# Transcript of Yong Chen, Ph.D.

**Date:** March 10, 2026
**Case:** 3D Systems Corporation, et al. -v- Intrepid Automation, Inc. (PTAB)

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1 UNITED STATES PATENT AND TRADEMARK OFFICE

2 BEFORE THE PATENT TRIAL AND APPEAL BOARD

3 ---

4 3D SYSTEMS CORPORATION AND 3D SYSTEMS, INC.,

5 Petitioner,

6

7 v.

8

9 INTREPID AUTOMATION, INC.,

10 Patent Owner.

11 ---

12 IPR2025-01241

13 U.S. Patent No. 11,014,310

14 -and-

15 IPR2025-01242

16 U.S. Patent No. 11,338,511

17 ---

18

19 REMOTE DEPOSITION of YONG CHEN, Ph.D.

20 Tuesday, March 10, 2026

21 5:02 p.m. CST

22

1 Job No.: 623602
2 Pages: 1 - 144
3 Reported By: Michelle M. Yohler, CSR, RMR, CRR
4
5
6 The deposition of YONG CHEN, Ph.D., held
7 remotely pursuant to notice before Michelle M.
8 Yohler, CSR, RMR, CRR, a certified shorthand
9 reporter, CSR No. 84-4531.
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1 P R O C E E D I N G S
2 (Technician read-on.)
3 (WHEREUPON, discussion was had off the
4 stenographic record.)
5 MS. REPORTER: Before I swear the witness
6 in, can I please have all attorneys identify
7 themselves and who they represent for the record.
8 MR. CATALANO: My name is Jeffrey
9 Catalano, Smith, Gambrell & Russell, and I
10 represent the Patent Owner, Intrepid Automation.
11 And with me are John Moy and Gene Volchenko.
12 Neither of them will be speaking today.
13 MR. ROXBOROUGH: Yes, Ben Roxborough from
14 Maynard Nexsen representing Petitioner 3D Systems,
15 and with me today is John Zimmer.
16 (WHEREUPON, the witness was duly sworn.)
17 MR. CATALANO: Before we get started, I'd
18 like to read a stipulation. I hope we can get a
19 stipulation here, and that is is that neither
20 party will object to the admissibility of this
21 transcript based on the proceeding taking place
22 remotely.

1 MR. ROXBOROUGH: We agree.
2 MR. CATALANO: Great. We agree as well.
3 Similarly, neither party will object to
4 the admissibility of this transcript because the
5 deposition is taken outside the United States, and
6 by that I mean Dr. Chen is currently located
7 outside the United States.
8 MR. ROXBOROUGH: Yes, Petitioner agrees,
9 Jeff.
10 MR. CATALANO: All right. And we agree
11 with that.
12 And, finally, the parties agree that this
13 deposition will be applicable and usable in both
14 IPR proceedings, that's IPR 2025-01241 and
15 IPR 2025-01242.
16 MR. ROXBOROUGH: Petitioner agrees.
17 MR. CATALANO: And we agree as well.
18 Great. Thank you.
19 MR. ROXBOROUGH: Jeff, I was just thinking
20 in terms of housekeeping, I don't think we need to
21 stipulate to this, but we're thinking breaking
22 after, say, 50 minutes.

1 MR. CATALANO: That works for me.
2 MR. ROXBOROUGH: Each hour, if that works
3 for you.
4 MR. CATALANO: Yeah, just if -- I'm really
5 bad at time so --
6 MR. ROXBOROUGH: Sure.
7 MR. CATALANO: -- just let me know.
8 MR. ROXBOROUGH: Yeah, and obviously it
9 might not be 50 minutes to the second, but we're
10 not going to be breaking mid question, mid answer.
11 YONG CHEN, Ph.D.,
12 called as a witness herein, having been first duly
13 sworn, was examined and testified as follows:
14 EXAMINATION
15 BY MR. CATALANO:
16 Q All right. Well, Dr. Chen, good morning.
17 A Morning.
18 Q And thank you for meeting with us so early
19 in Hong Kong.
20 MR. CATALANO: Before we get started, I'd
21 like to ask the court reporter to mark a few
22 deposition exhibits.

1 Deposition Exhibit Number 1 is the Chen
2 declaration with respect to the '301 patent.
3 That's in the 01241 IPR, Exhibit 1003.
4 Ky, you can put that in the chat.
5 (WHEREUPON, Chen Exhibit No. 1 was
6 presented to the witness.)
7 MR. CATALANO: I'm going to move on to the
8 next one. Deposition Exhibit 2 is the Chen
9 declaration with respect to the '511 patent, and
10 that's in the 01242 IPR, and it's IPR
11 Exhibit 1003.
12 And you can put that in the chat as well.
13 Thank you.
14 (WHEREUPON, Chen Exhibit No. 2 was
15 presented to the witness.)
16 BY MR. CATALANO:
17 Q And, Dr. Chen, do you have with you paper
18 copies of the '301 and the '511 declarations?
19 A Yes, I do.
20 Q Okay. And are there any notes or
21 annotations to those?
22 A No.



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1 Q Okay. Great.
2 MR. CATALANO: And we might as well mark
3 Exhibit 3, which is the '301 patent, U.S.
4 Patent 11,014,301, and that's -- in IPR 01241,
5 it's Exhibit 1001.
6 (WHEREUPON, Chen Exhibit No. 3 was
7 presented to the witness.)
8 MR. CATALANO: And the fourth deposition
9 exhibit is U.S. Patent Number 11,338,511, the
10 '511 patent, and that's in IPR 01242, and it's IPR
11 Exhibit 1001.
12 (WHEREUPON, Chen Exhibit No. 4 was
13 presented to the witness.)
14 BY MR. CATALANO:
15 Q And, Dr. Chen -- actually, if it's -- yes,
16 those are in the chat. Great.
17 And, Dr. Chen, do you have an unmarked
18 copy of -- paper copy of the '301 patent and the
19 '511 patent?
20 A Yes, I do.
21 Q Great. Fantastic.
22 Throughout the deposition, I'll have Ky



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1 put on the screen various portions of the
2 declaration and the patent, but I think if you
3 follow around on paper, Dr. Chen, I think it will
4 be a lot more efficient.
5 So I appreciate you coming to the
6 deposition with those. Okay.
7 A So the one in the chat, I do not need to
8 download that, right?
9 Q You do not need to download that, that's
10 for counsel. And we'll bring them up on the
11 screen, but you have those exhibits before you, so
12 that's great.
13 Okay. Is it your position that all claim
14 terms in the '301 and '511 patents are to be given
15 their plain and ordinary meaning to a person of
16 ordinary skill in the art?
17 A Yes.
18 Q Okay. And, just for clarification, your
19 declaration uses "POSITA," "person of ordinary
20 skill in the art," and "skilled artisan" seemingly
21 interchangeably; is that correct?
22 A Say that again.



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1 Q Yeah, so "POSITA" -- or POSITA
2 (pronunciation) -- "person of ordinary skill," and
3 "skilled artisan," you used all three of those
4 terms in your declaration, and I wanted to confirm
5 that those are synonyms. In other words, there's
6 no difference between them as you use them?
7 A Yes.
8 Q Okay. And so as I use any of those terms
9 in this deposition, I'm referring to a person of
10 ordinary skill in the art at the time the patent
11 application was filed. That fair?
12 A Okay.
13 Q Okay. In both of your declarations, you
14 discuss briefly the concepts of lexicography and
15 disavowal, and you state that these --
16 lexicography and disavowal, the standards are
17 exacting.
18 Do you recall that?
19 A Can you --
20 MR. ROXBOROUGH: Objection. Asking for
21 legal conclusion.
22



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1 BY MR. CATALANO:
2 Q I'm sorry. I didn't hear you, Dr. Chen.
3 MR. ROXBOROUGH: Objection. Legal
4 conclusion. Just the objection, Jeff.
5 MR. CATALANO: Oh, I'm sorry.
6 BY MR. CATALANO:
7 Q Dr. Chen, do you recall those statements
8 in your declaration?
9 A Can you show me in the -- in the
10 declaration?
11 Q Sure.
12 A Which page I should flip to?
13 Q So it's -- Exhibit 1 is the '301
14 declaration, and that's at Paragraph 71.
15 MR. CATALANO: And, Ky, you don't need to
16 put this one on screen, I don't think.
17 BY THE WITNESS:
18 A Paragraph 71.
19 BY MR. CATALANO:
20 Q Yeah. And I'll read from the second
21 sentence: "I understand that the POSITA should
22 only interpret a claim term more narrowly than its

1 ordinary meaning under two circumstances: 1, when
2 a patentee sets out a definition and acts as its
3 own lexicographer; or 2, when the patentee
4 disavows the full scope of a claim term either in
5 the specification or during prosecution history.
6 The standards for finding lexicography and
7 disavowal are exacting."
8 Did I read that correctly?
9 A Yes.
10 Q And that was in your '301 declaration?
11 A Yes.
12 Q Okay. And Exhibit 2 at Paragraph 76
13 includes the exact same language; do you agree?
14 You can look it up if you like.
15 A Which paragraph?
16 Q 76 of Exhibit 2, which is the '511
17 declaration.
18 A Mm-hm.
19 Okay.
20 Q And you agree the same language is in
21 there?
22 A Yes.

1 Q Okay. And I believe you take the position
2 in your declaration that none of the claim terms
3 require a special meaning or definition due to
4 lexicography; is that correct?
5 A Yes. So if there's no specific
6 definition, yeah, I just interpret based on what
7 my understanding of the field.
8 Q And the same question with respect to
9 disavowal; your position is that none of the claim
10 terms require a special meaning or definition due
11 to disavowal of claim scope, correct?
12 A Yes.
13 Q Okay. And so in all terms, you apply what
14 you believe to be the meaning that a skilled
15 artisan would attribute to the terms, and that's
16 in the context of the entire patent?
17 A Yes.
18 Q Okay. Your declarations include a section
19 on claim construction in which you discuss four
20 filters; is that correct?
21 A Yes.
22 Q Okay. And the exact claim language

1 differs between the claims. And we'll be precise
2 when we ask questions later, but at a high level,
3 we're talking about four filters: An irradiance
4 mask, a gamma adjustment mask, a warp correction
5 filter, and an edge blending bar; is that correct?
6 A That's right.
7 Q Okay. I'd like to begin with warp
8 correction filter.
9 And in claim 1 of the '301, it is: "A
10 warp correction filter configured to provide
11 geometric correction."
12 And in claim 11 of the '301 and claim 1 of
13 the '511, it's: "A warp correction filter that
14 provides geometric correction."
15 Do you recall that?
16 A Could you refresh my memory on which
17 paragraph we are talking about?
18 Q Sure. And, that, I do not have.
19 Why don't we go with Paragraph 85 of the
20 '301 declaration -- or declaration, and just above
21 85 there's a heading.
22 A Okay.

1 Q And -- hold on a second.
2 And if you look at Exhibit 2, the
3 declaration on the '511 patent, just above
4 Paragraph 90, it identifies the claim term as: "A
5 warp correction filter that provides geometric
6 correction."
7 And that's on the screen.
8 A Yes.
9 Q Okay. My first question is: For the
10 purpose of claim construction, is there a
11 difference between the formulations of the warp
12 correction filter between "configured to provide"
13 and "provides"? In other words, does that matter
14 for a POSITA's understanding of the claim terms?
15 A Could you ask that again. Because you
16 said "configured to provide" and --
17 Q Yes.
18 A -- "provide"?
19 Q So in one claim, claim 1, it's: "A warp
20 filter" -- sorry, claim 1 of the '301, it's: "A
21 warp filter configured to provide geometric
22 correction."

1 And in claim 11, it's: "A warp filter" --
2 "warp correction filter that provides geometric
3 correction."
4 And my question is just: Does the
5 difference between "configured to provide" and
6 "provide," matter for the purposes of claim
7 construction in this case?
8 MR. ROXBOROUGH: Objection. Calling for
9 legal conclusion.
10 BY THE WITNESS:
11 A My understanding is, essentially, you have
12 a distorted image due to hardware limitation, you
13 project to the resin surface, so you need some
14 calculation to change the image input, such that
15 the projected image can be straight out.
16 So they need some algorithm or some kind
17 of calibration based on the algorithm right now
18 you're using, which will be called "warp
19 correction filter."
20 So to me, you said "provide" or
21 "configured to provide," I think that's the same
22 to me. So, essentially, we have that filter,

1 which is a set of algorithm based on current
2 hardware is using, and then they will change
3 any -- any input to that projected image and
4 modify the input into the straight one.
5 And so the -- my understanding of the
6 claim is that algorithm or that filter is what
7 they claim in the patent.
8 Q Okay. So what, in your opinion, is the
9 plain and ordinary meaning of the warp correction
10 filter of the patent?
11 A So my understanding of the warp correction
12 filter -- right now, actually, in the Figure 3,
13 it's actually right under this page or the
14 headline. If you move down a little bit for
15 this -- yeah.
16 So my understanding when I read this is
17 exactly that. So because of the hardware
18 limitation of the projection system, it could be
19 any -- anything from opticals or from the mirror
20 or the chip itself.
21 So the projected image on the resin
22 surface is distorted, so we need to -- based on



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1 the calibrating results and to essentially modify
2 the input, such that the projected image on the
3 resin surface can be straight out.
4 So that's my understanding of this warp
5 correction filter. So they tried to do the
6 geometric correction of the projected image, such
7 that they can get a straightened image for the 3D
8 printing of any geometry model that you input to
9 the printers.
10 Q Okay. And, just to be clear, that answer
11 applies to the warp correction filter claimed both
12 in the '301 patent and in the '511 patent,
13 correct?
14 A Yes.
15 Q Okay. If you can turn -- and I'm going to
16 use --
17 MR. CATALANO: If you can go up a little,
18 Ky.
19 BY MR. CATALANO:
20 Q I'm going to use Paragraph 3 --
21 Paragraph 90 of the '511, Exhibit 2, as exemplary
22 here.

1 So: "A POSITA's understanding of a warp
2 correction filter is that it exists within at
3 least one of the digital filters and is applied to
4 correct for some type of geometric distortion."
5 Is that correct?
6 A Mm-hm.
7 Q What is "geometric distortion" in this
8 contract -- context?
9 A Geometric distortion is -- so for the --
10 for example, in your -- in your room, when you are
11 projecting an image using projector -- I think in
12 your projector, they call it keystone. For
13 example, keystone is one type of geometric
14 correction need to be added to composite. So,
15 essentially, you -- instead of getting a perfect
16 square, you get some type of distorted -- it could
17 be any geometry.
18 And my understanding of this filter -- or
19 warp correction filter is trying to compensate for
20 that type of distortion.
21 Q Okay. And, to be clear --
22 A Like a keystone. Like a keystone.

Q And that would also include, like, a barrel distortion --

A Yeah.

Q -- correct?

A Yeah. It could be, yes.

Q Any other types that you can think of?

A Yes.

Q So what other types do you know?

A It could be distorted like a parallel; it could be distorted like a barrel outside; it could be distorted in shape-wise, it's not perfect square.

Q What makes a distortion geometric vis-?-vis other types of distortions?

A Geometric correction -- or "geometric" means the projection shape to the resin surface. There could be other type of defects; for example, like light intensity's not uniform.

It could be -- yeah, it could be some spot that is missing or dimmed down or totally gone. It could be every projector there's a slight variation.

1 Yeah, those are some other type of
2 defects.
3 Q Okay. And for the purpose of this patent,
4 you know, there's -- agree with me, there's
5 basically two categories: There's geometric
6 corrections, and there is light-intensity
7 corrections -- and I'm using that generally -- is
8 that a fair statement?
9 A Yes.
10 Q And those are two different categories; a
11 barrel -- a correction for barrel distortion is
12 not a light intensity, for example, correct?
13 A Correct.
14 Q It's geometric?
15 A Yes.
16 Q Your definition on Paragraph 9 -- sorry,
17 90 of Exhibit 2, is that a warp correction filter,
18 that it exists within at least one of the digital
19 filters, and my question is: What is a digital
20 filter in this context?
21 A So digital filter to me is you have a
22 piece of code or algorithm located in your

1 personal computer or any controller you are using,
2 so you need to essentially do the calibration of
3 your hardware, such that, at the end of the day,
4 the light projected to your resin surface is -- is
5 uniform and based on what you want to photo cure
6 materials into the perfect layer shape with
7 certain cure depths.
8 Q Okay. And so that -- you said to you --
9 or "to me," I think you said, would that -- would
10 that be same --
11 A (Indiscernible) consider myself as a
12 POSITA.
13 Q Okay. So I'm going to use "skilled
14 artisan." I like it better than "POSITA."
15 A Okay.
16 Q So would you say that that definition you
17 just gave is the definition of a digital filter
18 from the view of a skilled artisan?
19 A Yeah.
20 Q Is that correct?
21 A Yeah. Yeah.
22 Q Okay. And so you started by saying a

1 piece of code that's on your computer, or your PC,
2 or any controller; is that correct?
3 A Mm-hm.
4 Q Can you explain what you mean by
5 "controller" in this context?
6 A So you have a DMD device, which is
7 typically, for example, from Texas Instruments.
8 And each device has millions of these small
9 mirror. You need to control their flip on or off
10 at any time. So you need a controller that will
11 be able to control each mirror, when to turn it
12 on, when to turn it off.
13 And so it could be any -- any devices.
14 For example, you can use a GPU to do the control;
15 you can use a microcontroller to do the control;
16 you can use whatever -- or customized-made
17 controller to do the control work. So I would
18 consider all this as a controller.
19 But typically we are using -- yeah,
20 typically we are using GPU or we are using PC; for
21 example, something you try to connect to your
22 projector in your -- in your conference room.

1 Q Understood.
2 MR. CATALANO: Ky, can you go to
3 Exhibit 1, the '301 declaration, at Paragraph 85.
4 BY MR. CATALANO:
5 Q And I just wanted to confirm, Dr. Chen,
6 that in the '301 patent with claim 1, you provide
7 here the same statement: "Based on the entire" --
8 or -- "the context of the entire patent, a
9 POSITA's understanding of the warp correction
10 filter is that it exists within at least one of
11 the digital filters and is applied to correct for
12 some type of geometric distortion"; is that
13 correct?
14 A Mm-hm. Yeah.
15 Q And so the definition of "warp correction
16 filter" -- or understanding of a warp correction
17 filter to a skilled artisan is the same in the
18 context of the '301 patent and the '511 patent,
19 correct?
20 A Correct.
21 Q Okay. Thank you.
22 To move on to the concept of an irradiance

1 mask, and this one, like the warp correction, has
2 slightly different language.
3 In claim 1 of the '301, it's: "An
4 irradiance mask configured to normalize
5 irradiance."
6 And then claim 11 of the '301 and in
7 claim 1 of the '511 patent, it's: "An irradiance
8 mask that normalizes irradiance."
9 And my question is --
10 A Could you.
11 Q Yeah.
12 A Could you tell me which paragraph now
13 you're reading --
14 Q Yeah. Sure. Why don't we go to
15 Exhibit 3.
16 A Exhibit 3.
17 MR. CATALANO: And why don't you go to
18 claim 1 just at the back. Go up one page, please.
19 And then if you can -- to the bottom and then zoom
20 in, please.
21 BY MR. CATALANO:
22 Q Okay. Yeah, so if you see at the bottom



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1 here, couple lines from the bottom: "A warp
2 correction filter configured to provide geometric
3 correction."
4 Do you see that?
5 A Mm-hm. Yeah.
6 Q And that is the claim term in the
7 '301 patent, claim 1. And my focus here was on
8 the words "configured to provide."
9 You see that?
10 A Yeah.
11 Q And then claim 11, at the bottom of the
12 next column, it's: "A warp correction filter that
13 provides geometric correction."
14 You see that?
15 A Yeah.
16 Q And my question is: Just as with the
17 warp -- oh, I'm sorry. Did I just read "warp
18 correction filter"? My apologies. We'll go back.
19 If you go up to line 59, it's an -- of
20 column -- the first column here on the left, it's
21 an: "Irradiance mask configured to normalize a
22 irradiance."

1 Do you see that?
2 MR. CATALANO: No, no, no. I'm sorry. Go
3 to the bottom.
4 BY MR. CATALANO:
5 Q Line 59; do you see that?
6 A Left or right?
7 Q On the left, where he's highlighting.
8 A Okay.
9 Q You see that?
10 So then on the right at line 57, there's
11 another irradiance mask, and it's: "A irradiance
12 mask that normal" -- "that normalizes irradiance."
13 Do you see that?
14 A Mm-hm.
15 Q And just as with the warp correction
16 filter, I just want to confirm that, for the
17 purposes of claim construction, "configured to"
18 and -- "configured to provide" and "that provides"
19 makes no difference to how a POSITA would
20 understand this term; is that correct?
21 MR. ROXBOROUGH: Objection. Calls for a
22 legal conclusion.

1 BY THE WITNESS:
2 A So -- okay. So my understanding is
3 "configured to provide" or "to normalize,"
4 essentially they're mentioning, based on the
5 current hardware you are using, you need to do the
6 calibration. So for each projector, you need to
7 slightly modify this filter based on the hardware
8 you're using.
9 So it's not the general algorithm or
10 general thing that you can utilize to any hardware
11 you are currently using right now. Because every
12 hardware, they have some unique characteristics,
13 so you need to do the calibration.
14 So in the field, we typically call it
15 calibration. So you need to calibrate your
16 hardware, configure that -- your filter with some
17 parameter so they can be customized to this
18 hardware.
19 So I think for the left side, they are
20 talking about configure this or do the calibration
21 to get this filter.
22 And then in the right side, after you get

1 this calibrated one, then you just apply this
2 filter to the hardware, and then you -- you
3 normalized that irradiance or you correct the
4 geometric distortion or anything like that.
5 Q Thank you.
6 MR. CATALANO: If you can go to Exhibit 1,
7 the Chen '301 declaration, at Page 53, it's going
8 to be note 7. You're on it.
9 Scroll a little bit down.
10 BY MR. CATALANO:
11 Q So you point out in your declaration in
12 the '301: "That the '301 patent expressly defines
13 the specific term 'irradiance' as 'radiant power,
14 per unit area, incident upon a surface, e.g., the
15 polymer interface.'"
16 Do you see that?
17 A Mm-hm.
18 Q And your position that you take here is
19 that this definition is consistent with the plain
20 and ordinary meaning of irradiance mask to the
21 skilled artisan; is that correct?
22 A Uh-huh.

1 Q Okay.
2 MR. CATALANO: So I'd like to go to
3 Exhibit 3. And let's go, I think, to column 3,
4 please. So way near the beginning.
5 If you scroll down.
6 BY MR. CATALANO:
7 Q You see on line 50 on the left column, it
8 says: "Irradiance: Radiant power per unit area,
9 incident upon a surface, e.g., the polymer
10 interface."
11 That's just what we talked about, correct?
12 A Yeah.
13 Q And that definition is consistent with the
14 plain and ordinary meaning of the term to a
15 skilled artisan, correct?
16 A Mm-hm.
17 Q Okay. I'd like to also direct your
18 attention to just below that: "Pixel."
19 And pixel is defined as: "The smallest
20 subdivision of the build area XY plane where
21 irradiance can be directly manipulated."
22 Do you see that?

A Mm-hm.

Q And is this consistent with how a skilled artisan would understand "pixel" in the context of this patent?

A Wait. So you mean what pixel means a smallest subdivision of the building area XY plane.

So it's typically for DMD device, we have many of the small pixels -- or I mean, many of the small mirror. And each mirror related to or corresponding to one small area in the XY plane, and that we call pixels.

Q And that pixel would be the smallest subdivision of the polymer interface or surface where irradiance could be directly manipulated; is that correct?

A That's right.

Q So, again, this is consistent with the plain and ordinary meaning of the term?

A Yeah.

Q Okay. So a pixel, is that a two-dimensional area?

1 A Yeah.
2 Q Okay. So if you were to apply the
3 definition of irradiance, where it says "radiant
4 power, per unit area, incident upon a surface," an
5 example of that per unit area would be a pixel,
6 correct?
7 A So typically when we define power per unit
8 area, we -- we typically like using millimeters
9 square or meters square.
10 So it's a -- for the pixel, it could be
11 bigger or smaller. So, for example, typically
12 using for every pixel in the 3D printer like
13 100-micron, which is 0.1 millimeter by 0.1
14 millimeter. So it's very small, tiny pixels.
15 So what I mean in the "per unit area,"
16 that means per millimeter square, for example, or
17 per meter square. So there's a scientific
18 definition of the power, there's some unit based
19 on that.
20 For the pixel, for every hardware
21 constraint or hardware configuration, they can
22 have different sides of the pixel size. So that's

1 a building area or subdivision of the building
2 area for each pixel could be bigger or could be
3 smaller.
4 Q See if I understand this.
5 So a pixel could be 100 microns or it
6 could be 70 microns or it could be --
7 A Yeah, or --
8 Q -- 120 microns depending on -- sorry --
9 depending on various factors, correct?
10 A Yes. That's correct.
11 Q But one could understand the concept of
12 irradiance -- one of skill in the art understands
13 that the context of irradiance could mean per
14 pixel, regardless of the size of the pixel in
15 terms of microns, correct?
16 A Typically we don't interpret that, we just
17 understand per unit area. You have an area which
18 is the size, and then per unit area which means,
19 for example, per square feet or per square meter
20 or per square millimeter or something like that.
21 Q Throughout this -- sorry about that.
22 Throughout the '301 patent, it does talk

1 about manipulating the irradiance on a
2 pixel-by-pixel basis, correct?
3 A Could you show me which paragraph or which
4 sentence you're talking about? Because I -- yeah,
5 it's a long document. I want to be accurate.
6 Q Do you recall in both patents a disclosure
7 of example 1, irradiance mask? And I'll direct
8 your attention to Exhibit 1 at column 23.
9 I'm sorry. Exhibit 3 at column 23.
10 So example 1 gives an example in which the
11 pixels in a projected image in the top left corner
12 are 5 percent less bright than elsewhere in the
13 field of view. And the irradiance mask in this
14 context brings the 100 percent bright pixels
15 elsewhere in the image down to 95 percent in order
16 to create a uniform irradiance across the whole
17 image.
18 Do you see that?
19 A Mm-hm.
20 Q So, here, the irradiance -- or the patent
21 is talking about using an irradiance mask to
22 adjust the pixels as opposed to micron units,

1 correct?
2 A Yeah. So irradiance mask is applied that
3 acts as a burn filter; is that what you're
4 referring to right now?
5 Q Well, and if you look at the next
6 sentence, it brings the 100 percent bright pixels
7 elsewhere in the image to 95 percent in order to
8 create a uniform irradiance.
9 You see that? So it's changing the pixel
10 brightness.
11 A Right. Because, again, you have a
12 million -- for example, 1,000-by-1,000 pixels --
13 and some pixel are darker, some pixel are
14 brighter.
15 So in order to make the whole image
16 homogenous and uniform light intensity, so you
17 need to apply certain grayscale value to certain
18 pixel that is brighter so that all the pixel
19 brightness can be dimmed down to the same level.
20 That -- that's commonly practiced in the
21 field. So I -- could you repeat the question
22 again? I don't quite get exactly the question

1 you're asking.
2 Q Well, let me follow up on your description
3 just there.
4 An irradiance mask adjusts the pixel
5 intensity on certain pixels that are brighter or
6 darker than the rest of the image in order to
7 perform -- or to create a uniform irradiance range
8 across the entire image; is that correct?
9 A Mm-hm.
10 Q Yes? Sorry.
11 A Yes.
12 Q Let me back up real quickly.
13 The court reporter has trouble with the
14 "uh-huh" and the no, so if you can answer "yes" or
15 "no," that would be helpful.
16 So the answer is "yes"?
17 A Yes.
18 Q Okay. Before I go too much further, are
19 the specifications of the '301 patent and the
20 '511 patent the same, other than, you know, maybe
21 the pagination, columns and lines?
22 A The first few -- I mean, first filter,

1 they are the same. I think the '511, they added
2 some moving -- way to move the projection image,
3 which is added to '301 patent.
4 Q And so my question now, though, is
5 referring not to the claims but to the
6 specification, the description. What I'd like to
7 avoid, Dr. Chen, is every time I point you to the
8 patent, having to point you to both patents. You
9 see what I'm saying?
10 So this example 1 appears in both the '301
11 and the '511, correct?
12 A Yes. Actually, because it's, again -- I
13 assume it's correct because, yeah, I mean, if you
14 can flip to 501 [sic] so we can double-check.
15 Q Okay. So on -- we don't need to assume.
16 So on Exhibit 2 -- I'm sorry. Exhibit 4
17 at column 23, we have example 1, the irradiance
18 mask.
19 Do you see that?
20 A Right.
21 Q And it's the same thing, right? It acts
22 as a burn filter to bring the 100 percent pixels



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1 down to the 95 percent.
2 Do you see that?
3 A Yeah.
4 Q Okay. If you can go to Exhibit 1, the
5 Chen '301 declaration, at 46.
6 So here it talks about -- well, it talks
7 about "irradiance" and "irradiance normalization."
8 And "irradiance" refers to: "Amount of life that
9 strikes the surface over a given area such as
10 square centimeter (cm2) of liquid resin."
11 Do you see that?
12 A Yeah.
13 Q I want to jump down a sentence.
14 "The total right [sic] exposure
15 experienced by a specific area or spot is equal to
16 the irradiance power multiplied by how long the
17 light shines on that spot."
18 Do you see that?
19 A Yeah.
20 Q And exposure is power times time, correct?
21 A Mm-hm.
22 Q My question is: Would one of ordinary

1 skill in the art understand that the irradiance
2 mask manipulates the duration -- or, in other
3 words, the amount of time -- the light shines on a
4 spot, or does the irradiance mask only manipulate
5 how strong the light is?
6 MR. ROXBOROUGH: Objection. Compound.
7 BY MR. CATALANO:
8 Q Let me break it up. Don't answer that
9 question.
10 Does the irradiance mask of the
11 '301 patent and the '511 patent change or
12 manipulate how long the light shines on any spot?
13 A Okay. So -- so here's how the DMD device
14 work. So, essentially, you control the
15 micromirror -- each micromirror, flip on or off.
16 So how long time you turn it on or off determine
17 how strong the light on that pixel is.
18 So -- so, to me, at the end of the day,
19 you are controlling the time on or off. So they
20 are controlling how exposure -- how long the
21 exposure is turned on for each pixel.
22 What I mean is that the light intensity

1 control, by the end of the day, is controlled by
2 how long you flip it on or flip it off of the
3 digital mirror. So for each digital mirror, you
4 can only have two states, which is on or off.
5 Q Okay. Let me see if I can break this
6 down.
7 When you -- you're saying that how strong
8 the light is is determined by the rate in which
9 the digital mirrors are turned on and off within
10 the projector, correct?
11 A That's correct.
12 Q Okay. Well, I want to ask about another
13 aspect I think you're talking about here, is how
14 long the light itself is shined upon the resin,
15 right? So eight seconds versus ten seconds.
16 Does -- would a POSITA understand, from
17 the 311 -- or '301 and '511 specifications that
18 the irradiance mask changed the duration of the
19 light projected onto the resin?
20 A For the irradiance mask, they tried to
21 make the projection image from a uniform light
22 intensity. So the projection, if you reason is

1 determined -- typically is determined -- or in the
2 field, common practice is determined by the resin
3 you are using. So we calibrate how long the
4 exposure time need to be based on the resin you
5 are using.
6 Q I guess what I'm trying to get at is:
7 Does the irradiance mask of the '301 and '511
8 patents adjust the amount of time on a
9 pixel-by-pixel basis that the light is exposed to
10 the resin or just the intensity of the light?
11 MR. ROXBOROUGH: Objection. Compound.
12 BY MR. CATALANO:
13 Q You can answer that one.
14 A My understanding is the intensity. Just
15 the intensity.
16 Q Thanks.
17 MR. ROXBOROUGH: Jeff, it's just kicked
18 over to 4:51 p.m. Did we want to have a break
19 soon?
20 MR. CATALANO: Yeah, we can go soon.
21 Unfortunately, I'm not as far along as one would
22 hope --

1 MR. ROXBOROUGH: Sure.
2 MR. CATALANO: -- after 50 minutes, but
3 let me see if I can finish this section.
4 BY MR. CATALANO:
5 Q What does it mean to normalize irradiance
6 to a skilled artisan?
7 MR. ROXBOROUGH: Objection. Calling for a
8 legal conclusion.
9 BY MR. CATALANO:
10 Q Let me ask the question again. I'm sorry.
11 What is your opinion on what a skilled
12 artisan would understand the concept of
13 normalizing irradiance to be?
14 A Normalize the irradiance means we try to
15 get uniform light intensity that is projected on
16 the resin surface to do the printing.
17 Q Okay. And when you say "the resin
18 surface," what are you referring to?
19 A The curing resin surface to define the
20 layer, the 2D layer to stack together to form 3D
21 geometry.
22 Q So you would say across the entire layer,

1 correct?
2 A Yeah, across a whole building area, yeah.
3 Q Right. Well, it also could be across a
4 sub-image, correct?
5 A Across sub-image? What do you mean?
6 Q So does the patent use the term
7 "sub-image"?
8 A Right, because they are trying to put
9 multiple projector together and --
10 Q And --
11 A -- each projector -- each projector is
12 they call it "sub-area" or "sub-image."
13 But produceable-wise, you use one
14 projector or multiple projector for the
15 irradiance, it's pretty much the same concept or
16 principal.
17 Q So if you're formalizing the irradiance of
18 a single sub-image from a single projector, you'd
19 be having a uniform intensity across the entire
20 sub-image, correct?
21 A Correct.
22 MR. CATALANO: This is a good time for a

1 break. And are we thinking ten minutes, something
2 like that?
3 MR. ROXBOROUGH: Ten minutes would be
4 great, Jeff.
5 (WHEREUPON, discussion was had off the
6 stenographic record.)
7 (WHEREUPON, a recess was had.)
8 MS. REPORTER: Back on the record at
9 6:03 p.m.
10 BY MR. CATALANO:
11 Q I'd like to talk to you about how a
12 skilled artisan would understand the blending bar
13 filter of the '301 and '511 patent.
14 A Okay.
15 MR. CATALANO: Can you pull up Exhibit 3,
16 please, and go to the back again.
17 There we go.
18 BY MR. CATALANO:
19 Q So at the bottom of the left column,
20 absolute bottom, it is: "An edge blending bar at
21 one or more sub-image edges."
22 Do you see that?

1 A Yeah.
2 Q And claim 11 on the right column near the
3 bottom has the same language: "An edge blending
4 bar at one or more sub-image edges."
5 Do you see that?
6 A Yeah.
7 MR. CATALANO: And then if we go to '511,
8 please. That's Exhibit 4. And all the way to the
9 back.
10 There we go.
11 BY MR. CATALANO:
12 Q On the left column -- actually, in the
13 right column, line 5, same language again: "An
14 edge blending bar at one or more sub-image edges."
15 Correct?
16 A Yeah.
17 Q Okay. How would a skilled artisan, in
18 your opinion, understand the meaning of "edge
19 blending bar at one or more" -- at the -- "at one
20 or more sub-image edges"?
21 A So the patent is talking about using
22 multi-projector system or multi-projection image

1 to cover a bigger area, a printing area, so they
2 can improve the building size, at the same time
3 maintain the same printing resolution.
4 So when you put multiple projector system
5 into one big projection area, you intentionally
6 overlap the projection image so you can avoid any
7 gap between the projection image.
8 And now when you have overlap between
9 neighboring projection images, then you have some
10 overlapping area, which is this -- we call the
11 edge blending bar. So essentially that area, you
12 have two projector expose the light to that
13 overlapping area, and that overlapping area will
14 be brighter by providing the light intensity from
15 two neighboring projection system and --
16 Q Can I stop you right there? Because I
17 think --
18 A Yeah.
19 Q -- what you've explained essentially is
20 the problem, correct? When you overlap
21 projectors, the region of the overlap will have
22 twice the light intensity, correct?

1 A Right. Right. So that overlap area, to
2 me, that means edge blending bar.
3 Q And what does the edge blending bar do
4 within the overlap area?
5 A So you need to specially treat them
6 different from other area, which only controlled
7 by one projector.
8 So now for that area, you are controlling
9 them by two projection system -- two neighboring
10 projection system or four projection system
11 determine how -- how much overlap we're talking
12 about.
13 So there is small corner that overlap by
14 full projector. And so they need to be specially
15 treated with some algorithm to adjust their light
16 intensity, such that the light over the whole
17 printing area will be controlled to get a better
18 printing quality.
19 Q So the adjustment that happens to the
20 irradiance within the overlap area, that
21 adjustment of the irradiance happens only within
22 the overlap area, correct?

1 A Wait. Wait. So you are talking about
2 irradiance mask now, or you're --
3 Q No, no, no.
4 A -- talking about edge blending bar?
5 Q Edge blending bar. Let me rephrase.
6 A Okay.
7 Q So when you manage the intensity of the
8 light within the overlap area, you are changing
9 the irradiance with respect to the pixels in the
10 overlap area, correct?
11 A Correct.
12 Q And you are not changing the intensity of
13 the pixels outside of the overlap area, correct?
14 A For the edge blending bar, if they are
15 outside pixel, then you don't need to do anything.
16 Q Okay. And, yeah, so let me rephrase
17 because it was a poor question.
18 When you're using a blending bar, you are
19 not adjusting the irradiance, with the blending
20 bar at least, outside of the area of overlap,
21 correct?
22 A Yeah, that's correct. So for edge

1 blending bar filter, they only consider that
2 overlapping area.
3 Q Okay. And are you familiar with -- this
4 is kind of a simple approach, but the concept of a
5 linear ramp?
6 A Linear ramp?
7 Q Linear ramp.
8 A Okay. Could you explain a little bit more
9 because I --
10 Q Sure.
11 A -- have some understanding, but to be
12 accurate, so I want to make sure my understanding
13 is the same as what you are talking about.
14 Q So I'm going to give a very simple
15 example, and if it's too simple, correct me.
16 Let's imagine a 10 pixel overlap area,
17 okay?
18 A Right.
19 Q In pixel zero -- outside of the blending
20 bar, right, it's 10 is the value of the irradiance
21 for simplicity. Understood?
22 A Mm-hm.

1 Q In pixel zero, it's 9 is the -- or the
2 intensity level, correct?
3 A Mm-hm.
4 Q And in pixel 1, it's 8. And --
5 A Okay.
6 Q -- so on and so forth all the way down to
7 pixel 9, where it would be 1.
8 Does that make sense?
9 A Yeah.
10 Q So that would be what I would call linear
11 ramp. The pixel intensity value changes linearly
12 every pixel the same amount.
13 Understood?
14 A Sure.
15 Q And if you're going to use an edge
16 blending bar -- or if you're going to use two edge
17 blending bars in this context with two projectors,
18 you would have a linear ramp that goes down from
19 the left projector starting at zero and a linear
20 ramp that goes down from the right projector
21 starting at 9.
22 Does that make sense?

1 A Right.
2 Q So the goal is that all -- every single
3 pixel within the overlap area is 10 intensity; is
4 that right?
5 A Yeah.
6 Q So that is a very simple description of an
7 edge blending bar; is that correct?
8 A Correct.
9 Q And there's other ways of doing it with
10 different algorithms, right?
11 A Yeah.
12 Q Can you give me some examples?
13 A I mean, this has been studied extensively
14 in the projector -- I mean, computer graphics area
15 because every one, if you go to a theater, a movie
16 theater, actually they use this multi-projector
17 putting together to display a movie to make it
18 much bigger.
19 So they handle this with a lot of
20 different approach come up with. You can do that
21 linear ramp down, or you can do long linear
22 composition. But, by the end of the day, you

1 composite all the light intensity together with
2 hope that the overlapping area, the light
3 intensity will be the same as a non-overlapping
4 area. So when you print a part, you cannot -- you
5 cannot see the defects because of the light
6 intensity difference.
7 Q Okay.
8 A So there's a -- yeah, so there's a lot of
9 ways to do it.
10 Q So, like, for example, a sigmoid function?
11 A Yeah or other --
12 Q Uh --
13 A -- functions.
14 Q Yeah.
15 (Reporter clarification.)
16 BY MR. CATALANO:
17 Q I believe you said "nonlinear functions"?
18 A Nonlinear functions, yeah. Yeah.
19 It could be exponential, or it could be
20 any other nonlinear function.
21 Q Okay. How, if at all, is the claimed edge
22 blending bar different than the claimed irradiance

1 mask, in your opinion?
2 A In my opinion, they are trying to address
3 different hardware constraint. So the irradiance
4 mask is trying to address the projection DMD
5 devices defects or optical lens defects for the
6 configuration when they put together defects. So
7 they got long homogenous distribution of the light
8 intensity over the area.
9 And then this edge blending bar is trying
10 to addressing a different problem or issue, which
11 is: You have multi-projector putting together,
12 and then you get a overlapping area. So we need
13 to address in that overlapping area.
14 So this is a -- edge blending bar is a
15 unique multi-projector system. If you use one
16 single projection system, then you don't have this
17 edge blending bar, but you still have a irradiance
18 mask issue need to be addressed.
19 Q Okay. We're going to set aside the gamma
20 for now, and we're just going to proceed on those
21 terms.
22 MR. CATALANO: So before we get going, I'd

1 like to mark Exhibit 5, which is the Shkolnik
2 reference. And Exhibit 5 is Patent
3 Number 8,666,142, and that is Exhibit 1004 in both
4 of the IPRs.
5 (WHEREUPON, Chen Exhibit No. 5 was
6 presented to the witness.)
7 MR. CATALANO: You can take that off
8 screen.
9 BY MR. CATALANO:
10 Q Can you turn to Paragraph 144 of
11 Exhibit 1. That's the Chen declaration on the
12 '301 patent.
13 A Wait, so go to Exhibit 5 or Exhibit 1?
14 Q Exhibit 1. I just wanted to mark it, but,
15 yeah, Exhibit 1.
16 And let me know when you're there,
17 Dr. Chen.
18 MR. CATALANO: And you can put this one up
19 on the screen, if you could, Ky.
20 Thank you.
21 BY MR. CATALANO:
22 Q And this is a section of your declaration

1 that deals with whether Shkolnik teaches
2 irradiance mask configured to normalize
3 irradiance; is that correct?
4 A Yes.
5 Q I'm going to focus on the first sentence.
6 I'm going to stop at the dash: "Among the many
7 types of adjustments of sub-images taught by
8 Shkolnik, Shkolnik specifically teaches adjusting
9 irradiance to match an ideal standard compensation
10 or normalized irradiance."
11 Did I read that correctly?
12 A Yes.
13 Q Okay. Is this a true statement?
14 A You mean the sentence regarding to
15 Shkolnik specifically teach adjusting irradiance
16 to match ideal or normalize irradiance?
17 Q Correct. Is that true?
18 A Yeah.
19 Q Okay. You stand by that one?
20 A Yeah.
21 Q Okay.
22 MR. CATALANO: Can we turn to Exhibit 2,

1 the '511 declaration, Paragraph 170.
2 Go up a little bit.
3 BY MR. CATALANO:
4 Q Okay. And I'm looking at sentence two,
5 and I'm not going to read, you can read it
6 yourself.
7 This is the same words that I just read
8 from Exhibit 1, correct?
9 A Right.
10 Q Okay. So, here, there's a list of words:
11 Ideal -- in parentheses -- or quotation marks,
12 sorry.
13 There's a list of terms in quotation
14 marks: "Ideal," "standard," "compensation," or
15 "normalized." My question is: Do all of these
16 terms in this sentence modify the word
17 "irradiance"?
18 A What do you mean by "modify irradiance"?
19 Q So what I mean is the sentence is
20 Shkolnik -- and I'm going to talk about "ideal"
21 now.
22 Are you saying that Shkolnik specifically

1 teaches adjusting irradiance to match an ideal?
2 Or Shkolnik specifically teaches adjusting
3 irradiance to match an ideal irradiance?
4 A What I mean is that -- because, again, so
5 I work in the field for long time, so I heard
6 people talk about, for example: We need to
7 normalize irradiance; we need to compensate the
8 irradiance; we need to have a standard irradiance.
9 So people talk about different term, but
10 they are referring to the same physical
11 phenomenon, which is when you project the image to
12 the resin surface, you want that light intensity
13 to be homogenous and uniform across a whole area.
14 Q Right. And I guess that's what I'm
15 getting at. When you say "ideal" here, you're
16 talking about ideal irradiance, correct?
17 A Right. Ideal -- ideally, it should be
18 homogenous and the uniform across the whole area.
19 Q Right. In a standard irradiance, correct?
20 A Right.
21 Q In a normalized irradiance?
22 A Right.

1 Q Okay. And when --
2 A Or compensated irradiance, yeah.
3 Q And when you say "specifically teaches"
4 and there's quotations, are you saying that the
5 patent, Shkolnik, actually uses the terms "ideal,"
6 "standard," "compensation," and "normalized"?
7 A They may not use it, but, again, so
8 typical practice is when you try to print the job,
9 first step is you try to get a normalized light
10 intensity for the whole printing area, such that
11 when you print, there's no defects because of the
12 long homogenous or long uniform light intensity.
13 So Shkolnik, yes, specifically teach us we
14 need to do the light intensity calibration, need
15 to adjust the pixel intensity to compensate for
16 any hardware limitation or hardware defects.
17 MR. CATALANO: Okay. Let's go back to the
18 '301 declaration, please.
19 BY MR. CATALANO:
20 Q In the '301 declaration at Paragraph 144,
21 I told you before I stopped before the dash. So
22 I'm going to read it again with the dash.



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1 "Among the many types of adjustments of
2 sub-images taught by Shkolnik, Shkolnik
3 specifically teaches adjusting irradiance to match
4 an 'ideal,' 'standard,' 'compensation,' or
5 'normalized' irradiance - all of which the POSITA
6 would treat as meaning the same thing."
7 Is that correct?
8 A Yeah.
9 Q What do you mean by "treat" in this
10 context?
11 A So that means when you read the words we
12 need to normalize irradiance, or we need to
13 compensate the irradiance, or we need to get the
14 standard irradiance, we would think it's meaning
15 the same thing.
16 Q And when you say "meaning the same thing,"
17 what would they understand that to mean?
18 A So that means when you use a projector
19 image, projecting to the resin surface and that
20 light intensity all over the printing area should
21 be homogenous, should be the same light intensity
22 all over the printing area.

1 Q Okay. Where in Shkolnik does it use the
2 word "normalized" in connection with "irradiance"?
3 You can go ahead and look at your
4 declaration, look at the patents, whatever you'd
5 like.
6 A Okay. I think in my declaration I gave
7 some example right after this. So I'm reading
8 right now.
9 So: [As read] "Shkolnik teaches a pattern
10 generator use methods to compensate for inaccuracy
11 of the pattern generator in order to provide
12 precise and consistent manufacturing processes."
13 And they specifically talk about intensity
14 composition and --
15 Q Let's --
16 A -- so --
17 Q I see what you're saying, but my specific
18 question is where does it use the word
19 "normalized" in connection with "irradiance"?
20 A Okay. So I'm reading on the printed
21 version of this paper version without any marks --
22 Q Okay. I can help you out --

A -- it will take me a while -- it will take me a while to find that.

Q It's late for us, so I'll help you out, how's that?

A Okay.

MR. CATALANO: Ky, could you put up Exhibit 3, please, and just go to the top. All the way to the top.

BY MR. CATALANO:

Q Dr. Chen, are you familiar with the control+F function in Adobe?

A Yes.

MR. CATALANO: So just to make it easy, Ky, can you control+F and just put in the word "normal."

Oh, I'm sorry. This is Exhibit -- Exhibit 5. Can you go to Exhibit 5, please.

BY MR. CATALANO:

Q This is the Shkolnik patent, correct?

A Yeah.

Q And so you're going to search for the word "normal," right?

1 So we're in column 15, and I searched for
2 "normal" just to make sure we don't have any, you
3 know, different ways of saying "normalized."
4 MR. CATALANO: And if you could zoom in.
5 I can't read that.
6 Thank you.
7 BY MR. CATALANO:
8 Q [As read] "A determination of mapping type
9 and action" -- "accuracy may be determined using
10 worst-case conditions and normal drift that may
11 incur during operation."
12 Can we agree that's not normalized
13 irradiance; that's a different thing?
14 A It's a different thing.
15 Q Okay.
16 MR. CATALANO: Again. Search again on
17 "normal."
18 BY MR. CATALANO:
19 Q Okay. And this one here, it also says
20 "normal drift"; do you see that?
21 A Mm-hm.
22 Q That's also not irradiance, correct?

1 A No.
2 Q Sorry. Yes, that's not -- or that is
3 correct, correct?
4 A That's correct.
5 Q Okay.
6 MR. CATALANO: Next.
7 BY MR. CATALANO:
8 Q Paragraph 24 -- or column 24, paragraph
9 starting on 35. And we're talking about:
10 [As read] "Original distance R is the distance
11 normal from the component boundary to the central
12 point C."
13 Again, this is not talking about
14 normalization of irradiance, correct?
15 A Correct.
16 MR. CATALANO: All right. One more.
17 BY MR. CATALANO:
18 Q This is another: "Distance normal from
19 the component..." this is not normalization?
20 A Correct.
21 Q Okay.
22 MR. CATALANO: So I think now we need to

1 put in "normalize." You don't need the D. For
2 some reason it didn't pop up; I don't know why.
3 Yep. There we go.
4 BY MR. CATALANO:
5 Q Column 35 at 27: [As read] "The system
6 includes a reactive material in liquid, powder,
7 paste, or other form, that may be considered as a
8 photo" -- "configured as a photopolymer. The
9 photopolymer may be laid, the thickness
10 normalized, and transported to a movable
11 platform/support plate."
12 So this use of the term "normalized"
13 refers to normalization of the resin, correct?
14 A This is normalize the thickness.
15 Q The thickness of the photopolymer?
16 A Yes.
17 Q And not the irradiance of the light?
18 A No.
19 MR. CATALANO: Can you hit "next" one more
20 time.
21 It says no more matches, but let's go to
22 the top just to make sure. Top of Exhibit 5,

1 please. Let's try to search "normalized" one more
2 time.
3 BY MR. CATALANO:
4 Q So the only reference to "normalize" in
5 the '301 patent is to normalizing the thickness of
6 resin, not light; is that correct?
7 A Correct.
8 Q Okay. And I can go through it if you'd
9 like, but I can represent to you that's the same
10 in the '511 patent; do you agree with that?
11 A Agree.
12 Q Okay. So the Shkolnik patent does not
13 teach explicitly, specifically, using the words
14 "normalized irradiance," correct?
15 A They probably use other words like
16 "standardized" or "calibrated."
17 Q Okay. Setting aside other words --
18 A If we can -- if we can search maybe
19 "standardize" or maybe "calibrate."
20 Q "Standard" is next, so I want to take it
21 one at a time --
22 A Or "calibrate" or "calibrated." Typical

1 people call the "pixel calibration" or "light
2 intensity calibration."
3 Q Let's go one by one. It doesn't use
4 "normalize"; can you agree with me there?
5 "Normalized irradiance" is not in the patent,
6 correct?
7 A Correct.
8 Q Okay.
9 MR. CATALANO: All right. Let's go back
10 up to Exhibit 1 at 144.
11 BY MR. CATALANO:
12 Q We're going to talk about standard, like
13 you said, a standard irradiance.
14 And, again, you say: "Shkolnik
15 specifically teaches adjusting irradiance to match
16 a standard irradiance"; is that right?
17 A No, what I mean is the principal or the
18 approach they present is trying to achieve a
19 normalized irradiance over the printing area.
20 They may not using the exactly word, but
21 the approach they teach and the problem or
22 limitation they try to address, they will try to

1 reaching that conclusion -- or that result, which
2 is normalized irradiance over the printing area.
3 Q So when you say "specifically teaches" --
4 "specifically teaches" -- and you use quotation
5 marks, you're not saying that Shkolnik,
6 specifically using those words, teaches the
7 concept of standard irradiance?
8 A So what I mean here is they specifically
9 teach adjusting irradiance. That's called
10 specifically teach adjusting irradiance.
11 And then they try to --
12 Q Okay. They specifically teach --
13 A -- reach the final results.
14 Q They teach --
15 A -- irradiance -- I'm sorry.
16 So, yeah, they specifically teach
17 adjusting irradiance --
18 Q But they don't --
19 A -- and then the --
20 Q -- teach to match a normalized irradiance,
21 though, correct?
22 A To -- to get homogenous, same intensity

1 over the printing area. They may not call it
2 "ideal irradiance" or "normalized irradiance," but
3 they specifically teach adjusting irradiance to
4 addressing the hardware limitation of, you know,
5 distorted lens or anything like that.
6 MR. CATALANO: All right. So let's go to
7 standard -- or, sorry. Let's go to Exhibit 5 to
8 the top, please.
9 Let's search on that.
10 BY MR. CATALANO:
11 Q Okay. This first one, it talks about
12 "modification of a file to compress into a
13 standard bitmap."
14 And that's not irradiance, correct?
15 A Correct.
16 MR. CATALANO: Go to the next one, please.
17 BY MR. CATALANO:
18 Q Okay. So here we go. And I'd like to
19 start at 15. It's column 34 of Exhibit 5,
20 Shkolnik at line 15.
21 [As read] "Used overlap regions may be
22 generated by either pattern generator, since they

1 cover the same area. However, they are typically
2 only generated by only one pattern generator to
3 avoid wide scale overexposure. If desired, both
4 pattern generators could generate overlap regions
5 and to avoid exposure, could each reduce the
6 intensity of the output so that the combined
7 intensity is standard."
8 Do you see that?
9 A Yes.
10 Q And that is adjusting the irradiance,
11 correct? That's a type of adjusting irradiance --
12 A Correct.
13 Q -- correct?
14 But this is a type of adjusting irradiance
15 within the overlap region, correct?
16 A That's right. But they need to make that
17 overlap area the same light intensity as outside
18 overlapping area.
19 So outside overlapping area is already
20 standardized. And now for this edge blending
21 filter, they need to adjust to the overlapping
22 area to make it standard, similar as outside area.

1 Q So, Dr. Chen, I appreciate that's your
2 position, but what I'm looking here is what the
3 patent says, right? And I just want to look at
4 what the patent says here. And here --
5 A Okay.
6 Q -- it's not talking about -- anything that
7 I just read does not talk about normalizing
8 irradiance; it's talking about essentially a
9 blending bar; is that right?
10 A Right. This is a blending bar. Yeah,
11 used for overlapping a region.
12 MR. CATALANO: Okay. If you can hit
13 "next," please.
14 BY MR. CATALANO:
15 Q So that's it.
16 So, again, like "normalized," will you
17 agree with me that the Shkolnik reference does not
18 teach standard irradiance; it doesn't use the
19 words?
20 A They did not use the word, but they teach
21 us how to adjust the light intensity to get a
22 uniform, homogenous light intensity all over the

1 printing area.
2 Q Okay. But not --
3 A (Indiscernible) not use the exactly words.
4 Q They're not using "standard," right?
5 Because when they use "standard," they're talking
6 about a blending bar or they're talking about
7 things that aren't anything to do with irradiance,
8 correct?
9 MR. ROXBOROUGH: Objection as to form.
10 BY MR. CATALANO:
11 Q You can answer.
12 A They did not use the word "standard."
13 Q Okay.
14 A Or "normalized" --
15 Q Let's go up to --
16 A -- but in the practice or in the field,
17 we, you know, typically call it compensate it or
18 calibration -- calibrate it.
19 So in the -- in the patent, they discuss
20 how to do the calibration. They specifically talk
21 about put the camera there, which is a typical
22 practice what we are doing in the field. And they

1 look at the projection image and they look at the
2 light intensity of every pixel, and they adjust
3 the pixel level to make them the same light
4 intensity.
5 So, to me, whatever language they're
6 using, but they exactly try to reach this
7 homogenous uniform, I would call it calibrated
8 light intensity.
9 Q Okay. I hear what you're saying, but,
10 again, what I'm talking about is what the patent
11 actually says, right? And so far in your
12 declaration, Paragraph 144, you know, looking at
13 the words that you cite in your declaration, we
14 haven't seen any reference to irradiance
15 normalization quite yet, correct?
16 A They did -- we searched the words of
17 "normalized" or "standard." We did not find the
18 words.
19 But, again, so I think in the declaration,
20 I talk about what they did in the Shkolnik patent,
21 and they discuss the approach they tried to
22 utilize. They discuss the problem, why they want



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1 to do this, and, in my understanding, this is
2 exactly the same as '301 patent or '511 patent.
3 Q All right. But, to be clear, when it uses
4 "standard irradiance," it's not talking about an
5 irradiance mask to configure -- configured to
6 normalize irradiance; it's talking about a
7 blending bar, correct?
8 MR. ROXBOROUGH: Objection. Compound.
9 Objection. Asked and answered.
10 BY MR. CATALANO:
11 Q Can you answer the question again?
12 A So they teach us need to do calibration,
13 the light intensity calibration in Shkolnik.
14 They try to adjust the light intensity by
15 using external camera and they try to look at the
16 light intensity, try to adjust the light intensity
17 of each pixel. So they call this irradiance mask,
18 which is similar to what the '301 or '511 patent
19 trying to do, try to get hom- -- unifies or
20 uniform light intensity over the printing area.
21 Q So you agree with me, though, that if it
22 says that in the patent, you would have cited it

1 in your declaration, correct?
2 A Cited which one, the approach or what they
3 did? Or they cited -- could you --
4 Q If the --
5 A -- ask the question again?
6 Q Sure. If Shkolnik explains or teaches to
7 use an irradiance mask configured to normalize
8 irradiance, if it actually says that in words or
9 in substance, you would have cited it in your
10 declaration, correct? You would have said: This
11 is where Shkolnik teaches irradiance mask,
12 correct?
13 A I think I gave some example. Could you
14 give me some minutes? I can -- I can --
15 Q Well, we're -- Dr. Chen, we're going to go
16 through the whole thing, all right? We'll going
17 to go one by one --
18 A Okay.
19 Q -- and we'll figure out where it says it.
20 A Okay.
21 Q So we're going to do compensation now, and
22 we'll just --

1 MR. CATALANO: Hold it right here.
2 BY MR. CATALANO:
3 Q "Shkolnik specifically teaches adjusting
4 irradiance to match a compensation irradiance."
5 I read that correctly, correct?
6 A So to match a compensated irradiance --
7 Q Well, it says "compensation," right?
8 A Right. So typically, again, we -- after
9 you do the calibrated -- calibration, light
10 intensity calibration, we -- in the field we call
11 this projection image is compensated for the
12 hardware limitation.
13 Q And your testimony is when you use the
14 word "compensated" in the context of irradiance,
15 it always and uniquely means irradiance
16 normalization, correct?
17 A It means the irradiance or light intensity
18 compensation or --
19 Q Right. And --
20 A -- light intensity calibrated -- yeah,
21 calibration.
22 And, afterwards, we call the light

1 intensity compensated for the hardware limitation.
2 Q Right. But when you use "compensated" in
3 the context of irradiance, isn't it true that that
4 can also use -- can refer to irradiance
5 compensation in the overlap region, a blending
6 bar?
7 A I think, again, they are two different
8 problem. Typically we do one by one. So that
9 means for the -- typically when you have a
10 projector, you do the lighting calibration. So
11 you adjust the light intensity to compensate for
12 any defects of the hardware limitation.
13 So after you make the light intensity
14 homogenous, you essentially get normalized light
15 intensity everywhere or standard light intensity
16 everywhere.
17 And then you have another filter or
18 another algorithm or piece of code, try to deal
19 with overlapping area, and try to adjust that
20 overlapping area up and down to get, not
21 standardized light intensity in that small area,
22 matching other place you have calibrated.

1 Q So, Dr. Chen, my internet cut out in the
2 middle of that answer. So I'm going to ask --
3 MR. CATALANO: Michelle, could you read
4 back his answer? I didn't hear him.
5 (WHEREUPON, the record was
6 read by the reporter.)
7 BY MR. CATALANO:
8 Q So, yeah, and my question specifically is
9 when you do the adjustment of the intensity in the
10 overlapping area, is that a form of irradiance
11 compensation?
12 A For that small overlapping area, no.
13 Q So when people say the word "irradiance
14 compensation" or "compensated irradiance," they
15 are only referring to an irradiance mask to
16 normalize irradiance and no other type of
17 compensation of light intensity?
18 A Yeah. So for the 3D printing development,
19 we used to use single-projection system, and for
20 the single-projection system, we utilize
21 normalized irradiance. And there's only one mask
22 need to be normalized at light intensity.

1 And for this patent, they tried to use
2 multi-pool projection system. So they tried to
3 adjust the overlapping area as well. So that's
4 unique to multi-projection system.
5 Q Okay. But in the context of a
6 multi-projection system, when you manipulate the
7 irradiance in the overlap region, you're saying
8 that a person of ordinary skill would not
9 understand the manipulation or compensation of
10 light within the overlapping area to be irradiance
11 compensation?
12 A Could you say that again? I got caught up
13 a little bit. So you said -- again, so could you
14 repeat that question again?
15 Q Yeah, so let me back up from the 3D
16 printing world. Because you said prior to
17 Shkolnik -- right? -- 3D printing was focused on
18 single-projector systems, right? At least in the
19 context of a projective SLA; is that correct?
20 A Right.
21 Q Okay. How about in the context of
22 computer graphics or projected -- you gave the

1 example of a cinema, right?
2 A Right. That's even longer.
3 Q Yeah. So in that context where they used
4 multiple projectors, did they refer to the
5 manipulation of the light within an overlap region
6 to refer -- or as compensated irradiance or
7 irradiance compensation?
8 A They may use different words, but the
9 essence -- again, so I'm looking at the approach
10 you are taking, not the words you are using. You
11 can use whatever word to describe the same thing
12 or different thing, but, by the end of the day,
13 what's actually -- exactly actually you're doing,
14 that's what I'm talking about.
15 So essentially you're adjusting the light
16 intensity to make the light intensity uniform or
17 homogenized over the projection area.
18 So for the computer graphics, when you try
19 to project a movie to your screen, you --
20 essentially before you project the movie, you need
21 to do the same thing; you need to make sure the
22 light intensity homogenized or uniform over the

1 area.
2 So you need to actually adjust the light
3 intensity to compensate for any hardware defects
4 or hardware limitations.
5 And so they have done that for, like,
6 30 years. And for our 3D printing industry,
7 initially we have a single-projection system, and
8 every one is doing this lighting calibration or
9 compensation for the light intensity defects
10 because of hardware limitation.
11 So we try to adjust the light intensity to
12 make the whole printing area a single-projection
13 system to be homogenized.
14 And then --
15 Q Right.
16 A -- later people come out with
17 multi-projection system. And even you use the
18 multi-projection system, you still need to do the
19 same thing as single-projection system, you need
20 to adjust the light intensity to make every
21 sub-image to be homogenized, to be uniform.
22 Q So I understand what you're saying --



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1 A And then -- go ahead. Yeah.
2 Q Yeah, well, my question was, again: When
3 the word "compensated" or "compensation" is used
4 in connection with "intensity" or "irradiance,"
5 your position is that intensity compensation means
6 the same as an irradiance mask configured to
7 normalize irradiance and no other type of
8 intensity compensation, correct?
9 A Well, what do you mean "no other type"?
10 Q So when you manipulate the irradiance for
11 any purposes -- for any purpose, is that
12 compensating irradiance?
13 A I got a short-circuit on my screen. So
14 could you ask your question again? Because I'm
15 trying to understand what you're trying to ask.
16 Because I describe -- again, so for the
17 action perspective, you are trying to adjust the
18 light intensity of every pixel to make the light
19 intensity over the printing area the same light
20 intensity or same power.
21 And so, afterwards, then you adjusting
22 other type of a constraint or limitation of the

1 hardware one by one. So typically we are doing
2 that in the industry.
3 Does that answer your question or you're
4 asking something different?
5 Q Yeah, no, I'm just asking what the word
6 means -- the words mean. I'm not asking what
7 people do. You know, I think you've been very
8 clear -- right? -- you've explained that quite
9 well.
10 I'm just saying the words "intensity
11 compensation" in the context of projectors only
12 means to normalize irradiance; it has no other
13 meaning?
14 A Intensity compensation...
15 Okay. So what do you mean actually no
16 other meaning? Actually, I don't quite understand
17 exactly the question you're asking.
18 Q Yeah. So, you know, as I understand -- my
19 understanding -- and it doesn't matter, I'm not a
20 POSITA, I was a politics major.
21 My understanding of the term
22 "compensation" in the context of light is to

1 manipulate the light, right? I don't understand
2 intensity compensation to mean necessarily
3 normalization; it's any type of manipulation of
4 the intensity.
5 Do you disagree with my understanding,
6 from a perspective of a POSITA?
7 A To my understanding, this irradiance mask
8 or this -- you have several steps to address a
9 different approach.
10 So for this irradiance mask, you are
11 trying to addressing -- when you project one
12 single image, you get long homogeneous lighting
13 distribution over the projected area. So you
14 adjusting the light intensity of every mask to
15 make homogenized.
16 And then later, when you put the multiple
17 projector together, you get overlapping area. So
18 after you compensate or make the whole projection
19 image of every projection system the same light,
20 so now you need to further reduce or compensate
21 that overlapping area. So make that overlapping
22 area the same light intensity as well.

1 Q Okay. I'm going to move on.
2 A And they are -- they call the edge
3 blending bar.
4 But, by the end of the day, again, you try
5 to make the whole printing area which can consist
6 multi-pool projection sub-images to be
7 homogenized, the light intensity over the whole
8 printing area to be uniform light intensity.
9 MR. ROXBOROUGH: Jeff, I can see it's
10 5:52. I don't know if this is an appropriate
11 juncture.
12 MR. CATALANO: You know, this is actually
13 the perfect time, so I was just going to say give
14 me a second.
15 MR. ROXBOROUGH: Sure.
16 (WHEREUPON, discussion was had off the
17 stenographic record.)
18 (WHEREUPON, a recess was had.)
19 MS. REPORTER: Back on the record at 7:03.
20 MR. CATALANO: Okay. Let's go to
21 Exhibit 5 at column 18 at the top. If you can
22 pull that up, Ky.

1 There are a ton of figures. It's really
2 far back.
3 There we go. Zoom in, please.
4 BY MR. CATALANO:
5 Q Column 18 of Shkolnik is talking about a
6 voxelized construction process.
7 And it says: "...both the position and
8 the intensity (e.g. a grayscale value) may be
9 adjusted to correct for linear and nonlinear
10 distortions."
11 Do you see that?
12 A Correct.
13 Q It says: "Such intensity compensation is
14 also useful for achieving sub-pixel features
15 during the build process."
16 Do you see that?
17 A Yes.
18 Q And this is referring to grayscaling,
19 right? Or grayscale value?
20 A You mean sub-pixel -- intensity
21 composition?
22 Q No, the words here, this particular thing

is talking about -- it says: "E.g. a grayscale value," and then it talks --

A Oh.

Q -- about achieving sub-pixel features during the build process, which I understand means grayscale here because then, actually, if you look at the next sentence, it talks about grayscale values again.

You see that?

A Right. So grayscale value adjustment, yes.

Q What is a grayscale value adjustment?

A So for DMD devices, every pixel you can individually control. And every micromirror, you can control frequency, like in thousands per second.

So you can -- typically for the graphics card, they provide you, if 8 bits control bit, so then you can have a zero, 1, until 255 light intensity. You can specify to each pixel. And the controller going to take that value and then control the percentage for every second.

1 For example, if you have 255, that means
2 the light intensity or the micromirror will be
3 always on. If it's zero, then the light
4 intensity, or the micromirror, will always be off.
5 If it's 128, then half of the time, the
6 micromirror will be on; half the time it will be
7 off.
8 So they can vibrate really, really fast,
9 within 1,000 hertz. So they can adjust the
10 percentage of the light to turn on that
11 micromirror to be on or off. So, that, we call
12 grayscale value.
13 Essentially, it's associate with what the
14 light intensity for every micromirror you put into
15 that small area, which we define as a pixel.
16 Q Okay. Let me try to make this simple.
17 And thank you for your explanation.
18 If it's zero, it's black, it's off,
19 essentially, correct? And each pixel can be zero,
20 right, or not. And one example would be 255,
21 which would be fully bright, correct?
22 A Correct.

1 Q And so every pixel could be zero or 255;
2 each pixel could be different, correct?
3 A Or could be 128, it could be 200, it could
4 be 50, yeah.
5 Q Right. But the 200 in this context would
6 not be fully on or fully off, but that would be
7 what would be referred to as a "grayscale value"?
8 A Correct.
9 Q And when you use a grayscale value in the
10 context of a 3D printer, you're not using a
11 grayscale across the entire sub-image; you're
12 using a grayscale value with respect to specific
13 pixels, correct?
14 A Correct.
15 Q So, for example, in the boundary --
16 A So each pixel --
17 Q -- region --
18 A Sorry. So, yeah, each pixel you can
19 individually control. So each pixel have their
20 own value.
21 Q So you can, for example, in the boundary
22 region of your part -- right? -- you can put, you

1 know, one pixel black and the pixel next to it
2 gray, call it 128, and then the next pixel white,
3 which would show there is a boundary there between
4 the part and not the part, correct?
5 A Correct.
6 Q Okay. And, here, the patent refers to
7 achieving those sub-pixel features or those
8 grayscale values as intensity compensation,
9 correct?
10 A Right.
11 Q Okay.
12 MR. CATALANO: All right. Let's go to the
13 top of the Shkolnik reference, which is Exhibit 5.
14 Let's kind of do the same thing; if you
15 can control+F on "compensation."
16 And if you scroll down a little bit and
17 zoom in on -- your cursor is in the right spot, or
18 at least the highlight is in the right spot.
19 BY MR. CATALANO:
20 Q So this is column 5 at lines 38
21 through 53. And if I recall correctly, you cite
22 this in your declaration, but let's just look at

1 what this says.
2 A Mm-hm.
3 Q "To provide precise and consistent
4 manufacturing processes, the pattern
5 generation" -- "generator use methods to
6 compensate for inaccuracies."
7 Correct?
8 A Correct.
9 Q And then it talks about: [As read] "A
10 calibrated imager, a camera, may be used to view
11 an uncompensated test pattern to determine the
12 inaccuracies for a pattern generator," correct?
13 A Correct.
14 Q And: [As read] "The uncompensated test
15 pattern may be then compared with the ideal or
16 expected pattern to generate a pattern correction
17 map," correct?
18 A Correct.
19 Q And as the patent uses the term "pattern
20 correction map," this is referring to geometric
21 correction, correct?
22 A Right.

1 Q So the next line says: "The pattern
2 correction map include positional compensation
3 (e.g., to adjust linear and nonlinear
4 distortions)..."
5 And I'm going to finish the sentence, but
6 that's so far, yes? Correct?
7 A Yes.
8 Q And, here, positional compensation is a
9 form of geometric correction, correct?
10 A Correct.
11 Q And then it also says: "...and may also
12 provide for intensity compensation."
13 A Mm-hm.
14 Q See that?
15 A Yeah.
16 Q And then the next sentence says: "In
17 general, the compensation may include X and Y
18 positional offsets for each pixel associated with
19 a bitmap."
20 Did I get that right?
21 A Mm-hm.
22 Q So I guess the point I'm trying to get to

1 is, you would agree with me that it says: "May
2 also provide for intensity compensation"?
3 A Mm-hm.
4 Q But the rest of the discussion of the
5 types of compensation refers to geometric
6 compensation, other than those words?
7 A So in the field, what we did is typically
8 we put a camera, we look at the projected image,
9 and that camera can compensate for distortion.
10 Also, we can use the camera to compensate for the
11 light intensity difference.
12 So my understanding is they use a camera
13 to get a pattern, and then this pattern correction
14 map can include a positional compensation and also
15 intensity compensation.
16 This is pretty standard for the industry
17 practice. I do not see any issue with that.
18 That's --
19 Q And I guess my --
20 A -- pretty normal.
21 Q I guess my question is, it says "intensity
22 compensation," but throughout that paragraph, it

1 gives a number of examples, and all those examples
2 are geometric correction, other than the word
3 "intensity compensation."
4 A Right, they use geometry compensation as
5 example. Yeah, they talk about positioning
6 offset; those are geometry compensation.
7 Q Right. I agree.
8 Next --
9 MR. CATALANO: Sorry, Ky, can you hit to
10 the next button.
11 BY MR. CATALANO:
12 Q Right. Okay. So this is another version.
13 I'll be quick. Same column. It talks about
14 compensation due to changes in system alignment or
15 components.
16 This is another example of geometric
17 correction, correct?
18 A Let me read it. Hold on.
19 Not necessarily because, again, such
20 monitoring adjustment allow for continuous
21 compensation, which means you have a camera and
22 during your running of the DMD chip or running of

1 the DLP's projection system, your hardware make
2 continuous change.
3 And with the hardware continuous change,
4 my understanding of what they are trying to say is
5 that they continue using a camera to read what the
6 projection image look like, and then they can
7 continue doing the compensation. It could be
8 change of the light intensity; it could be change
9 of the geometry distortion.
10 So they try to allow for continuous
11 compensation for those type of distortion or
12 change over the printing process.
13 MR. CATALANO: Ky, can you go to the next,
14 please. And zoom out a little bit because it's
15 not all on the page. There we go.
16 BY MR. CATALANO:
17 Q Okay. This particular -- and this is
18 at --
19 MR. CATALANO: Could you scroll to the top
20 so we can see where this is.
21 BY MR. CATALANO:
22 Q Column 6, and it's 52, line 52. Here,



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1 there's a discussion of using a camera to correct
2 the pattern generator's output and provide
3 feedback at closed-loop compensation.
4 It talks about calibration templates to
5 calibrate the imager and subsequent images are
6 compensated to provide their true location.
7 The reference to "true location," again,
8 is a geometric correction, correct?
9 A Correct.
10 MR. CATALANO: All right. Can you hit
11 "next" again, Ky.
12 BY MR. CATALANO:
13 Q All right. We talked about this. This is
14 column 18. This is the intensity compensation
15 reference to grayscale value.
16 You see that?
17 A Right. Okay. [As read] "Such light
18 intensity compensation is useful achieving
19 sub-pixel" -- yeah.
20 Q Okay. So this is a use of intensity
21 compensation in the context of grayscale values.
22 We talked about this, correct?

1 A Mm-hm.
2 MR. CATALANO: Okay. Next.
3 BY MR. CATALANO:
4 Q So here it seems like this is still a --
5 so we're at 38. So if we were talking about 38
6 around 7, we're talking about compensation system
7 that provides the level of reactive material
8 located at the ideal or near-ideal distance from
9 the pattern generator which may be accomplished by
10 volume compensation and/or a lifting mechanism.
11 That also does not refer to -- that
12 doesn't refer to irradiance normalization,
13 correct; this is talking about reactive material?
14 A Mm-hm.
15 Q And that refers to -- you said "yes,"
16 correct?
17 A Correct.
18 Q And that refers -- when you say "reactive
19 material volume," that's -- in this context, we're
20 talking about photopolymer or resin, correct?
21 A Correct.
22 Q Okay.

1 MR. CATALANO: One more on "next," I hope.
2 One again. There we go.
3 BY MR. CATALANO:
4 Q So those are all the references to
5 compensation. And I just wanted to be clear,
6 here, other than saying "intensity compensation"
7 generally with no explanation, there is no express
8 discussion of intensity compensation to normalize
9 irradiance across a sub-image, correct?
10 A Could you search "light intensity" or
11 search "calibration" or "calibrate," something --
12 Q I think we're going to get a lot of
13 "calibration."
14 A Yeah. Because typically in the field, we
15 call it the calibration. And the essence of the
16 calibration in the field commonly practice for --
17 since Chuck Hull invented the SLA, it has been
18 practiced for, like, 30 years. And we --
19 typically we see calibration, we know what that
20 mean. We typically normalize the light intensity
21 over the projection area.
22 So if you search "calibration," probably

1 you can find the more related to light intensity
2 what exactly they did.
3 Q Okay. So I'm going to stay with --
4 A They may not call it to normalize, they
5 may call it calibrated more, yeah. Sorry.
6 Q Well, I'm just going to stick with the
7 words in your declaration.
8 Hold on a second.
9 So we were talking about Paragraph 144 of
10 Exhibit 1, which is your declaration on the
11 '301 patent.
12 So after the sentence we've been talking
13 about, which ends with "all of which the POSITA
14 would treat as meaning the same thing," it says:
15 "For instance, Shkolnik teaches that the pattern
16 generator uses methods to compensate for the
17 inaccuracies of the pattern generator in order to
18 provide precise and consistent manufacturing
19 processes, and these methods include intensity
20 compensation."
21 And your citation is to column 3:38-49,
22 which we just talked about, right; "the pattern

1 generator to provide precise and consistent
2 manufacturing processes," correct?
3 A Okay.
4 Q We've already discussed that, correct?
5 A Correct.
6 Q So -- oh, I said column 3. I meant
7 column 5. My apologies. So it's column 5, 38-49,
8 and that's something we've already discussed.
9 And you say: "By 'intensity,' I
10 understand Shkolnik to mean the "brightness" of
11 light striking a given pixel or voxel, which is
12 the same as irradiance."
13 So that's what "brightness" means in this
14 context?
15 A Right.
16 MR. CATALANO: Let's go to 145.
17 BY MR. CATALANO:
18 Q 145 says: "Shkolnik further teaches that
19 the typical sources of error in the pattern
20 generator may include mechanical misalignment of
21 the components or supporting structure, misaligned
22 lenses or mirrors, and malformed lenses and

1 mirrors..." I'm going to stop right there.
2 These -- these sources of error can cause
3 problems that require geometric correction,
4 correct?
5 A Both geometric and the intensity
6 compensation.
7 Q Right. But it does include -- these
8 would -- all of these would cause geometric
9 problems as well as intensity, in your testimony?
10 A Yes.
11 Q Great. And you said: "As well as heating
12 and cooling during operation which may cause
13 components to move or expand changing their
14 position, or in the case of optical components,
15 the position, shape, and size may change with
16 heating and/or cooling."
17 Again, you're referring to something here
18 that would cause issues that would require
19 geometric correction, correct?
20 A Yeah, all the hardware limitation or
21 hardware change would change the position of the
22 projection system, as well as the light intensity

1 up and down, yes. They would --
2 Q They would --
3 A -- change --
4 Q And, just to be clear, it would include
5 geometric correction?
6 A It would --
7 Q Problems that -- yeah.
8 A It will include the problem for geometric
9 correction.
10 Q So the next sentence, it talks about DLP
11 pattern generators: "Micromirrors may change
12 shape or position to cause both linear and
13 nonlinear distortions which may be compensated
14 for."
15 See that?
16 A Mm-hm.
17 Q And that is -- you have bolded "linear and
18 nonlinear distortions."
19 Would you agree with me that linear and
20 nonlinear distortions can cause problems that
21 would be remedied by geometric correction?
22 A Geometric composition is for the position

1 problem or position inaccuracy. And light
2 intensity compensation is for the light intensity
3 modulation or change over the printing process.
4 Q No, I understand, but my question is:
5 Linear and nonlinear distortions, when you use
6 that "causing linear and" -- "both linear and
7 nonlinear distortions" --
8 A Right.
9 Q -- linear and nonlinear distortions can
10 cause problems that require geometric correction,
11 correct?
12 A Right.
13 Q So the last sentence here: [As read]
14 "Whether a micromirror has physically changed
15 shapes, position" -- "position, shape, or size, it
16 would have a direct impact on intensity, and in a
17 stare" -- "scenario where such a change has
18 occurred, Shkolnik is teaching here that there's a
19 need for compensation to normalize."
20 I read that correctly? I'm sorry, I'm
21 coughing.
22 A Correct.

1 Q So would you agree with me, though, that
2 when a micromirror has changed -- physically
3 changed its position, shape, or size will also
4 have a direct impact on the shape of the projected
5 image or alignment of the projected image which
6 would require geometric correction?
7 A Correct.
8 MR. CATALANO: All right. Let's go to --
9 I'm sorry. I'm coughing like crazy.
10 Can we go to 146, please.
11 BY MR. CATALANO:
12 Q Okay. [As read] "Shkolnik further teaches
13 that the brightness or irradiance and exposure
14 time may be for parameters for the bitmap together
15 or separately."
16 What does that mean?
17 A Wait. So which -- which one -- see, I did
18 not --
19 Q First sentence of --
20 A -- know which --
21 Q -- Paragraph 146 of Exhibit 1.
22 A Right. So for every pixel, you can

1 control the brightness or grayscale value. So
2 that will lead into the brightness of that pixel
3 change. Or -- and, also, you can control, for
4 every pixel, how long you set it on. So that's
5 related to the exposure time.
6 So those two brightness and exposure time
7 are two feed parameter to control every pixel,
8 which form a bitmap. So you can --
9 Q What is --
10 A -- control them -- you can control them
11 together, or you can control them separately.
12 Q And a bitmap is an image file, correct?
13 A That's correct.
14 Q Okay. And when you put brightness and
15 exposure time as parameters for the bitmap, you're
16 talking about -- or Shkolnik is talking about
17 putting in the brightness values in the image file
18 itself, correct?
19 A Correct.
20 Q Okay.
21 And you say: "Shkolnik assigns an
22 intensity value to each pixel or voxel, such as an

1 integer between zero and 255, and states that the
2 intensity value may be compensated or adjusted
3 before being sent to the pattern generator..." I'm
4 going to stop right there.
5 So what that's talking about here, the
6 intensity value being compensated or adjusted
7 before being sent to the pattern generator, does
8 that mean the integer is changing from 255, for
9 example, to 243?
10 A Yeah.
11 Q Okay. And it also says: "May be
12 compensated or adjusted at the pattern generator
13 or both."
14 Again, is this changing the intensity
15 value, like the number, the integer?
16 A Yeah. The intensity value means the
17 grayscale value for every pixel in the bitmap,
18 yeah.
19 Q Okay. And so what I think -- I mean, the
20 next sentence kind of brings it home what the
21 point of this paragraph is.
22 Here, you're talking not about irradiance



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1 uniformity, but the fact that the intensity
2 compensation can occur on the sub-image level,
3 right? If you look at the next sentence.
4 A I don't know what you mean. Basically,
5 you have a multi-projector and you have multiple
6 chip; you control them separately. So you are
7 controlling the pixel of sub-images. And you can
8 only control the pixel of sub-images.
9 Q Okay.
10 MR. CATALANO: If you can scroll down to
11 157 -- or, sorry, 147.
12 BY MR. CATALANO:
13 Q First sentence says: "If desired, the
14 intensity value can provide grayscaling of pixels
15 or voxels per Shkolnik."
16 You see that?
17 A Mm-hm.
18 Q We've talked about grayscaling before.
19 Grayscaling is a form of intensity compensation
20 that is different than irradiance normalization,
21 correct?
22 A Say that again. I did not catch your

1 question again.
2 Q Yeah. Earlier in the context of column 18
3 of Shkolnik, we talked about grayscaling -- or
4 Shkolnik talks about grayscaling as being a form
5 of intensity compensation that's different than an
6 irradiance mask that normalizes irradiance,
7 correct?
8 A What's the difference? I do not quite get
9 what you mean "difference."
10 So they adjust the grayscale value of each
11 pixel to make the light intensity of the whole
12 projection area uniform or homogenized or the
13 same, essentially, light intensity.
14 And my understanding, that's -- that's
15 exactly what do -- what was done in the irradiance
16 pattern or irradiance mask.
17 Q We talked about grayscaling earlier --
18 right? -- where you would have one pixel at zero,
19 one pixel at, for example, 200, and another pixel
20 at 255 in order to --
21 A Right.
22 Q -- for example, identify a boundary

1 region; do you recall that?
2 A Right.
3 Q And the -- that does not normalize the
4 irradiance across the sub-image; it actually
5 intentionally changes irradiance to make it
6 non-uniform in specific places of the sub-image,
7 correct?
8 A We are talking about different problem or
9 issue.
10 For that one, we are talking about, for a
11 pixel, inside a pixel, we only occupy half of that
12 pixel. So the boundary lay over that's
13 neighboring -- boundary lay over that's a boundary
14 pixel.
15 So you don't use 1 or 255 to expose that
16 pixel. You also don't use zero to expose that
17 pixel. You use certain grayscale value to expose
18 that pixel because it's only occupying 50 percent
19 of that pixel. So you change the light intensity
20 or grayscale value for that pixel only.
21 But for irradiance mask, we are talking
22 about way, way, way before you sending the

1 projection image or the slicing image, which
2 is the -- so for the -- when you have constructed
3 the hardware or the printing system, you do the
4 calibration. So you make sure you only sent two
5 white pixel to the whole projection area, and then
6 you adjusted the light intensity or grayscale
7 value.
8 For example, we know that pixel is bright;
9 it's super bright, much brighter than every other
10 one. So then we multiple -- for example, we
11 change that image, so we know the light intensity
12 image associated with that pixel to be, for
13 example, 0.9. So every time when you try to send
14 a pixel, you multiply that mask or that calibrated
15 mask, so you know every time, whatever value you
16 send there, you multiply this scale factor 0.9 to
17 dim it down.
18 And even you dim it down, you know at that
19 output of the physical system, you get the same
20 light intensity as everyone else.
21 So we are talking about two different
22 thing. One is for the hardware limitation so you



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1 actually calibrate the whole thing. After
2 calibrating the whole thing, then you sending a
3 slicing image. That slicing image could be a
4 tease, it could be a toy, it could be anything.
5 And then for that pixel with full bright
6 or full black or some boundary, then you send a
7 different type of grayscale value associated with
8 that geometry.
9 Q Yeah, I think to sum what you just said,
10 Dr. Chen, I think what you said was grayscaling
11 and irradiance masking are solving different
12 problems; they're two different things, correct?
13 A Correct. The irradiance mask and this
14 grayscale for sub-pixel resolution is different.
15 Q Okay. Next sentence: "Similarly" --
16 well, two sentences down: "Similarly, in the
17 context of edge blending discussed further below,
18 Shkolnik teaches that multiple pattern generators
19 (e.g., multiple DLP devices) could reduce" --
20 "could each reduce the intensity of the output so
21 that the combined intensity is standard."
22 Right? And this is citing Shkolnik at 34,

1 19 through 22.
2 And, again, we've talked about this. Edge
3 blending or blending bars are solving a different
4 problem than an irradiance mask, correct?
5 A Correct.
6 Q And when you talk about reducing the
7 output so that the combined intensity is standard,
8 that is a different thing than the irradiance
9 normalization mask, correct?
10 A Correct.
11 Q Okay.
12 MR. CATALANO: Go down to the top of the
13 next page, please. The first sentence of -- at
14 the top of -- I don't know what page that is. Can
15 you go up just a little bit -- or down.
16 BY MR. CATALANO:
17 Q First sentence at the top of Page 59,
18 that's more edge blending. You see: Such edge
19 blending dot, dot, dot?
20 A Yeah.
21 Q Okay. And it also talks about: [As read]
22 "A significant theme of the entirety of Shkolnik

1 is the accurate represent" -- "reproduction of the
2 original or ideal image."
3 You see that?
4 A Mm-hm. Yeah.
5 Q It says: "Shkolnik particularly teaches
6 that corrected or adjusted or fixed bitmaps or
7 datasets are adjusted for linear or nonlinear
8 distortion of the pattern genner" -- "generator,
9 so, when projected, the ideal pattern from the
10 pattern generator is generated on the build
11 surface."
12 You see that?
13 A Yes.
14 Q And, again, we talked about
15 linear -- compensating or adjusting for
16 nonlinear -- linear or nonlinear distortion, that
17 can refer to either geometric correction or some
18 type of intensity generation, correct?
19 A Correct.
20 Q In the next sentence, it says: [As read]
21 "In other words, Shkolnik teaches that pattern
22 generation [sic], such as DLP devices, which each

1 produce sub-image, must be adjusted for
2 distortion, such as distortion caused by defects
3 in micromirrors or other optical elements, and one
4 of the ways to correct for distortion is to ensure
5 that intensity irradiance matches a standard
6 normalized value."
7 Do you see that?
8 A Yes.
9 Q And I see there's no cite here, right?
10 You're not citing anything from Shkolnik, correct?
11 A Correct. So I -- again, so this is a
12 common practice when you do the light intensity
13 compensation or calibration.
14 So we calibrate every projection system
15 based on the hardware right now we have, and then
16 we try to adjust the light intensity of every
17 pixel to make the light intensity normalized or
18 reaching some standard value so everywhere it's
19 the same light intensity.
20 So this problem has been there for
21 20 years, since beginning using of the
22 single-projection system. So you are using

1 multi-projection system or single-projection
2 system. Essentially for this step, it's the same.
3 There's no difference of multi-projection
4 system or a single-projection system; you have to
5 use every image system of your multi-projectors,
6 same light intensity everywhere before you can go
7 to the next step.
8 Q Okay. And when you said -- when you say
9 one of the ways to correct for distortion is to
10 ensure that intensity matches a standard value,
11 another of the ways to correct for such a
12 distortion is to perform geometric correction,
13 correct?
14 A You need both. So essentially, ideally,
15 to make a good printing result, you need a perfect
16 square. At the same time, everywhere inside that
17 perfect square, you have the same light intensity.
18 So to get that perfect square, you do
19 geometric correction. For light intensity
20 uniform, you do the irradiance mask filter. You
21 apply calibration -- intensity calibration.
22 So this is -- no matter you are doing

1 multi-projection system or single-projection
2 system, that you have to do or have to be done
3 before you print the job.
4 Q Okay. And so the next -- the line said
5 for -- is to ensure that intensity irradiance
6 matches a, quote, standard, end quote,
7 parentheses, normalized, close parentheses value.
8 We talked earlier, Shkolnik does not refer
9 to standard irradiance in the context of
10 irradiance mask; he's referring to a blending bar.
11 Do you recall that?
12 A Right. They may not using the exact word,
13 but typically everyone doing light intensity
14 calibration, we try to set a standard or try to
15 set a value, and then we try to adjust it to
16 matching that value everywhere.
17 Q Okay. And so you agree with me on
18 standard value -- when they use the word "standard
19 intensity," that's a blending bar in Shkolnik,
20 correct?
21 A They may not use that exactly word of
22 "standard value" or "standard value" in the

1 patent. But, again, this is a common practice for
2 20 years. I think that you can call it whatever
3 you -- way -- I mean, I typically call it
4 "calibrated value" or "standard value." Typically
5 I call it a "standard value" or "calibrated
6 value."
7 Q Okay. The word "normalized," which is in
8 parentheses here, that appears in the claim, but
9 "normalized," as we discussed earlier, in
10 Shkolnik, refers to normalizing resin, correct?
11 A Right. So -- okay. So here's a common
12 practice in the field as well. So when you use a
13 resin, you do the resin calibration, you expose
14 the light. And so you normalize the resin or
15 normalize the exposure time or light intensity
16 based on the resin you are using.
17 So we try to calibrate every pixel inside
18 that projection image to matching that normalize
19 the value. So that's a typical practice in the
20 field.
21 So, yeah, so I would -- when I read the
22 patent, I -- in my mind, that's an image I'm

1 thinking about. So maybe I call it a
2 "standardized value" or "normalized value." They
3 may use a different word in the patent.
4 Q Right. And in the patent, just to be
5 clear, when it uses the word "normalize," the only
6 context of "normalized" in the patent, which we
7 talked about earlier, is in the context of
8 normalized resin thickness, correct?
9 A Right. Normalize the resin, yeah.
10 Q Okay. I realize I didn't talk about
11 "ideal," so I need to go back up to Paragraph --
12 MR. CATALANO: Oh, by the way, just scroll
13 down real quick. We're on Exhibit 1.
14 BY MR. CATALANO:
15 Q You see that we're now moving into a gamma
16 adjustment. So the section on irradiance is done;
17 do you see that?
18 A Mm-hm.
19 Q Correct?
20 A Yeah.
21 Q Okay.
22 MR. CATALANO: Let's go back up to 144.



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1 BY MR. CATALANO:
2 Q So we've talked about "normalized"; we've
3 talked about "compensation"; we've talked about
4 "standard"; we have not talked about "ideal."
5 And my question is: Does Shkolnik
6 specifically, using the words, teach adjusting
7 irradiance to match an ideal irradiance?
8 A Ideal, again, in my mind, every projection
9 system it's non-perfect; they always have defect,
10 all kinds of different defects.
11 So you do the light intensity calibration
12 and do the light intensity compensation to make
13 the projection image ideal. That's -- again, I
14 don't know. I mean, I am immigrant. English is
15 my second language. So I call it ideal projection
16 image that you project onto the resin surface.
17 So they may not use the word, but the --
18 you know, their procedures or steps they are
19 taking conform to the common practice that were
20 used in the -- in the field.
21 And, by the end of the day, we will get, I
22 would call it, ideal projection image, which is



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1 the perfect square and inside this square,
2 everywhere the light intensity is the same.
3 Q Okay. And, again, I'm specifically asking
4 you whether they use the words "ideal irradiance."
5 Do you know the answer, yes or no?
6 A If you can search inside the patent --
7 Shkolnik patent, we can be sure. So we can do
8 that, just like what you did, just control+F
9 "ideal," we can see are they using that exact word
10 of "ideal."
11 Q So I'll tell you, Dr. Chen, it uses the
12 word "ideal" 38 times, and it's getting late, so
13 what we're going to do instead is look at what you
14 cite in your declaration.
15 MR. CATALANO: If you can go to -- scroll
16 down to, like, 147.
17 Nope. Sorry. 146.
18 Actually, 147. Sorry.
19 I need to look at the paper.
20 Okay. So it's in a later section, which
21 is Paragraph 190, which is discussing irradiance
22 mask in the context of claim 11.

1 Okay. It's actually in the other one,
2 too, I just couldn't find it.
3 BY MR. CATALANO:
4 Q "A significant" -- so we're now at, like,
5 four or five lines from the bottom of Page 126 of
6 Exhibit 1.
7 MR. CATALANO: Scroll down a little bit.
8 BY MR. CATALANO:
9 Q It says: [As read] "A significant theme
10 of the entirety of Shkolnik is the accurate
11 representation" -- or "reproduction of an original
12 or ideal image."
13 It says: [As read] "Shkolnik particularly
14 teaches that the corrected or adjusted or fixed
15 bitmaps or datasets are adjusted for linear and
16 nonlinear distortion of the pattern genner" --
17 "generator, so that when projected, the ideal
18 pattern from the pattern generator is generated on
19 the build" -- next page -- "surface."
20 All right. So you use "ideal" in there a
21 couple of times, and I just want to go through
22 your citations here. The first one is to Shkolnik



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1 28, 43 through 48 --
2 MR. CATALANO: Can you go to Exhibit 5 at
3 28, 43 through 48.
4 BY MR. CATALANO:
5 Q Okay. 28, 43 through 48, There's a step
6 190 [sic], the corrected bitmap --
7 MR. CATALANO: If you go up to the next
8 one, 36.
9 BY MR. CATALANO:
10 Q So this is before yours.
11 "At step 195, the bitmap is corrected for
12 linear and nonlinear distortion, for example,
13 based on the correction methodologies described
14 herein to provide a corrected output to the
15 pattern generator. The position of each pixel may
16 be corrected and the on/off value for each pixel
17 may be determined to provide an image minimizing
18 any distortions of the crushed" -- "construction
19 system."
20 Do you see that?
21 A Mm-hm. Yeah.
22 Q And when it talks about XY -- when it

1 talks about an XY -- where is it?
2 Oh, the position of each pixel here, that
3 here is a -- that's a geometric correction,
4 correct?
5 A Yes.
6 MR. CATALANO: Go down to the next
7 paragraph.
8 BY MR. CATALANO:
9 Q "The corrected bitmap is projected using
10 the pattern generator. The corrected bitmap has
11 been adjusted for linear and nonlinear distortions
12 of the pattern genner [sic] so when projected, the
13 ideal pattern is generated on the build surface."
14 Again, we testified this -- you testified
15 this earlier: Linear and nonlinear distortion
16 can -- refers to -- can refer to geometric
17 correction, correct?
18 A Yeah, it can -- correct, it can apply to
19 the geometric correction, yes.
20 MR. CATALANO: Go to Exhibit 1 at --
21 sorry -- Exhibit 5 at 30, 14 through 25.
22

1 BY MR. CATALANO:
2 Q So if you look at -- let's look at 25.
3 "Moreover, the subdivided bitmaps allow
4 for construction of work pieces that may
5 otherwise" -- I'm sorry. Let's go up to 22.
6 "The corrected bitmaps have been adjusted
7 for linear and nonlinear distortions of the
8 pattern generator so that when projected, the
9 ideal pattern is generated on the build surface.
10 Moreover, the subdivided bitmaps allow for
11 construction of work pieces that may otherwise
12 curl or distort due to their shape and shrinkage
13 of reactive material during the construction
14 process."
15 Do you agree with me that this paragraph
16 here also can refer to geometric correction?
17 A Yes.
18 Q Okay.
19 MR. CATALANO: Go down to 30, 65 near the
20 bottom of this line. Keep going.
21 BY MR. CATALANO:
22 Q And this is very similar, the step 556:

1 [As read] "The corrected subdivided box" -- "voxel
2 datasets are projected using the pattern
3 generator. The corrected voxel datasets have
4 adjusted for linear/nonlinear" --
5 (Reporter interruption.)
6 MR. CATALANO: I'm sorry. I'm trying to
7 move along and getting tired, but I'm not
8 considering you, so I'll slow down.
9 BY MR. CATALANO:
10 Q I'll start from the beginning.
11 "In step 556, the corrected subdivided
12 voxel datasets, 582, 584 are projected using the
13 pattern generator. The corrected voxel datasets
14 have been adjusted for linear and nonlinear
15 distortion of the pattern generator so that when
16 projected, the generators" --
17 MR. CATALANO: Slide down, please.
18 BY MR. CATALANO:
19 Q I'm sorry. "When projected" --
20 MR. CATALANO: You can go to the left.
21 BY MR. CATALANO:
22 Q "The ideal pattern is generated on the

1 build surface. Moreover, the subdivided voxel
2 datasets allow for the construction of work pieces
3 that may otherwise curl or distort due to their
4 shape and shrinkage of reactive material during
5 the construction process."
6 Do you see that?
7 A Mm-hm. Yeah.
8 Q Again, this is very similar to the last
9 thing; it just changes "pixel" to "voxel," right?
10 This also can be describing geometric correction,
11 correct?
12 A Mm-hm. Yeah.
13 MR. CATALANO: Let's go back to 5 -- it's
14 Exhibit 5 at 37.
15 BY MR. CATALANO:
16 Q We've talked about this before.
17 MR. CATALANO: I'm sorry. Exhibit 5 at
18 column 5. Column 5, line 37.
19 BY MR. CATALANO:
20 Q So we've talked about this paragraph
21 before, Dr. Chen. I'm going to go down to the
22 line 44.

1 "The uncompensated test pattern may then
2 be compared with the ideal or expected test
3 pattern to generate a pattern correction map."
4 We talked about this earlier, pattern
5 correction map in this patent is a geometric
6 correction, correct?
7 A Let me read the whole paragraph here.
8 Q Sure.
9 A Give me a second.
10 Q Sure. Take your time.
11 A So they talk about intensity compensation
12 specifically here. We are talking about line 49
13 here?
14 Q Right. And we talked about this before.
15 This says: "May also provide for intensity
16 compensation," right? But every?
17 A Right.
18 Q -- other example in this paragraph is
19 geometric, correct?
20 A They use geometry as example, but they
21 talk about: "This pattern correction map may
22 include position compensation and also provide for

1 intensity compensation."
2 Q Okay. So clarification.
3 But, again, it doesn't actually explain
4 what form of intensity compensation, right? It
5 just says: "May also provide" --
6 A This is -- this is commonly practiced for
7 20 years. For single-projection system, we are
8 doing that day in and day out. So every hardware
9 construction through, you know, building the
10 hardware, you always have inaccuracy, always have
11 some variable defect.
12 So the first step, after construction of
13 hardware, you do the compensation. You put the
14 camera, take a look at the bitmap of the
15 camera-captured image of your projection system,
16 and then you compensate for the position and
17 accuracy, you compensate for the light intensity
18 compensation.
19 I think this is exactly we are doing.
20 Actually in our lab, we are doing that as well.
21 So, to me, when I read this sentence, I
22 think it's quite clear to me what they are trying

1 do. That's exactly what we are doing in the field
2 for 20 years.
3 So they just said, okay, this -- need to
4 consider both, and then they use example for XY
5 positioning offset to do positioning compensation.
6 They didn't, you know, talk about other things,
7 but, in practice, I think it's quite clear to me
8 what they are trying to do.
9 MR. CATALANO: Okay. I think we've been
10 going 50 minutes, Ben.
11 MR. ROXBOROUGH: Yeah.
12 MR. CATALANO: Let's go off for ten.
13 (WHEREUPON, discussion was had off the
14 stenographic record.)
15 (WHEREUPON, a recess was had.)
16 MS. REPORTER: Back on the record at
17 8:17 p.m.
18 BY MR. CATALANO:
19 Q Okay. Dr. Chen, we spent a good deal of
20 time talking through your declaration on the
21 '301 patent from Paragraphs 144 to 147.
22 What I'd like to do now is confirm that



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1 the evidence you cite in Exhibit 2 on this issue
2 is the same as the evidence you cite in Exhibit 1
3 on this issue, and if there's any difference,
4 we'll discuss it.
5 You understand?
6 A Sure.
7 Q And I'm going to just try to walk you
8 through it.
9 So looking at Exhibit 1, at Paragraph 44,
10 and Exhibit 2 at Paragraph 170, Paragraph 170
11 starts with: "Shkolnik teaches a set of filters
12 comprising an irradiance mask that normalizes
13 irradiance."
14 And, here, this is not -- you're not
15 citing any evidence; this is more of a statement
16 of your conclusions or opinions; is that correct?
17 A Yeah.
18 Q The next sentence: "Among many types of
19 adjustments," we talked about that at length.
20 This is the same sentence that appears in the
21 first sentence at Exhibit 1, 144, correct?
22 A Correct.

1 Q And all of our discussion previously will
2 apply, correct? There's no difference?
3 A Yeah, it's the same paragraph.
4 Q Right. And let's just go -- we'll try to
5 make it easier. The rest of Paragraph 144 is the
6 same as the rest of Paragraph 170.
7 And take your time, but if you can confirm
8 that, that would be very helpful.
9 A Yeah, just slight difference. So, you
10 know, in the left side, it have: "...all of which
11 POSITA would treat." So in the right side, it
12 don't have that.
13 But everything else -- let me see -- is
14 the same, yeah. Everything else is identical.
15 Q Right. And so our discussion previously
16 would apply equally to Exhibit 2 to the
17 '511 patent, correct?
18 A Correct.
19 Q Let's take this sentence by sentence to be
20 fair to you, Dr. Chen.
21 Paragraph 145 of Exhibit 1 and
22 Paragraph 171 of Exhibit 2, as I read the first

1 sentence, those are identical.
2 Would you agree with me?
3 A 145.
4 Q 145 of Exhibit 1 and 171 of Exhibit 2.
5 A Could you move down a little bit? Because
6 right now we're looking at 144. Could you move
7 the right side a little bit down?
8 Yeah, they look identical.
9 Q Okay. And the next sentence as well,
10 right: "For example..." on both sides?
11 A You mean 172 and 147 --
12 Q Oh, I'm sorry. The next sentence of 171,
13 which starts: "For example..." and the next
14 sentence of 145 -- or, sorry, the next sentence of
15 Exhibit 2 at 171 is: "For example..."
16 The next sentence of Exhibit 1,
17 Paragraph 145 is: "For example." "For example,
18 Shkolnik teaches..."
19 Do you see that?
20 A Yes.
21 Q And I think this sentence is the same in
22 both Exhibit 1 and Exhibit 2, correct?

1 A Correct.
2 Q And the next sentence: "What Shkolnik" --
3 in both of them, the next sentence: "What
4 Shkolnik is teaching here is a micromirror..."
5 that's the same in both sentences as well,
6 correct?
7 A Yes.
8 Q And the last sentence: "Whether a
9 micromirror has been physically changed..."
10 that's also the same sentence, correct?
11 A Yes.
12 Q Great. Thank you.
13 And my point here is that all of our
14 testimony about Paragraph 145 of Exhibit 1 is
15 equally applicable to Paragraph 171 of Exhibit 2;
16 you agree with me?
17 A Yes.
18 Q Thank you for your patience, Dr. Chen.
19 MR. ROXBOROUGH: And, Jeff, just to
20 confirm, just to put it on the record, you'll
21 extend the same courtesy to us to truncate -- or
22 not to truncate, but to make things more

1 efficient, right?
2 MR. CATALANO: Of course. Yes. I think
3 we're just trying to make a clear record --
4 MR. ROXBOROUGH: Certainly. Certainly.
5 MR. CATALANO: -- and nobody wants to be
6 here for another hour and a half so --
7 MR. ROXBOROUGH: No. No. I completely
8 hear that.
9 MR. CATALANO: Okay. Yes, and we will
10 obviously extend the same courtesy.
11 MR. ROXBOROUGH: Yes.
12 BY MR. CATALANO:
13 Q Exhibit 1 at Paragraph 145 and Exhibit 2
14 at Paragraph 172.
15 Hold on a second. I may be looking at the
16 wrong thing.
17 MR. ROXBOROUGH: Could it be 146 --
18 MR. CATALANO: Yeah. Sorry. 146.
19 MR. ROXBOROUGH: Yeah.
20 MR. CATALANO: Thank you.
21 BY MR. CATALANO:
22 Q Paragraph 146 of Exhibit 1, the '301

1 petition, and Paragraph 171 of --
2 MR. ROXBOROUGH: 172, Jeff.
3 MR. CATALANO: All right. Let me back up
4 and do this again.
5 BY MR. CATALANO:
6 Q All right. Exhibit 146 of Deposition
7 Exhibit 1 -- sorry, Paragraph 146 of Deposition
8 Exhibit 1, the Chen '301 declaration, and we're
9 going to compare that to Exhibit 17- -- or
10 Paragraph 172 of Exhibit 2, the Chen '511
11 declaration.
12 And, again, looking only at the first
13 paragraph -- or, sorry, the first sentence, those
14 are the same in both exhibits, correct?
15 A Correct.
16 Q And sentence 2 in those paragraphs,
17 starting with "Critically..." those are also the
18 same?
19 A Correct.
20 Q And Paragraph 3, starting with "A
21 POSITA..." those are the same?
22 A Yes. Yes.

1 Q And that goes all the way to the end with
2 the parenthetical.
3 So, again, the question is: Does our
4 testimony about the '301 declaration,
5 Paragraph 146, equally apply to Paragraph 172 of
6 the Chen declaration on the '511?
7 A Yes.
8 Q Okay. Last one. Unfortunately, it's
9 pretty long. Paragraph 147 of Deposition
10 Exhibit 1, and we're going to compare that to
11 Paragraph 173 of Deposition Exhibit 2.
12 And, again, the first sentence of these
13 two paragraphs is identical, correct?
14 A Correct.
15 Q And the second sentence starting with
16 "Adjustment..." that's also identical?
17 A Correct.
18 Q And the third sentence starting with "For
19 example..." that's --
20 A Yes.
21 Q -- also identical?
22 A Yeah.

Q Fourth sentence starting with "Similarly..." that's also identical?
A Yeah.
Q Fifth sentence starting with "Likewise..." that's also identical?
A Where's "likewise"? I didn't see.
Q About five from the bottom of Exhibit 1. About five from the top of that page -- right? -- of Exhibit 2.
A Oh, yeah. I see it. Okay. Okay. Sorry.
Q No problem.
A Yes.
Q Those are the same?
A Yeah.
Q Okay. And then down on Exhibit 1 to the next page. Next sentence starts with "Such" -- so I've been told that I got the numbers wrong again -- no, I think I got it right. No, I got it right.
So the next sentence starts with: "Such edge blending..."
A Yes.

1 Q And that sentence is the same in both?
2 A Yes.
3 Q And the next sentence is: "A significant
4 theme..." and that sentence --
5 A Could you move the right side -- could you
6 move right side up a little bit more? A little
7 bit more.
8 Okay. Great.
9 So we're talking about the sentence: "A
10 significant theme..." now, right?
11 Q Correct.
12 A Yes.
13 Q Those are the same?
14 A Yes.
15 Q And then the next sentence: "In other
16 words, Shkolnik teaches..." and that's the same as
17 well, correct?
18 A Yes.
19 Q Okay. And then the last sentence in
20 Exhibit 1, Paragraph 147, is the same as
21 Paragraph 174 of Exhibit 2, correct?
22 A Yes.

1 Q Okay. Then my last question on this
2 section is: Can we agree that your testimony
3 regarding 147 -- Paragraph 147 of the Chen '301
4 declaration equally applies to Paragraph 173 of
5 the Chen '511 deposition -- or declaration?
6 A Yes.
7 MR. CATALANO: Okay. Thank you so much
8 for your patience on that for everyone. It was a
9 little awkward, but I think we got what we needed.
10 And I'm going to pass the witness.
11 MR. ROXBOROUGH: You have nothing further,
12 Jeff?
13 MR. CATALANO: Nothing further.
14 MR. ROXBOROUGH: Okay. If we could take a
15 15 -- let's make it a 20-minute break. If we're
16 back earlier, that's a bonus, but if we could take
17 a 20-minute break, Jeff. I don't expect there to
18 be much from me, but I'd like to consult with
19 John --
20 MR. CATALANO: Understood.
21 MR. ROXBOROUGH: -- Zimmer. And if we
22 could be back at ten to the hour, ten minutes to

1 the hour.
2 MR. CATALANO: That works for me.
3 MR. ROXBOROUGH: Okay. Excellent.
4 (WHEREUPON, a recess was had.)
5 MS. REPORTER: Back on the record at
6 8:50 p.m.
7 MR. ROXBOROUGH: This will be short, Jeff:
8 There's nothing further from Petitioner.
9 MR. CATALANO: Well, I have more -- no, I
10 do not. Thank you very much. We can go off.
11 (WHEREUPON, discussion was had off the
12 record and the deposition was concluded at
13 8:51 p.m. CST.)
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1 CERTIFICATE OF SHORTHAND REPORTER
2
3 I, Michelle M. Yohler, Certified
4 Shorthand Reporter, Registered Professional
5 Reporter, Registered Merit Reporter, Certified
6 Realtime Reporter, within and for the State of
7 Illinois do hereby certify:
8 That YONG CHEN, Ph.D., the witness whose
9 deposition is hereinbefore set forth, was duly
10 sworn by me before the commencement of such
11 deposition and that such deposition was taken
12 before me and is a true record of the testimony
13 given by such
14 witness.
15 I further certify that the adverse party,
16 3D SYSTEMS CORPORATION, was represented by counsel
17 at the deposition.
18 I further certify that the deposition of
19 YONG CHEN, Ph.D., occurred remotely on the 10th
20 day of March, 2026, commencing at 5:02 p.m. CST to
21 8:51 p.m. CST.
22



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1 C E R T I F I C A T E O F R E P O R T E R
2
3 I, MICHELLE M. YOHLER, a Certified
4 Shorthand Reporter within and for the County of
5 Will, State of Illinois, do hereby certify:
6 That previous to the commencement of the
7 examination of the witness, the witness was duly
8 sworn to testify the whole truth concerning the
9 matters herein;
10 That the foregoing deposition transcript
11 was reported stenographically by me, was
12 thereafter reduced to typewriting under my
13 personal direction and constitutes a true record
14 of the testimony given and the proceedings had;
15 That the said deposition was taken
16 remotely before me at the time and place
17 specified;
18 That I am not a relative or employee or
19 attorney or counsel, nor a relative or employee of
20 such attorney or counsel for any of the parties
21 hereto, nor interested directly or indirectly in
22 the outcome of this action.



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IN WITNESS WHEREOF, I do hereunto set my hand and affix my seal of office at Chicago, Illinois, this 11th day of March, 2026.

Michelle M. Yohler

Michelle M. Yohler, CSR, RMR, CRR
Certified Shorthand Reporter
CSR No.: 84-4531

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Re: Deposition of **Yong Chen, Ph.D.**
Date: 3/10/2026
Case: 3D Systems Corporation, et al. -v- Intrepid Automation, Inc. (PTAB)

Dear Sir/Madam,

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| Page | Line | Correction/Change and Reason |
|---|---|---|
| 42 | 21 | from -> form / improper translation |
| 49 | 14 | full -> four / improper translation |
| 53 | 21 | long linear -> non-linear / improper translation |
| 54 | 1 | composite -> compensate / improper translation |
| 54 | 2 | the -> at the / improper translation |
| 55 | 7 | long homogenous -> non-homogeneous / improper translation |
| 60 | 12 | long homogenous -> non-homogeneous / improper translation |
| 60 | 12 | long uniform -> non-uniform / improper translation |
| 73 | 22 | what -> that / improper translation |
| 78 | 20 | not -> now / improper translation |
| 80 | 2 | multi-pool -> multiple / improper translation |
| 85 | 12 | long homogeneous -> non-homogeneous / improper translation |
| 85 | 15 | make -> make it / improper translation |
| 86 | 6 | multi-pool -> multiple / improper translation |
| 89 | 10 | turn on -> turn / improper translation |
| 112 | 4 | tease -> teeth / improper translation |
| 120 | 14 | am -> am an / improper translation |
| 130 | 1 | do -> to do / improper translation |
| 21 | 14 | composite -> compensate / improper translation |
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