went into my
7 analysis of the prior art.

8 Q. Okay. And would that be the same?
9 You understand that there's an issue about what
10 was well-known and conventional in the industry,
11 and I think you offered some opinions on that as
12 well. Correct?

13 A. I did.

14 Q. When you consider what was well-known
15 and conventional in the industry, was that also
16 how you understood the sequence of stimuli
17 limitation to be interpreted?

18 MR. WALTERS: Objection. Form.

19 A. Well, that term, yes, sir. That's
20 the sequence of stimuli, yes, sir.

21 MR. FERGUSON: Okay. Let's go
22 back. If we can pull back up claim 1 from

1 Exhibit 1001, second-to-last page.

2 BY MR. FERGUSON:

3 Q. Okay. What is your understanding of
4 what it means where it says that the sequence of
5 stimuli comprises particulate concentrations?

6 A. Particulate concentration is the
7 concentration of the proppant in the slurry.

8 Q. And how, if at all, does particulate
9 concentrations constitute a sequence of stimuli,
10 under your understanding?

11 A. Well, the sequence of stimuli may
12 include, according to this claim limitation,
13 particulate concentrations at particular times.

14 Q. In order for it to be a sequence of
15 stimuli, as you've understood it, would the
16 particulate concentrations need to change over
17 time or could they be constant?

18 A. They could be constant; could change.

19 Q. All right. And what does it mean
20 there when it says that the sequence of stimuli
21 comprises chemical concentrations?

22 A. Just the plain and ordinary meaning

1 of chemical concentrations: the percent acid that
2 you may apply, the gel or the breakers or the
3 viscosity enhancers, any other chemicals applied
4 to the slurry.

5 Q. In that last answer, you referenced a
6 gel. What's the gel?

7 A. Gel has kind of fallen out of
8 fashion. But gel is a viscosity enhancer to help
9 suspend the proppant in the fluid.

10 Q. And then --

11 A. I think I actually said gel breakers,
12 but anyway...

13 Q. Fair. Fair.

14 And then what does it mean to say the
15 sequence of stimuli comprises a pump rate control?

16 A. Pump rate control is changes in the
17 rate of the pumps pumping the slurry downhole.
18 Pump or pumps, I should say.

19 Q. In that answer, you referred to the
20 pumps pumping the slurry downhole. Is another
21 term for slurry fracturing fluid?

22 A. Yes. Fracturing fluid's actually

1 probably a more precise answer because sometimes
2 we pump just pure water, not a proppant.

3 MR. FERGUSON: I'd like to go
4 back to column 2 of the '058 patent. Let's
5 look at lines 30 through 37 in column 2.

6 BY MR. FERGUSON:

7 Q. The first full sentence there reads,
8 "In some examples, a sequence can include a
9 particular stimulus (e.g., injection rate) being
10 stepped through a sequence of various amplitudes
11 (e.g., high, medium, low, etc.)."

12 You've read this sentence before,
13 right?

14 A. Yes, sir.

15 Q. What's the injection rate referred to
16 there?

17 A. That's one of the examples of a
18 stimulus that's in this embodiment.

19 Q. Is there any relation between the
20 injection rate referred to here in the
21 specification and the pump rate control in the
22 sequence of stimuli claim limitation?

1 A. There could be.

2 Q. And how could there be?

3 A. Well, if you're using the pump rate
4 control to precisely control the injection rate,
5 then they would be related.

6 Q. Does the injection rate refer to the
7 amount of fluid that's being pumped over a given
8 time period?

9 A. No, sir.

10 Q. Why is that not accurate?

11 A. Well, the injection rate is the
12 amount of fluid being injected into the well over
13 a particular time frame, not necessarily what's
14 being pumped.

15 Q. But it's fair -- would you agree
16 there's a relationship, then, between the pump
17 rate and the injection rate?

18 A. There can be. Yes, sir.

19 Q. The pump rate that's referred to in
20 the claim, that can be expressed as an amount of
21 fluid in a given time period; is that right?

22 A. It can be. The amount of fluid being

1 pumped at a given time is one way to express that.

2 Q. And that could be like gallons per
3 second or gallons per minute; would that be fair?

4 A. Yes. It could be.

5 Q. Have you ever heard of the term
6 "barrels per minute" in the industry?

7 A. Yes, sir.

8 Q. And what does that refer to?

9 A. It's the number of barrels--a barrel
10 is 42 gallons--being, in your example, "pumped"
11 over a given -- over one minute.

12 MR. FERGUSON: If we could go
13 back to claim 1. Sorry to keep jumping
14 around.

15 BY MR. FERGUSON:

16 Q. So in claim 1, would you agree that a
17 sequence of stimuli comprising a pump rate control
18 can refer to, for example, change in the amount of
19 fluid that is pumped over time?

20 A. Yes, sir. Change the amount of
21 fluids pumped over time could be a pump rate
22 control.

1 Q. In the oil and gas industry, have you
2 ever heard of a step rate test?

3 A. Yes, sir.

4 Q. Do you know what a step rate test is?

5 A. Yes, sir.

6 Q. Can you explain it?

7 A. Broadly speaking, it's a series of
8 changes in injection rate typically at the end of
9 a fracturing sequence to measure, typically, water
10 hammer as a result of the rate step test and, from
11 that water hammer, calculate certain
12 characteristics of the formation.

13 Q. Based on your understanding, were
14 step rate tests well-known in the industry before
15 2019?

16 A. I would say they were known,
17 certainly.

18 Q. Okay. In the oil and gas industry,
19 have you ever heard of a mini-fracture test or a
20 mini-frac test?

21 A. Yes, sir.

22 Q. And what's that?

1 A. A mini-frac test is when you go in at
2 typically a lower injection rate into a very small
3 area of fracture formation to, again, generally
4 speaking -- very broadly speaking, determine how
5 the -- how and when the fractures began and
6 progressed.

7 Q. Do you know if mini-frac tests were
8 known in the industry before 2019?

9 A. Broadly speaking, yes.

10 Q. Still looking at claim 1, the next
11 step beneath the sequence of stimuli step is
12 "receiving formation response data comprising data
13 from one or more downhole sensors or surface
14 sensors." Do you see that?

15 A. Yes, sir.

16 Q. Can you explain in your words what
17 that means?

18 A. I don't think I prepared an analysis
19 of that claim limitation. No, I did not. So I
20 will just refer you to the way it's described in
21 the patent.

22 Q. Well, you've offered opinions from

1 the standpoint of a person of ordinary skill in
2 the art, right?

3 A. Correct.

4 Q. And how would you explain the way a
5 person of ordinary skill in the art would have
6 understood this limitation?

7 A. It's just plain and ordinary meaning
8 the way it reads, "receiving formation response
9 data comprising data from one or more downhole
10 sensors or surface sensors."

11 Q. What's a downhole sensor?

12 A. A sensor in a well below the surface.

13 Q. And then what's a surface sensor?

14 A. A sensor on the surface, not in the
15 well.

16 Q. What's formation response data?

17 A. Formation response data is the data
18 that you receive in response to the sequence of
19 stimuli that was applied in the previous
20 limitation.

21 MR. FERGUSON: Let's go back to
22 column 2 and pull up lines 30 through 37

1 again.

2 BY MR. FERGUSON:

3 Q. You'll see in the middle it says,
4 "Accordingly, response variables (e.g., responsive
5 sensor data values such as pressure or flow
6 distribution or microseismic events or strain
7 events) can be measured over time to generate a
8 record of a dynamic formation response." Do you
9 see that?

10 A. Yes, sir.

11 Q. Would you agree that passage
12 identifies what claim 1 calls formation response
13 data?

14 A. In that embodiment, yes, sir. One
15 example.

16 Q. And one type of formation response
17 data is a pressure value; is that fair?

18 A. Yes. That's what it says.

19 Q. We talked about this before. The
20 injection rate can refer to the amount of fluid
21 flowing into the well at a given -- over time; is
22 that fair?

1 A. Yes, sir. That's correct.

2 Q. And then the formation response data
3 can be the pressure value measured at a certain
4 point in the formation in response to that
5 injection rate; is that fair?

6 A. That's what it says in this
7 embodiment. Yes, sir.

8 MR. FERGUSON: Okay. Let's go
9 to claim 1 again. And, Sarah, if you could
10 also add claim 2 right underneath it. So
11 that would be at the top of the next column.
12 Thank you.

13 BY MR. FERGUSON:

14 Q. Dr. Durham, you see that claim 1 has
15 a limitation "selecting a representative system
16 model based on the received formation response
17 data and sequence of stimuli." Do you see that?

18 A. Yes, sir.

19 Q. And claim 2 says, "wherein in the
20 representative system model is retrieved from a
21 data store based" -- I believe it's supposed to
22 say, "based on the received formation response

1 data." Do you see that?

2 A. I do.

3 Q. Do you agree that the term "data
4 store" as used in claim 2 can include computer
5 memory or computer storage?

6 A. Yes, sir. My recollection, that's
7 the way the '058 patent describes it.

8 MR. FERGUSON: Okay. Let's
9 look, then, just to confirm that, at column
10 7, lines 17 through 21.

11 BY MR. FERGUSON:

12 Q. And this states that "Treatment
13 optimization system may retrieve system models
14 from model store 304 and store updated system
15 models in model store 304, which may be a local
16 data store, such as a local memory, or a remote
17 data store, such as networked memory or storage."

18 Would you agree that local memory in
19 that sentence could be, for example, a computer
20 hard drive?

21 A. That's my understanding. Yes, sir.

22 Q. Okay. And remote data store, would

1 you agree that one example of that could be like
2 data stored on a server?

3 A. I think that would meet this
4 description. Yes, sir.

5 Q. You know what a diverter is in the
6 oil and gas industry, right?

7 A. Yes, sir.

8 Q. How would you describe a diverter
9 from the standpoint of a person of ordinary skill?

10 A. A diverter is a product dropped into
11 the wellbore to block off flow to particular
12 fractures or particular perforations, either
13 temporary or --

14 Q. Would you agree that the -- I'm
15 sorry.

16 A. I'm sorry. Either temporarily or
17 permanently.

18 Q. So diverters can be used, then, to
19 divert the flow of fluid from perforations taking
20 more fluid to ones taking less fluid; is that
21 fair?

22 A. Often that's when they're used. Yes,

1 sir.

2 Q. Would you agree that diverters have
3 been in use in the industry for many decades
4 before 2019?

5 A. Well, I would say they've been used
6 for some time. I don't have a back-end on when
7 diverters were developed.

8 Q. Fair enough.

9 And is it your understanding that
10 when diverters are used, that they are often
11 monitored to determine the effectiveness of the
12 diverters?

13 MR. WALTERS: Objection. Form.

14 A. I don't know that I have an opinion
15 on that, whether it's often monitored or not.

16 BY MR. FERGUSON:

17 Q. Have you heard of monitoring the
18 effectiveness of a diverter?

19 A. Yes, sir.

20 Q. And how would that be done?

21 A. Well, there's examples in Dawson how
22 that could be done.

1 Q. Dawson, for the record, you're
2 referring to one of the pieces of prior art that's
3 been used in this proceeding, right?

4 A. Yes, sir. Exhibit 1024, I believe.

5 Q. Correct, Exhibit 1024.

6 MR. FERGUSON: Okay. I'm going
7 to turn to another topic now, so would you
8 like to take a short break?

9 THE WITNESS: Yeah. This would
10 be a good time.

11 MR. FERGUSON: Okay. Sounds
12 good. Thank you.

13 TRIAL TECHNICIAN: Off the record
14 at 10:20.

15 (A recess was taken from
16 10:20 a.m. until 10:30 a.m.)

17 TRIAL TECHNICIAN: We will go
18 back on the record at 10:30.

19 BY MR. FERGUSON:

20 Q. Dr. Durham, let's now turn to Pankaj,
21 which is Exhibit 1005.

22 (Exhibit Number 1005 was

1 introduced at this time.)

2 BY MR. FERGUSON:

3 Q. For the record, this is the United
4 States Patent Application Publication U.S.
5 2018/0230782. We've referred to this as Pankaj in
6 this proceeding. You've seen this document
7 before, correct?

8 A. Yes, sir, I have.

9 Q. Have you read the entirety of Pankaj?

10 A. Yes, sir. Multiple times.

11 Q. I'm going to ask you to take a look
12 at paragraphs 53 and 69 of your declaration. And
13 I'll just ask you to review those, refresh your
14 memory, and then let me know when you're done and
15 I'll ask a couple questions.

16 A. What were those paragraphs again? 63
17 to 69?

18 Q. 53 and 69. Feel free to review the
19 ones that --

20 A. 53 and --

21 Q. Yeah. You can review the ones in the
22 middle, but I'm focusing on 53 and 69 for now.

1 A. (Reviewing.) Okay.

2 Q. Okay. In paragraph 53--and this is
3 your declaration, Exhibit 2013--you described
4 Pankaj's disclosed method as including generating
5 fracture parameters, correct?

6 A. Correct.

7 Q. And then in paragraph 69, you
8 indicate that in Pankaj, the parameters may be
9 adjusted after the fracturing process is started;
10 is that fair?

11 A. I don't see that. Hold on a second.
12 (Reviewing.) No, sir, I don't see that.

13 Q. Let's do it this way. In paragraph
14 69, you cite to a portion of Pankaj. And it's
15 footnote 80, and it's Exhibit 1005, paragraph 61.
16 Do you see that?

17 A. Yes, sir.

18 Q. And you quote from that in paragraph
19 69 where it states, "in particular, injection may
20 be manipulated by adjusting the material being
21 injected and/or the way it is injected to achieve
22 the fractures which draws fluid from formations

1 into the wellbore and up to the surface." Do you
2 see that?

3 A. Yes, sir.

4 Q. Okay. Did you review Pankaj to
5 determine what it discloses concerning the, quote,
6 "material" that is being injected in reference to
7 that paragraph 61?

8 A. Yes, sir.

9 Q. And what is the material being
10 injected, according to Pankaj?

11 A. I believe it's described -- it's
12 described in paragraphs 59 and 60 of Pankaj or at
13 least some examples of the fluid being injected.

14 Q. And in paragraph 59 of Pankaj, for
15 example, it refers to "Various fluids, such as
16 conventional stimulation fluids with proppants
17 (slurry)," et cetera, right?

18 A. Yes, sir.

19 Q. Okay. So that's one example of the
20 materials that Pankaj refers to in paragraph 61 as
21 being injected into the well; is that fair?

22 A. Yes, sir. That's the way I

1 understand it.

2 MR. FERGUSON: Okay. I'd also
3 like to ask you to -- if we could pull up
4 paragraphs 59 and -- excuse me. Strike that.

5 Can we pull up paragraphs 55 and
6 56 of Pankaj.

7 BY MR. FERGUSON:

8 Q. And let me know when you've had a
9 chance to review those.

10 A. Sure. (Reviewing.) Okay. I've
11 briefly reviewed those.

12 Q. Okay. In those two paragraphs, would
13 you agree that Pankaj discloses that the material
14 being injected can be a fracturing fluid? Right?

15 MR. WALTERS: Objection. Form.

16 A. That term is not used, but, broadly
17 speaking, that's a broad generalization of what's
18 being said in 55 and 56.

19 BY MR. FERGUSON:

20 Q. Okay. Well, you see in paragraph 56
21 the --

22 A. I see that.

1 Q. -- second-to-last sentence, it does
2 refer to "a fracturing (or injection) fluid,"
3 fair?

4 A. Yes. I do see that now.

5 Q. Okay. And it also indicates that
6 this fracturing, or injection, fluid can include,
7 among other things, water, the gelling agent, and
8 a proppant, right?

9 A. Yes, sir.

10 Q. Do you agree that a person of
11 ordinary skill in the art as of September 2019
12 would have understood from reading Pankaj that
13 adjusting the material being injected would mean
14 making some change to the composition of the
15 fracturing fluid? Right?

16 A. Yes, sir.

17 Q. And one such change could be changing
18 the concentration of the gel agent; would that be
19 fair?

20 A. That's one option, yes.

21 Q. And another such change could be
22 changing the concentration of the proppant; is

1 that fair?

2 A. Yes, sir. That's described in
3 Pankaj.

4 Q. And a person of ordinary skill in the
5 art as of September 2019 would have understood
6 from reading Pankaj that adjusting the way the
7 material is injected would include, for example,
8 adjusting the rate at which the fracturing fluid
9 is pumped; is that fair?

10 MR. WALTERS: Objection. Form.

11 A. (Reviewing.) I don't see that
12 specifically called out in these paragraphs of
13 Pankaj. I would have to do a reread to look for
14 that.

15 BY MR. FERGUSON:

16 Q. Okay. And I wasn't limiting my
17 question to just those two paragraphs. So based
18 on your understanding of Pankaj as a whole, do you
19 agree that a person of ordinary skill in the art
20 as of September 2019 would have understood that
21 adjusting the way the material is injected would
22 include, for example, adjusting the rate at which

1 the fracturing fluid is pumped? Is that fair?

2 MR. WALTERS: Objection.

3 A. I would need to reread Pankaj with
4 that in mind. I don't recall a reference to that
5 in Pankaj, but I can certainly do that.

6 BY MR. FERGUSON:

7 Q. Let me put a hold on that for now
8 because I want to ask you a few more questions.

9 Do you recall a discussion earlier
10 this morning about the sensors that can be used in
11 the '058 patent? I believe the patent refers to
12 the sensors can be downhole or surface sensors.
13 Right?

14 A. Yes, sir.

15 Q. Do you agree that Pankaj discloses
16 downhole sensors?

17 A. Yes, sir.

18 Q. Do you agree Pankaj discloses surface
19 sensors?

20 A. Yes, sir.

21 MR. FERGUSON: If we look at
22 paragraph 53 of Pankaj. Pull that up.

1 BY MR. FERGUSON:

2 Q. And take a moment to review that.

3 A. (Reviewing.) Okay. I've reviewed
4 that.

5 Q. The second sentence begins, "As the
6 fluid flows through the wellbore, measurements are
7 taken of fluid properties, such as flow rates,
8 pressures, composition, etc."

9 Do you agree that a person of
10 ordinary skill in the art would understand that
11 those measurements could be made by one or more
12 sensors? Is that fair?

13 A. Yes, sir, that's fair.

14 Q. In the '058 patent, the claims use
15 the term "sequence of stimuli." You recall that,
16 right?

17 A. Yes, sir.

18 Q. Do you remember what the '058 patent
19 describes as being the stimuli?

20 A. In the claim 1 it calls it "one or
21 more of particulate concentrations, chemical
22 concentrations, or a pump rate control."

1 Q. So do you agree, therefore, that
2 within the meaning of the '058 patent, a proppant
3 is a stimulus?

4 A. Yes. A concentration of a proppant
5 in particular.

6 Q. Okay. Fair enough.
7 And would you agree that within the
8 meaning of the '058 patent, a gel agent would be a
9 stimulus?

10 A. A concentration of the gel agent
11 would be.

12 Q. Okay. And do you agree that within
13 the meaning of the '058 patent, the pump flow rate
14 is a stimulus?

15 A. Yes, sir.

16 MR. FERGUSON: I'd like to
17 return to Pankaj. And if we can look at
18 paragraph 104.

19 BY MR. FERGUSON:

20 Q. So 104.

21 A. I'm getting there.

22 Q. Yeah. I want you to read that

1 paragraph to yourself. Just let me know when
2 you're done.

3 A. Sure. (Reviewing.) Okay.

4 Q. The second sentence here says, "As
5 the fracturing fluid pumping treatment continues
6 for some duration (e.g. around a couple of hours),
7 the hydraulic fracture extension, the fluid and
8 proppant flow in the fractures is determined from
9 simulation on the collected wellsite information."
10 Do you see that?

11 A. Yes, sir.

12 Q. And then it continues, "The sequence
13 of increasing the proppant concentration on the
14 surface is also a parameter that may be recorded
15 while pumping."

16 So would you agree that that's
17 referencing a sequence of stimuli in the form of
18 the proppant concentration?

19 A. Not in the way the term is used in
20 the claim.

21 Q. And why do you say that?

22 A. Because, as I stated in my

1 declaration, in the claim the sequence of stimuli
2 is the predetermined particular sequence. This is
3 talking about on-the-fly adjustments.

4 MR. FERGUSON: Let's turn to
5 paragraph 116 and Table I.

6 BY MR. FERGUSON:

7 Q. Take a look at that, please.

8 A. Okay. (Reviewing.) All right.

9 Q. So this refers to "The input wellsite
10 data includes a pumping schedule." Do you see
11 that?

12 A. Correct. As an input for the
13 simulator.

14 Q. And then in Table I, it shows that
15 pumping schedule, fair?

16 A. Yes, sir.

17 Q. And do you agree that in that Table I
18 schedule, there are different proppant
19 concentrations shown?

20 A. Yes, sir.

21 Q. As it runs -- yeah. As it goes --
22 there's nine different proppant concentrations

1 shown; is that fair?

2 A. Yes, sir. I count nine.

3 Q. So would you agree that that's a
4 sequence of stimuli?

5 A. Again, not in the way that it's used
6 in the claim. This is an input from the
7 simulator. You may be able to extend that and say
8 it's probably for injection application to the
9 well environment, but it doesn't state that.

10 Q. So here one of the issues that you
11 take with this is that this Table I is used in a
12 simulator, whereas, in your opinion, what is
13 claimed requires that it be used in the actual
14 well environment; is that fair?

15 A. Yes, sir, that's fair.

16 Q. Do you agree that Pankaj discloses
17 that the fracture parameters include a pump rate?

18 A. If you could point me to a reference
19 there, I'd be glad to look at it.

20 Q. Sure.

21 MR. FERGUSON: Let's look at
22 paragraph 62 --

1 A. It's not my --

2 MR. FERGUSON: Okay. Let's look
3 at paragraph 62 of Pankaj.

4 A. Okay. (Reviewing.) Yes. That's one
5 of the definitions of fracture parameters Pankaj
6 makes. It includes pump rate.

7 BY MR. FERGUSON:

8 Q. Let me just make sure I have a clean
9 record on that. Do you agree that Pankaj
10 discloses that one of the fracturing parameters
11 may be a pump rate? Is that fair?

12 A. Yes. That's one of the definitions
13 of fracture parameters. As I recall, there were
14 other definitions of fracture parameters, but
15 that's one.

16 Q. Okay. And we've looked previously --
17 you agree that Pankaj discloses starting the
18 fracturing process and making adjustments based on
19 how the fracturing process is proceeding? Is that
20 fair?

21 A. Yes, sir.

22 Q. Okay. And do you also agree that

1 Pankaj discloses that the fracture parameters can
2 be adjusted to achieve desired stimulation
3 objectives to maximize well production? Is that
4 fair?

5 A. Yes, sir. I believe I recall that.

6 MR. FERGUSON: Let's look at
7 paragraph 37 of Pankaj.

8 BY MR. FERGUSON:

9 Q. This refers to a surface unit 134.
10 Do you see that?

11 A. Yes, sir.

12 Q. And the surface unit 134 can include
13 computer facilities, right?

14 A. Yes, sir.

15 Q. And the surface unit 134 as disclosed
16 in Pankaj can "be used to communicate with the
17 drilling tools and/or offsite operations." Do you
18 agree with that?

19 A. Yes, sir.

20 Q. And the surface unit can send
21 commands to the drilling tools, correct?

22 A. Yes.

1 MR. FERGUSON: Let's look at
2 paragraph 41.

3 A. (Reviewing.) Okay. I've reviewed
4 that.

5 BY MR. FERGUSON:

6 Q. Okay. Paragraph 41 of Pankaj
7 discloses that "the surface unit may be an
8 automatic system." Do you see that?

9 A. Yes, sir.

10 Q. And how, in your opinion, would a
11 person of ordinary skill in the art interpret the
12 phrase "automatic system" there?

13 A. Broadly speaking, it would operate
14 without human interface, this data collection unit
15 134.

16 MR. FERGUSON: And if we move
17 down to paragraph 42, please.

18 BY MR. FERGUSON:

19 Q. Do you see it indicates that "The
20 surface unit may also be provided with or
21 functionally connected to one or more controllers
22 for actuating mechanisms at the wellsite 100"? Do

1 you see that?

2 A. Yes, sir.

3 Q. Do you agree that a person of
4 ordinary skill in the art would understand
5 actuating mechanisms at the wellsite 100 to
6 include the pumps?

7 A. No, sir. Not necessarily.

8 Q. You say, "Not necessarily," but it
9 could, right?

10 A. Well, we're talking about a drilling
11 system here. So I would say no, you would not
12 understand that to operate mechanisms for
13 fracturing pumps, as I understood your question.

14 Q. Okay. Do you see towards the bottom
15 of this, it refers to portions of the operation
16 include pump rates or other parameters?

17 A. Correct. For drilling. Right.
18 Drilling them.

19 MR. FERGUSON: Let's take a look
20 at paragraph 55.

21 A. (Reviewing.) Okay.

22 BY MR. FERGUSON:

1 Q. Paragraph 55 -- okay. Sorry. Have
2 you had a chance to review that?

3 A. Yes, sir, I have.

4 Q. Paragraph 55 refers to pump system
5 329, right?

6 A. Yes, sir.

7 Q. These are the pumps for pumping
8 fracturing fluid into the wellbore; is that fair?

9 A. Yes, sir.

10 MR. FERGUSON: All right. And
11 if we go to now paragraph 58, please.

12 A. (Reviewing.)

13 BY MR. FERGUSON:

14 Q. Do you agree that Pankaj discloses
15 that "A computerized control system may be
16 employed to direct the entire pump system 329
17 during the fracturing operation"? Is that fair?

18 A. Yes, sir.

19 Q. Now, the POSITA -- excuse me. A
20 person of ordinary skill in the art would
21 understand that to mean that a computer system is
22 controlling one or more of the fracturing pumps;

1 is that fair?

2 A. I think that's fair. That's a broad
3 description of the fracturing system.

4 Q. Okay. You recall in claim 6 of the
5 '058 patent it requires selecting a representative
6 system model based on the received formation
7 response data and the sequence of stimuli,
8 correct?

9 A. Yes, sir.

10 Q. It's my understanding that, in your
11 opinion, using formation response data to update
12 an existing model does not meet that claim
13 limitation. Is that fair?

14 A. Yes, sir, that's fair.

15 Q. Let me ask an example here. Before
16 any fracturing operations have taken place, a
17 system model is chosen as approximating a
18 particular well. Can you understand that?

19 A. Okay.

20 Q. All right. And then using that
21 selected model, fracturing fluid is pumped at
22 different rates over time, and sensors are used to

1 measure the pressure response to the different
2 pump rates. Can you follow that?

3 MR. WALTERS: Objection. Form.

4 A. Okay.

5 BY MR. FERGUSON:

6 Q. Okay. And then that sensor data is
7 used to update the selected model, and then the
8 operations continue to proceed based on the
9 updated system model. Do you understand that?

10 MR. WALTERS: Objection. Form.

11 A. Yes, sir.

12 BY MR. FERGUSON:

13 Q. So, in your opinion, the process that
14 I just described, does that meet claim 1 of the
15 '058 patent?

16 MR. WALTERS: Objection. Form.

17 A. In a broad sense. In that limited
18 hypothetical, I would say probably not.

19 BY MR. FERGUSON:

20 Q. Is that because, in your view, the
21 limitation requiring selecting a representative
22 system model based on the received formation

1 response data and sequence of stimuli is not met?
2 Is that fair?

3 MR. WALTERS: Objection. Form.

4 A. Yes, sir. That's the particular
5 claim limitation that I think is missing from your
6 example.

7 BY MR. FERGUSON:

8 Q. Okay. And do you have an
9 understanding that that limitation is also present
10 in claim 9 and claim 16 of the '058 patent? Is
11 that right?

12 A. Yes, sir. In different forms. But
13 yes. Same basic concepts.

14 MR. FERGUSON: Okay. Keeping
15 with Pankaj now, let's go to paragraph 75.

16 BY MR. FERGUSON:

17 Q. You've seen this paragraph before,
18 right?

19 A. Yes, sir.

20 Q. And actually, I believed you
21 referenced Mangrove in one of your earlier
22 answers. What's your understanding of what

1 Mangrove is?

2 A. Mangrove is, very, very broadly
3 speaking, a software package that integrates
4 multiple fractures in a -- in a wellbore or system
5 of wellbores to look at the entire fracture
6 network.

7 Q. Okay. In this paragraph, paragraph
8 75, Pankaj states that "Simulators (e.g.,
9 MANGROVE) may have built-in unconventional
10 hydraulic fracture models like UFM." Do you see
11 that?

12 A. Yes.

13 Q. Do you agree that those built-in
14 models are preexisting in the simulator?

15 A. But UFM is a software package, so
16 yes, software packages would be preexisting.

17 Q. Okay. And would the models in UFM be
18 preexisting?

19 A. I'm not sure I understand your
20 question.

21 Q. Okay.

22 A. UFM, again, is a calculation package.

1 Q. Going back to paragraph 75, it refers
2 to the simulator, like Mangrove, may have built-in
3 unconventional hydraulic fracture models.

4 A. Right.

5 Q. Is it your understanding that that
6 means that the models are part of the UFM software
7 package?

8 A. I take this to mean, based on my
9 understanding of the various software packages,
10 that UFM is a planar fracture model system, model
11 calculator, that it calculates planar model as it
12 interfaces with the existing fractures.

13 So I take this to mean that Mangrove
14 has built in the same calculation engine, if you
15 will, that does that planar model -- planar model
16 development interfacing with both the preexisting
17 natural fractures and the induced fractures.
18 That's the way I read this.

19 MR. FERGUSON: Okay. I'll ask
20 Sarah to pull up Exhibit 2013, which we've
21 previously marked as your declaration. And
22 let's look at your paragraph 112.

1 A. (Reviewing.) Okay. I've read that.

2 BY MR. FERGUSON:

3 Q. This paragraph in your declaration
4 refers to equations 1 through 5 that petitioner's
5 expert, Dr. Nikolaou, identified as linear
6 equations in Pankaj; is that fair?

7 A. Yes. That's correct.

8 Q. Now, you have indicated that those
9 equations 1 through 5 are not linear equations,
10 right?

11 A. Yes, sir. That's correct.

12 Q. Okay. And an equation that's not a
13 linear equation is a nonlinear equation, fair?

14 A. Correct.

15 Q. So looking at claims --

16 MR. FERGUSON: Let's look at
17 claim 4 of the '058 patent. That's
18 Exhibit 1001, claim 4.

19 BY MR. FERGUSON:

20 Q. Claim 4 refers to "determining one of
21 a linear or a non-linear relationship." Do you
22 see that?

1 A. "Between the sequence of stimuli and
2 received formation response data," yes, sir --

3 Q. Yes.

4 A. -- to have the whole quotation.

5 Q. Fair.

6 So you agreed that the equations 1
7 through 5 in Pankaj are indicative of a nonlinear
8 relationship?

9 A. They are nonlinear relationships, but
10 they certainly don't meet the rest of the claim
11 limitation.

12 MR. FERGUSON: Okay. Why don't
13 we take like just a five-minute break. I
14 might be finished.

15 TRIAL TECHNICIAN: Off the
16 record at 11:06.

17 (A recess was taken from
18 11:06 a.m. until 11:12 a.m.)

19 TRIAL TECHNICIAN: Let's go back
20 on the record at 11:12.

21 BY MR. FERGUSON:

22 Q. Dr. Durham, prior to 2019, a person

1 of ordinary skill in the art would have understood
2 that pump rates at a hydraulic fracturing site
3 could be varied, correct?

4 A. Yes. I can agree with that.

5 MR. FERGUSON: I have no further
6 questions pending any questions from your
7 counsel. Thank you for your time.

8 MR. WALTERS: Can we take a
9 break? Maybe about ten minutes?

10 MR. FERGUSON: Sure.

11 MR. WALTERS: Why don't we come
12 back at 11:25.

13 TRIAL TECHNICIAN: Off the
14 record at 11:13.

15 (A recess was taken from
16 11:13 a.m. until 11:22 a.m.)

17 TRIAL TECHNICIAN: Let's go back
18 on the record at 11:22.

19 MR. WALTERS: Okay. I don't
20 have any further questions.

21 MR. FERGUSON: Okay.

22 TRIAL TECHNICIAN: Anything else

1 to state for the record at this time?

2 MR. FERGUSON: Just for the
3 court reporter.

4 Can I get the final of this by
5 Wednesday, next Wednesday?

6 COURT STENOGRAPHER: Of course.

7 And, Mr. Walters, would you also
8 like expedited?

9 MR. WALTERS: I don't need the
10 transcript.

11 COURT STENOGRAPHER: Okay. You
12 don't want the tran- --

13 MR. WALTERS: I don't need one,
14 but he would like to read and sign.

15 COURT STENOGRAPHER: Okay. So
16 no transcript copy, but you want to read and
17 sign?

18 MR. WALTERS: Correct.

19 COURT STENOGRAPHER: Okay. That
20 sounds good.

21 And, Mr. Ferguson, did you want
22 a draft? I could send that later today.

1 MR. FERGUSON: That'd be great.
2 Thank you. I would appreciate it.

3 COURT STENOGRAPHER: Okay.
4 Thank you very much, everybody.

5 MR. FERGUSON: Thank you all.

6 TRIAL TECHNICIAN: That ends the
7 deposition. Let's go off the record at
8 11:23.

9
10 (Time noted: 11:23 a.m.,
11 May 2, 2024.)

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CERTIFICATE

I, Myrina A. Kleinschmidt,
Registered Merit Reporter, and Remote Notary
Public, hereby certify that I reported the
deposition, and that the deponent was by me
first duly sworn to tell the whole truth;

The deponent was located in
Dallas, Texas;

That the testimony was
transcribed under my direction and is a true
record of the testimony of the deponent;

That I am not a relative or
employee or attorney or counsel of any of the
parties or a relative or employee of such
attorney or counsel;

That I am not financially
interested in the action and have no contract
with the parties, attorneys, or persons with
an interest in the action that affects my
impartiality;

The transcript is a true record
of the testimony given by the deponent;

There was not an attorney
present for the opponent;

The deposition was held remotely
using the Zoom platform on May 2, 2024,
beginning at 10:28 a.m. Central and ending at
11:23 a.m. Central;

The witness did not refuse to
read or sign the transcript.

WITNESS MY HAND AND SEAL this
6th day of May 2023.



Myrina A. Kleinschmidt

Veritext Legal Solutions
1100 Superior Ave
Suite 1820
Cleveland, Ohio 44114
Phone: 216-523-1313

May 9, 2024

To: MR. WALTERS

Case Name: Profrac v. Halliburton Company, Et Al.

Veritext Reference Number: 6661498

Witness: Robert Durham Deposition Date: 5/2/2024

Dear Sir/Madam:

Enclosed please find a deposition transcript. Please have the witness review the transcript and note any changes or corrections on the included errata sheet, indicating the page, line number, change, and the reason for the change. Have the witness' signature notarized and forward the completed page(s) back to us at the Production address shown

above, or email to production-midwest@veritext.com.

If the errata is not returned within thirty days of your receipt of this letter, the reading and signing will be deemed waived.

Sincerely,

Production Department

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DEPOSITION REVIEW
CERTIFICATION OF WITNESS

ASSIGNMENT REFERENCE NO: 6661498

CASE NAME: Profrac v. Halliburton Company, Et Al.

DATE OF DEPOSITION: 5/2/2024

WITNESS' NAME: Robert Durham

In accordance with the Rules of Civil Procedure, I have read the entire transcript of my testimony or it has been read to me.

I have made no changes to the testimony as transcribed by the court reporter.

Date Robert Durham

Sworn to and subscribed before me, a Notary Public in and for the State and County, the referenced witness did personally appear and acknowledge that:

They have read the transcript;
They signed the foregoing Sworn Statement; and
Their execution of this Statement is of their free act and deed.

I have affixed my name and official seal
this _____ day of _____, 20____.

Notary Public

Commission Expiration Date

DEPOSITION REVIEW
CERTIFICATION OF WITNESS

ASSIGNMENT REFERENCE NO: 6661498

CASE NAME: Profrac v. Halliburton Company, Et Al.

DATE OF DEPOSITION: 5/2/2024

WITNESS' NAME: Robert Durham

In accordance with the Rules of Civil Procedure, I have read the entire transcript of my testimony or it has been read to me.

I have listed my changes on the attached Errata Sheet, listing page and line numbers as well as the reason(s) for the change(s).

I request that these changes be entered as part of the record of my testimony.

I have executed the Errata Sheet, as well as this Certificate, and request and authorize that both be appended to the transcript of my testimony and be incorporated therein.

Date

Robert Durham

Sworn to and subscribed before me, a Notary Public in and for the State and County, the referenced witness did personally appear and acknowledge that:

They have read the transcript;

They have listed all of their corrections in the appended Errata Sheet;

They signed the foregoing Sworn Statement; and

Their execution of this Statement is of their free act and deed.

I have affixed my name and official seal
this _____ day of _____, 20____.

Notary Public

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ASSIGNMENT NO: 6661498

PAGE/LINE(S) /	CHANGE	/REASON

Date Robert Durham
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DAY OF _____, 20____ .

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Minnesota Rules of Civil Procedure

Part V. Depositions and Discovery

Rule 30

Rule 30.05 Review by Witness; Changes; Signing

If requested by the deponent or a party before completion of the deposition, the deponent shall have 30 days after being notified by the officer that the transcript or recording is available in which to review the transcript or recording and, if there are changes in form or substance, to sign a statement reciting such changes and the reasons given by the deponent for making them. The officer shall indicate in the certificate prescribed by Rule 30.06(1) whether any review was requested and, if so, shall append any changes made by the deponent during the period allowed.

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COMPANY CERTIFICATE AND DISCLOSURE STATEMENT

Veritext Legal Solutions represents that the foregoing transcript is a true, correct and complete transcript of the colloquies, questions and answers as submitted by the court reporter. Veritext Legal Solutions further represents that the attached exhibits, if any, are true, correct and complete documents as submitted by the court reporter and/or attorneys in relation to this deposition and that the documents were processed in accordance with our litigation support and production standards.

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