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Transcript of William Singhose, Ph.D.

Date: April 15, 2026

Case: Axon Enterprise, Inc., et al. -v- Airspace Defense, Inc. (PTAB)

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Axon Enterprise, Inc., Dedrone Holdings, Inc.,
And Skydio, Inc.
Petitioners,
v.
Airspace Defense, Inc.
Patent Owner

Case No. IPR2025-00629
U.S. Patent No. 10,514,711

REMOTELY CONDUCTED DEPOSITION OF
WILLIAM SINGHOSE, PHD
WEDNESDAY, APRIL 15, 2026
10:01 A.M. EST

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PAGES: 1 - 66
REPORTED BY: KARISA EKENSEAIR, CCR RPR RMR RDR

1 DEPOSITION OF WILLIAM SINGHOSE, PHD, CONDUCTED
2 VIA ZOOM VIDEOCONFERENCE.

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10 Pursuant to notice, before Karisa J.
11 Ekenseair, Certified Shorthand Reporter in and for
12 the States of Arkansas, Oklahoma, Missouri,
13 Illinois, Tennessee, Georgia, New Mexico,
14 Washington, and California; National Registered
15 Professional Reporter; National Registered Merit
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1 P R O C E E D I N G S

2 THE REPORTER: Good morning. We are on
3 the record.

4 Today's date is April 15, 2026. The time
5 is 10:01 a.m. Eastern time. My name is Karisa
6 Ekenseair. I am a certified shorthand court
7 reporter.

8 We are here today for the deposition of
9 Dr. William Singhose.

10 Will counsel please state their
11 appearances for the record?

12 MR. WADEKAR: Yeah. My name is Suhrid
13 Wadekar and I represent the Patent Owner Airspace.

14 MR. WALTERS: This is Chad Walters of
15 Baker Botts representing Petitioners Axon
16 Enterprise and Dedrone Holdings.

17 MS. RAO: This is Sasha Rao with Nixon
18 Peabody representing Skydio, Inc.

19 MR. BARAZESH: And -- and this is Ellyar
20 Barazesh with Baker Botts, also representing Axon
21 and Dedrone Holdings.

22 WILLIAM SINGHOSE, PHD

1 of lawful age, being first duly sworn, deposes and
2 says in reply to the questions propounded as
3 follows:

4 MR. WADEKAR: Before we start, can we
5 agree that since there are two different counsel
6 representing different -- different Petitioners,
7 can we agree that only one of the counsel would be
8 defending objections, etcetera?

9 MR. WALTERS: Yes.

10 MS. RAO: Yes.

11 MR. WADEKAR: Thank you.

12 EXAMINATION

13 BY MR. WADEKAR:

14 Q Good morning, Dr. Singhose. And did I --
15 did I say your name correctly?

16 A Good morning. Yeah. That's perfectly
17 fine.

18 Q Thank you. Thank you for taking the time
19 today. As I mentioned, my name is Suhrid Wadekar
20 and I represent Airspace Defense.

21 Could you please state your full name for
22 the record?

1 A William Singhose.

2 Q And where you are you located, Dr.
3 Singhose, today?

4 A Atlanta, Georgia.

5 Q Is there anyone in the room with you?

6 A No.

7 Q Do you currently have any documents before
8 you?

9 A Yes, I do.

10 Q What documents are those?

11 A These are documents that I just pulled out
12 of a box a few minutes ago and they appear to be a
13 collection of the petitioner exhibits, the patent
14 owner exhibits, and then I have a couple of
15 binders labeled Briefs 1 and Briefs 2.

16 Q And are those all hard copies?

17 A Yes.

18 Q And are they clean copies?

19 A Yeah. I just pulled them out of a box, so
20 I didn't put anything on them.

21 Q Okay. Do you have any other documents
22 with you other than those that you mentioned?

1 A No.

2 Q And you have been deposed before; is that
3 correct?

4 A Yes.

5 Q And about how many times?

6 A Probably between 40 and 50 times.

7 Q Okay. And you have also testified in
8 court; is that correct?

9 A Yes.

10 Q So may I assume that you remember the --
11 the usual rules of deposition?

12 A Yes.

13 Q Is there anything that would prevent you
14 today from testifying truthfully and accurately?

15 A No.

16 Q Okay. You prepared a total of two
17 declarations in this case so far; is that correct?

18 A Yes.

19 Q And are those Exhibits 1003 and
20 Exhibit 1030?

21 A Yes. I think that's what they were
22 marked.

1 Q Okay. And would it be okay if we refer to
2 Exhibit 1003 as the first declaration?

3 A Yes.

4 Q And would it also be okay if we refer to
5 Exhibit 1030 as the second declaration?

6 A Yes.

7 Q Okay. And you attached your CV to the
8 first declaration; is that correct?

9 A Yes, I did.

10 Q And is that CV up to date?

11 A Yeah. I -- it's up to date, I think, at
12 the time that I submitted that, so yes, very close
13 to up to date.

14 Q Okay. And so at a high level, could you
15 please describe your professional background?

16 A Well, I'm a mechanical engineer and a
17 professor of mechanical engineering at Georgia
18 Tech. I've had a fairly long career and so I've
19 been involved in a number of things over the
20 years.

21 I think most relevant to this matter is
22 that I've worked most of my professional career in

1 control systems and aerial vehicles, and I've also
2 worked on machine learning, neural networks
3 specifically, for a long period of time.

4 Q Thank you. So looking at your CV, you
5 have also listed 17 cases since 2009 where you
6 served as an expert; is that -- is that -- does
7 that sound about right?

8 A Since 2009 or --

9 Q 2019.

10 A Yeah. That sounds about right.

11 Q And are these all cases that relate to
12 patents?

13 A I don't think so. I'd have to look at the
14 list, but part of my job is to investigate
15 accidents of generally machines with control
16 systems and see if something went wrong. So some
17 portion of those cases would be -- would be
18 related to investigating an accident.

19 Q Do you have a -- a rough sense of how many
20 related to patents?

21 A Probably during that time frame, it would
22 be about two-thirds of those cases were related to

1 patents or -- not just patents, but intellectual
2 property such as trade secrets and things like
3 that.

4 Q Okay. And how much of your time, work
5 time, involves consulting or testifying for
6 parties involved in litigation?

7 A Well, that really depends a lot on the
8 time of the year. When you're a professor, you
9 don't get paid for the summer so you basically
10 have a period of three or four months in the
11 summer where Georgia Tech doesn't pay you because
12 you're not teaching. And -- and you go off and do
13 various things in your own time, start companies,
14 do consulting like this.

15 So during the summer, it's -- it's very
16 close to 100 percent of my time. I probably still
17 work for Georgia Tech 10 or 20 percent of the time
18 managing my research group.

19 And then during what I'll call the
20 academic year, that would be more like one day a
21 week, so something like 20, 25 percent of my time
22 during the fall and spring.

1 Q Okay. Thank you. Have you had an expert
2 opinion that you submitted excluded by a court or
3 any other forum?

4 A Well, I've had some of my opinions -- I
5 don't know if they're excluded. They've been
6 restricted or moved out of the case. I think
7 that's happened just a -- two or three times over
8 the course of my career. For -- for some reasons,
9 I will prepare some material and when we get to
10 trial, that -- that material cannot be used.

11 Q Okay. So if I understand correctly,
12 you're saying that not the -- not the opinion in
13 its entirety, but portions of it?

14 MR. WALTERS: Objection, form.

15 A Yeah. I mean, I could just really quickly
16 give you some examples that I -- I remember.

17 One case I did was an accident case where
18 a Segway machine, that self-balancing transporter
19 that you may have heard about, it got involved in
20 a lot of accidents. So I did some tests on it
21 where I videotaped the machine behaving improperly
22 and falling over.

1 And that material was turned over to the
2 other side before trial, but on the eve of the
3 trial, the other side claimed that they couldn't
4 play movie files. And so the judge said, well,
5 since they couldn't play the movies, you can't
6 show them to the jury. You just have to describe
7 what is in the movies. So that was one case.

8 At another case at the ITC, the law firm I
9 was working with, they did not upload my
10 demonstratives that went along with my report,
11 like all the slides and all stuff. And I guess
12 they missed the deadline. So when I got up to the
13 ITC, they made a ruling that I could not testify
14 about all the stuff that hadn't been uploaded. So
15 it's that kind of -- it's that kind of thing.

16 Q Okay. Thank you.

17 So when were you first contacted about
18 this IPR?

19 A I don't have my records right in front of
20 me, but I'm thinking it's the fall of 2024, maybe
21 a year and a half ago sounds about right.

22 Q And who contacted you?

1 A That, I don't remember.

2 Q Was it somebody from one of the
3 petitioners?

4 A Yeah. I believe it was somebody from
5 Baker Botts contacted me, but I wouldn't -- I
6 wouldn't remember who that is.

7 Q Oh, so -- okay. So -- so by -- so you
8 were contacted by counsel -- counsel for
9 Petitioners?

10 A Yes. I think that's correct.

11 Q Okay. And were you asked to give an
12 expert opinion?

13 A Well, not -- not at that time. I -- I
14 think my --

15 MR. WALTERS: Object -- I'd like to log a
16 privilege objection.

17 I ask you not to reveal any statements
18 from counsel.

19 Q Yes. Yes. Yes. I am not asking about
20 specific discussions between you and -- you and
21 the counsel. I am simply asking what kind
22 of -- what -- what -- for what type of services

1 were you contacted? That's all I'm asking.

2 A They contacted me saying that they were
3 planning --

4 MR. WALTERS: Dr. Singhose, I -- Dr.
5 Singhose, I'd like to -- I'd like -- you can
6 answer to the question to the extent that you
7 don't reveal any communications between us.

8 THE WITNESS: Okay.

9 A When I was contacted, my understanding was
10 that my job was to provide technical expertise in
11 an IPR proceeding.

12 Q Are you being compensated for your
13 services in this case?

14 A Yes.

15 Q And how are you being compensated?

16 A I keep a work log of what I do for this
17 case, and then I submit that on a fairly regular
18 basis with an invoice for my work.

19 Q And do you know who is paying your fees?

20 A I don't know who is paying the fees. I --
21 I send them to Baker Botts and they get paid.
22 I -- I don't know the accounting --

1 Q Okay.

2 A -- part of it.

3 Q Is the fee that you're charging in this
4 case, what -- let me strike that.

5 Do you have a -- for this type of
6 consultation, legal consultation, do you have a
7 standard rate of fee?

8 A Yes, I do.

9 Q And is that the rate that you're charging
10 in this case?

11 A Yes, it is.

12 Q And roughly for how many hours have you
13 worked on this case so far?

14 A I don't have my records in front of me,
15 but given this has involved a little extra work
16 than a normal IPR, I would think it would be about
17 100 to perhaps 120 hours at this point.

18 Q Okay. And has anyone else assisted you in
19 your work on this matter?

20 A I mean, I -- I have some assistants that
21 may proofread something I've given them, but I
22 can't remember doing that in this case. And then,

1 of course, you know, I work with the attorneys to
2 prepare my report, but I'm not relying on them for
3 any technical analysis or expert opinion.

4 So I think this is primarily -- you know,
5 these declarations that you -- that you have in
6 front of you are primarily my work product.

7 Q Okay. So could we please turn to
8 Exhibit 1003, your first declaration?

9 A Okay. Let me pull that up.

10 Okay. I have that near me.

11 Q And who prepared this first declaration?

12 A Well, I mean, I prepared it, but as I said
13 just a -- a little while ago, you know, there's
14 this interaction with -- with the attorneys that I
15 go through during this process. So I'm sure some
16 of these sections, they -- like the legal
17 background and stuff like that, I'm pretty sure
18 they had a large amount of -- of input on those
19 sections. But, essentially, this is a Word
20 document that I started and ultimately finished.

21 Q So other than the -- the legal background
22 section, did you write -- did you write yourself

1 the -- all of it, the rest of it?

2 A I mean, I wrote, physically typed, most of
3 it. There's probably some sections in here,
4 things like the claims, you know, when we list out
5 the claims, that may have just been passed on to
6 me from the attorneys. It -- it would be tough
7 for me to go and, like, point out every single
8 instance like that where they had shared text with
9 me. But, yeah, this is primarily my writing.

10 Q Okay. And when you received the text that
11 is included in your declaration, did you -- did
12 you review those portions?

13 A Yes, certainly.

14 Q And now, could we please turn to
15 Exhibit 1030 which is the second declaration?

16 A Okay. Okay. I have that near me now.

17 Q Okay. And who prepared this declaration,
18 second declaration?

19 A I did.

20 Q And other than the portions that you
21 mentioned, legal background or claim listing, did
22 anyone else help you with preparation of

1 this -- with the preparation of this declaration?

2 A Well, I think it was the same sort of
3 process where I started it and put a lot of things
4 in place and then they would, you know, pass over
5 to me, like, text like the claims.

6 Like, in this one, I think they sent me
7 more of the text with the added -- added material
8 underlined and things like that.

9 So I think I got a little bit more of that
10 type of material in here because of the -- of this
11 motion to amend material.

12 Q And did you review all that material?

13 A Yes, I did.

14 Q Have you reviewed any of your declarations
15 in preparing for today's deposition?

16 A Yes.

17 Q Which ones?

18 A Both of them.

19 Q Okay. And do you know that Patent Owner's
20 expert Dr. Papanikolopoulos has provided a
21 declaration in this matter?

22 A Yes. I'm aware of that.

1 Q And did you review that declaration?

2 A Yes, I did.

3 Q When?

4 A I think it was probably soon after he
5 submitted it in this matter. So I think he
6 submitted it; it went to the attorneys at Baker
7 Botts. And I think probably soon after that, it
8 was passed on to me and I, at that point, started
9 to review it.

10 Q What else did you do to prepare for
11 today's deposition?

12 A Well, I've been preparing for this for a
13 long time. The whole -- the whole course of my
14 work is sort of preparing for this point. But in
15 the -- in the near recent history, I reviewed my
16 declarations, as we talked about. I reviewed all
17 of the prior art that is being used. I reviewed
18 some legal standards, related to Section 112
19 invalidity. That's probably the -- sort of the
20 documents that I reviewed in preparation for this.

21 Q And other than the counsel for -- for the
22 petitioners, did you talk to anyone else in

1 preparing for this deposition?

2 A Yes.

3 Q And with whom?

4 A My wife.

5 Q Oh, okay. Do you -- did you discuss
6 technical substantial material with your wife?

7 A Mostly that was discussion of -- of how to
8 take care of three kids when I'm gone the whole
9 day, but she does have a PhD in mechanical
10 engineering and she knows a lot about this
11 process. So I mentioned that I would have to be
12 covering, like, motion to amend material and
13 things like that. But she didn't offer me any
14 advice or anything. I was just going over, like,
15 how long the deposition would take because of
16 the -- the subject matter that would be covered.

17 Q Did you review any documents that are not
18 the exhibits?

19 A Not that I recall.

20 Q You mentioned earlier that you received a
21 box and that box included all clean copies; is
22 that correct?

1 A Yeah. It was -- it was a couple boxes.

2 Q Okay. Did you take any notes before --
3 before you received that box relating to any of
4 the exhibits?

5 MR. WALTERS: Object to the form.

6 A I guess I don't understand the question.
7 I've been taking notes this whole time.

8 Do you mean did I take any notes on the
9 documents?

10 Q No. (Technical disruption.)

11 THE REPORTER: I'm sorry, Counsel. You're
12 kind of fading in and out. Can you start your
13 question over, please?

14 MR. WADEKAR: Sure. Yeah. Let me -- let
15 me restart.

16 Q You -- you just mentioned that you have
17 been taking notes.

18 Are these handwritten notes or
19 computer-type notes?

20 A I mean, like, I generally take notes on
21 the document. Like, if I'm reviewing a petition
22 or something that's sent to me, I'll -- I'll read

1 it and I'll -- I'll make some notes along the way
2 during my analysis, noting certain things that are
3 in these documents. If that's what you mean by
4 notes, I've been doing that this whole -- this
5 whole case.

6 Q I -- I understand. So those documents
7 where you may have some notes written, those
8 documents are not with you right now; is that
9 correct?

10 A No -- no, they're not. Yeah. That's
11 right. That -- a lot of that stuff is probably
12 thrown away by now. Basically, that's just part
13 of my process of -- of declare -- of making these
14 declarations.

15 Q All right. Give me one second.

16 Please turn to paragraph 38 of your second
17 declaration. It's on page 19.

18 A Page 19, okay.

19 Q Page 19, yeah. Paragraph 38.

20 A Okay. Okay. I'm at paragraph 38.

21 Q And you said in this paragraph that you
22 believe what the plain and ordinary meaning of

1 "autonomously navigating," that -- that -- that
2 claim term; is that correct?

3 A Yes.

4 Q And who derived this construction?

5 A Well, I'm not sure it's a -- I guess it is
6 a legal -- you're, again, you're using a legal
7 term, "construction." I -- I just think it's just
8 the plain and ordinary meaning.

9 And, I mean, I think I was just discussing
10 it with the attorneys and they asked my opinion
11 and I probably said something very much like this,
12 and I wrote it down.

13 Q Okay. So now let's go to paragraph 40.

14 A Okay.

15 Q Here you say in paragraph 40 that
16 "Petitioners' interpretation is also consistent
17 with and inclusive of the '711 patent's
18 embodiments describing ground stations providing
19 commands."

20 Do you see that?

21 A Yes.

22 Q And then you cite several portions of the

1 '71 [sic] patent in that paragraph.

2 Do you see that?

3 A Yes, I do.

4 Q Does the '71 patent use the work
5 "autonomous" or "autonomously" in any of those
6 portions that you cite here?

7 A I would have to look at each one to answer
8 that question.

9 Q Yes. Yeah. Please feel free to. That
10 would be Exhibit 1001.

11 A Okay. Let me grab that.

12 Okay. I have reviewed those sections.
13 But could you repeat the question, just to make
14 sure I did it correctly?

15 Q I'll repeat the question.

16 Does the '71 patent use the words
17 "autonomous" or "autonomously" in any of those
18 portions that you cite?

19 A No. I could not find "autonomously" in
20 those portions.

21 Q Okay. Now, could we please turn to
22 Exhibit 1031?

1 A What is 1031, just to know what I'm --

2 Q I'm sorry, so that is -- that is a -- a
3 listing from dictionary.com, a Wayback Machine
4 listing from dictionary.com.

5 A Okay. I think I know what -- you said
6 1031, right?

7 Q 1031. Yes.

8 A Okay. I -- I've got that. Well, it
9 starts off with a -- with a declaration from, what
10 I believe, is like a -- a archivist or something
11 like that.

12 Q Yeah. Yes.

13 A Yeah.

14 Q So --

15 A Then it goes to Exhibit A, and then after
16 that I seem to have some definitions of
17 "autonomous."

18 Q Right. Yes. So -- so I'm looking at
19 page 5 of the -- of the exhibit, so if you could
20 turn to that page.

21 A I'm there.

22 Q Okay. So and do you see that the

1 dictionary provides four definitions for
2 "autonomous"?

3 A Yes, I do.

4 Q Okay. And you have quoted the third
5 definition; is that correct?

6 A Yeah. That one seems the most relevant to
7 the -- the aerial vehicles that we're talking
8 about here.

9 Q Okay. And do you see that the third
10 definition actually states "under normal road
11 conditions"?

12 Do you see that?

13 A Yes, I do.

14 Q So despite those words, why do you think
15 the third definition is relevant to autonomous
16 aerial vehicles?

17 A Well, it's a definition of autonomous
18 that's related to vehicle, and it actually speaks
19 to navigating and maneuvering by a computer
20 without the need for human control or
21 intervention. That's, I think, exactly what
22 "autonomous" means in view of the subject matter

1 that we're considering.

2 Now, it does say "road conditions," but it
3 could be airspace conditions, and I think it would
4 be equally applicable.

5 Q Did you review the second definition?

6 A Yes, I did.

7 Q But you did not rely on that during your
8 analysis; is that correct?

9 A Well, I think I, in some sense, relied on
10 all of these, in that I read them all and they
11 are -- you know, they're all definitions of the
12 word "autonomous," so I considered them all. But
13 some of them aren't really relevant to what we're
14 doing, for example, the first one have -- having
15 to do with, like, governance, and the last one
16 having to do with biology.

17 The second one I considered, but the third
18 one, since it's specifically talking about
19 vehicles, that one is clearly the most relevant to
20 this subject matter.

21 Q Okay. So now let's go back to your second
22 declaration, Exhibit 1030.

1 A Okay.

2 Q And let's go to paragraph 28 which is on
3 page 12.

4 A Okay.

5 Q Do you see that here, you're discussing an
6 interpretation of autonomously navigating by -- by
7 the patent owner?

8 A Yes.

9 Q And you do not agree with this
10 interpretation; is that correct?

11 A That is correct.

12 Q Other than Patent Owner's interpretation
13 that you see here, are you aware of any other
14 interpretation of the term "autonomous" that
15 is -- that may be used in the context of aerial
16 vehicles?

17 MR. WALTERS: Objection, form.

18 A I didn't -- I didn't do an exhaustive
19 search of all dictionaries or textbooks that use
20 "autonomous" in relation to aerial vehicles. I
21 had an understanding of the term, a very good
22 understanding of the term, before I was -- I was

1 asked to opine on this issue.

2 So I -- my investigation in this matter
3 was simply to go to a few texts and find
4 definitions that agreed with mine to show that the
5 rest of the world, or at least persons of ordinary
6 skill in the art, would agree with my definition.

7 Q Okay. Now, let us go to -- give me one
8 second, page 68 and -- page 68, 69, paragraph 179
9 specifically of your second declaration.

10 A Okay. I'm on page 68.

11 Q Great. On page 68, there is just a
12 heading. It just says "Overview of Redmon."

13 Do you see that?

14 A Yes, I do.

15 Q And then the paragraph 179 is on the next
16 page.

17 Do you see that?

18 A Yes, I do.

19 Q So you are providing an overview of Redmon
20 in this paragraph; is that correct?

21 A Yes.

22 Q And do you see that Redmon teaches two

1 different YOLOs?

2 A Yes.

3 Q Are you aware of any other types of YOLO?

4 MR. WALTERS: Objection, form.

5 A Yes. I mean, YOLO is a term that
6 describes a sort of general class of algorithms so
7 you could always find subsets of those algorithms.
8 And Redmon just talks about two of those: One
9 that kind of operates slowly, and one that
10 operates more quickly.

11 So there's a bunch of different YOLOs.
12 They're all -- they reside along a spectrum of
13 algorithms.

14 Q And just to make sure that I heard you
15 correctly, you used -- you said YOLO, right,
16 Y-O-L-O?

17 A Yeah.

18 Q Okay. And you -- you mentioned that
19 there -- there are other types of YOLOs.

20 Do -- do you know any such types?

21 A Well, again, a YOLO is -- is a technical
22 term, but it -- it encompasses a large range of

1 algorithms, and they're essentially algorithms
2 that you just look at one image and do your
3 analysis on that so you only look one time.

4 And so, you could do those kind of --
5 there could be all kinds of algorithms where all
6 you're given is one image and you try to find an
7 object in that image. So it encompasses quite a
8 range of -- of algorithms.

9 Q So now let's go to paragraph 225, which
10 I'll -- I will give you a page -- the page number
11 in a second.

12 Okay. So paragraph 225 starts on page 88
13 and then continues on to page 89.

14 A Okay. I'm there.

15 Q So if you want to review that
16 paragraph --

17 A Okay.

18 Q -- please do. Yeah.

19 A Okay. I've reviewed that.

20 Q Okay. So do you agree that the base YOLO
21 can detect objects at a rate of 45 frames per
22 second?

1 A Yes. That's what it's teaching.

2 Q Okay. And you have said that the base
3 YOLO satisfies the claim limitation, the first
4 neural network; is that correct?

5 A Well, yeah. It's the first robustness is
6 what I was pointing to, I believe, there, but yes.

7 Q And the first neural network has a first
8 refresh rate; is that correct?

9 A Yes.

10 Q So is it correct to say that if the base
11 YOLO is the first neural network, 45 frames per
12 second is the first refresh rate?

13 A Yes, if that's the way we're defining it.

14 Q And do you agree that the fast YOLO can
15 detect objects at a rate of 155 frames per second?

16 A Yes. That's what it's teaching.

17 Q And then you have said that the fast YOLO
18 satisfies the claim limitation, the second neural
19 network?

20 A Yeah. I mean, I guess you could call
21 either one, but I think for this particular
22 limitation we are setting up that way because we

1 have to do this comparison between which one is
2 faster and which one is more robust.

3 Q Okay. And so the second neural network
4 also has a -- a second refresh rate; is that
5 correct?

6 A Yes.

7 Q Okay. And so are you saying that if the
8 fast YOLO is the second neural network, then 155
9 frames per second is the second refresh rate?

10 A Yes. The -- the faster one is -- it's
11 less robust so we can go faster and refresh
12 faster.

13 Q Okay. And that's how the claim
14 requirement, the first refresh rate being smaller
15 than the second refresh rate, is met?

16 A That's correct. One of these has a
17 refresh rate that's smaller and so it -- it
18 matches that limitation, and one is higher or
19 larger and so it meets -- it meets the requirement
20 of the other neural network.

21 Q And are you aware that the '711 patent
22 describes a relationship between compute cost and

1 refresh rate?

2 MR. WALTERS: Objection, form.

3 A I don't -- I don't remember that, but if
4 you -- you know --

5 Q Sure.

6 A -- point me towards the section, I'll
7 review that.

8 Q So let's go to the -- 71 -- '711 patent
9 which is Exhibit 1001.

10 A Okay. I got that.

11 Q And if we go to column 27.

12 A Actually, let me --

13 Q It's column 27 lines 53 to 64.

14 A I've got the whole thing now. Column 37?

15 Q 27.

16 A Okay.

17 Q Column 27 lines 53 to 64.

18 A Okay. I believe that -- you kind of cut
19 out there for a second, but I believe you said
20 starting at lines 52. Is that --

21 Q 53. 53 --

22 A Okay.

1 Q -- to 64.

2 A Okay. I'll review that.

3 Okay. I've reviewed that section.

4 Q So do you want me to repeat my question?

5 A Yes, please.

6 Q So do you see that the 711 patent
7 describes a relationship between cost and refresh
8 rate?

9 Do you see that?

10 A Yes. Before you had -- yeah. I think
11 you'd said something slightly different. But
12 yeah, it -- it's -- it's definitely teaching that
13 when you have a high cost you have a low refresh
14 rate and then sort of the inverse of that. If you
15 have a low cost, you can achieve a high refresh
16 rate.

17 Q Okay. Now, let's go back to your
18 declaration, second declaration.

19 A Okay.

20 Q And let's go to -- give me one second.
21 Paragraph 210.

22 A Okay.

1 Q And if you look at the previous paragraph
2 of 209, which is on page 81, we are
3 discussing -- you are discussing Claim Element
4 36.d; is that correct?

5 A Yes.

6 Q Okay. And now, going again ---- going
7 back again to paragraph 210, so is it your opinion
8 that YOLO is a high robustness neural network?

9 MR. WALTERS: Objection, form.

10 A It's my opinion that a YOLO can be a high
11 robustness -- what we just talked about, there can
12 be an entire spectrum of YOLO neural networks. So
13 you can definitely have a high robust one.

14 Q Okay. So to which YOLO are you referring
15 in paragraph 210, which version?

16 MR. WALTERS: Objection, form.

17 A I'm not speaking to a -- a specific YOLO.
18 I'm teaching -- I'm referring to the -- the
19 teachings that we've gotten this prior art
20 that -- that YOLOs can be high robustness. So
21 here, I'm -- I'm suggesting that we use the
22 teaching of a high robust YOLO which comes, as we

1 just talked about, with a high commute -- compute
2 cost. So that's the -- the class of algorithm
3 that we would be using here.

4 Q So are you saying that the YOLO that is --
5 let me -- let me strike that. Let me go back.

6 Do you recall that we discussed earlier
7 base YOLO and a fast YOLO?

8 A Yes.

9 Q Okay. So are you saying that either one
10 of them could be used as a YOLO here?

11 MR. WALTERS: Objection, form.

12 A No. I'm -- in fact, I'm not saying we
13 have to use those exact -- those exact neural
14 networks that are in the prior art. We're using
15 the teachings of those.

16 And in this case, we're using a teaching
17 that you can come up with a YOLO that has high
18 robustness and high commute costs -- compute
19 costs. That's what I'm using here.

20 Q Okay. Now, let's go to paragraph 211 on
21 the next page. So are you saying here that LSTM
22 is an example of a -- of a medium or low

1 robustness neural net?

2 A Yes.

3 MR. WALTERS: Objection, form.

4 A Yes. That's what this paragraph is
5 discussing.

6 Q So if I were to compare the refresh rate
7 of YOLO which is described as a high robustness,
8 high cost algorithm with the refresh rate of LSTM
9 which is the -- described here as a low or medium
10 robustness neural network, should I expect the
11 refresh rate of the LSTM -- LSTM to be higher?

12 MR. WALTERS: Objection, form.

13 A Yes. That would be the general
14 relationship. As you increase the robustness of
15 these neural networks, they take longer to perform
16 so they cannot refresh as quickly. So when you go
17 to one that has lower robustness, it can generally
18 refresh faster.

19 Q Now, let's go to paragraph 213.

20 A Okay.

21 Q And you are discussing claim 37 here; is
22 that correct?

1 A Yes.

2 Q And in this paragraph, do you see that you
3 discuss Park's little and big system
4 architectures?

5 A Yes, I do.

6 Q And you say that Park teaches whether to
7 use a low-energy or a high-energy object detection
8 model; is that correct?

9 A Yes.

10 Q And do you recall how Park operates
11 its -- little and big models or system
12 architectures as you've described?

13 A Yes, I do.

14 Q Could you describe how?

15 A Sure. Park describes a teaching where you
16 obtain an image of something you want to analyze
17 and the first thing it does is it sends that image
18 to a -- what it's calling the little neural
19 network or the little DNN and that little neural
20 network which would operate quickly and with low
21 energy, it would provide a classification that is
22 what it found about objects in there.

1 And then Park takes that output and he
2 says well, let me check it to see if I -- see if
3 you really think you got something here. And he
4 goes through, like, I think he calls it a success
5 checker, I think is the terminology that they use.
6 And if that success checker says, I don't have a
7 lot of confidence in this, my confidence level is
8 low, then it takes that image and it passes it
9 through its big neural network which takes longer
10 and uses more energy. And then they use the
11 output of the bigger neural network as the output
12 of their analysis.

13 Q Okay. And you -- mentioned the success
14 checker just now and you -- in this paragraph of
15 your declaration, you also mention the score
16 margin.

17 Do you see that?

18 A Yes.

19 Q So the -- so does the success checker use
20 the score margin?

21 A Yes. The score margin, I believe, without
22 reviewing it word by word, it's essentially a

1 threshold. They do this analysis on the output
2 and they get a score margin or a confidence level,
3 like, how confident are they. And if they're
4 highly confident, then they just use that result
5 from the -- from the little neural network. They
6 use that as the output. But if the confidence
7 level -- if the confidence is below that threshold
8 level, then they send it back through the big
9 neural network to -- to try again.

10 Q So let's go to Park. Park is
11 Exhibit 1035.

12 A Okay. Just a sec.

13 Okay. I have Park in front of me now.

14 Q Okay. And then if you go to what is
15 marked as page 11 in the -- in the label at the
16 bottom, and on the paper itself, it's page 126.

17 A Okay.

18 Q So do you see Figure 3 on that page?

19 A Yes, I do.

20 Q And feel free to read the paragraph right
21 below Figure 3.

22 A Okay.

1 Q Yeah. And it goes on a little bit over to
2 the next page.

3 A Okay. I've reviewed that.

4 Q Okay. So the last line of that paragraph,
5 it says, "Thus if the score margin is larger than
6 the threshold, the interference result from the
7 little DNN is considered as correct and taken as
8 the final interference result." [As read]

9 Do you see that?

10 MR. WALTERS: Objection, form.

11 A You kind of mixed up some words there, but
12 I read -- I read that sentence and I understand
13 it.

14 Q Let me -- let me read it exactly. So,
15 "Thus if the score margin is larger than the
16 threshold, the interference result from the little
17 DNN is considered as correct and taken as the
18 final interference result." [As read]

19 Did I --

20 MR. WALTERS: Objection, form.

21 Q Did I read that accurately this time?

22 A No. The -- it's not "interference." It's

1 "inference." It's --

2 Q Oh, I'm sorry. My mistake. Yes. With
3 that correction, inference -- my mistake. Not
4 interference, inference --

5 A Yes.

6 Q -- both times, yes. Okay.

7 So my question, the question I really
8 wanted to ask is: What is the score margin?

9 MR. WALTERS: Objection, form.

10 A The score margin as they're describing it
11 here is the output from that success checker. The
12 success checker is just an algorithm that they run
13 and it's -- it's going to spit out some number or
14 some sequence of numbers and that's the score
15 margin.

16 Q And so the score margin is used here to
17 make a decision whether to use the inference
18 result or not from the little DNN?

19 A Yes. That's correct. If the -- the
20 confidence that they've determined is above a
21 threshold, then they say I'm going to accept that
22 and -- and go forward with whatever I'm doing. I

1 believe that the little neural network did its job
2 and I have a high confidence level it's above a
3 threshold, and I'm going to keep going on. But if
4 it's below that level, that threshold, then it
5 sends the image back through the more complicated,
6 the bigger neural network to -- to basically try
7 again to get a better answer.

8 Q And when it does that, when it goes
9 through the -- the big DNN, does it now evaluate
10 the score margin again?

11 A You know, I didn't search for that. Let
12 me read the next paragraph and just see what it
13 does in that case, see if it tells us exactly what
14 it does. I mean, it could do it or it doesn't
15 have to do it. But let's see if it -- what it
16 says here.

17 Q Okay. Sure, please, go ahead.

18 A Well, I read the next paragraph, you know,
19 following on its description. In that paragraph,
20 it doesn't say whether or not it runs the success
21 checker again.

22 Q Okay. So you started out by describing

1 that you -- you get an image and then the process
2 that you described is followed; is that correct?

3 A Yeah. I mean, this whole thing starts by
4 inputting an image into these algorithms and the
5 first is put into the little neural network.

6 Q So for the next image, the whole process
7 would be repeated again?

8 MR. WALTERS: Objection, form.

9 A Assuming there's a next image. I mean,
10 this algorithm would just be used over and over
11 again. So if you have a series of -- of images
12 that you want to analyze, yeah, you would then put
13 in the next image that you wanted to analyze and
14 run through this process.

15 Q Okay. Now, let's go back to your second
16 declaration, paragraph 213 that's on page 84.

17 Before I go and ask my question about
18 that, I know we've been going on for about one
19 hour. Would you like to take a short break?

20 A Yeah. Because I've got a bunch of papers
21 out of order here actually.

22 What was -- you wanted to go back to which

1 declaration?

2 Q We could -- we could just go back to it
3 after the break, if you would like to take a break
4 now.

5 A Let's take a break and let me get all
6 these papers a little bit organized and then pick
7 up again in, like, five minutes or something would
8 be fine with me.

9 MR. WADEKAR: Okay. All right. So we
10 can -- we can go off the record.

11 THE REPORTER: Off the record at 11:03.

12 (Whereupon a break was had.)

13 THE REPORTER: Back on the record at
14 11:11 a.m.

15 BY MR. WADEKAR:

16 Q So let's go back to your second
17 declaration, paragraph 213. And that is on
18 page 84.

19 A Okay. I'm there.

20 Q Okay. We see that you discuss Redmon's
21 base YOLO and then it goes on the next page, the
22 fast YOLO in this paragraph.

1 A Yes.

2 Q And you describe here using the base YOLO
3 or the fast YOLO for object detection; is that
4 correct?

5 A Yes.

6 Q So now, if you go on to paragraph 214, the
7 next paragraph, do you want to review? It's a
8 long paragraph. It goes on to the next page.

9 A Okay. I'll review it and let you know.

10 MR. WADEKAR: I'm sorry, I did not
11 understand. Was somebody saying something?

12 THE WITNESS: I didn't say anything.

13 MR. WADEKAR: Okay. I just heard
14 something I thought, so...

15 A Okay. I've reviewed it, paragraph 214.

16 Q Okay. All right. So -- and so, you say
17 here that a score margin value associated with
18 using the fast YOLO is determined; is that
19 correct?

20 A Yes. In this combination, that's how it
21 would work.

22 Q Okay. And then you say that based on that

1 score margin, one can decide whether to use the
2 base YOLO or the fast YOLO; is that correct?

3 A Yes.

4 Q And so in this combination, that -- that
5 you're discussing here that's described as DP --
6 sorry, BLPRR [sic] combination, would -- would
7 Beard's image processor make this decision?

8 MR. WALTERS: Objection, form.

9 A Yes. Well, it's the Beard's image
10 processor modified with the techniques taught
11 by -- in this -- this paragraph is talking about
12 what's taught by Park and Redmon. Those would go
13 into the modified Beard image processor.

14 Q Okay. And so then would Beard's image
15 processor implement the base YOLO?

16 MR. WALTERS: Objection, form.

17 A Yes. In certain cases when the fast YOLO
18 didn't reach the confidence level required.

19 Q Let -- let me rephrase that.

20 So -- so to start the process, would
21 Beard's -- Beard's image processor first execute
22 the fast YOLO?

1 MR. WALTERS: Objection, form.

2 A Yeah. It would execute a fast YOLO.

3 Q Okay. And then based on the decision it
4 would make that we just discussed, it would then
5 decide whether to execute a base YOLO or not; is
6 that correct?

7 MR. WALTERS: Objection, form.

8 A Yeah. That's right. That's how this
9 process works. It would look for that confidence
10 level threshold. And if it did not meet the
11 required threshold, then it would run the base
12 YOLO.

13 Q Okay. And does -- does Redmon discuss
14 using both the base YOLO and a fast YOLO in this
15 manner?

16 MR. WALTERS: Objection, form.

17 A No, not exactly in that manner. That's
18 why we integrate the teachings of Park.

19 Q Okay. But then when those teachings are
20 incorporated or integrated with Beard's image
21 processor, would it operate then in a manner in
22 which Park described?

1 MR. WALTERS: Objection, form.

2 A Yes. The modified Beard image processor
3 would modify -- would operate in the way described
4 by Park.

5 Q So to make the combination work that you
6 just described, would there be any modification
7 necessary to the fast YOLO as Redmon's -- Redmon
8 describes it?

9 MR. WALTERS: Objection, form.

10 A I don't think so. I mean, again, we're
11 not talking about a specific fast YOLO in Redmon.
12 We're talking about the teaching in Redmon of
13 using a fast YOLO. So the fast YOLO that is
14 integrated in -- in Beard would operate in the
15 same way.

16 Q Okay. So let's go to Redmon, which is
17 Exhibit -- give me one second, Exhibit 1036.

18 A Okay. I have that.

19 Q And then if you could go to what is marked
20 as page 49 at the very bottom, and then on the
21 paper, it is page 700 -- 780, 7-8-0.

22 A Okay.

1 Q So on this page in the right column or
2 column to the right, do you see the subheading,
3 "network design"?

4 A Yes, I do.

5 Q So here it says, "Our network has 24
6 convolution layers followed by two fully connected
7 layers."

8 Do you see that? It's the second
9 paragraph in that section.

10 A Yes, I do.

11 Q And then in the third paragraph, it says,
12 "Fast YOLO uses a neural network with fewer
13 convolution layers, 9 instead of 24, and fewer
14 filters in those layers."

15 Do you see that?

16 A Yes.

17 Q Okay. So in the combination that we
18 were -- we discussed earlier where you mentioned
19 that Beard would integrate or incorporate all of
20 these teachings, so if Beard is executing a fast
21 YOLO, would it be something similar to what is
22 described here, 9 convolution layers instead of

1 24?

2 A Well, I mean, the 9 and 24 are just
3 specific examples of this idea, this concept. So
4 I'm not saying they would use exactly 9. They
5 could use 9. But I -- what it's teaching here is
6 that you use one that is fast. And to make it
7 faster than the base, you -- you will have to use,
8 in general, fewer convolution layers and fewer
9 filters.

10 So this was describing a very clear
11 teaching to a person of ordinary skill in the art
12 have -- that you should have two different
13 networks, one that is fast and it will generally
14 have a smaller structure so it can operate more
15 quickly, and then you have a larger one that you
16 run from time to time when you need it.

17 Q Okay. So -- so is it then correct that
18 instead of using 9 convolution layers, you
19 could -- you could have a version of a fast YOLO
20 that has, just say, 8 or 10; is that possible?

21 A Yes. That's certainly possible.

22 Q And if you have a fast YOLO like that,

1 would that have to be trained again to -- trained
2 again to operate and function properly or would
3 the training that was done for a 9-layer YOLO
4 would be sufficient?

5 A You do the training on whatever neural
6 network structure you choose. So I don't think
7 you would choose 9, train it, and then choose 8
8 and retrain it. You would just choose 8 or 9 and
9 then you would train it once. That's
10 what -- that's what this teaching is. You don't
11 retrain stuff. You just train one that is fast
12 and one that is -- that -- that takes longer and
13 essentially is better at detecting objects under a
14 variety of conditions.

15 Q And the training would then determine the
16 parameters of the particular neural network; is
17 that correct?

18 A Yes. That's right. When you train it,
19 you're basically just choosing numbers within all
20 this operation that gives you the best outputs for
21 the inputs that you train it with.

22 Q And do some of those parameters include

1 what are known as weights of a neural networks?

2 A Yes. You can certainly call them weights.

3 Q Okay. Now, without using a different kind
4 of YOLO -- in the combination that you described,
5 would it be possible to use the base YOLO as
6 is -- as is -- as it is described here, as it is
7 described in Redmon?

8 A Yeah. I'm suggesting we use it as
9 described, but I'm not -- I'm not saying that we
10 have to use exactly 24, right. It's -- I'm using
11 the teaching of having a -- a base YOLO and a fast
12 YOLO, which is very similar as we talked about
13 before with Park which had the little neural
14 network and the big one. Those are basically
15 actually the same concept.

16 Q Okay. All right. So do you know, Dr.
17 Erika -- I'm not sure if I'm saying her last name
18 correctly, but Bee -- Biediger or Biediger. I
19 don't know if I'm saying that correctly, but do
20 you know --

21 A Yes, I do. Erika --

22 Q Yeah.

1 A -- Biediger. Erika OotenBiediger is how I
2 know her. She was married.

3 Q And --

4 A Who you're referring to.

5 Q Yeah. And she was the -- was she your
6 student?

7 A Yes. She was one of my -- actually, one
8 of my very first graduate students at Georgia
9 Tech.

10 Q Okay. So I'm going to introduce an
11 exhibit. And I think the way we are to do that is
12 I will -- I'll put that in the -- in the chat and
13 then you can download it, so give me one second.

14 MR. WADEKAR: So I have added that
15 exhibit.

16 A I am attempting to download it here.
17 Okay. I have this article open.

18 Q Do you recognize this document?

19 A Yes, I do. It's from quite a while ago
20 though.

21 Q Yep. Okay. So would you mind reviewing
22 the abstract?

1 A Sure.

2 THE REPORTER: Will this be marked as an
3 exhibit, Counsel?

4 MR. WADEKAR: Yes. This will be -- this
5 should be marked as Exhibit 1.

6 (Exhibit 1 marked for identification.)

7 A Okay. I remember this.

8 Q Okay. And do you see that it says -- the
9 abstract says here that one of the difficulties
10 with formation flying is that the satellites must
11 be autonomous and able to generate and correct
12 their own orbit and attitude profiles, and then it
13 says "without continual guidance from the ground."

14 Do you see that?

15 A Yes. I see that.

16 Q Okay. So was there a satellite described
17 in this paper controlled by itself?

18 A Well, this paper doesn't describe any
19 particular satellite. It describes a method for
20 taking multiple satellites, two at least but we
21 use this example of three, and you are trying to
22 get them to fly, or in this case orbit. It's not

1 really flying like aerial vehicles. It's not
2 really in the air; it's in outer space, if you
3 will.

4 And we're trying to fly these satellites
5 around the earth and keep them in the same
6 position relative to each other so they can work
7 together. And if you're able to do that, you're
8 able to essentially form, for example, a large
9 telescope with several smaller ones.

10 So in that case, you want them to
11 essentially have a feedback control that keeps
12 adjusting themselves relative to the other ones so
13 you -- you keep a formation. That's what this
14 paper is about.

15 Q Okay. So then could you please go to
16 page 8?

17 A Okay.

18 Q On that page, there is a subheading that
19 says "Local Satellite Control."

20 A Yes.

21 Q And then the first line says, "The local
22 control of the satellites was achieved using a

1 standard PD controller."

2 A Yes.

3 Q So was this PD controller a part of the
4 satellite?

5 A Yes. There's parts of this controller on
6 the satellite, but all of the satellites have to
7 be communicating because satellite A has to know
8 where satellite B and C are, so that it can adjust
9 its position appropriately and keep in formation
10 with -- so satellites A, B, and C all stay in the
11 formation that you desire.

12 Q All right.

13 MR. WADEKAR: So thank you. Thank you so
14 much for your time today. That -- that's all I
15 have. Those are the questions I have. I would
16 like to pass the witness.

17 MR. WALTERS: I'd like to take a break.
18 Can we go off the record?

19 MR. WADEKAR: Yeah.

20 THE REPORTER: Off the record at
21 11:31 a.m.

22 (Whereupon a break was had.)

1 THE REPORTER: We are back on the record
2 at 11:47 a.m.

3 MR. WALTERS: I don't have any additional
4 questions. Thank you for your time, Dr. Singhose.

5 THE WITNESS: Okay.

6 MR. WADEKAR: Thank you, again. Thank
7 you, Dr. Singhose. Yeah.

8 THE REPORTER: One moment. This concludes
9 the deposition of Dr. William Singhose. The time
10 is 11:48 a.m.

11 Can I get transcript orders, please?

12 MR. WADEKAR: Yes. So we would like --
13 I'm assuming that Dr. Singhose would like to
14 review and sign -- sign the errata; is that --

15 MR. WALTERS: Yes.

16 MR. WADEKAR: -- correct?

17 MR. WALTERS: Yes.

18 MR. WADEKAR: Yeah. So -- so by when do
19 you think -- well, first question: So by when do
20 you think we can get the final? This is not a
21 very long deposition. I think it's less than two
22 hours, so...

1 THE REPORTER: I -- I was -- I do have
2 standing orders for a rough draft today. I don't
3 have an order for expedited. So as it stands
4 right now, the transcript will be prepared on the
5 27th. If you'd like --

6 MR. WADEKAR: No. So we would -- we would
7 definitely like it expedited.

8 THE REPORTER: Okay. When would you like
9 it expedited to?

10 MR. WADEKAR: So we -- we have to file a
11 paper on the 20th. So -- so and Dr. Singhose will
12 need some time to -- to review. So -- so if -- if
13 you are able to get the -- the final, say, by
14 Friday morning, would he be able to turn around
15 and give the signed version by, say, Saturday?

16 THE WITNESS: It looks like I'm being
17 asked something. What -- what was going on?

18 MR. WALTERS: So -- so you're going to
19 need to review and sign the transcript and prepare
20 an errata, if needed.

21 So how much -- they're talking about
22 getting it to you Friday morning.

1 THE WITNESS: Yeah. I won't be able to do
2 anything on Friday because I got -- I'm busy all
3 day, but I'm certainly willing to look at it over
4 the weekend and get it back on the next Monday.

5 MR. WADEKAR: Okay. So would it be
6 possible to, say, get it early on Monday? Because
7 we have to actually file a paper on Monday
8 evening, so would it be possible --

9 THE WITNESS: I'll -- I'll look it over
10 and get any errata back by, like, Sunday night.
11 How about that?

12 MR. WADEKAR: Okay. All right. So -- so
13 for that to happen, when do you need to get the
14 final? Say, something -- sometime on Friday then?

15 THE WITNESS: Yeah. I -- I have stuff
16 all -- I'm running a robot contest on Friday that
17 will go into the evening, so if you send it to me
18 in the evening, I'll -- I'll look at it Saturday
19 or Sunday and get it back Sunday evening.

20 MR. WADEKAR: Okay. So would that work
21 for you -- not you, I mean for -- for Karisa.
22 Would that work for you, final by Friday?

1 THE REPORTER: Yes. Yes. That's doable.

2 MR. WADEKAR: Okay. All right. So then
3 let's do that, final by Friday. We will receive
4 rough today and then final by Friday.

5 And, Dr. Singhose, you will be able to
6 send the -- the signed with errata sheet sometime
7 Monday morning?

8 THE WITNESS: Yes. I'll shoot for that.

9 MR. WADEKAR: Okay. All right. Thank you
10 so much.

11 THE REPORTER: And, Mr. Walters, did you
12 want to order a copy?

13 MR. WALTERS: We don't need a copy.

14 THE REPORTER: And Ms. Rao?

15 MS. RAO: We don't need a copy either.

16 (Whereupon the proceedings were concluded at
17 11:51 a.m. EST)

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1 CERTIFICATE OF SHORTHAND REPORTER - NOTARY PUBLIC

2 I, Karisa Ekenseair, Certified Reporter and
3 Notary Public within and for the State of Arkansas
4 do hereby certify: That WILLIAM SINGHOSE, PHD,
5 the witness whose deposition is hereinbefore set
6 forth, was duly sworn by me before the
7 commencement of such deposition and that such
8 deposition was taken before me and is a true
9 record of the testimony given by such witness.

10 I further certify that the adverse party,
11 Petitioner was represented by counsel at
12 the deposition.

13 I further certify that the deposition of
14 WILLIAM SINGHOSE, PHD, occurred virtually on
15 April 15, 2026, commencing at 10:01 A.M. EST to
16 11:51 A.M. EST.

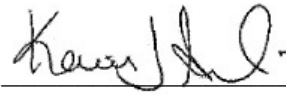
17 I further certify that I am not related to
18 any of the parties to this action by blood or
19 marriage, I am not employed by or an attorney
20 to any of the parties to this action, and that
21 I am in no way interested, financially or
22 otherwise, in the outcome of this matter.

1 IN WITNESS WHEREOF, I have hereunto set my hand
2 and affixed my notarial seal this 16TH DAY OF
3 APRIL, 2026..

4 My commission expires: 6-18-2028

5

6



7

Karisa Ekenseair, CCR, RPR RMR RDR

8

LS #802

9

Notary Public in and for

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Pulaski County, Arkansas

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Commission No. 12704567

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