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Transcript of Mikael Lindstrand, Ph.D.

Date: April 11, 2025
Case: Giesecke+Devrient GMBH -v- Lumenco, LLC (PTAB)

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

1 UNITED STATES PATENT AND TRADEMARK OFFICE

2 _____

BEFORE THE PATENT TRIAL AND APPEAL BOARD

3 _____

4 GIESECKE+DEVRIENT GMBH,
GIESECKE+DEVRIENT CURRENCY TECHNOLOGY GMBH, AND
5 PAPIERFABRIK LOUISENTHAL GMBH,

6 Petitioners,

7 vs.

8 LUMENCO, LLC,

9 Patent Owner.

10 _____

11 IPR2024-00836

12 PATENT NO. 10,189,294 B2

13 IPR2024-00838

14 PATENT NO. 10,901,191 B2

15 IPR2024-00839

16 PATENT NO. 11,448,863 B2

17 _____

18 STENOGRAPHIC DEPOSITION OF
MIKAEL LINDSTRAND, PH.D.
19 ATLANTA, GEORGIA
FRIDAY, APRIL 11, 2025

20

REPORTED BY: TANYA L. VERHOVEN-PAGE,
21 CCR-B-1790 (GA), CSR-12254 (TX),
LCR-991 (TN)

22 FILE NO. 578968

1 April 11, 2025
2 9:10 a.m.
3
4 Stenographic deposition of
5 MIKAEL LINDSTRAND, PH.D., held at Regus -
6 Spaces Colony Square, 1201 Peachtree
7 Street, N.E., Atlanta, Georgia before
8 Tanya L. Verhoven-Page, Certified Court
9 Reporter (GA), Licensed Court Reporter
10 (TN) and Certified Shorthand Reporter (TX).
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Giesecke+Devrient GmbH,
Giesecke+Devrient Currency Technology GmbH,
and Papierfabrik Louisenthal GmbH.

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16

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18 - - -

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22

1 I N D E X

2

3 WITNESS: MIKAEL LINDSTRAND, PH.D.

4

5 Examination Page

6 BY MR. ROTHENBERG 6
BY MR. ROZIER 152
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1 EXHIBITS INDEX:

2

Lindstrand Deposition Exhibit	Description	Page
Exhibit 1052	Dictionary.com definition of the term hyperplane	127
Exhibit 1053	Dictionary definition of the term hyperplane	129
Exhibit 1054	United States Patent Patent No. 10,189,294 B2 (Figure 1 with blue handwritten markings drawn in by the witness)	151

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1 ATLANTA, GEORGIA; FRIDAY, APRIL 11, 2025
2 9:10 A.M.
3
4 Thereupon --
5 MIKAEL LINDSTRAND, PH.D.,
6 called as a witness, having been first duly sworn,
7 was examined and testified as follows:
8
9 EXAMINATION
10 BY MR. ROTHENBERG:
11 Q Good morning, Dr. Lindstrand.
12 A Good morning.
13 Q Can you please state your full name for
14 the record.
15 A My name is Dr. Mikael Lindstrand.
16 Q Have you been deposed before,
17 Dr. Lindstrand?
18 A This is the first time I'm being deposed.
19 Q Okay. So since this is your first time,
20 just make sure we're on the same page, some ground
21 rules that just help the deposition go a little more
22 smoothly.

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1 You understand you're under oath today?
2 A I do understand I'm under oath.
3 Q Okay. So I'll be asking you a number of
4 questions, as you probably know. If you don't
5 understand a question, you just let me know and I'll
6 repeat it. And if you think -- are unclear what I
7 said, just, you know, pause and I'm happy to repeat
8 any questions or clarify.
9 For the sake of the reporter, if you
10 could just wait until I finish my question before you
11 begin. And then we're not talking over each other
12 and it will make her job a little bit easier.
13 Does that sound good?
14 A Sounds fine.
15 Q If you need to take a break at any time,
16 just let me know. We'll take some periodic breaks,
17 but if you want to take a break before then, just let
18 me know. And we can take some breaks, maybe
19 periodically, every hour, hour and a half, but if you
20 want to take a break before then, just let me know.
21 Is there any reason you can't provide
22 complete and truthful testimony today?

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1 A There's no reason for not -- I can get
2 the full testimony.
3 Q So how did you prepare for today's
4 deposition?
5 A From the start, we are having
6 collaboration, reading documents and preparing the
7 declaration. And this week, we met yesterday and
8 I've been preparing for this deposition.
9 Q And did you meet with anybody?
10 A I met with Matt here and his colleague,
11 Jonathan Hardt.
12 Q Did you talk with anybody else?
13 A I met one colleague briefly at the office
14 space, but we didn't discuss this -- this deposition.
15 Q Okay. How long would you say you met?
16 A I met Matt yesterday at -- for roughly
17 six hours, and the talk with Jonathan Hardt was
18 roughly one hours on video link.
19 Q And did you review any documents during
20 your preparation?
21 A Yes, a lot of documents.
22 Q Which documents?

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1 A The most relevant documents I have stated
2 in my declaration, but I reviewed many other
3 documents, especially those referred to by
4 Dr. Hesselink.
5 Q Did you review documents that are not
6 cited or discussed in your declaration?
7 A Yes, yes. I mean, not I can recall and
8 refer to because the most relevant documents I cited
9 in my declaration, but I have considered many other
10 documents, especially those cited by Dr. Hesselink.
11 Q Did you consider any that were not cited
12 by Dr. Hesselink?
13 A I would say that many things of what I've
14 considered is based on my professional education,
15 professional work. Those I've not cited, but they
16 are relevant in this case. I formed my opinion and
17 my declaration based also on my professional
18 background.
19 Q Okay. But in your preparations in the
20 last few days, did you consult any other texts or
21 documents to further form your opinions that are not
22 cited in your declaration or cited by Dr. Hesselink

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1 in his declaration?
2 A Again, the most relevant documents I have
3 stated in my declaration, but we have discussed other
4 documents that -- especially referenced by
5 Dr. Hesselink, but we consider -- I consider -- I
6 consider those of minor importance in this case, and
7 that I've explained in my declaration.
8 Q Okay. You didn't include a listing of
9 any evidence that you considered in your declaration,
10 right?
11 A Sorry. Can you repeat that again,
12 please.
13 Q Let me -- let me come back to this in a
14 second when I show you your declaration.
15 You understand this deposition is being
16 conducted for IPR No. 2024-00836, which is the IPR
17 for U.S. Patent No. 10,189,294?
18 A Is it okay that I have my dep -- sorry --
19 the declaration so I can follow it?
20 Q Yeah.
21 A If we can -- if we can go into details, I
22 would be more convenient if I have my declaration.

1 Is it okay to have my declaration?
2 Q Yeah, we will. I'm -- I'm just
3 confirming before we get into that.
4 You provided opinions about three
5 different patents. And you understand that this
6 deposition is being conducted with respect to all
7 three, not just any one of the three. There's U.S.
8 patent number that ends in 294, and then there's the
9 one that I just said, and then there's 10,901,191 and
10 then there's U.S. Patent No. 11,448,863.
11 And you understand this deposition is
12 being conducted for the IPR proceedings of all three
13 of those patents?
14 MR. ROZIER: Object to form.
15 You can answer.
16 THE WITNESS: I understand that
17 there are multiple patents that are
18 involved, but if you would like me to
19 remember the numbers, I don't know them
20 by heart. So if you would like me to
21 answer that, I would prefer to have my
22 declaration.

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1 BY MR. ROTHENBERG:
2 Q Okay. I'm going to show you -- this
3 is -- this is Exhibit 1001 in IPR number ending in
4 00838.
5 Is this U.S. Patent No. 10,901,191?
6 A Yes.
7 Q And will you understand if I refer to
8 this as the '191 patent?
9 A I do understand it.
10 Q I'm handing you Exhibit 1001 in the IPR
11 ending in '839, which is U.S. Patent No. 11,448,863.
12 Do you understand this as U.S. Patent No. 11,448,863?
13 A I understand that.
14 Q And will you understand if I refer to
15 this as the '863 patent?
16 A I do understand, yes.
17 Q And I'm handing you Exhibit 1001 in
18 Patent No. -- or IPR No. 00836. Do you understand
19 this as U.S. Patent Number 10,189,294?
20 A I do understand that.
21 Q Is this the '294 patent?
22 A It is the '294 patent.

1 Q Okay. And you provided a declaration
2 with respect to inter partes review with respect to
3 all three of these patents?
4 A I believe that is correct, but I would
5 prefer to have my declaration in order to cross check
6 the numbers.
7 Q Okay.
8 A And then I can confirm it.
9 Q So -- and would you understand, if I
10 refer to the respective IPR proceeding numbers as the
11 '294 IPR, the '191 IPR, and the '836 IPR?
12 A I do.
13 Q And if I refer to them together as three
14 IPRs or Lumenco IPRs, you understand that, as well?
15 A I do understand that, as well.
16 Q So I'm handing you Exhibit 2004 in the
17 '294 IPR. Is this the declaration you submitted in
18 the '294 IPR?
19 A Giving it a short glance, I remember each
20 of the pages so far. It seems to be my declaration,
21 yes.
22 Q Is that your signature on the last page?

1 A Just give me a moment. I'm skimming
2 through it.
3 Yes, it is my signature. It is my
4 signature.
5 Q Now I'm handing you Exhibit 2004 in the
6 '191 IPR.
7 A Sorry.
8 Q Is that the declaration you submitted for
9 the '191 IPR?
10 A Yes.
11 Q I'm handing you Exhibit 2001 in the '863
12 IPR. Is this the declaration you submitted for the
13 '863 IPR?
14 A This is the declaration that I submitted
15 for the '863 IPR.
16 Q And you submitted a single declaration
17 for all three IPRs, correct?
18 A I did submit one single declaration.
19 Q And so Exhibit 2004 of the '294 and '191
20 IPRs in Exhibit 2001 of the '863 IPRs, I'll represent
21 those are -- what I've shown to you, those are all
22 the same document?

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1 MR. ROZIER: Object to form.
2 THE WITNESS: As glancing through
3 these documents, I would say it seems to
4 be correct.
5 BY MR. ROTHENBERG:
6 Q Other than the cover page, the exhibits
7 are identical, the three exhibits I just handed you
8 are identical?
9 A As far as I can see after giving them
10 just a glance, I would say that they appear to be
11 identical.
12 Q Well, you prepared them. Do you have any
13 reason to believe they wouldn't be identical?
14 MR. ROZIER: Object to form.
15 THE WITNESS: No, I know what I
16 prepared, but you asked me are these
17 identical. Should I go through them in
18 detail to cross-examine them?
19 BY MR. ROTHENBERG:
20 Q Do you --
21 A I see that they appear to be identical,
22 yes.

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1 Q And so if I refer to these three exhibits
2 as your declaration, you would understand I'm
3 referring to the same document?
4 A I understand that.
5 Q And also the IPRs?
6 MR. ROZIER: Object to form.
7 BY MR. ROTHENBERG:
8 Q For each IPR, you would understand I'm
9 referring to your declaration?
10 A I understand that.
11 Q Okay. And did you write your
12 declaration?
13 A I've written my declaration.
14 Q How many hours would you say you spent
15 preparing your declaration?
16 A I would say that I spent more than 40
17 hours preparing the declaration.
18 Q And that includes the analysis and the
19 drafting, together?
20 A That would include the writing of the
21 document. Reviewing documents is in excess of those
22 40 plus hours.

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1 Q Okay. What would you estimate is the
2 total number of hours?
3 MR. ROZIER: Object to form.
4 THE WITNESS: I haven't kept track
5 of the exact hours. But given that this
6 type of process is new to me, I'm not
7 skilled in doing this deposition and
8 writing the declarations. So a lot of
9 hours. I would say more than 50, 60
10 hours in total. It may be substantially
11 more, but a lot of hours.
12 BY MR. ROTHENBERG:
13 Q Okay. So your declaration doesn't
14 include any listing of evidence that you considered
15 in forming your opinions, right?
16 MR. ROZIER: Object to form.
17 Mischaracterizes the document.
18 THE WITNESS: Sorry. Can you
19 please repeat.
20 BY MR. ROTHENBERG:
21 Q In your declaration, there's no list of
22 evidence that you considered in forming your

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1 opinions?
2 MR. ROZIER: Objection.
3 Mischaracterizes the document.
4 THE WITNESS: I'm not -- I'm not
5 sure I follow you. I have references,
6 but those are not what you referred to.
7 Can you please describe --
8 BY MR. ROTHENBERG:
9 Q So earlier you were saying you considered
10 a number of documents in forming your opinions.
11 A I understand. Yeah.
12 Q Is there a list in your declaration of
13 the references that you considered?
14 A I do not have a list of documents, but I
15 have referred to documents in the text.
16 Q So if a document is referenced in the
17 text, you considered it?
18 A That is correct.
19 Q And so if a document is not identified in
20 your declaration, you didn't consider it?
21 MR. ROZIER: Object to form.
22 THE WITNESS: That I would oppose.

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1 As I stated in the beginning, I reviewed
2 very many documents. Some are more
3 relevant, some are less relevant. Those
4 that I refer in my declaration are those
5 documents I considered most relevant, and
6 especially those cited by Dr. Hesselink.
7 BY MR. ROTHENBERG:
8 Q Okay. So let me ask it again then.
9 So if certain documents are not
10 identified in your declaration, then it's either not
11 relevant, not considered or both?
12 MR. ROZIER: Object to form. Asked
13 and answered.
14 THE WITNESS: If a document isn't
15 in my declaration, I consider it less
16 relevant than those cited. I have based
17 my declaration on very many substances.
18 The most relevant documents are in my
19 declaration.
20 BY MR. ROTHENBERG:
21 Q Is there relevant evidence that you
22 considered but did not include in your declaration?

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1 MR. ROZIER: Object to form. Asked
2 and answered.
3 THE WITNESS: The documents that I
4 considered relevant enough to base my
5 declaration on, those are mentioned and
6 described in my declaration. That -- not
7 to say that all other documents in the
8 universe are of no relevance, but I -- I
9 have stated the most relevant documents
10 in my declaration and I consider them to
11 be the basis of my declaration.
12 BY MR. ROTHENBERG:
13 Q Can you identify any documents of
14 relevance that you considered but did not include in
15 your declaration?
16 MR. ROZIER: Objection to form.
17 Asked and answered maybe four or five
18 times now. You can try one more time.
19 This is the last one.
20 THE WITNESS: There are many
21 documents that I considered of some
22 relevance, especially those describing

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1 the difference of collimated light and
2 diffusive light. I may include very many
3 documents. I may have included very many
4 documents, but I consider them of less
5 importance in this context, so therefore
6 I didn't include them explicitly in my
7 declaration.
8 BY MR. ROTHENBERG:
9 Q And why were they of less importance?
10 A They -- because I've considered them as
11 common knowledge for the POSITA.
12 Q Did you consider the file histories of
13 the Lumenco patents as part of your opinions in your
14 declaration?
15 A I've considered the referenced documents.
16 Q The reference documents?
17 A I've considered the referenced documents.
18 Q What are the reference documents?
19 A On top of my mind, I cannot list the
20 referenced documents, but if you would like me to
21 state them I can go through the specific patent and
22 we can -- I can state -- state them for you.

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1 Q Do you know -- do you understand that
2 when you apply for a patent, there's what they call a
3 file history that includes all of the documentation
4 that was provided by the applicant and by the
5 examiner in obtaining the patent, and it's prepared
6 in a public file history called either the file
7 history or the file wrapper or the prosecution
8 history of the patent?
9 MR. ROZIER: Object to form.
10 THE WITNESS: Yeah, I -- put it
11 this way. I've considered a lot of
12 documents, especially those documents
13 that were referenced by Dr. Hesselink in
14 this case. I have reviewed very many
15 documents. If you ask me if I reviewed
16 every listed documents considered in all
17 these patents, I cannot give you the
18 definite -- definite answer to that. But
19 those documents that are in my
20 declaration, those I have definitely
21 reviewed.
22 BY MR. ROTHENBERG:

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1 Q So I wasn't asking about all documents.
2 I'm asking about three specific documents. They're
3 called the file history. So the '191 patent, the
4 '294 patent and the '863 patent.
5 Did you review the file histories of
6 those three patents in forming your opinions for this
7 declaration?
8 MR. ROZIER: Object to form. Asked
9 and answered.
10 THE WITNESS: Can you direct me
11 what you mean? I realize that I probably
12 don't follow your question. Could you
13 please direct me to what you're asking
14 about?
15 BY MR. ROTHENBERG:
16 Q Are you familiar with the concept of a
17 file history of a patent?
18 MR. ROZIER: Object to form.
19 THE WITNESS: Do you mean that a
20 patent can be revised or --
21 BY MR. ROTHENBERG:
22 Q Are you familiar with the term "file

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1 history"?
2 MR. ROZIER: Object to form.
3 THE WITNESS: The file history in
4 terms of patent, can you describe that
5 further?
6 BY MR. ROTHENBERG:
7 Q Do you understand that there's a process
8 to obtain a patent? When you apply for a patent,
9 it's not automatically granted. There's a process of
10 examination?
11 A I do understand there is a process.
12 Q And do you understand that that
13 process -- all the documentation of that process goes
14 into what is called a file history or a prosecution
15 history?
16 MR. ROZIER: Object to form.
17 THE WITNESS: I do understand that
18 it is a process and that it produce
19 documents in certain variance, that you
20 can call that a file history. It may be
21 a difficult with language and
22 nomenclature, but I am familiar with that

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1 process.
2 BY MR. ROTHENBERG:
3 Q So did you consider any documentation of
4 the file histories of these patents in forming your
5 opinions?
6 A The documents I have considered are those
7 documents that you have provided here. If you ask if
8 I looked at the former documents before this stage of
9 documents that you have provided here, I'm not sure.
10 I believe I may have, but I'm not sure. I do not
11 recollect for sure that I have done so.
12 Q Okay. You understand the concept of a
13 POSITA, a person of ordinary skill in the art?
14 A I do understand the POSITA, the concept
15 of that.
16 May I take an opportunity to point to a
17 small typo that we realized yesterday, if I may?
18 Q Of course.
19 A In my declaration, on Page 9, Paragraph
20 23. Do you follow?
21 Q Yep.
22 A I refer to a year there that is a

1 small -- or a typo. The year 2007 is incorrect. It
2 should be 2017. And I -- my -- my declaration is
3 given in that context, that is 2017, the year 2017.
4 So we realized -- I realized that yesterday when
5 preparing for this deposition.
6 Q And when you prepared your declaration,
7 did you -- did you believe the date was 2007?
8 MR. ROZIER: Object to form.
9 THE WITNESS: I believe -- I
10 believe that the year was 2017.
11 BY MR. ROTHENBERG:
12 Q Okay.
13 A So this -- the year stated 2000 -- did I
14 say '17 -- '15. 2015, it should be. The year 2007
15 is a typo.
16 The 2015, that is the year that I've
17 considered and written my declaration based upon.
18 Q So now it's '15?
19 MR. ROZIER: Object to form.
20 THE WITNESS: It is -- the correct
21 year is 2015.
22 BY MR. ROTHENBERG:

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1 Q Okay.
2 A 2-0-1-5.
3 Q So in Paragraph 23, in your opinion this
4 is the level of ordinary skill you applied in forming
5 your obviousness opinions in your declaration?
6 A This is my opinion regarding POSITA.
7 Q Did you apply any other level of ordinary
8 skill in forming your obviousness opinions in your
9 declaration?
10 A Is the question if I have other opinions
11 regarding the level of a POSITA? I'm not sure if I
12 understand your question. Can you please --
13 Q In Paragraph 23 you present a level of
14 ordinary skill that you applied in your opinions,
15 correct?
16 A That is correct.
17 Q Do you have any other levels of ordinary
18 skill you applied in forming your opinions?
19 MR. ROZIER: Object to form.
20 THE WITNESS: The following
21 paragraph referred to the level I
22 considered regarding POSITA, 24, 25, et

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1 cetera.
2 BY MR. ROTHENBERG:
3 Q But those other paragraphs don't have any
4 other levels of ordinary skill, right?
5 MR. ROZIER: Object to form.
6 THE WITNESS: All those paragraphs
7 refer to what I considered are relevant
8 with regard to the POSITA.
9 BY MR. ROTHENBERG:
10 Q Of Paragraph 23?
11 MR. ROZIER: Object to form.
12 THE WITNESS: Again, I may not
13 understand your question. Could you
14 please direct me a little bit further.
15 BY MR. ROTHENBERG:
16 Q Paragraph 23 provides an opinion on what
17 the level of ordinary skill is, correct?
18 MR. ROZIER: Object to form. Asked
19 and answered.
20 THE WITNESS: Paragraph 23 is
21 referring to what I consider as one of
22 the factors relevant for deciding a

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1 POSITA.
2 BY MR. ROTHENBERG:
3 Q It's only a factor?
4 A It's one of --
5 MR. ROZIER: Object to form.
6 Give me a little beat to make some
7 objections. Okay.
8 THE WITNESS: It is one of the
9 factors.
10 BY MR. ROTHENBERG:
11 Q In Paragraph 23 you provide an
12 educational level and an experience level of a
13 POSITA, that you believe a POSITA would have,
14 correct?
15 A That is one of the criteria. There are
16 others.
17 Q You say: A POSITA, at the time of the
18 invention, in the relevant field of the Lumenco
19 patents, would have an undergraduate degree in
20 electrical engineering, mechanical engineering,
21 physics or a similar field.
22 Do you have any other opinions other than

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1 this educational level of what the educational level
2 of a POSITA is?
3 MR. ROZIER: Object to form.
4 THE WITNESS: Regarding the
5 education, that is what I consider
6 relevant, but that is not the only
7 criteria for -- for being sufficient to
8 consider oneself a POSITA in this
9 context. That is my opinion.
10 BY MR. ROTHENBERG:
11 Q I understand that.
12 Can you point me to any other educational
13 levels of a POSITA that you provide other than this
14 one in your declaration?
15 MR. ROZIER: Object to form. Asked
16 and answered.
17 THE WITNESS: Regarding education
18 only.
19 BY MR. ROTHENBERG:
20 Q Correct. I understand there's other
21 factors.
22 A Yeah.

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1 Q One factor is the educational level of
2 the POSITA. And here you provide undergraduate
3 degree in electrical engineering, mechanical
4 engineering, physics or similar field.
5 Can you point me to any other educational
6 levels that you believe a POSITA would have, in your
7 declaration?
8 MR. ROZIER: Object to form. Asked
9 and answered.
10 THE WITNESS: Regarding education,
11 that is sufficient with -- as far as I
12 can value it.
13 BY MR. ROTHENBERG:
14 Q And the experience level, in Paragraph 23
15 you say: At least two years of experience with
16 diffusive light optic security features.
17 Did you apply any other experiential
18 levels of the POSITA in forming your opinions in your
19 declaration?
20 MR. ROZIER: Object to form.
21 Mischaracterizes the document.
22 THE WITNESS: In my declaration, at

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1 Paragraph 26, I refer also to the
2 experience of diffusive light
3 micro-optics security features as
4 relevant in this context. So I point to
5 my Paragraph 26.
6 BY MR. ROTHENBERG:
7 Q And Paragraph 23 also says diffuse light
8 optic security features, right?
9 MR. ROZIER: Object to form.
10 THE WITNESS: In 26, the context is
11 wider as it refers to diffusive light in
12 the context of micro-optics security
13 features. So that extends the level
14 sufficient to be considered a POSITA in
15 my opinion.
16 BY MR. ROTHENBERG:
17 Q In Paragraph 23, you say -- you reference
18 a similar field; is that correct?
19 A I do refer to also that a similar field
20 may be relevant in this context.
21 Q And in Paragraph 25, you say: A similar
22 field would include at least computer science degrees

1 with engineering course work.
2 MR. ROZIER: Object to form.
3 BY MR. ROTHENBERG:
4 Q Is that correct?
5 A Sorry. Can you please repeat that again?
6 Q You say: More specifically, an
7 undergraduate degree in a similar field to electrical
8 engineering, mechanical engineering or physics would
9 include computer science degrees with engineering
10 course work.
11 MR. ROZIER: Objection.
12 BY MR. ROTHENBERG:
13 Q Is that correct?
14 MR. ROZIER: Object to form.
15 THE WITNESS: I do state that, at
16 least computer science degrees with
17 engineering course work are relevant --
18 are relevant in this context.
19 BY MR. ROTHENBERG:
20 Q Would any engineering course work suffice
21 to be a POSITA?
22 A In my declaration, I haven't cited other

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1 course work or degrees that may be relevant enough to
2 be considered a POSITA. What I stated, that at least
3 this example is sufficient in my opinion.
4 Q So civil engineering course work would be
5 enough to be a POSITA?
6 MR. ROZIER: Object to form.
7 Mischaracterizes the document. Misstates
8 testimony.
9 THE WITNESS: I haven't considered
10 that. I -- I do not have an opinion. I
11 haven't stated anything about civil
12 engineering in my declaration. It may,
13 it may not. I have no opinion.
14 BY MR. ROTHENBERG:
15 Q Do you have any opinion about how much
16 engineering course work is required?
17 MR. ROZIER: Object to form.
18 THE WITNESS: Again, I haven't
19 considered that in my declaration. I
20 have given one example that I believe is
21 relevant in this context. It may have --
22 it may be other -- it may exist in other

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1 degrees and course work that are
2 relevant, but I haven't considered that.
3 BY MR. ROTHENBERG:
4 Q I'm asking for your opinion.
5 Do you think a civil engineering degree
6 with two years of experience in diffusive light optic
7 devices could be a POSITA?
8 MR. ROZIER: Object to form. Asked
9 and answered.
10 THE WITNESS: It may be the case
11 that certain course work in that field is
12 relevant and is sufficient, but I haven't
13 considered that. If I -- if you would
14 like me to give an in-depth answer on
15 that, I would need to look on the course
16 work and what they are covering.
17 It -- it all -- I know in Sweden we
18 have a very -- a big variety of course
19 work. So if I should give you an answer,
20 then I would need to look in details of
21 the course work. So I haven't considered
22 that in my deposition. Sorry. I haven't

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1 considered that in my declaration.
2 BY MR. ROTHENBERG:
3 Q And you have a computer science degree,
4 correct?
5 A I have a computer science degree.
6 Q Did you take any engineering courses with
7 your computer science degree?
8 A In my education for the master's degree,
9 it's obligatory to have engineering. It's
10 compulsory. So I have taken many engineering courses
11 in my master's degree.
12 Q And what year was that master's degree?
13 A I started in 1990 and finished in 1995,
14 or perhaps 1991 or 19- -- and finished in 1996. I do
15 not recall the exact year now. But to educate, the
16 Master's Degree education was 4.5 years.
17 Q And what engineering courses did you
18 take?
19 A I do not have the full list of courses,
20 but they included modern physics and different type
21 of engineering course works. It depends -- I mean,
22 basic math and a range of different physics-related

courses.

Q Do you remember what they were?

MR. ROZIER: Object to form. Asked and answered.

THE WITNESS: As I said before, I don't have the full list, but there were a substantial -- an substantive amount of courses, including physics-related, electric engineering courses, electronics, filtering courses. With filtering, I mean electronic filters, how to design the filter, how to implement filters, et cetera.

I would say that, in extent of 40 percent of the time spent during these four and a half years was engineering-related courses.

BY MR. ROTHENBERG:

Q And you state in Paragraph 23: The experience of a POSITA would be at least two years of experience with diffusive light micro-optics security features.

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1 Is that correct?
2 A I state that at least two years of
3 experience with diffusive light optics security
4 features.
5 Q So if a person with two years of
6 experience in micro-optics security features were to
7 review these patents, would they be able to
8 understand the invention?
9 MR. ROZIER: Object to form.
10 THE WITNESS: That experience
11 should be considered in the context of
12 also having an education that I refer to
13 in the initial paragraph of 23.
14 BY MR. ROTHENBERG:
15 Q Assuming they do have that education.
16 MR. ROZIER: Object to form.
17 THE WITNESS: As I state, in my
18 opinion, with this education and with
19 this practical training, in my opinion,
20 then such a person would -- should be
21 considered a POSITA.
22 BY MR. ROTHENBERG:

1 Q Would a person with the educational level
2 you describe in Figure 23 and at least two years of
3 experience with micro-optics security features be
4 able to understand the invention of the Lumenco
5 patents?
6 MR. ROZIER: Object to form.
7 Mischaracterizes the document.
8 THE WITNESS: As I stated in my
9 declaration, this person should be
10 considered a POSITA, and that is what
11 I -- that is my opinion. As I've been
12 informed, a POSITA is an established
13 entity, and I refer to that as an
14 established entity.
15 BY MR. ROTHENBERG:
16 Q Would you agree that the Lumenco patents
17 describe micro-optics security features?
18 A I agree that the Lumenco patents describe
19 micro-optics security features within the context of
20 diffusive light.
21 Q In forming your opinion that a POSITA
22 would have at least two years of experience with

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1 diffusive light micro-optics security features, did
2 you consider whether the patent use the term "diffuse
3 light"?
4 A Yes, I consider that the patent -- the
5 application of the patents is within the field of
6 diffusive light.
7 Q Do you agree the patents do not use the
8 term "diffuse"?
9 MR. ROZIER: Object to form. Asked
10 and answered.
11 THE WITNESS: My opinion is that
12 the patent -- the applicability of the
13 patent are within the field of diffusive
14 light.
15 BY MR. ROTHENBERG:
16 Q That, respectfully, wasn't my question.
17 Do you agree that the patents do not use
18 the term "diffuse"?
19 MR. ROZIER: Object to form. Asked
20 and answered.
21 Answer how you see fit,
22 Dr. Lindstrand.

1 THE WITNESS: As I read the patent,
2 for me it's obvious that the context of
3 the applicability of the patents are
4 within diffusive light. The exact term
5 "diffusive," you can describe in very
6 many terms.
7 If they are using diffusive as a
8 term, I cannot recollect, but for me it
9 hasn't been an issue whether the
10 patent -- the applicability of the
11 patents are within the field of diffusive
12 light.
13 BY MR. ROTHENBERG:
14 Q I'm not asking about the applicability.
15 I'm asking about the use of the term "diffuse."
16 Do you, sitting here today, recall that
17 term ever being used in the Lumenco patents? Yes or
18 no?
19 MR. ROZIER: Object to form. Asked
20 and answered. He's told you he doesn't
21 remember. You need to stop asking him
22 questions five times in a row.

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1 MR. ROTHENBERG: I'm asking a
2 yes-or-no question.
3 MR. ROZIER: He doesn't have to
4 give you a yes-or-no answer. He gets to
5 answer how he wants to.
6 MR. ROTHENBERG: If I ask a
7 yes-or-no question, he has to provide a
8 yes-or-no response.
9 MR. ROZIER: No, he does not. You
10 can call the Court, but that's not going
11 to happen. Do you want to call the PTAB?
12 That's not how it's going to do today.
13 He answers how he wants to answer your
14 question.
15 MR. TENNANT: There's no speaking
16 objections in here. You can call the
17 PTAB and --
18 MR. ROZIER: We can call and say
19 he's demanding -- telling him how to
20 answer. We can call. Do you want to
21 take a break and call?
22 MR. TENNANT: We can call, but I

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1 would -- let's just take a break. There
2 are no speaking objections. The Trial
3 Practice Guides directly --
4 MR. ROZIER: Don't tell my witness
5 how to answer, and I won't do a speaking
6 objection. We can call the PTAB.
7 MR. TENNANT: Your witness can
8 answer the way your witness can answer
9 the question, okay.
10 MR. ROZIER: Thank you.
11 MR. ROTHENBERG: But he doesn't get
12 to have speaking objections from you.
13 MR. ROZIER: You can answer,
14 Mikael.
15 MR. TENNANT: Maybe just repeat the
16 last question, please, or, Jacob, you can
17 withdraw and ask again.
18 MR. ROTHENBERG: I'll withdraw.
19 BY MR. ROTHENBERG:
20 Q So just to be clear, you don't recall the
21 term "diffuse" ever being used in the Lumenco
22 patents?

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1 MR. ROZIER: Objection. Asked and
2 answered.
3 You can answer, Dr. Lindstrand.
4 THE WITNESS: As I said, I do not
5 recollect if the term, the exact term
6 "diffusive" is used in the patent.
7 For me, the relevant issue as an
8 expert is whether -- the context of the
9 applicability is within the field of
10 diffusive light. Diffusive light is one
11 of many ways to describe this type of
12 context. You can imagine, for instance,
13 a non-collimated light. There are a
14 number of ways of describing what this
15 context of diffusive light is, and I do
16 not recollect the exact term used in
17 the -- in the patents.
18 But for me, the relevant thing is
19 that the context is diffusive light.
20 BY MR. ROTHENBERG:
21 Q Could you please turn to Page 23 of the
22 '294 patent.

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1 A Page 23 on '294 patent. I'm there.
2 Q Do you see Column 1, Line 15 says Field
3 of the Description?
4 A I do see that line.
5 Q Did you consider this paragraph from 15
6 to 23 in forming your opinions about what a POSITA
7 is?
8 A As I recollect, I have considered this.
9 Q And do you agree, diffuse light is not
10 referenced in this paragraph?
11 MR. ROZIER: Object to form.
12 THE WITNESS: Again, there are very
13 many ways to set the scope of an
14 applicability. If a certain term isn't
15 used, it may be described in other
16 fashions. So that is other words in
17 saying the same answer I gave before.
18 For me, it's obvious that the
19 applicability of this patent is within
20 the context of diffusive light.
21 BY MR. ROTHENBERG:
22 Q And what in this paragraph would indicate

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1 that to you?
2 MR. ROZIER: Object to form.
3 Mischaracterizes testimony.
4 THE WITNESS: For instance, but not
5 only, they refer to, in the last section
6 of the paragraph: Multi-planer image
7 that is viewable without special
8 eyewear -- a special eyewear. For
9 instance, if you are allowed to use
10 special eyewears, it would be possible,
11 with certain limitations, to -- to have
12 other solutions, not as sophisticated as
13 this, that would work with diffusive
14 light.
15 But they are describing here in
16 other words that the context is diffusive
17 light by referring to applicabilities
18 without special eyewears. They are
19 indicating the same thing. I read that
20 as an expert. That is my opinion.
21 BY MR. ROTHENBERG:
22 Q Did you provide that opinion in your

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1 declaration?
2 MR. ROZIER: Object to form.
3 THE WITNESS: I have considered it,
4 but I have not stated it in explicitly.
5 It's many things that I've considered not
6 explicitly stated in my declaration, that
7 this type of patent, the application of
8 it, is -- that is in the context of
9 diffusive light. It's obvious to me, and
10 it's described with very many
11 descriptions. But I haven't referred to
12 that explicitly in my declaration.
13 BY MR. ROTHENBERG:
14 Q Let's turn to Page 28 of your
15 declaration, please.
16 A Page 28 of my declaration, yes, I'm
17 there.
18 Q And is this your CV?
19 A This is my CV.
20 Q Does this CV include the experiences that
21 qualify you as an expert or a POSITA?
22 MR. ROZIER: Object to form.

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1 THE WITNESS: I would say that this
2 is part of the -- part of the
3 explanation, motivation why I'm
4 considered to be a POSITA.
5 BY MR. ROTHENBERG:
6 Q Do you have two years of experience with
7 diffusive light optics security features?
8 A I do have two years of experience, of
9 diffusive light experience.
10 Q And what are those experiences?
11 A I see many references, but I'm looking
12 through my CV to see if I can start with the most
13 relevant. Let's go with, on Page 30, at the bottom
14 of the page, second last paragraph, SDFI SCA,
15 papermaking industry. That was the starting point of
16 my optical engineering practices, so to say, where I
17 devised a measurement tool that approximated the
18 paper surface using micro facets in the optics
19 environment. And the relevant here -- one of the
20 relevant issues here is that it should be applicable
21 in the diffusive light context. So this measurement
22 device mimic how a human explore and evaluate the --

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1 the printed paper surface in the context of diffusive
2 light.
3 I worked at the Research Institute for a
4 couple of years, from '96 up to -- I would say --
5 2001, and thereafter with a private company, SCA, on
6 the same topic until 2006.
7 Q And what kind of paper products did they
8 produce?
9 A SCA produced coated printing paper. A
10 special issue with printing paper in this context is
11 that it becomes very glossy, and it also had a
12 topography. The substrate had undulation. So you
13 have an -- an unintended inclination variation such
14 that the light balances in all directions.
15 And that is relevant in this context
16 because here you have unintended light reflectances
17 that you ideally want to avoid. But in the security
18 field, those are intended light inclination
19 variation. You intend the light to go in certain
20 directions. But the relevant thing in this context
21 is that the tools to modulate, to analyze, to make
22 predictions, are the same irrespective if you do not

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1 want the light variation or if you decided to have
2 and designed a light variation.
3 So that was one of my starting practice,
4 so to say.
5 Q These paper products were not security
6 features, were they?
7 A Those were not security features. So
8 that was my basis of my -- that formed my starting
9 background, so to say.
10 Then after 2006, I generalized the
11 measurement system to be able to characterize also
12 security features. So from 2007, I formed my own
13 business, and then the applicability was within the
14 security features. So in 2000 -- sorry.
15 Q Is that gonioLabs AB, 2007 to 2009?
16 MR. ROZIER: Object to form.
17 THE WITNESS: The gonioLabs AB,
18 2007 to 2009, is part of that process
19 that I -- that is the starting point.
20 BY MR. ROTHENBERG:
21 Q Did this experience include any diffusive
22 light micro-optics security features?

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1 MR. ROZIER: Object to form.
2 THE WITNESS: The whole measurement
3 system, the measurement system
4 commercialized by gonioLabs was intended
5 solely in the context of diffusive light
6 and micro mirror security features, such
7 that I was able to analyze. Not produce,
8 not fabricate, but instead to analyze
9 such products.
10 BY MR. ROTHENBERG:
11 Q So the gonioLabs DOVID Reader is
12 referenced there in 2007, 2009, and also was the
13 subject of -- or reported by R. Van Raness.
14 Was that DOVID Reader a diffusive light
15 micro-optics security feature?
16 MR. ROZIER: Object to form.
17 Mischaracterizes the testimony and the
18 document.
19 THE WITNESS: As I've stated in my
20 declaration, this measurement device was
21 able to characterize -- the aim of the
22 measurement device was to characterize

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1 any security feature, whatever technical
2 background they have used to produce
3 optical variable features, including
4 micro-optics.
5 So it was not limited to
6 micro-optics only, but I analyzed and
7 characterized and I've written reports on
8 micro-optic features based on the
9 measurement device that I have invented
10 and produced.
11 BY MR. ROTHENBERG:
12 Q So this DOVID Reader, was it based on
13 diffusive light?
14 MR. ROZIER: Objection.
15 THE WITNESS: It was not --
16 MR. ROZIER: One second. Sorry.
17 Object to form. Asked and
18 answered.
19 Go ahead.
20 THE WITNESS: The measurement
21 device used diffusive light source, and
22 then it was -- it had -- it has optics

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1 that collimate the light source in order
2 to have a controlled environment to be
3 able to analyze the substrate.
4 Part of the relevance -- relevant
5 features of this measurement device is
6 that the inclination of the substrate
7 measured are deliberately curved in such
8 a way that I am able to analyze the --
9 the optical response of the surface in
10 various inclination. Therefore, I'm able
11 to give opinion of how this optical
12 substrate behaves in a diffusive light
13 environment.
14 BY MR. ROTHENBERG:
15 Q The light that was incident onto the
16 substrate is collimated light?
17 A It was intendedly a collimated, in order
18 to be able to analyze the optical behavior of the
19 surface in different angular settings.
20 Q And so that was 2007 to 2009?
21 A That was during 2007 to 2009, but the
22 work continued after 2009, as well. This section

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1 you're referring to is part of that experience.
2 Q And what other experience of diffusive
3 light micro-optic security features do you have?
4 A Essentially, I have measured very many
5 surfaces during 2009 to, essentially, 2013, with
6 customers, with acute security, document security
7 industry, but also projects that were not really
8 commercialized. I mean, it was prospect work or
9 without payment.
10 So I did a lot of work for multiple
11 different central banks, including central banks in
12 Europe, in North America and in Australia, during the
13 time of 2007 to 2013.
14 Q In this --
15 A I didn't -- sorry.
16 Q Sorry. You can finish your --
17 A Yeah. In this context, it may be
18 relevant to know that often I didn't know what I was
19 measuring. It was optical feature, potentially, that
20 could end up in a passport product or a bank note.
21 And it has certain optical features that would
22 target, that would -- it would aim to be used in a

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1 diffusive light context. It would aim to have a
2 human being as the evaluator of this security
3 feature. That is the narrow target of this
4 measurement device.
5 Q And are those experiences described here?
6 A Those experiences are described partly
7 here and partly in my declaration.
8 Q And was that with the DOVID Reader?
9 A That was with the DOVID Reader.
10 And I can add there also, my experience
11 did not end in this context on the year 2013 because
12 I presented new research findings in 2020, as well.
13 So it's more recent that -- it was not ended in 2013,
14 but it continued afterwards.
15 Q Okay. Are any of the other experiences
16 listed here in your CV involving diffusive light
17 optics security measures -- security features?
18 A On Page 28, last paragraph, there I refer
19 to the commercialization of scientific research
20 again. What I mentioned in the year 2020, that was
21 presented at a research conference in 2020. But I
22 believe that is the full context on this CV, and

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1 other experiences -- experiences are described in the
2 main part of the -- my declaration.
3 Q Okay.
4 MR. ROTHENBERG: Is this a good
5 time to take a break?
6 THE WITNESS: Yeah, sure.
7 (Brief pause.)
8 BY MR. ROTHENBERG:
9 Q Dr. Lindstrand, did you discuss the
10 contents of your testimony during the break?
11 A We were commenting just in general how I
12 feel -- felt, and especially when I've traveled a lot
13 and if I'm tired and so on. But not in detail.
14 Nothing in detail.
15 BY MR. ROTHENBERG:
16 Q Are you familiar with the term "ray
17 optics"?
18 A I'm familiar with the term "ray optics."
19 Q What is ray optics?
20 MR. ROZIER: Object to form.
21 THE WITNESS: It depends on the
22 context, but in general sense, it is a

1 way of characterizing light traveling in
2 space.
3 BY MR. ROTHENBERG:
4 Q And how does ray optics characterize
5 light traveling in space?
6 MR. ROZIER: Object to form.
7 THE WITNESS: It depends on the
8 context. Depending if it is a
9 theoretical problem, you end up with
10 certain characteristics. If you use it
11 in ray tracing for computer science
12 application, you end up in -- limitations
13 in that context. It heavily depends on
14 the context of the application.
15 BY MR. ROTHENBERG:
16 Q Would a POSITA have been familiar with
17 ray optics?
18 A I would -- I would assume that to be
19 correct.
20 Q And earlier we talked about your POSITA
21 definition in Paragraph 23, right? Do you remember
22 that discussion?

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1 A I remember that.
2 Q And you disagreed with Dr. Hesselink's
3 definition?
4 A Yeah, in my declaration I have pointed to
5 the specifics of my disagreement, that is correct.
6 Q And so would a POSITA have under- -- have
7 been familiar with ray optics under yours and
8 Dr. Hesselink's POSITA definitions?
9 A As I stated before, the ray optics is a
10 very general term and it depends on the context. So
11 if you restrict yourself to PERLA light, that type
12 of ray optics I would consider not to be sufficient
13 to be a POSITA. But if you include diffusive light
14 in your ray optics model, then I would admit that it
15 may be sufficient. So it depends.
16 Ray optics is a very general and broad
17 term of optics. It's suffice not to say only ray
18 optics because it can mean anything depending on
19 the -- on the context of application.
20 Q Would a POSITA under both your and
21 Dr. Hesselink's definition been at least familiar
22 with the concept?

1 MR. ROZIER: Object to form.
2 THE WITNESS: I would believe that
3 that is a fair statement.
4 BY MR. ROTHENBERG:
5 Q I'm going to hand you Exhibit 1028, which
6 is Chapter 1 of Fundamentals of Photonics, by Saleh
7 and Teich, First Edition, 1991.
8 Are you familiar with this text?
9 A I'm not familiar with this text.
10 Q Have you ever read this text or reviewed
11 it?
12 A If I've read this text?
13 Q Have you ever read this text?
14 A No, I have not read this text.
15 Q So this is Chapter 1 of a 1991 textbook
16 called Saleh and Teich, Fundamentals of Photonics.
17 Do you see the title of the chapter is
18 called Ray Optics?
19 A I see that.
20 Q Let's turn to Page 2. Do you see the
21 second paragraph that says: When light waves
22 propagate?

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1 A I see that.
2 Q Can you please read that paragraph,
3 please.
4 A When light waves propagate through and
5 around objects whose dimensions are much greater than
6 the wavelength, the wave nature of light is not
7 readily discerned so that its behavior can be
8 adequately described by rays obeying a set of
9 geometrical rules. This model of light is called ray
10 optics. Strictly speaking, ray optics is the limit
11 of wave optics when the wavelength is infinitesimally
12 small.
13 Shall I continue?
14 Q No. Thank you very much.
15 So would you agree the ray model is
16 generally used when waves become infinitesimally
17 short?
18 MR. ROZIER: Object to form.
19 Mischaracterizes the document.
20 THE WITNESS: I would say that -- I
21 do not contradict this statement. It is
22 obviously -- it seems okay for me, but

1 what I say is that ray optics can -- it
2 can be addressed in very man-made
3 contexts. But, again, your statement
4 sounds reasonable for me. I haven't
5 given the verdict about this document,
6 but it sounds reasonable.
7 BY MR. ROTHENBERG:
8 Q You don't disagree with anything in this
9 paragraph?
10 MR. ROZIER: Object to form.
11 THE WITNESS: I see no reason to
12 object to this text.
13 BY MR. ROTHENBERG:
14 Q And what is the wavelength of light, the
15 range?
16 MR. ROZIER: Object to form.
17 THE WITNESS: I'm not sure if I
18 remember this correctly, but if I -- I
19 would say that it is in the range of 370
20 nanometers, up to 900ish nanometers. But
21 that is -- I haven't used that in my
22 declaration, and it's remembering those

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1 figures from 20 plus years, something
2 from school. It may be incorrect.
3 BY MR. ROTHENBERG:
4 Q Okay. If you don't mind turning to Page
5 3, flipping the page.
6 A Yes, I'm there.
7 Q Do you see the heading Ray Optics?
8 A I do see the heading.
9 Q Can you please read that paragraph.
10 A Ray optics is the simplest theory of
11 light. Light is described by ray that travels in
12 different optical media in accordance with a set of
13 geometrical rules. Ray optics is therefore also
14 called geometrical optics. Ray optics is an
15 approximation -- an approximate theory. Although it
16 adequately described most of our daily experiences
17 with light, there are many phenomena that ray optics
18 does not adequately describe, as amply testified to
19 by the remaining chapters of this book.
20 Q And can you read the next sentence, just
21 that one additional sentence.
22 A Ray optics is concerned with the location

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1 and direction of light rays.
2 Q And the next sentence, please.
3 A It is, therefore, useful in the study of
4 image formation, the collection of rays from each
5 point to an object and their redirection by an
6 optical component onto a corresponding point of an
7 image.
8 Q So under the ray model, would a POSITA
9 have understood that light travels in rays according
10 to geometrical rules?
11 MR. ROZIER: Object to form.
12 THE WITNESS: Again, I would assume
13 that that is reasonable to assume.
14 BY MR. ROTHENBERG:
15 Q Can you turn the page again, please. The
16 paragraph under the heading Propagation Homogenous
17 Medium.
18 Could you please read that paragraph.
19 A In a homogenous medium, the refractive
20 index is the same everywhere and so is the speed of
21 light. The path of minimum time required by Fermat's
22 principle, it is therefore also the path of minimum

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1 distance. The principle of the path of minimum
2 distance is known to us here as principle. The path
3 of minimum distance between two points in a straight
4 line so that a homogenous medium light rays travel in
5 straight lines. Figure 1.1.1.
6 Q Would you agree that light travels in
7 straight lines in a homogenous medium?
8 MR. ROZIER: Object to form.
9 THE WITNESS: Sorry. Can you
10 please state that again.
11 BY MR. ROTHENBERG:
12 Q Would a POSITA have understood that light
13 travels in straight lines in a homogenous medium?
14 MR. ROZIER: Object to form.
15 THE WITNESS: I would assume that
16 is a reasonable assumption.
17 BY MR. ROTHENBERG:
18 Q You'd assume? Or do you know that to be
19 true?
20 MR. ROZIER: Object to form. Asked
21 and answered.
22 THE WITNESS: I do not know if it's

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1 objectively true, but I assume that it is
2 a reasonable assumption.
3 BY MR. ROTHENBERG:
4 Q Okay. If you turn to Page 5, please.
5 Are you familiar with the law of
6 reflection?
7 A I am familiar with the law of reflection.
8 Q Is this page describing the law of
9 reflection?
10 MR. ROZIER: Object to form.
11 If you need to take the time to
12 look at it, please do.
13 BY MR. ROTHENBERG:
14 Q I can rephrase, if you'd like.
15 A Please.
16 Q Would a POSITA have understood that,
17 under the law of reflection, the angle of incidence
18 of a ray on a mirror is equal to the angle of
19 reflection of a ray from a mirror?
20 MR. ROZIER: Object to form.
21 Outside the scope.
22 THE WITNESS: I believe that is

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1 correct.
2 BY MR. ROTHENBERG:
3 Q Okay. And then this italicized
4 paragraph: The reflected ray lies in the plane of
5 instance. The angular reflection equals the angle of
6 incidence.
7 Is that, in your opinion, another way to
8 state the law of reflection?
9 MR. ROZIER: Objection. Form,
10 scope.
11 THE WITNESS: I would -- I would
12 agree with that statement.
13 BY MR. ROTHENBERG:
14 Q If you turn to Page 6, what is Snell's
15 law?
16 A It refers to light interaction with
17 medium of different refractive indices.
18 Q Would a POSITA have understood Snell's
19 law?
20 MR. ROZIER: Objection. Form,
21 scope.
22 THE WITNESS: It sounds reasonable

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1 that you would assume that.
2 BY MR. ROTHENBERG:
3 Q Can you please read the paragraph under
4 Figure 1.14 that says -- that begins with, The three
5 simple rules.
6 A The three simple rules. Propagation in
7 straight lines and the loss of reflection and
8 refraction are applied in Section 1.2 to several
9 geometrical configurations of mirrors and transparent
10 optical components without further recourse to
11 Fermat's principle.
12 Q So would a POSITA have understood that
13 those three simple rules that we discussed are
14 applied to geometrical configurations of mirrors?
15 MR. ROZIER: Object to form.
16 Mischaracterizes the document.
17 THE WITNESS: I would assume that
18 you can make such an assumption.
19 BY MR. ROTHENBERG:
20 Q Okay. I'd like to now turn to your
21 opinions regarding the claim term: Wherein a voxel
22 is created at each of the points on the plane via

1 intersection of two or more beams of the reflected
2 ambient light.
3 A At what page?
4 Q So in your view, the official translation
5 of what is referred to as FUS '262 -- which is German
6 Patent No. 102010048262.
7 Do you recall reviewing that?
8 A Are you reading now from my declaration
9 or shall I -- is it from my declaration?
10 Q We can -- we can turn there, yeah. So
11 Page 16 -- sorry. Fifteen. Do you see '262?
12 Do you see that in Paragraph 38?
13 A I do see that.
14 Q And so these are opinions about FUS '262;
15 is that correct?
16 A These are opinions about FUS '262.
17 Q And so from Paragraphs 42 to 58, these
18 are opinions regarding the claim term: Wherein a
19 voxel is created at each of the points on the plane
20 via intersection of two or more beams of the
21 reflected ambient light.
22 Is that correct?

1 A That is correct.
2 Q Would you agree that a voxel is a pixel
3 with volume?
4 A I would say that the voxel is a pixel
5 with a volume.
6 Q So is a voxel a type or a subspecies of a
7 pixel?
8 A No --
9 MR. ROZIER: Object to form.
10 Sorry.
11 THE WITNESS: No. I would say that
12 a pixel is a special case of a voxel, in
13 that meaning, that a pixel bear less
14 information than a voxel. Voxel --
15 BY MR. ROTHENBERG:
16 Q A voxel is not a type of pixel?
17 MR. ROZIER: Object to form. Asked
18 and answered.
19 THE WITNESS: A voxel contains more
20 information than a pixel, I would say.
21 BY MR. ROTHENBERG:
22 Q If a pixel has volume, it's a voxel even

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1 if the term voxel isn't used; would you agree with
2 that?
3 MR. ROZIER: Object to form. Asked
4 and answered.
5 THE WITNESS: I'm not sure I follow
6 your question. Can you please repeat
7 that?
8 BY MR. ROTHENBERG:
9 Q A voxel is a pixel with volume, correct?
10 MR. ROZIER: Object to form. Asked
11 and answered, twice.
12 THE WITNESS: It depends on the
13 context. A pixel bear less information.
14 If you state that you -- your application
15 uses pixels, you also indicate that you
16 are -- you're considering a smaller
17 amount of information than if you
18 intentionally describe it as a voxel.
19 The a voxel bears more information, I
20 will say.
21 BY MR. ROTHENBERG:
22 Q Outside of the claims, do the '292 and

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1 '191 patents use the term "voxel"?
2 A I'm not sure if I recollect that, but can
3 you point me to the -- did you say -- please, can you
4 repeat that question.
5 Q Outside of the claims themselves, do the
6 '292 patents -- the '292 or '191 patents use the term
7 voxel?
8 A I do not recollect that specific answer.
9 Q So sitting here today, you're unaware if
10 the '292 and '191 patents use the term voxel in the
11 description?
12 MR. ROZIER: Object to form.
13 THE WITNESS: Could you point to
14 the documents, please? '292, you said.
15 That is the document.
16 BY MR. ROTHENBERG:
17 Q Sorry. '294. The '294 patent or the
18 '191 patent.
19 A Yeah.
20 Q Do you understand those patents to have
21 the same description?
22 A If you say '294 all the time, it's --

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1 then I misheard you.
2 Yes, those are equal as far as I
3 understand.
4 Q Does the description of the '294 and '191
5 patents use the term voxel?
6 A Glancing through the documents right
7 here, I cannot see that they are using the term
8 voxel. The reason why I -- the context of the
9 applicability in this diffusive light, and therefore
10 the inclination in volume, is both described and
11 assumed and taken care of.
12 So it's not merely -- not -- not as a --
13 it is described and taken care of. So I assume that
14 the volume of the information -- of the light rays
15 are well described. I see that as a basis for
16 describing this is a volume of light reflectance,
17 i.e., a voxel.
18 Q Earlier, you said that you would
19 intentionally describe a voxel and use that term in
20 order to describe a voxel.
21 So, in your opinion, why does the '294
22 and '191 patents intentionally not use the term

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1 voxel?
2 MR. ROZIER: Object to form.
3 Mischaracterizes testimony, compound.
4 THE WITNESS: My declaration
5 describes how, in my opinion, the
6 applicability of this patent is relevant
7 in the context of a diffusive light.
8 Voxel is a volume element that's taking
9 care of the information gathering, the
10 information processing, and the -- it
11 facilitates all these features and
12 characteristics.
13 So, in my opinion, this -- these
14 patents are aimed at diffusive light
15 applications, and therefore the relate --
16 the relation to volume element, voxels,
17 in my opinion, it's well described. It's
18 not my assumption, but I read this text
19 that it's an application of volume
20 information about light rays and light
21 reflectances. It is clearly written in
22 the patent.

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1 BY MR. ROTHENBERG:
2 Q How are voxels described in the patent?
3 MR. ROZIER: Object to form.
4 Vague.
5 THE WITNESS: The reflectance of
6 light in certain -- certain applications
7 are trivial. In theoretical applications
8 you have -- you have small challenges
9 describing the reflectance with Fresnel's
10 law, et cetera. But going to application
11 in real life with diffusive light, it
12 becomes very much messier. And then you
13 have more -- you have to use more
14 sophisticated tools, like volume, volume
15 consideration.
16 And as this -- the whole document
17 addresses applications in the volume --
18 sorry -- in the diffusive light context.
19 So even if the term voxel is not
20 explicitly mentioned, if the
21 applicability is within the area of
22 ambient light, the volume of light

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1 reflectance is addressed. I see no
2 contradiction in the text in the patent
3 in that context.
4 BY MR. ROTHENBERG:
5 Q Can you point me to where in the '294
6 patent the creation of voxels is described?
7 MR. ROZIER: Object to form. Asked
8 and answered.
9 THE WITNESS: I cannot see the
10 specific point where voxel is created,
11 but as to application, it is within the
12 area of diffusive light. That implies
13 that you have light contributing from all
14 the different directions, and as a
15 consequence you have light reflecting in
16 all directions as a consequence. You
17 have to address that in order to have the
18 patent relevant. So as the patent -- it
19 states that it will be relevant in the
20 context of ambient light.
21 It also addresses this issue of
22 volume -- volume information about

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1 reflectance, i.e., the concept of voxel.
2 BY MR. ROTHENBERG:
3 Q Where are you reading that? The volume
4 information, did you read that from the patent or was
5 that --
6 A That's how I read that -- now I'm --
7 Q Where are you reading from?
8 MR. ROZIER: Object to form. If
9 he's talking, please let him finish.
10 THE WITNESS: I can read in the
11 Summary on Page 23, Column 2, the second
12 paragraph on the Summary starting with,
13 In other words: In other words, text
14 imagery and so forth can be written with
15 space -- with ambient light by focusing
16 the micro mirrors to different spacial
17 planes above the plane of the security
18 device, which is typically provided on
19 the surface of the document, for instance
20 currents, or product being authenticated
21 with a security device. Conversely, the
22 technology can then be reversed to the

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1 viewer by having the bright pixels go
2 dark and the background reverse from
3 light to dark with change of perspective.
4 For instance, occurring while the viewer
5 changes their viewing angle or rotates
6 the document products contained in the
7 security device.
8 This is a description of the volume
9 information I was referring to. This is
10 one section where they amply didn't
11 describe that they are considering the
12 volume information. The angle and
13 different direction is relevant. If they
14 would not have considered the volume
15 information, this paragraph wouldn't have
16 been correct or relevant.
17 BY MR. ROTHENBERG:
18 Q Okay. Let's turn to Paragraphs --
19 Paragraph 45 of your declaration. You say: Creation
20 of a voxel in an ambient light environment using a
21 micro mirror array is a highly technical endeavor.
22 Did I read that correctly?

1 A You read that right, yes.
2 Q And Paragraph 46 says: More
3 specifically, creation of a voxel involves technical
4 challenges and considerations above and beyond those
5 required to create a pixel.
6 Did I read that right?
7 A You read that right.
8 Q What technical challenges does your
9 declaration identify?
10 A In my opinion, you should read those
11 Paragraphs 45 and 46 in the context of the
12 applicability area being diffusive light. Then you
13 have disturbances and non-intentional reflections
14 that form part of the challenges that I referred to
15 in 45 and 46 paragraphs.
16 Q What specifically are those technical
17 challenges?
18 MR. ROZIER: Object to form. Asked
19 and answered. The document speaks for
20 itself.
21 THE WITNESS: There are many
22 challenges. One is the light

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1 conservation in that context that, if you
2 have a certain level of incoming light,
3 you need to use that in most
4 conservative, vague way such that they
5 are useful information for the user, that
6 is, the intended path of the light.
7 So energy conservation is one --
8 one challenge, and the other challenge is
9 deterioration of the intended image. If
10 you have reflections coming from
11 non-intended directions, that will
12 attenuate the intended image such that
13 they -- you have disturbances and noise
14 that deteriorate from the intended image.
15 So those are two principal
16 different challenges that you have to
17 address. There are others, but I would
18 say that those are two highly relevant
19 challenges in this context.
20 BY MR. ROTHENBERG:
21 Q Are Paragraphs 47 through 49 describing
22 the degradation challenge you just referred to?

1 MR. ROZIER: Object to form.
2 THE WITNESS: Those describe part
3 of the challenges I was just referring
4 to.
5 BY MR. ROTHENBERG:
6 Q And you don't refer to the '294 patent in
7 this discussion, correct?
8 MR. ROZIER: Object to -- object to
9 form. Mischaracterizes the document.
10 THE WITNESS: I am referring to the
11 -- I mean, this section of my declaration
12 referred to -- it is given in the context
13 of the '294 patent.
14 BY MR. ROTHENBERG:
15 Q Do you provide any citations to the '294
16 patent?
17 MR. ROZIER: Object to form.
18 Vague.
19 THE WITNESS: Page 16, Paragraph
20 42, that is the -- that is the reference
21 to '294. The whole section deals with
22 the challenges in the context of

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1 reflective ambient light. So these pages
2 from Paragraph 42 down to Paragraph 58
3 refers to the -- my position relates to
4 patent '294.
5 BY MR. ROTHENBERG:
6 Q Does the '294 patent ever use the term
7 "interference"?
8 MR. ROZIER: Object to form. The
9 document speaks for itself.
10 THE WITNESS: Sorry. Can you
11 repeat that question, please.
12 BY MR. ROTHENBERG:
13 Q Does the '294 ever use the term
14 "interference"?
15 MR. ROZIER: Same objections.
16 You have the patent if you need to
17 look at it, Dr. Lindstrand.
18 THE WITNESS: In my recollection --
19 sitting here, I cannot remember or I
20 cannot recollect if they use that exact
21 term or if they only refer to the
22 applicability of this patent in the

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1 context of diffusive light. I'm not
2 sure.
3 BY MR. ROTHENBERG:
4 Q Do they ever -- does the '294 patent ever
5 generally describe interference using any related
6 term?
7 MR. ROZIER: Object to form.
8 THE WITNESS: Again, I
9 cannot recollect if that term and that
10 exact term is used in the patent, but I
11 am sure that the applicability of this
12 patent is within the field of diffusive
13 light.
14 BY MR. ROTHENBERG:
15 Q I'm not asking whether it's in the field
16 of diffusive light.
17 I'm asking if the concept of interference
18 is discussed in the '294 patent?
19 MR. ROZIER: Object to form. Asked
20 and answered several times.
21 THE WITNESS: Again, I cannot
22 recollect if that exact term is used.

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1 BY MR. ROTHENBERG:
2 Q I'm not asking about the term. I'm
3 asking about the concept, using any term.
4 MR. ROZIER: Object to form. Asked
5 and answered. I think that's the fifth
6 time.
7 THE WITNESS: Yeah, and my answer
8 is, for me, the term -- I'll put it this
9 way.
10 Dealing with challenges with the
11 diffusive light is enough for me as an
12 expert to value if this is -- the
13 applicability of having this patent in
14 diffusive light environment is clear to
15 me, even if I cannot recollect if that
16 specific term or concept is described in
17 the patent.
18 BY MR. ROTHENBERG:
19 Q Let's turn to Paragraph 47 of your
20 report.
21 A Forty-seven?
22 Q Yeah. You say: Light rays reflected

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1 from a micro mirror encounters interference from
2 incoming light rays and potentially from light rays
3 reflected from other mirrors in the array.
4 Is this concept discussed in the '294
5 patent?
6 MR. ROZIER: Object to form.
7 THE WITNESS: Again, I cannot
8 recall if this specific sections --
9 section is referred to in the patent, but
10 this is a general statement that
11 describes one of the challenges one
12 should consider within this context.
13 BY MR. ROTHENBERG:
14 Q In Paragraph 48, it says: Interference
15 degrades the quality and shape of light rays as they
16 move towards an intersection point.
17 Is this concept discussed in the '294
18 patent?
19 MR. ROZIER: Object to form.
20 THE WITNESS: Again, I cannot
21 recollect if this is referred to in the
22 patent, but what I can say, that is

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1 relevant in the context of application
2 within the interference -- sorry -- the
3 ambient light context. So for the
4 applications in the ambient light
5 context, these section are part of the
6 challenges that need to be considered.
7 BY MR. ROTHENBERG:
8 Q The next sentence says: Because creating
9 a pixel requires less information than creating a
10 voxel, a security feature in which only pixels need
11 to be produced requires less refinement and
12 complexity.
13 Is that concept discussed in the '294
14 patent?
15 MR. ROZIER: Object to form.
16 THE WITNESS: If -- it's addressed
17 at least implicitly, but still
18 substantially by describing that you're
19 producing the image-forming pixels by
20 multiple micro mirrors. So in that
21 context, they are definitely describing a
22 much more sophisticated image

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1 formation -- image formation setup. So I
2 would say that is one bearing part of it.
3 BY MR. ROTHENBERG:
4 Q So a POSITA would understand this
5 technical challenge by the '294 patent's description
6 of creating pixels with multiple micro mirrors?
7 A I would say that a POSITA uses this as a
8 basis to produce a product that is more robust in the
9 application of -- in the context of a diffusive light
10 environment.
11 Q Paragraph 49 says: A pixel can be
12 displayed at an intersection of light rays even when
13 there's been substantial degradation of those rays
14 due to interference. In contrast, creating the voxel
15 requires more focus and intense rays that are less
16 susceptible to degradation from interference in the
17 ambient light environment.
18 Is that concept discussed in the '294
19 patent?
20 MR. ROZIER: Object to form.
21 THE WITNESS: It is discussed in
22 the context that you have micro mirrors

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1 forming each single image pixel. So you
2 have multiple micro mirrors that together
3 form and define each single image pixel.
4 BY MR. ROTHENBERG:
5 Q Paragraph 50 says: Creation of more
6 intense rays needed for the resulting voxel adds
7 layers of complexity, as well as substantial
8 additional design cost to assist them. In my
9 opinion, a POSITA would not expend the time and money
10 to achieve higher level design required to produce a
11 voxel if only pixels were necessary to achieve the
12 desired design in each volt.
13 Is that concept discussed in the '294
14 patent?
15 A Implicitly, because they are addressing
16 the application of the patent is within the field of
17 diffusive light, hence we have a number of
18 challenges, and those are addressed, in part, by
19 using volume information of reflectance.
20 In other words, if the applicability of
21 this patent was within a lab context where -- with a
22 controlled light environment, we need not to have

1 volume information of pixels. Then we can go for a
2 simpler solution, what I am stating in the Paragraph
3 50. You address a certain problem with an SEC or a
4 simple solution as possible, but not any simpler.
5 And due to the fact that the application
6 is diffusive light, with all the problems within that
7 field of application, they cannot go with the simple
8 solution. They have to address this with a volume of
9 information, volume of information regarding the
10 reflectance. So they are definitely referring to
11 Paragraph 50 in the patent. The whole concept of the
12 patent relates to this.
13 Q And you don't have any opinions in your
14 declaration that FUS '262 doesn't teach diffusive
15 light, correct?
16 MR. ROZIER: Object to form.
17 Vague.
18 THE WITNESS: It is my opinion that
19 they do not address this because they are
20 talking about pixels. They do not
21 describe or handle the challenges that I,
22 with my background, see as necessary in

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1 order to have a reasonable handling of
2 diffusive light. Or at least I cannot
3 read that from the patent.
4 BY MR. ROTHENBERG:
5 Q In Paragraph 51, you state: In certain
6 applications, the extra computational and storage
7 payload of 3D voxels is justified because creation of
8 3D voxels provides heightened benefits for security.
9 This is because, in the art of security features, the
10 more difficult to disrupt the feature, the more
11 valuable and secure that feature is.
12 Is the concept of extra computational and
13 storage payload discussed in the '294 patent?
14 MR. ROZIER: Object to form.
15 While he's looking at that, if we
16 can take a break after this question,
17 after he answers. It's been about an
18 hour.
19 MR. TENNANT: Do you have a few
20 more questions?
21 MR. ROTHENBERG: Yeah, I have a few
22 to wrap up this section.

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1 THE WITNESS: Well, I cannot find
2 the section right now, but in my
3 recollection they are referring to the
4 fast evolvement of the industry and the
5 technical advancements.
6 So, in general, in my paragraph I
7 was referring to the push and the need
8 from the industry to look for new -- new
9 technical endeavors in order to make it
10 more difficult to make fraud -- fraud
11 documents. But I cannot find the exact
12 section. I find in the Summary they are
13 generally describing the technical
14 advancements of these documents or these
15 types of documents.
16 But the short answer is I cannot
17 recollect now where they are referring to
18 this section.
19 MR. ROTHENBERG: Okay. I think we
20 can take a break.
21 MR. ROZIER: Appreciate it.
22 (Brief pause.)

1 BY MR. ROTHENBERG:
2 Q You stated before that the Lumenco
3 patents are diffusive light systems; is that correct?
4 MR. ROZIER: Object to form.
5 THE WITNESS: I said before that
6 the Lumenco patents are aimed for
7 applications within the diffusive light
8 environment.
9 BY MR. ROTHENBERG:
10 Q Are they aimed for other applications in
11 other light environments?
12 A To my recollection, they aim for
13 diffusive light environment. As those environments
14 are more challenging, I would assume that the -- they
15 intend also other applications, but I've not
16 considered that. They are aimed -- they are aiming
17 for diffusive light condition and that is the gold
18 standard in this context, I would say. That is my
19 opinion.
20 Q Would they work with other kinds of
21 light?
22 MR. ROZIER: Object to form.

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1 Vague.
2 THE WITNESS: I would assume that
3 they would work in other more restricted
4 light conditions. I would say more
5 restricted, and hence easier tasks. I
6 would assume that, but I haven't
7 considered it and I haven't -- I have no
8 opinion about that.
9 BY MR. ROTHENBERG:
10 Q So your opinion -- strike that.
11 Earlier, you testified that you couldn't
12 identify the term "diffuse" used in the '294 patent;
13 is that correct?
14 A As I remember, I stated that I cannot
15 recollect that they are -- they are referring to that
16 term.
17 Q What can you recollect about the patent's
18 use of diffuse light?
19 MR. ROZIER: Object to form.
20 THE WITNESS: What I can recollect
21 is that they are addressing the
22 applicability of the patent within the

1 field of diffusive light.
2 BY MR. ROTHENBERG:
3 Q The patent uses the term "ambient light";
4 is that correct?
5 A Could you direct me to a certain section
6 or should I read?
7 Q So Figure 1, Page 3. You might want to
8 unclip it and then follow me on Column 6 and Figure
9 1, because that's where Column 6 describes Figure 1.
10 A So Figure 1, and again? Sorry.
11 Q You'd agree the patent is describing
12 Ambient Light 130?
13 A That is correct.
14 Q Okay. And you'd agree Claim 1 of the
15 '294 patent describes an array of micro mirrors
16 receiving ambient light?
17 A That is correct.
18 Q So is ambient light interchangeable with
19 diffuse light?
20 A I would say, in this context, you can use
21 them interchangeably.
22 Q Let me just -- you said: I would say, in

1 this context, you can use them interchangeably.
2 What context are you referring to?
3 MR. ROZIER: Object to form.
4 THE WITNESS: I would say in the
5 context of micro mirror security features
6 aiming for application in either ambient
7 light or diffusive light, I would use
8 those terms interchangeably. That is, to
9 the best of my knowledge, a fair
10 description if you interchange those
11 concepts.
12 BY MR. ROTHENBERG:
13 Q Is sunlight diffuse light?
14 MR. ROZIER: Object to form.
15 THE WITNESS: It depends.
16 BY MR. ROTHENBERG:
17 Q What does it depend on?
18 A If you're very near to the sun, then you
19 have light from all direction. If you are very close
20 to the sun, you have light rays from all direction.
21 It may be characterized as diffusive light. If
22 you're far off the surface -- surface of the Earth,

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1 but in the void space, then you have the sun as a
2 point source far, far away. Then it would be a
3 parallel light, not diffusive. It's, in fact, close
4 to parallel light. But then entering again closer to
5 the Earth, you have disturbances in our atmosphere.
6 Then it becomes messy, again, bouncing around, and
7 then you have light rays from different directions.
8 And on the surface of the Earth you have bouncing
9 arounds from the whole environment, the cars and the
10 mirrors and everything, then you have an ambient
11 light condition.
12 So it depends. You start off as being an
13 ambient light, and towards the Earth it becomes a
14 parallel light source, and down on the Earth it,
15 again, becomes messy and ambient light source.
16 Q So for somebody standing on the surface
17 of the Earth, is sunlight ambient light?
18 A In normal conditions, if you haven't a
19 lab setting or something and you go out in the normal
20 environment, the sunlight is best approximated as an
21 ambient light source because you have reflections
22 from all around the environment.

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1 Q Would the sunlight contain parallel rays?
2 MR. ROZIER: Object to form.
3 THE WITNESS: In certain
4 conditions, yes. As I said, in the void
5 space outside, far from the Earth, but
6 also from away from the sun, it's best
7 approximated as a parallel light source.
8 BY MR. ROTHENBERG:
9 Q So assume for now on, when I reference
10 sunlight, I'm talking about someone standing on the
11 surface of the Earth and not in outer space.
12 Why do objects cast shadows in ambient
13 light, such as sunlight?
14 A Sorry. Where do you read now?
15 Q I'm not reading from anything.
16 A Okay. So, again, what --
17 Q So you're standing in sunlight and the
18 sunlight creates a shadow, why is that?
19 MR. ROZIER: Object to form.
20 THE WITNESS: That is because --
21 all that I've said, it's approximations.
22 As I said you, approximate the sunlight

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1 close to the sun, you approximate the
2 characteristics in the void space, and
3 you approximate the sunlight close to the
4 Earth or on the Earth.
5 And, again, those approximations,
6 you -- it's -- of course, it's not one or
7 zero. So shadows is a consequence that
8 you -- you have parallel light including
9 in all the energy or light emitted from
10 the sun, including the bouncing around,
11 the reflectances. So if you -- if you
12 place something that limit the light
13 rays, of course, it becomes darker in the
14 background.
15 If you had a laser, it would have
16 been more distinct. But even if -- with
17 a diffusive light, you have -- you have
18 shadows. It's -- for me, it's nothing
19 strange.
20 BY MR. ROTHENBERG:
21 Q So in sunlight, it's a combination of
22 parallel light and diffusive light?

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1 MR. ROZIER: Object to form.
2 THE WITNESS: I would say that it's
3 a combination of parallel light and
4 diffusive light. And we are talking
5 about going away from theoretical
6 experiments into practice, we are always
7 combination of parallel light and
8 diffusive light, in all conditions.
9 BY MR. ROTHENBERG:
10 Q So in ambient conditions such as
11 sunlight, in practical terms, there's a combination
12 of diffuse light and parallel light?
13 MR. ROZIER: Object to form.
14 THE WITNESS: I would say it's a
15 combination, but it is a reason why we
16 characterize certain light sources as
17 dominantly ambient or dominantly
18 parallel. There's a reason for that,
19 because they are dominated by one or the
20 other.
21 BY MR. ROTHENBERG:
22 Q So I think you have Figure 1 open.

1 A Yes.
2 Q Do you mind turning back to that, Figure
3 1 of this -- of the '291 patent.
4 Figure 1 is showing a single mirror, a
5 micro mirror; is that correct?
6 A Yeah, I believe that is correct.
7 Q Okay. And the patent describes the
8 incident light in Figure 1 as Ambient Light 130 or
9 Incoming Ray 130; is that fair?
10 A I believe that is a fair description.
11 Q And the Ambient Ray 130 is instant on the
12 micro mirror surface at an angle beta with respect to
13 the normal vector of the micro mirror?
14 MR. ROZIER: Object to form.
15 THE WITNESS: That seems a fair
16 description, yes.
17 BY MR. ROTHENBERG:
18 Q And would you say Figure -- it's fair to
19 say Figure 1 is representing incident light according
20 to the ray model?
21 MR. ROZIER: Object to form.
22 THE WITNESS: It depends, because

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1 as I said this morning, the ray model can
2 describe very many things. In Figure 1,
3 we intentionally describe the incident
4 like as ambient, hence, a number of
5 consequences arises. If it instead in
6 Figure 1 would have said laser light or
7 collimated light or something similar,
8 parallel light, then we have -- the
9 consequences have been another.
10 So Figure 1, for me, it says
11 ambient light, then the -- I read into
12 that that it is not one single ray
13 hitting the micro mirror.
14 I read this image as it is an
15 approximation. If there have been --
16 this is an approximation. You read into
17 this that you actually have a number of
18 different rays hitting this micro mirror,
19 but same ambient light. They can just
20 draw one arrow and the image becomes less
21 massive.
22 BY MR. ROTHENBERG:

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1 Q Would this ray -- strike that.
2 Are you familiar with the term "chief
3 ray"?
4 A I'm familiar with the term "chief ray."
5 Q Is this ray and the reflected ray, is
6 that depicting the chief ray?
7 A It depends on the context, again, because
8 sometimes when you refer to the chief ray, it's --
9 you can use it also in the context of parallel light.
10 You have some messiness. It is not a perfect
11 parallel light, but it is basically a parallel light.
12 But you also have disturbances because light is light
13 and it's messy.
14 In this context, you say that it is
15 ambient light. The non-intended light contribution
16 is not small. It is substantial in contribution of
17 non-intended light. So I wouldn't interchange those.
18 If you instead talked about a parallel light, then
19 you say, almost all the energy is controlled and
20 parallel. We have some disturbances, but in essence
21 the light entering that micro mirror is parallel and
22 it is under control and -- but Figure 1 says

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1 something completely different.
2 We have ambient light. We have light
3 from a number of different location and we need to
4 handle that in order to have functional equipment.
5 Q When you say another of other light,
6 that's not shown in Figure 1 or described anywhere in
7 the patent, correct? You're inferring that?
8 MR. ROZIER: Objection.
9 THE WITNESS: Sorry. Can you state
10 that again, please.
11 BY MR. ROTHENBERG:
12 Q When you say there's other light besides
13 Ambient Light 130, you're inferring that, but it's
14 not -- it's not -- you agree it's not shown in Figure
15 1?
16 A I disagree, because it says Ambient
17 Light. It says Ambient Light and I read into that
18 that you have ambient light, hence, you have light
19 from -- coming from different direction. That is
20 what I read into the concept of ambient light.
21 Q Would you agree that the patent describes
22 130 as Incoming Ray 130?

1 MR. ROZIER: Object to form.
2 THE WITNESS: Do you read that from
3 the patent or should I read something in
4 the patent?
5 BY MR. ROTHENBERG:
6 Q If you go to Column 6, Line 48.
7 A Column 6. I'm just going to read the
8 section so I see the context.
9 Yes, and the question again was?
10 Q You'd agree the patent describes incident
11 light as Incoming Ray 130 that forms an angle beta
12 with the normal vector?
13 MR. ROZIER: Objection. Form.
14 THE WITNESS: Yeah, but I read that
15 as not very -- an abbreviation. If you
16 go up a few lines, in the middle of that
17 paragraph, it says: When the Image
18 Display Assembly 100 is in use, Ambient
19 Light 130.
20 So there they're referring to 130
21 as the ambient light. And then the --
22 again referring to the 130, they used a

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1 short form of incoming ray. But I would
2 read this as in the context of ambient
3 light. It's the same 130.
4 BY MR. ROTHENBERG:
5 Q So when it says Ambient Light 130 strikes
6 the Reflective Upper Surface 124 of the Micro Mirror
7 120 and is reflected as shown at 134.
8 Do you see 134 in Figure 1?
9 MR. ROZIER: Object to form.
10 THE WITNESS: I see 134 in the
11 image, in the figure.
12 BY MR. ROTHENBERG:
13 Q And you'd agree, Reflected Light 134
14 forms an angle beta with the normal vector?
15 MR. ROZIER: Object to form.
16 THE WITNESS: I would say, again,
17 this is a simplified form of figure.
18 They are not including all the rays that
19 are relevant, but -- but stating we have
20 ambient light as the source, 130. I read
21 into that, that we have a number -- a
22 multiple different reflected lights in

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1 different beta angles, Beta 1, Beta 2, et
2 cetera.
3 But the figure would become stupid,
4 would become no use if you include all
5 that. Instead, they have depicted a
6 simplified form by erasing all the
7 examples and only give one example. But
8 the important stuff here is that they
9 also state that they use ambient light.
10 They use ambient light, hence, we have
11 multiple reflectance in different
12 directions. And this is one of many
13 examples of reflected lights.
14 BY MR. ROTHENBERG:
15 Q Reflected Light 134 is one example, and
16 it shows an angle beta being formed with the normal
17 vector?
18 MR. ROZIER: Object to form. Asked
19 and answered several times.
20 THE WITNESS: I would say that is a
21 fair characterization.
22 BY MR. ROTHENBERG:

1 Q And the angle beta of the reflected light
2 with the normal vector is the same angle beta as in
3 the angle formed between the normal vector and the
4 Ambient Light 130; is that correct?
5 MR. ROZIER: Object to form.
6 THE WITNESS: Under the assumption
7 that this ambient light ray depicted in
8 Figure 1 is that -- the only one
9 considered for the moment. So, again,
10 it's one of many examples, but then you
11 have roughly the same beta in the
12 incoming light as the reflected light, as
13 an approximation, because that is also
14 important, as an approximation.
15 BY MR. ROTHENBERG:
16 Q And that's the law of reflection?
17 A That is the law of reflection in theory,
18 because it -- again, it is an approximation. If we
19 are talking about metallic surfaces, that is one of
20 the given examples in the text in the patent, it is
21 roughly correct. It is to close to the correct
22 angle. But if we go back to the substrate that I

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1 discussed previously in papermaking, the papermaking
2 industry, the beta would change from the incoming to
3 the outgoing reflected light.
4 But, again, that's an approximation and
5 this is a useful image. It is a useful figure in
6 this context.
7 Q And what does Reflected Light 134
8 represent?
9 MR. ROZIER: Object to form. The
10 document speaks for itself.
11 THE WITNESS: 134 represent one of
12 the assumed reflected light rays in this
13 context. One of many relevant reflective
14 light rays.
15 BY MR. ROTHENBERG:
16 Q Could you please read the sentence
17 starting at Line 51.
18 A In my --
19 Q In Column 6.
20 A In Column 6. Again, line -- sorry. I
21 didn't --
22 Q Line 51.

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1 A Fifty-one: The Reflected Light 134 is
2 preferably directed or aimed so as to cross an Image
3 Display Plane 140, which is spaced apart at Height H1
4 above or away from the Substrate Surface 112 and
5 Reflected Surface 124, which may be substantially
6 co-planar due to the small thickness of the Body 124
7 at a location. XYZ coordinates may be defined, this
8 location, relative to the Surface 112 and 134,
9 coinciding with for defining one of the plurality or
10 Written Pixels 142 of an image displayed by the
11 Assembly 100 in the Plane 140. While not shown, a
12 plurality of other micro mirrors configured
13 similar or -- similar to Micro Mirror 120 would also
14 reflect their receipt ambient light to the point
15 Pixel 142 in the Plane 140. A plurality of
16 reflective light beams from micro mirrors would
17 intersect at the point Pixel 142 so as to provide a
18 point source of light at 142 in a viewable by the
19 Viewer 102.
20 Q So when it says the reflected light is
21 preferably aimed -- directed or aimed to coincide
22 with the location of the pixel, you'd agree that's

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1 done by orienting the micro mirror normal vector,
2 right?
3 MR. ROZIER: Object to form.
4 THE WITNESS: I would say that that
5 is a fair description.
6 BY MR. ROTHENBERG:
7 Q I'm just fundamentally asking how this
8 would be understood.
9 So you have a normal vector of a mirror.
10 You'd have a pixel, reflected light. The normal
11 vector produces -- has some sort of surface normal.
12 The reflective light forms an angle beta with the
13 normal vector. And by the law of reflection, ambient
14 light that also has an angle beta with the normal
15 vector, produces that reflected light towards the
16 pixel; is that a fair summary?
17 MR. ROZIER: Object to form.
18 Compound, vague.
19 THE WITNESS: I would say that that
20 is a fair description, yes.
21 BY MR. ROTHENBERG:
22 Q And earlier you mentioned that a POSITA

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1 would understand that not all the rays of ambient
2 light are shown in this picture, right?
3 MR. ROZIER: Object to form.
4 THE WITNESS: I would say that is a
5 fair statement.
6 BY MR. ROTHENBERG:
7 Q Would you also understand there would be
8 other incoming rays at angle beta that would strike
9 the entire surface and not just that center point?
10 MR. ROZIER: Object to form.
11 THE WITNESS: I would say that is a
12 reasonable assumption.
13 BY MR. ROTHENBERG:
14 Q And if those other rays were also an
15 angle beta -- understanding that there's many other
16 rays not at angle beta, but those other rays that are
17 angle beta, if those other ambient rays are angle
18 beta, they would also be reflected towards the pixel?
19 MR. ROZIER: Object to form.
20 THE WITNESS: I will say that's a
21 reasonable assumption.
22 BY MR. ROTHENBERG:

1 Q Do you think you can annotate Figure 1 to
2 show that?
3 A Sorry. Again, what would you like me to
4 do?
5 Q So I'd like you to show to -- with the
6 understanding that we just agreed that that Incoming
7 Ray 130 is a simplification of the other Incoming
8 Rays 130 that would strike that surface and form the
9 pixel, could you depict a more accurate
10 representation of that?
11 A So, yeah, I assume I can do that.
12 Q You can just draw on the --
13 A Sorry. You mean I can take another
14 direction here?
15 Q No. Other -- other rays at angle beta.
16 So we just agreed --
17 MR. ROZIER: Dr. Lindstrand, if you
18 understand what he's asking you to do,
19 you can. If he's asking you to draw how
20 you understand this, you can draw
21 whatever you feel is proper to draw. You
22 don't need to draw what he instructs you

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1 to draw.
2 That's an improper question.
3 THE WITNESS: If you asked me to
4 draw other incoming light in the
5 direction of beta, then I misunderstood
6 your question. If you asked about other
7 rays in the beta direction. Was that
8 your question? What was --
9 BY MR. ROTHENBERG:
10 Q So that image, as you've said, is showing
11 a single ray at an angle beta, correct?
12 A Correct.
13 Q Which is an approximation. It's not in
14 actuality how the ambient light would appear.
15 You also agree the ambient light would
16 not just strike the center of the surface, it would
17 strike the entire surface, correct?
18 MR. ROZIER: Object to form.
19 Mischaracterizes testimony, relevance.
20 THE WITNESS: I would say that that
21 is a fair and accurate description.
22 BY MR. ROTHENBERG:

1 Q So can you depict an Incoming Ray 30 that
2 strikes this portion of the mirror?
3 MR. ROZIER: Objection to
4 relevance.
5 I'd like the record to note that
6 counsel is pointing at the figure and
7 attempting to show the witness where to
8 draw a line. It's an improper question.
9 BY MR. ROTHENBERG:
10 Q Maybe I could --
11 A I mean, it's possible to draw different
12 incoming light rays as an example, light rays omitted
13 in this simplified figure. Now you would like me to
14 draw another light ray?
15 Q Let me ask it a different way. It's not
16 meant to be a confusing question.
17 Do you see Written Pixel 142 in Figure 1?
18 A 142? Yeah.
19 Q And Written Pixel 142 has a given width
20 in whatever dimension Figure 1 is showing, right?
21 MR. ROZIER: Object to form.
22 Relevance, vague.

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1 THE WITNESS: I would say that is a
2 fair characterization.
3 BY MR. ROTHENBERG:
4 Q Written Pixel 142 is a voxel, correct?
5 A It is an information that has to deal
6 with volume.
7 Q So as a voxel, it has a width, a height
8 and a depth, it has three dimensions, right?
9 MR. ROZIER: Object to form.
10 THE WITNESS: I would say that is a
11 fair characterization.
12 BY MR. ROTHENBERG:
13 Q The reflected ray shown as 134 only
14 strikes the center of the Pixel 142; is that a fair
15 description of Figure 1?
16 MR. ROZIER: Object to form.
17 Scope, relevance, mischaracterizes the
18 document.
19 THE WITNESS: In this simplified
20 figure, it hit the center of the Written
21 Pixel 142.
22 BY MR. ROTHENBERG:

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1 Q So can you explain and annotate, if
2 helpful, how the reflected light forms the entire
3 volume of Pixel 142 and not just the center point?
4 MR. ROZIER: Object to form.
5 Relevance, scope.
6 THE WITNESS: In order to
7 understand this, you have to understand
8 that here you have information
9 processing. So when you say that you
10 have a depth of a pixel, that is the
11 voxel or information volume. You have
12 more information that you have in the
13 solo pixel. You have additional
14 information.
15 And as they have stated that the
16 application is within the area of ambient
17 light, then in this context you have
18 inclination information. You have
19 information about the ambient light in
20 this written pixel. Again, ambient
21 light, light coming from a different
22 direction. They say that the written

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1 pixel is a volume entity, hence,
2 characterizing and able to handle the
3 light coming from different directions.
4 BY MR. ROTHENBERG:
5 Q Would those light from different
6 directions strike this mirror and form this pixel?
7 MR. ROZIER: Object to form.
8 Scope, relevance.
9 THE WITNESS: I would say that the
10 ambient light coming from different
11 directions are handled within the concept
12 of the voxel.
13 BY MR. ROTHENBERG:
14 Q Can you -- can you draw other rays that
15 would strike this micro mirror and form this pixel?
16 MR. ROZIER: Objection. Relevance,
17 scope, vague.
18 If you understand the question, you
19 can try.
20 THE WITNESS: If the question is
21 how would the written pixel handle
22 information about light rays in other

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1 direction than the beta angle?
2 BY MR. ROTHENBERG:
3 Q Or the same beta. Any other -- it's your
4 opinion there's many other rays and only this one is
5 shown in Figure 1?
6 A Uh-huh. I --
7 Q I'm asking you, any other rays that are
8 present that would strike this mirror and form this
9 pixel, please annotate the figure to show what those
10 would look like.
11 MR. ROZIER: Objection. Vague,
12 scope, relevance, physically impossible.
13 THE WITNESS: I would say, now we
14 are --
15 MR. TENNANT: Is that an objection?
16 Is the claim possible?
17 MR. ROTHENBERG: He's using his
18 finger to --
19 MR. TENNANT: We can call the
20 Board. I'm tired of --
21 MR. ROZIER: You're not deposing
22 him. We can call the Board. You're not

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1 deposing him.
2 MR. TENNANT: If you keep on these
3 speaking objections --
4 MR. ROZIER: If you keep talking,
5 we can call the Board. You could have
6 taken the deposition, but you chose not
7 to.
8 MR. TENNANT: We'll call the Board
9 for you to stop these speaking
10 objections.
11 MR. ROZIER: Okay. We can call
12 them on the break.
13 THE WITNESS: As I understand this
14 figure, now we are really into the
15 details on the configuration of how the
16 exact implemented. I can speculate and I
17 can give you example of a potential
18 interpretation given my background.
19 And one interpretation about --
20 among different interpretation, is that
21 you have different light rays parallel to
22 this example, Ambient Light Ray 130, that

1 fall into the area of the micro mirror.
2 All those end up in the written pixel
3 area within that space. That is an
4 approximation. That is the image
5 resolution limits.
6 So all those incoming light rays
7 are interpreted as the same. It doesn't
8 give you information about where on the
9 micro mirror it hits.
10 BY MR. ROTHENBERG:
11 Q Can you please draw some of those?
12 A I can give -- that is one stream and
13 another stream here (indicating), all parallel. That
14 is parallel with that (indicating) and parallel with
15 that (indicating). And now we are discussing
16 different examples of light rays with the exact same
17 angle of incidence, beta.
18 And then we have other ambient light
19 directions where you have small differences. You
20 have beta prime, and then you have beta prime in the
21 reflectance. And then you have to handle that, and
22 that becomes the additional dimension of the written

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1 pixel. So that's where you have the depth of the
2 written pixel.
3 So the small angular differences, that
4 becomes useful information in the written pixel.
5 That is the additional dimension. But the spatial
6 difference of where the parallel light instance is,
7 that is not useful information. That is -- it
8 becomes a mean value of the written pixel.
9 Q Okay. So --
10 A Again, I do not know exactly how they
11 have implemented this, but that is one possibility of
12 how to implement Figure 1 in an image-forming system.
13 Q Okay.
14 A In my opinion.
15 Q Thank you.
16 MR. ROTHENBERG: I'd like to submit
17 this as -- we'll give you another fresh
18 copy, but if we could take this. Thank
19 you. Exhibit 1051.
20 (Lindstrand Deposition Exhibit No.
21 1051 was marked for the record, later
22 remarked as Exhibit 1054.)

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1 BY MR. ROTHENBERG:
2 Q Just to finish up this discussion of
3 Figure 1.
4 So it's understood in Figure 1 that there
5 would be other micro mirrors besides this one --
6 MR. ROZIER: Object to the form.
7 BY MR. ROTHENBERG:
8 Q -- that would form this pixel?
9 MR. ROZIER: Object to form.
10 BY MR. ROTHENBERG:
11 Q And I can read you the --
12 MR. ROZIER: Sorry. I'm sorry. I
13 didn't know you WERE --
14 MR. ROTHENBERG: No, that's okay.
15 THE WITNESS: Sorry. Did you say
16 on what page?
17 BY MR. ROTHENBERG:
18 Q Yeah. So Line 59, Column 6.
19 A Fifty-nine, Column -- now it's in the
20 reverse. Fifty-nine, yep.
21 Q It says: While not shown, a plurality of
22 other micro mirrors configured similar to 120 would

1 also reflect ambient light to the point Pixel 142.
2 Did I read that right?
3 A Yes, I would agree you read that
4 correctly.
5 Q And so when you have these plurality of
6 other mirrors all aiming towards Pixel 142, the
7 reflected light would superimpose upon Pixel 142 to
8 form the voxel; is that a fair description?
9 MR. ROZIER: Object to form.
10 Relevance, scope.
11 THE WITNESS: I would say that, as
12 described in the patent, the micro
13 mirrors are contributing to forming this
14 pixel. So that is an essential
15 characteristics of this patent, that you
16 have multiple micro mirrors contributing
17 to each image-forming pixel.
18 BY MR. ROTHENBERG:
19 Q And would the reflected light of each
20 intersect or superimpose -- you can use the words, I
21 don't want to speak for you -- but I'm trying to
22 understand how the voxel is formed at the

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1 intersection of the different micro mirrors'
2 reflected light.
3 A I do not read how to -- how the
4 contribution is formed. All I have stated, that we
5 have multiple micro mirrors that contribute. They
6 are reflecting light. So at each pixel you have
7 different contributions of light energy sourcing from
8 the different micro mirrors that are directed to this
9 specific image pixel.
10 But exactly how the contribution is
11 generated, I haven't addressed it in my declaration.
12 It may be done in different ways, but I haven't
13 addressed that.
14 Q And if you look at -- turn the page to
15 Column 7, around Line 20 it says that: The length of
16 the micro mirrors is typically around 35-microns,
17 such as 50, often in the range of 40 to 60-microns.
18 Did I read that correctly?
19 MR. ROZIER: Object to form.
20 Mischaracterizes the document.
21 THE WITNESS: I -- I would say
22 that's a fair description of the section,

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1 yeah.
2 BY MR. ROTHENBERG:
3 Q Does that length of micro mirror define
4 the volume, or I think you used the term resolution
5 earlier, of the voxel?
6 MR. ROZIER: Objection. Vague,
7 relevance, form.
8 THE WITNESS: I'm just reading the
9 sentences before it so as to value the
10 context of this.
11 No, not necessarily. The size of
12 resolution of the micro mirrors do not
13 necessarily -- it is not necessarily the
14 same as the resolution of the voxel. It
15 may be the same, but it can be smaller or
16 larger depending on the application.
17 BY MR. ROTHENBERG:
18 Q Would you agree, if you have plurality of
19 micro mirrors, all things the same, if you have
20 10-micron micro mirrors versus 100-micron micro
21 mirrors, the size of the voxel of the 100-micron
22 micro mirrors would be larger than the 10?

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1 MR. ROZIER: Object to form. Scope
2 and relevance.
3 THE WITNESS: I may define an
4 application where there -- that is not
5 true. If you have, for instance,
6 100-micron micro mirrors and you have the
7 image formation a smaller size, then you
8 have spaces between those image-formation
9 pixels. I have seen the useful
10 application of that.
11 But, in theory, you can end up with
12 different resolutions of the micro
13 mirrors and the voxels. They need not to
14 be the same. They may be the same. It
15 may be favor -- favorable to have the
16 same in order to conserve as much light
17 energy as possible. But if you ask me is
18 it a given that they indeed are the same,
19 I would say no.
20 BY MR. ROTHENBERG:
21 Q I guess my question was more is it not
22 necessarily the same, but is it -- in general, do

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1 larger mirrors produce larger voxels, all things
2 given otherwise the same?
3 MR. ROZIER: Object to form.
4 Relevance, scope.
5 THE WITNESS: Assuming you have
6 no -- I mean, the general answer is that
7 they may be the same, but I gave you an
8 example where they're not the same.
9 MR. ROTHENBERG: Okay. Take a
10 break?
11 THE WITNESS: Sure.
12 (Brief pause.)
13 BY MR. ROTHENBERG:
14 Q So I'd like to move onto your opinions
15 regarding the limitation: Further in response to
16 receiving the ambient light, the array of micro
17 mirrors displays a second image in a second plane,
18 spaced a distance apart from the plane displayed in
19 the image.
20 A On Page 20?
21 Q Twenty, yep.
22 And your opinions regarding this

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1 limitation are from Paragraph 59 through 71?
2 A True.
3 (Lindstrand Deposition Exhibit No.
4 1052 was marked for the record.)
5 BY MR. ROTHENBERG:
6 Q I'd like to introduce 1052. I'll give
7 you time to review this document.
8 A Yes. I've finished.
9 Q Whenever you've had a chance to look at
10 it. Are you finished?
11 A Yeah.
12 Q Okay. Does this document appear to you
13 as a dictionary definition of the term hyperplane?
14 MR. ROZIER: Objection. Scope,
15 form.
16 THE WITNESS: I see no obvious
17 problems with the description in this
18 document.
19 BY MR. ROTHENBERG:
20 Q And what is the definition of hyperplane
21 given here?
22 A If I read from the document: The

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1 sub-space of a vector space that has dimension one
2 less than the dimension of the vector space.
3 Q Does this definition agree with your
4 understanding of a hyperplane?
5 MR. ROZIER: Object to form.
6 THE WITNESS: I use the hyperplane
7 concept as a higher order description of
8 a surface, such that you have at least
9 one dimension more than the X and Y
10 dimension of the pixel. So it may be --
11 it may be included in this definition,
12 but I assume that there are other
13 definitions of hyperplane.
14 In my context, I mean something --
15 something more than just the pixel
16 information. You have a volume of
17 information. The pixel, XY dimension,
18 but it's not only X and Y.
19 You have additional information
20 related to, for instance, inclination in
21 terms of ambient light. I don't see that
22 this contradict. It may be the same, but

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1 I -- it may be possible to give an
2 example that contradict my
3 interpretation. But I -- I would guess
4 that you can find different type of
5 definition. I would say this may or may
6 not be the standardized definition of the
7 term "hyperplane."
8 (Lindstrand Deposition Exhibit No.
9 1053 was marked for the record.)
10 BY MR. ROTHENBERG:
11 Q Okay. I'd like to introduce Exhibit
12 1053. Can you please read the first sentence of the
13 second page.
14 A A hyperplane is a flat affine sub-space
15 of one dimension less than its ambient space. In an
16 N-dimensional space, a hyperplane has 1 minus 1 -- N
17 minus 1 dimensions. It can be defined by linear
18 equation.
19 Q Does this definition agree with your
20 understanding of a hyperplane?
21 MR. ROZIER: Object to the form.
22 Scope and relevance.

1 THE WITNESS: I see no obvious
2 reason to contradict this. It is a fair
3 description of what I assume is a
4 hyperplane.
5 BY MR. ROTHENBERG:
6 Q So in -- in 2D space, a hyperplane would
7 be a line. In 3D space, a hyperplane would be a
8 plane. In 4D space, a hyperplane would be three
9 dimensions, and so on and so forth.
10 Is that your understanding?
11 MR. ROZIER: Object to form. Scope
12 and relevance.
13 THE WITNESS: According to this
14 definition, you reduce the dimension by
15 one, but I would not say that this is the
16 only -- you have given me two definitions
17 of -- two documents that define
18 hyperplane. I cannot say that there are
19 not other definitions that are equally
20 relevant, but I have no specific
21 objections on your definitions. They
22 are -- they are fair, to my opinion.

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1 BY MR. ROTHENBERG:
2 Q Okay. What definition of hyperplane
3 would you apply in your analysis?
4 A As I said, it is a higher information
5 concept relative to the pixel. It is not a pixel
6 bare limit. It is a pixel with additional
7 information. The three-dimensional pixel would be a
8 hyperplane in this context.
9 If you assume this definition, then I
10 implicitly say that we have reduced information. We
11 have -- we started with fourth dimension information.
12 But I would say that -- in the context of my
13 declaration, that is of less relevant to what was the
14 initial information volume. But in my context, I
15 stated that the pixel, the two-dimensional pixel, is
16 not information enough. That would fail to define
17 the relevant concept defined in the patent. You have
18 to have more information. You have three
19 dimensional.
20 That is the concept that I -- that is the
21 background and the concept of hyperplane that I use.
22 Q Is that your definition that you came up

1 with or is that an ordinary definition that you'd
2 expect to find in a dictionary like this one?
3 MR. ROZIER: Object to form. Scope
4 and relevance.
5 THE WITNESS: To the best of my
6 recollection, I have -- I have met the
7 usage of hyperplane in that context, but
8 I see -- don't see that it contradicts
9 any of the two documents that you present
10 here.
11 To the best of my opinion, it is of
12 less relevance in this context. In my
13 opinion, what is relevant is that it is
14 not barely a two-dimensional concept. It
15 is more than two dimensional. It is
16 three dimensional, and that is necessary
17 for the patent, an image information
18 volume.
19 BY MR. ROTHENBERG:
20 Q Does the patent refer or discuss
21 hyperplanes?
22 MR. ROZIER: Objection. Vague,

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1 relevance.
2 THE WITNESS: Would you like me
3 to -- I cannot recollect that detail
4 here. Would you like me to read the
5 patent?
6 BY MR. ROTHENBERG:
7 Q I can represent that it doesn't use that
8 term.
9 Is your opinion that hyperplanes are
10 relevant to this patent based on any particular
11 teachings of the patent?
12 MR. ROZIER: Objection. Vague,
13 relevance.
14 THE WITNESS: What is relevant in
15 this context is my interpretation and my
16 usage of the hyperplane as I have been
17 taught, and that is that hyperplane is a
18 higher information concept, as I
19 describe, two or three -- not only
20 two-dimensional, but three-dimensional
21 information concept, and that is
22 necessary.

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1 So, in the patent, they are
2 referring to this depth of information
3 and, hence, it's necessary to store and
4 to make use of the three-dimensional
5 information volume.
6 BY MR. ROTHENBERG:
7 Q What do you mean, the information of the
8 pixel?
9 MR. ROZIER: Object to form.
10 Relevance.
11 THE WITNESS: The information
12 attributed to a pixel is typically the
13 intensity. If it is a gray -- a gray
14 scale representation is only one
15 information -- information unit, so to
16 say. You have gray scale information.
17 If it's color space, you can represent
18 that with three dimensional. If you add
19 to that the angle dimension, then you add
20 another dimension.
21 So the image representation is
22 dependent upon the application. To say

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1 that it's a color application and the
2 angular information is important, then
3 you have four-dimensional information
4 adding to the X and Y dimensional
5 position of the pixel.
6 So it depends on the application,
7 but talking about the depth of an image,
8 then you have to have some information of
9 the position of the -- that specific
10 information unit in terms of depth of the
11 intended image. So that is one
12 representation of the information.
13 BY MR. ROTHENBERG:
14 Q Can you identify where in the '294 patent
15 information of pixels is discussed?
16 MR. ROZIER: Objection. Relevance,
17 scope.
18 THE WITNESS: This (indicating) is
19 one representation or one example.
20 BY MR. ROTHENBERG:
21 Q Can you state for the record what you're
22 pointing to?

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A Yes. Sorry. On Page 1 of the patent.
Q The cover page?
A Cover page.
Q Okay.
A That is one example, all read on the first page, that this information about the depth and the inclination of the reflected light from the micro mirrors are relevant. Yeah.
Q So going back to this claim limitation, Page 120 of your declaration.
A Yes. I'm there.
Q The term "plane" is used in the claim; is that right?
A Are you reading from Paragraph -- where is it?
Q Fifty-nine, or the heading right above it.
A Yes.
Q So what meaning did you apply to the term "plane," if any?
MR. ROZIER: Object to scope.
THE WITNESS: It is the position of

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1 the image as it appears to an observer.
2 BY MR. ROTHENBERG:
3 Q But did you -- did you consider the
4 ordinary meaning of it or a particularized meaning?
5 A I read that in the context of the patent,
6 application of the patent, and how they describe that
7 the micro mirrors contribute to the specific pixels.
8 And how --
9 Q And how does the patent -- sorry. Go
10 ahead.
11 A And how -- exactly how the image is
12 formed, I do not know, but they describe this as
13 image formation with different planes. And then I
14 interpret that as the position where the image is
15 formed, as perceived by an observer.
16 Q Does the patent describe any
17 three-dimensional planes?
18 MR. ROZIER: Object to form.
19 Relevance, vague.
20 THE WITNESS: Can you state the
21 question, again, please.
22 BY MR. ROTHENBERG:

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1 Q Are there any examples in the '294 patent
2 of three-dimensional planes?
3 MR. ROZIER: Object to relevance.
4 Scope, vague.
5 THE WITNESS: Sitting here, I
6 cannot recollect that they refer to that
7 exact term, but I read the patent that
8 the depth from the volume is essential to
9 the patent. If they use the exact term
10 or not, I cannot recollect sitting here.
11 BY MR. ROTHENBERG:
12 Q So let's talk about -- could you put the
13 pages in order of --
14 A Yeah, I was beginning to do that.
15 Q At the bottom, it says Page -- all the
16 page numbers on the bottom left?
17 A Yes.
18 MR. ROZIER: I'm happy to do it if
19 you'd like.
20 THE WITNESS: Yeah.
21 MR. TENNANT: You're struggling
22 over there with too many papers.

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1 BY MR. ROTHENBERG:
2 Q Go to Paragraph 75 of your declaration.
3 Seventy-five through 84 are your opinions with regard
4 to the limitation: Wherein each of the sets of micro
5 mirrors are selected randomly from a plurality of
6 micro mirrors located in a base of a cone on a
7 surface containing the array of micro mirrors.
8 Is that correct?
9 A That is correct.
10 Q I'd like you to -- either internally or
11 out loud, if you want to just re-read your opinion
12 about -- in Paragraph 76, just to refresh yourself.
13 I'd like to ask you about it.
14 A It's okay to read to myself?
15 Q Yes.
16 A Yes.
17 Q I'd like to ask about your conclusion in
18 the last sentence that says: When read in context,
19 Claim 3 requires that each of the micro mirrors that
20 form each of -- that form each set of pixel-producing
21 micro mirrors is selected randomly from the available
22 micro mirrors located in the base of the cone for

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1 that particular set of micro mirrors.
2 Did I read that correctly?
3 A Yes, you read it correctly.
4 Q So we're stepping back.
5 We all acknowledge a set of micro mirrors
6 is a plurality that produces a given pixel, and then
7 there's multiple sets that produce each of the
8 plurality of pixels, correct?
9 MR. ROZIER: Object to form.
10 Mischaracterizes the declaration.
11 BY MR. ROTHENBERG:
12 Q I'm just talking about the claim
13 language. Do you want me to walk you through the
14 claim or did that -- do you agree with that
15 characterization?
16 A Roughly, that was a fair
17 characterization, I would say.
18 Q So is it your opinion that each single
19 individual micro mirror must be selectively -- must
20 be selected randomly to satisfy this limitation, or
21 is it your opinion that each set of micro mirrors
22 must be selected randomly to satisfy this limitation?

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1 MR. ROZIER: Object to form.
2 THE WITNESS: As I stated in my
3 declaration, each set of micro -- of the
4 pixel-producing micro mirrors is selected
5 randomly. So it's the set of micro --
6 pixel-producing -- sorry. I have to read
7 it again.
8 MR. ROTHENBERG: Take your time.
9 THE WITNESS: Yeah. As stated
10 here, the micro mirrors should be
11 selected randomly. And you asked if the
12 set, instead, was selected randomly. And
13 I cannot -- I cannot answer that sitting
14 here. It would be less restricted form
15 of selection. Is it possible that that
16 also would work? I would -- I would
17 say -- now I'm speculating. I would say
18 that it's less robust, it's a less rigid
19 claim.
20 But what I've stated in my
21 declaration is definitely true and, other
22 than that, we become speculation. It may

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1 or may not work with a less rigid rule.
2 So you -- you put less restriction on the
3 selection process, it may work, but I
4 cannot say if it would work.
5 BY MR. ROTHENBERG:
6 Q Okay. And setting aside if it would work
7 or not work, and I don't want you to speculate, I'm
8 more just asking, when you read the claim sitting
9 here today, do you read it as requiring random
10 selection of each individual micro mirror or random
11 selection of each set of micro mirrors?
12 MR. ROZIER: Objection. Vague,
13 scope.
14 THE WITNESS: To give it perfectly
15 correct -- because the declaration is
16 what I've reviewed many times. So when
17 read in context: Claim 3 requires that
18 each of the micro mirrors that form each
19 set of pixel-producing micro mirrors is
20 selected randomly from the available
21 micro mirrors located within the base of
22 the cone that -- for that particular set

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1 of micro mirrors.
2 So here I have stated that the
3 selection of micro mirrors should be
4 random.
5 BY MR. ROTHENBERG:
6 Q The individual micro mirrors selection?
7 A Correct.
8 MR. ROZIER: Object to form on that
9 last question, please.
10 BY MR. ROTHENBERG:
11 Q That was how we interpreted the sentence,
12 but we were just wanting to confirm.
13 Paragraph 80 says that -- talks about
14 micro mirrors having the same width and arranged in
15 even increments next to each other, laid out in a
16 regular grid, with identical lengths and widths.
17 And that's that figure shown on the next
18 page, as well.
19 Do you see that?
20 A I see that.
21 Q So is it your opinion that laying micro
22 mirrors out in a regular grid indicates no random

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1 selection?
2 MR. ROZIER: Object to form.
3 Relevance.
4 THE WITNESS: I would say that it
5 indicates nothing with regard to the
6 selection process, whether random or
7 non-random. It doesn't tell.
8 BY MR. ROTHENBERG:
9 Q So what's the purpose of Paragraph 80
10 with respect to your opinion about this claim
11 limitation?
12 MR. ROZIER: Objection. Vague,
13 form.
14 THE WITNESS: I would say that this
15 is -- the Paragraph 80 is a means to
16 describe the full context of FUS '925.
17 In Paragraph 79, I disagree. I state
18 that I disagree with Dr. Hesselink, his
19 opinion that FUS '925 teaches a suggested
20 random selection of mirrors. And
21 Paragraph 80 is a way to describe the
22 regular patent -- it is a way to describe

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1 the full picture.
2 We see no random selection. It
3 doesn't -- it isn't mentioned. It isn't
4 implied or -- and in order to claim that
5 reasonable, I gave Paragraph 80 as to be
6 complete or give a fuller description of
7 the context. It's not super relevant,
8 but it is a way to build on my position
9 in Paragraph 79.
10 BY MR. ROTHENBERG:
11 Q Okay. But you'd agree you can randomly
12 select micro mirrors that are in a regular grid
13 pattern? There's nothing inherently contradictory
14 about that?
15 A It's nothing inherently contradicting in
16 that.
17 Q And in Paragraph 83, you note that:
18 Every one of the mirrors in FUS '925 was used to
19 reflect light for images created by FUS 925's optical
20 security feature.
21 Is that -- did I read that correctly?
22 A You read that correctly.

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1 Q Why does using every micro mirror in an
2 array indicate the micro mirrors are not selected
3 randomly?
4 MR. ROZIER: Object to form.
5 Mischaracterizes the document.
6 THE WITNESS: I'm not sure I
7 understand the question.
8 BY MR. ROTHENBERG:
9 Q So you point out that FUS '925 -- in FUS
10 '925 every one of the micro mirrors is used to
11 reflect light. And then in the next sentence you
12 say: FUS '925 does not disclose any selection of a
13 subset of micro mirrors.
14 Is it your opinion that this claim
15 limitation requires only a selection of a subset of
16 micro mirrors?
17 MR. ROZIER: Object to form.
18 Vague.
19 THE WITNESS: Given that the
20 application of the patent issued in -- is
21 used in diffusive light environment, it
22 is an essential feature of the patent, of

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1 the '294 patent, that they don't use
2 every micro mirrors to contribute to the
3 image.
4 That is one aspect, and the other
5 aspect, that the selection is done
6 randomly. That is a way of being -- of
7 being robust in terms of light condition.
8 That is an essential feature of the -- of
9 the '9 -- sorry -- the '294 patent.
10 What I argue in Section -- in
11 Paragraph 83 is that the FUS '925 use
12 every pixel, hence, the robustness cannot
13 be -- it is not a robust construction as
14 they use every pixel to form the image.
15 I see there's an inherent deficit or
16 drawback with FUS '925.
17 BY MR. ROTHENBERG:
18 Q Do you mean -- when you say a "selection
19 of a subset," does that mean for a particular image
20 or is it in total for the -- for any image?
21 A To the best of my recollection, I would
22 say that it is a general feature -- that it is a

1 general feature irrespective of the particular image.
2 It's not dependent of the specific image that you
3 would represent. It is rather related to the
4 characteristics of the light conditions where you aim
5 the application of the patent.
6 So, yeah, as it is a diffusive light
7 condition, then these -- this configuration of using
8 only a subset of micro mirrors make the invention
9 more robust in this sense. It can handle different
10 light settings in a more beneficial way.
11 Q I guess what I'm trying to clarify is
12 when you say a subset are selected, does that mean --
13 let's say you have image -- you have an array of
14 micro mirrors and they're producing Image A and Image
15 B.
16 Are you saying there are some -- when you
17 select only a subset, there are some micro mirrors
18 that are not selected for either A or B, they're
19 completely unused, or are you saying, when you select
20 a subset, it's a subset for Image A and a subset for
21 Image B, but together they can comprise all of the
22 micro mirrors?

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1 MR. ROZIER: Object to form.
2 Compound.
3 THE WITNESS: I haven't addressed
4 that. So both possibilities may be
5 possible in this application, in this
6 patent. What is important is -- what is
7 defined is the contributional micro
8 mirrors to every given pixel. So for
9 every given pixel, the essential part is
10 that you select the micro mirrors on the
11 random basis and you don't use every
12 micro mirrors -- micro mirrors for
13 contributing to that pixel.
14 So the -- not using every micro
15 mirrors and the random selection together
16 is part of the basis for -- for
17 contributing to the robustness of the
18 solution. Especially relevant when
19 talking about diffusive light.
20 BY MR. ROTHENBERG:
21 Q When you read the claim language shown on
22 Page 24, what explicitly in the claim language

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1 requires that?
2 MR. ROZIER: Object to form.
3 Vague.
4 THE WITNESS: In this section, the
5 important part, in my opinion, is the
6 random selection of the plurality of the
7 micro mirrors. I mean, the random
8 selection is the vital part, referring to
9 what -- what I described previously.
10 BY MR. ROTHENBERG:
11 Q Just to clarify, when you say "selection
12 of a subset," at the very top of Page 27 -- do you
13 see that?
14 A I see that, yes.
15 Q "A selection of a subset of micro
16 mirrors," do you mean a selection for a given pixel,
17 a given image, all the images? Can you clarify what
18 you mean by a subset?
19 MR. ROZIER: Object to form.
20 Compound.
21 THE WITNESS: In this context, the
22 subset referred to the formation of the

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1 pixel and selection of the subset of
2 micro mirrors, whether random or
3 otherwise, in the context of formation of
4 the image pixel. So you do not end up
5 with all the micro mirrors contributing
6 to one single pixel. That is my
7 statement there.
8 MR. ROTHENBERG: Okay. I think we
9 can take a break.
10 (Brief pause.)
11 MR. ROTHENBERG: Exhibit 1051 has
12 been restamped as Exhibit 1054.
13 (Lindstrand Deposition Exhibit No.
14 1054 was marked for the record.)
15 MR. ROTHENBERG: That concludes our
16 examination.
17 THE WITNESS: Thank you.
18 MR. ROZIER: We -- sorry. We may
19 need a little break. I may have some
20 short redirect.
21 (Brief pause.)
22 MR. ROZIER: This is -- I'll

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1 introduce myself. This is Matt Rozier
2 for patent owner Lumenco, doing redirect
3 of the witness.
4
5 EXAMINATION
6 BY MR. ROZIER:
7 Q Dr. Lindstrand, counsel earlier asked you
8 some questions about whether the description of the
9 '294 and '191 patent used the term "voxel."
10 Do you remember that?
11 A I remember that.
12 Q Do the '294 and '191 patent use the term
13 "voxel"?
14 MR. ROTHENBERG: Object to form.
15 Vague.
16 THE WITNESS: Can I answer?
17 The patent used the term "voxel."
18 It is used in the claim.
19 BY MR. ROTHENBERG:
20 Q Do you understand what the, quote,
21 description of a patent is?
22 A Now, I realize that there is a former

1 version of the patent. That was the reason why I was
2 a bit confused and puzzled. So that was the reason
3 why I didn't -- I didn't recall what was referred in
4 the description of the document you refer to. But in
5 the patent, I know that it is referred to.
6 Q Okay. Switching gears. Counsel asked
7 you some questions about hyperplanes.
8 Do you remember that?
9 A I remember that.
10 Q And he showed you a couple of definitions
11 of hyperplanes.
12 Do you remember that?
13 A Yes, I remember that.
14 Q Had you seen those documents before
15 today?
16 A I have not.
17 Q And I believe you discussed hyperplanes,
18 for example, in Paragraph 63 of your declaration; is
19 that correct?
20 A Sixty-three, yes, that is correct.
21 Q In your declaration, what do you mean
22 when you discuss hyperplanes?

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1 MR. ROTHENBERG: Object to form.
2 Vague.
3 THE WITNESS: As I said in
4 Paragraph 63, a POSITA would understand
5 that planes, like images, can be
6 two-dimensional or they can be
7 three-dimensional. That is, they can
8 have depth, in addition to length and
9 width. Three-dimensional planes are
10 sometimes -- sometimes referred to as
11 hyperplanes. So I refer to it as a
12 three-dimensional entity.
13 BY MR. ROZIER:
14 Q Switching gears again, I just want to
15 see -- I forget the exhibit number.
16 A Is it the first one?
17 Q The marked-up figure of the '294.
18 Dr. Lindstrand, counsel earlier asked you
19 to mark up Figure 1 of the '294 patent, and they
20 marked that exhibit, Exhibit No. 1054.
21 Do you remember that?
22 MR. ROTHENBERG: Objection. Object

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1 to form. Hearsay, vague.
2 BY MR. ROZIER:
3 Q And are you -- do you have that figure in
4 front of you?
5 A I have.
6 Q With your -- does that figure have your
7 markups on it?
8 A It does.
9 Q And in that figure, what did you mark?
10 What did you draw into that figure?
11 MR. ROTHENBERG: Object to form.
12 Asked and answered.
13 THE WITNESS: I have marked a few
14 of the multiple possible light rays
15 entering to that micro mirrors, micro
16 mirror.
17 BY MR. ROZIER:
18 Q Would light rays from other angles hit
19 that mirror in a practical application?
20 MR. ROTHENBERG: Object to form.
21 Vague.
22 THE WITNESS: Yes, that is correct.

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As I described, while writing this, light rays may enter to that micro mirror in different directions, including parallel to the light ray written in the original figure, the number 130. We have other -- we have light rays in parallel with that. We have other light rays not parallel to the vector 130.

So we have different types of incident light rays in Figure 1. I have only written a few of the -- all the possible light rays.

MR. ROZIER: Thank you. That's all I have on redirect.

MR. ROTHENBERG: We can go off the record.

MR. ROZIER: Yeah.

(Thereupon, the deposition was concluded at approximately 2:17 p.m.)

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CERTIFICATE OF SHORTHAND REPORTER - NOTARY PUBLIC

I, Tanya L. Verhoven-Page, Reporter and Notary Public within and for the State of Georgia do hereby certify:

That Mikael Lindstrand, Ph.D., the witness whose deposition is hereinbefore set forth, was duly sworn by me before the commencement of such deposition and that such deposition was taken before me and is a true record of the testimony given by such witness.

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

I further certify that the deposition of Mikael Lindstrand, Ph.D. was held at Regus - Spaces Colony Square, 1201 Peachtree Street, N.E., Atlanta, Georgia, on Friday, April 11, 2025, commencing at 9:10 a.m. to 2:17 p.m.

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

IN WITNESS WHEREOF, I have hereunto set my hand this 23rd day of April, 2025.

My commission expires:
April 31, 2026

NOTARY PUBLIC IN AND FOR THE
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