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Transcript of David Kessler, PhD

Date: October 12, 2023

Case: Apple Inc. -v- ImmerVision, Inc., (IPR2023-00472)

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1 UNITED STATES PATENT AND TRADEMARK OFFICE

2
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD

4
5 APPLE INC.

6 Petitioner

7 v.

8 IMMERSION, INC.

9 Patent Owner

10
11 Case IPR2023-00472

12 Patent No. 10,795,120

13
14 Deposition of DAVID KESSLER, PhD

15 Conducted virtually via Zoom

16 Thursday, October 12, 2023 - 7:59 a.m. CST

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21 Reported by: THERESA A. VORKAPIC,

22 CSR, RMR, CRR, RPR

1 Deposition of David Kessler, PhD,
2 conducted virtually via Zoom, pursuant to notice
3 before Theresa A. Vorkapic, a Certified Shorthand
4 Reporter, Registered Merit Reporter, Certified
5 Realtime Reporter, Registered Professional
6 Reporter and a Notary Public in and for the State
7 of Illinois.

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20 ALSO PRESENT:

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P R O C E E D I N G S

THE REPORTER: Would you raise your right
hand, please.

(The witness was duly sworn.)

MR. MURRAY: Thank you.

DAVID KESSLER, PhD,
called as a witness herein, having been first duly
sworn, was examined and testified as follows:

EXAMINATION

BY MR. MURRAY:

Q Thank you. Good morning, Doctor.

A Good morning.

Q Could you please state your full name for
the record.

A David Kessler.

Q And your present business address?

A Right now, 205 East 77th Street, New York,
New York, 10075, Apartment 11-A.

Q Have you ever been deposed before?

A Yes, I did.

Q About how many times?

1 A Twice.

2 Q When was the last time you were deposed?

3 A 2018.

4 Q Have you ever done one of these remote
5 depositions before?

6 A No.

7 Q For all of us since 2020.

8 So I'm just going to go over a couple of
9 quick procedural things just to get started. For
10 purposes of the deposition, if you could answer
11 the questions out loud for the benefit of our
12 reporter. She can't record head nods and things
13 of that sort, so verbal answers are best.

14 If you don't understand a question, please
15 ask me to rephrase it. I'm happy to make sure you
16 understand before you give an answer.

17 Is there any reason that you can't give
18 your full, fair and honest testimony today?

19 A No.

20 Q Do you understand that the oath that you
21 just took is the same as you would in a court of
22 law?

1 A Could you speak a little bit slower.

2 Q Oh, my apologies, sure.

3 Do you understand that the oath that you
4 just took is the same as you would in a court of
5 law?

6 A I do.

7 Q And from time to time, Mr. Holt may object
8 for the record, but unless he instructs you not to
9 answer, please answer the question asked. And I
10 try to go about every hour and take a break at
11 that point, but if you need a break at any time,
12 please let me know. The only thing I ask is that
13 we don't have a question pending at the time we
14 take a break; is that okay?

15 A Okay.

16 MR. MURRAY: Mr. Holt, just for
17 recordkeeping purposes, since everything I plan to
18 use for the deposition already has an exhibit
19 number in the record, I was just going to use
20 those as exhibits numbers for the deposition
21 rather than confuse things with multiple exhibit
22 numbers.

1 Is that okay with you?

2 MR. HOLT: Yes, absolutely.

3 MR. MURRAY: Excellent.

4 So, Mr. Merlo, could you please open
5 Exhibit 1003?

6 (A certain document was marked Kessler
7 Deposition Exhibit 1003 for
8 identification, as of 10/12/2023.)

9 BY MR. MURRAY:

10 Q Dr. Kessler, have you seen this document
11 before?

12 A Yes, I did.

13 Q And, Mr. Merlo, if we could turn to
14 Page 125 which is the last page.

15 Dr. Kessler, did you place the electronic
16 signature on this document?

17 A Yes, I did.

18 Q What is this document?

19 A This document is my declaration.

20 Q And this declaration relates to US Patent
21 No. 10,795,120; is that correct?

22 A Yes, it is.

1 Q Is it all right if I refer to that as the
2 '120 patent for today?

3 A Sure.

4 Q Did you draft this declaration yourself?

5 A Can you repeat the question? Sorry.

6 Q Did you draft this declaration yourself?

7 A Yes, I did.

8 Q The conclusions in this declaration, did
9 you form them independently?

10 A Yes, I did.

11 Q As you sit here today, does this
12 declaration include the complete bases for your
13 opinions in this proceeding?

14 A That's my belief.

15 Q Thank you. What did you do to prepare for
16 today's deposition?

17 A I basically went over my declaration. I
18 went over some of the examples and basically
19 talked to Dave Holt to tell me how do these things
20 work, yeah, the depositions.

21 Q When you say "examples," what examples are
22 you referring to?

1 A Well, I don't remember the numbers, but
2 Thibault paper from 2014, the 180-degree, and
3 the lens that he has there, Miyamoto, that's, I
4 think, example 13. What else? Yeah, the patents
5 by our ground 2 which is Matsusaka, and the patent
6 by Mr. Kim; that's our ground 3. Let's see, what
7 else. And, of course, I read again the '120.

8 Q Thank you. Have you ever done work on
9 behalf of Apple before?

10 A No, I don't think so.

11 Q Have you ever been retained by Fish &
12 Richardson before?

13 A Fish & Richardson. I don't think so.

14 MR. MURRAY: Mr. Merlo, could you please
15 put up Exhibit 1021.

16 (A certain document was marked Kessler
17 Deposition Exhibit 1021 for
18 identification, as of 10/12/2023.)

19 BY THE WITNESS:

20 A Yes, that's my CV, yes.

21 BY MR. MURRAY:

22 Q Could we turn to the last page of the CV,

1 please. Thank you.

2 On this last page you have a heading
3 "Expert witness testimonies."

4 Do you see that?

5 A Yes.

6 Q Under that heading you have two ITC cases
7 listed, correct?

8 A Right.

9 Q These are two cases in which you provided
10 testimony to the ITC?

11 A Correct.

12 Q You testified on behalf of the defendant
13 in both of these cases; is that correct?

14 A 3Shape and MasterImage, yes.

15 Q Was the 3Shape the one in which you were
16 most recently deposed?

17 A Correct.

18 Q What is the 3Shape case about generally?

19 A As it says, Align Technologies, maker of
20 3D systems for the dental industry sued the Danish
21 company 3Shape at the ITC court, and I was on --
22 retained to help 3Shape.

1 Q What was the nature of the testimony you
2 provided in that case?

3 A Basically I showed -- I provided evidence
4 that 3Shape technology is very different from
5 Align Technologies and thus not infringing on
6 Align Technologies.

7 Q Did you provide any testimony regarding
8 validity of any patents in that case?

9 A Some. Though I was not the validity
10 expert, I was asked to help a little bit there.

11 Q When you say you were asked to help, did
12 you actually provide testimony for purposes of
13 validity?

14 A I was actually on the stand at the court
15 cross-examined about this validity issue.

16 Q What was the MasterImage case about
17 generally?

18 A That has to do with 3D cinema projectors
19 where RealD is the leading provider of this
20 technology in the US and in the world, and
21 MasterImage is a Korean company with what we
22 claimed was a different technology. And I was

1 retained by the MasterImage side to show it's a
2 different technology and thus not violating or not
3 infringing on RealD.

4 Q In that case your testimony related,
5 again, to noninfringement?

6 A Yeah.

7 Q Did you provide any testimony in that case
8 about validity?

9 A No.

10 Q Going back to the 3Shape case, do you know
11 whether the ITC adopted any of your testimony in
12 their decision?

13 A As far as I know, yes. Align Technologies
14 wanted to prevent 3Shape from selling in the US,
15 and the ITC did not do that, and basically to a
16 large extent, I didn't go and follow the
17 post-trial, but in my understanding is that 3Shape
18 prevailed.

19 Q And in the MasterImage case, do you know
20 whether the ITC adopted any of your testimony in
21 their decision?

22 A I don't know if it was based on my

1 testimony or not, but the result on this case was
2 not that beneficial for MasterImage.

3 Q Can we go back to Exhibit 1003, please.
4 Could we go to Page 1?

5 If you scroll down to the bottom. Yes,
6 there we go. Yes.

7 And, Dr. Kessler, if you can see here, we
8 have Paragraph 15 of your declaration. This is
9 where you list the -- you begin to list the level
10 of ordinary skill in the art that you determined
11 for this case; is that correct?

12 A Yes.

13 Q According to Paragraph 15, you say that
14 the "person of ordinary skill in the art ... would
15 have had at least a bachelor's degree in physics,
16 optical engineering and/or electrical
17 engineering"; is that correct?

18 A Yes, and the five years' experience.

19 Q It says "at least five years' experience
20 in developing and designing optical imaging
21 systems," correct?

22 A Yes.

1 Q What types of activities would you expect
2 this person would have performed in those five
3 years?

4 A The core of the '120 is actually -- can be
5 defined as optical architecture, a term that is
6 used more and more, but the main issue is to be
7 able to design optical systems, analyze and
8 evaluate and compare different optical systems.

9 Q What do you mean by "optical
10 architecture"?

11 A It is the optical configuration chosen for
12 the task. In the case of lenses, it could be, for
13 example, first of all what kind of lens, how is
14 the lens structured, what groups it has in and of
15 that nature.

16 Q So when you say a person would have at
17 least five years' experience in developing and
18 designing optical imaging systems, in that
19 timeframe, you would expect they would have been
20 designing lenses?

21 A It's not specifically stated. I hope they
22 would have some, but the term "optical

1 engineering" is a very broad term, okay, and it's
2 supposed to include a lot of different things but
3 not always it does. For example, people who do
4 optical coding may call themselves optical
5 engineers where they don't know anything about
6 lenses. That's why the definitions of levels of
7 ordinary skill in the art are many times a little
8 fuzzy, and we keep it this way by saying "related
9 fields" and things like that.

10 Q Why do we keep it fuzzy?

11 A Because it's hard to pinpoint a specific
12 skill. It always is buried under different kind
13 of broad terms; but this definition is broad
14 enough, I think.

15 Q You also state at the top of Page 10 there
16 that the person would "have familiarity with image
17 processing algorithms and optical design
18 software." Do you see that?

19 A Yes.

20 Q What do you mean by "familiarity with"?

21 A Can you repeat that?

22 Q What do you mean when you say "familiarity

1 with"?

2 A Familiarity. Familiarity means that they
3 can use the program or at least know their
4 capabilities and limitations.

5 Q Why would image processing algorithms be
6 relevant to the skill of the art for this patent?

7 A I think it's relevant because at the end
8 of the day, this lens is used together with some
9 imaging -- image processing software to extract,
10 modify, edit to capture the image, enhance certain
11 domain, things of that nature. So you need to
12 have some understanding of the capabilities.

13 Also, there is a lot of image processing
14 knowledge buried within the optical design
15 programs because when you want to analyze -- well
16 I don't want to go into a tutorial, but let's say
17 the fact that in an optical design program, you
18 usually have a merit function. That's where the
19 designer will put all his wishes for the program
20 to fix. Basically by writing a merit function, he
21 is writing algorithms.

22 Q When you say -- I think the word you used

1 was "programs" -- what types of programs are you
2 referring to?

3 A There are two sets of programs. One is
4 called sequential optical design programs. In
5 that case we have Code V, Zemax, a bunch of
6 others, TracePro, then you have another set of
7 programs which can -- sometimes they
8 overlap -- that more intended for use in
9 illumination systems. They're under the category
10 of nonsequential optical design programs, and the
11 counterpart of Code V, the sequential is light
12 tools and Zemax does both and TracePro can do
13 both. The latest on the block is called Thread.
14 So there's a whole bunch of optical design tools
15 that optical designers use.

16 Q In the last sentence in Paragraph 15, it
17 says that: "Additional education in a relevant
18 field, or relevant industry experience may
19 compensate for a deficit in one of the other
20 aspects of the requirements stated above."

21 Do you see that?

22 A Yes.

1 Q What do you mean in that sentence?

2 A Part of the optical design is to design
3 systems that can be made with not much difficulty,
4 namely, loose tolerances, things like that. If
5 you have a person who came from a background of
6 optical manufacturing, grinding lenses, polishing
7 and so forth, he has a very strong background in
8 the manufacturing, okay, and his insights usually
9 go beyond just manufacturing. He knows a lot
10 about tolerancing and therefore he may know more
11 about this part of the optical design, the
12 tolerancing.

13 So if you have someone very strong in
14 this, I would pay attention and say, okay, he
15 might have qualifications that maybe I can ignore
16 a little bit his physics background or optical
17 engineering, but I know he's very strong here. He
18 must know some more things. So these kind of
19 things.

20 As an aside, when I hire people into
21 codec, optical people, if I knew they are amateur
22 astronomers, therefore sit in the basement and

1 polish glasses, I would go beyond the job
2 description and say this guy has a good feeling
3 for everything optics, okay, as an example.
4 That's why I said sometimes it's fuzzy, even
5 though it doesn't abide by whatever I wrote in the
6 requisition.

7 Q So even if they don't have the degrees
8 that you specify here, if they have some other
9 type of relevant background, they could be
10 considered nonetheless one of ordinary skill in
11 the art?

12 A Potentially. I'd have to look into it but
13 yes.

14 Q Can we turn to Page 12 of the declaration,
15 please, and specifically Section 5 there.

16 You've titled this the "Legal Standards"
17 section of your declaration, correct?

18 A Uh-huh.

19 Q And in the Paragraph 19, you acknowledge
20 you're not an attorney, correct?

21 A Correct.

22 Q So your understanding for this Section 5

1 of the declaration comes entirely from counsel?

2 A Yes, entirely. He suggested that and I
3 incorporated it, yes.

4 Q Paragraph 20, this paragraph explains that
5 if you are going to assess validity, you construe
6 the claims and then compare them to the prior art.

7 Have I summarized that correctly?

8 A Yeah.

9 Q What is your understanding of prior art?

10 A I have 106 granted US patents, so I think
11 I by now know what prior art is, and in my best
12 way to say that is prior art is something -- is a
13 patent or a publication that preceded the priority
14 date of whatever invention we're talking about.

15 Q Can we scroll down a bit, please.

16 Mr. Merlo, can you scroll down to the next page,
17 please. Thank you.

18 This is Section A, "Legal Standards for
19 Prior Art."

20 Do you see that, Doctor?

21 A Yes.

22 Q And the purpose of this section is to

1 explain how one determines whether a patent or
2 publication qualifies as prior art; is that
3 correct?

4 A Yes.

5 Q Could we scroll to Section B, please.

6 This section is titled "Legal Standard for
7 Obviousness."

8 Do you see that?

9 A Yes.

10 Q What is your general understanding of
11 obviousness?

12 A General understanding is that if somebody
13 has an invention or claims to have an invention
14 but it's only so because he was confronted --
15 first confronted with this problem but any other
16 POSITA in his being place being confronted with
17 the same problem would have come to the same
18 invention.

19 Q Your declaration contains opinions that
20 the claims of the '120 patent are obvious; is that
21 right?

22 A Yes, they are obvious.

1 Q Can we scroll to the next section, please.

2 Your declaration also contains opinions
3 that the claims of the '120 patent are
4 anticipated; is that right?

5 A Is this in the section that you are
6 showing now?

7 Q No, my -- no. Again, the first question
8 is have you opined in this declaration that
9 certain claims of the '120 patent are anticipated
10 by the prior art?

11 A Yes, I did and provided a couple of
12 grounds, yeah.

13 Q But your declaration doesn't set out the
14 legal standard for anticipation, does it?

15 A Legal standard, I don't really understand
16 what you're asking me.

17 Q The Section B we were just looking at was
18 entitled "Legal Standard for Obviousness."

19 A Can you put it up again.

20 Q Mr. Merlo, can you scroll back up again to
21 Section B.

22 Do you see that?

1 A Yes.

2 Q You would agree there is no legal standard
3 for anticipation set forth in your declaration,
4 correct?

5 A I'm not sure what this term means. I show
6 here the obviousness issue, right.

7 Q Correct. Would you agree anticipation is
8 different from obviousness?

9 A Anticipation has more to do, it
10 seems -- but I don't know. Do I have to go into
11 the legal differences between obviousness and
12 anticipation? Anticipation means that there's
13 prior art out there that basically based on this
14 prior art, this invention shouldn't have been
15 granted. That's all.

16 Q You would agree that's different from
17 obviousness, correct?

18 A I think anticipation is more like what
19 happens with prior art. If there is prior art out
20 there, then the new invention is anticipated, but,
21 I don't know. This seems to be like legal
22 terminology.

1 Q Could we turn to Page 25, please. Could
2 we shrink that down a little bit. I'm looking for
3 Section D there.

4 Doctor, do you see there Section D is
5 titled "Using Aspherics to Control Distortion"?

6 A Yes, I do.

7 Q This section describes aspherical lenses,
8 is that correct?

9 A Yes, that's part of the historical
10 background of lens design in general and the
11 introduction of aspheres in about 1990.

12 Q Could we scroll down a little bit. Right
13 there is good.

14 And this section also references gradient
15 index or GRIN elements?

16 A Right.

17 Q And then if you go to Paragraph 60, you
18 remark here that aspherics won over the GRIN
19 solution; is that correct?

20 A Yes, it's the preferred solution. They do
21 similar things, GRIN lenses and aspheres. Yes,
22 definitely GRINS are so much more difficult to

1 make.

2 Q What do you mean by "won"?

3 A Won? Because the industry basically
4 adopted aspheres. So when they need an aspheric
5 surface, they will go and do it as opposed to keep
6 it spherical and change and make it index
7 aspherical which is much more time-consuming and
8 tough. I don't see papers today -- or I don't see
9 products today that really use GRIN lenses even
10 though they could have been used especially early
11 on when aspheres were in the infancy, aspheric
12 surfaces, yes. So, yes, there is a transition in
13 the industry to the GRIN -- to the aspherics.

14 Q Do you know about when the industry -- I
15 withdraw that question.

16 Do you know when the industry adopted
17 aspheres?

18 A I don't think there's a date. These are
19 processes that are developed over years, and you
20 can look now at what's happening with your phone
21 camera. It's made by -- consists of six or eight,
22 or maybe even more now -- plastic highly aspheric

1 elements to get the image quality you expect, but
2 cameras today, billions are being made don't have
3 GRIN lenses.

4 Q What relevance does this section have to
5 your analysis for the '120 patent?

6 A It is a review, and actually, this section
7 may be more relevant for the '990.

8 Q But you would agree the '120 patent
9 doesn't claim aspheric lenses, correct?

10 A Oh, claim, no, but it's in the teaching or
11 in the Thibault papers. There's no way to get
12 good lens today, panoramic lens or anything
13 without the use of aspheres. Sometimes it's
14 mentioned, sometimes it's not, but if you look at
15 my grounds where they give you all the information
16 as opposed to the '120 that doesn't disclose the
17 lens, the ground 2 and 3 disclose the lenses and
18 including their aspheric terms.

19 Q Could we turn to Page 36, please.

20 And you have a section here called "File
21 History of the '120 Patent."

22 Do you see that?

1 A Yes.

2 Q What's your general understanding of what
3 a file history is?

4 A It's whatever documents the US Patent
5 Office has all the way from the provisional
6 through all the office actions and whatever and
7 any invalidity or infringement action happening
8 through, yeah, all the -- yeah. Basically that's
9 what it is.

10 Q In Paragraph 74 there, you mention: "The
11 examiner rejected all claims based on U.S.
12 Publication No. 2012/0314296 to Shabtay."

13 Do you see that?

14 A Yes.

15 Q Did you review the Shabtay reference?

16 A Actually I did. A lot of patents in this
17 field are from fellow countrymen, Israeli.
18 Shabtay is Israeli; so just for that, I looked at
19 what he was doing.

20 Q You didn't rely on Shabtay at all for any
21 of your grounds about patentability in this
22 declaration, true?

1 A Right.

2 Q Just out of curiosity, what did you learn,
3 if anything, from Shabtay?

4 A Gee, I don't remember. I have to go and
5 look at it, just scanned it to see what it's all
6 about and figure out why he was rejected, but I
7 cannot recall right now. If you bring it, I will
8 immediately tell you.

9 MR. MURRAY: Mr. Merlo, can we open
10 Exhibit 1005, please.

11 (A certain document was marked Kessler
12 Deposition Exhibit 1005 for
13 identification, as of 10/12/2023.)

14 BY MR. MURRAY:

15 Q Dr. Kessler, do you recognize this
16 document?

17 A Yes, the Matsusaka.

18 Q So this is the Matsusaka reference you
19 relied upon in your declaration?

20 A One of the ones I relied on, uh-huh.

21 Q There's more Matsusaka references?

22 A No, he has more actually, but I looked at

1 this one.

2 Q Matsusaka provides a number of lens
3 examples, would you agree?

4 A True.

5 Q Can we go back to Exhibit 1003 and go to
6 Paragraph 19 which should be Page 49.

7 In Paragraph 93, you say Examples 6, 8,
8 18, 19, 20, 22 and 23 show that certain claims of
9 the '120 patent are anticipated and/or obvious; is
10 that correct?

11 A Yes, I chose 19.

12 Q And you chose 19 it says here for
13 simplicity; is that true?

14 A I didn't want to go through all of them.
15 It's a little bit labor intensive to analyze each
16 one of them, so, yes, I picked this one. I can
17 tell you how, but that's how I did it.

18 Q Did you analyze any of the other examples?

19 A Not technically. Each example provides
20 some information as to the performance including
21 distortion -- not the same way '120 does it, but
22 the traditional way. And, therefore, I can

1 estimate, you can say, the linearity or
2 non-linearity of the design. So I chose one like
3 19 which seemed to be a nonlinear design.

4 Q Can you explain to me what is the
5 traditional way distortion is represented as you
6 saw it in Matsusaka?

7 A Oh, the traditional way is that the field
8 is vertical on the Y axis and the deviation for
9 flatness is on the X axis. So it's deviation
10 from -- deviation from a flat surface at the image
11 as a function of the field which is on the
12 vertical axis.

13 Q How does that differ from the '120 method?

14 A They show it -- okay. They show it in a
15 different format. They show, first of all, the
16 field is on the X axis, and what is shown on the Y
17 axis is not deviation from the flat but position
18 at the image or derivative of the position at the
19 image. Different kind of a curve.

20 They don't care much when they do that
21 about is there the focus -- in '120, for example,
22 the crux of the matter is the position of the

1 center of the beam, the chief ray at the image
2 from where it's supposed to be on a linear scale
3 and a nonlinear scale, whereas traditionally they
4 care about what is the deviation from flatness,
5 what is the focusing problem if you want. So
6 that's sort of the difference, okay, but, and
7 also, most of the time it's done for -- no, I'm
8 not going to go into that. It's a different
9 curve.

10 Q Is it possible to transform one curve into
11 the other?

12 I'll withdraw the question.

13 Is it possible to transform the
14 traditional distortion curve as you call it into
15 the curve in the way the '120 patent portrays it?

16 A To transform, I guess it can be done, but
17 I think a much better way is to just check it
18 directly on the lens, okay.

19 Q How would you check it directly for a lens
20 in, say, a patent like this, Matsusaka?

21 A Well, that's why I looked at the patent.
22 And a strong patent like Matsusaka gives you lens

1 design examples. And there, you are enabled -- as
2 I guess it should be always in lens design -- you
3 are enabled to put it on your optical system and
4 verify that indeed his claims and his figures are
5 what they're supposed to be, yeah. So that's why
6 I went to the example in 19 and modeled it on my
7 optical system based on his data, Matsusaka data,
8 and verified that indeed his lens does work.

9 Q But you didn't model any of the other
10 examples you referred to here on your optical
11 program, correct?

12 A I might have. I have to go look it in my
13 file if I checked any of the other ones before I
14 honed on 19, yeah. I cannot say for sure.

15 Q But even if you did, those models don't
16 appear in this declaration, correct?

17 A No.

18 Q In Paragraph 94 you used Zemax to do the
19 modeling?

20 A Yes.

21 Q Did you use your own personal version of
22 Zemax to do the modeling?

1 A I don't know -- I own the most advanced
2 Zemax version, current version, yeah.

3 Q Can we open Exhibit 1018, please.

4 (A certain document was marked Kessler
5 Deposition Exhibit 1018 for
6 identification, as of 10/12/2023.)

7 BY MR. MURRAY:

8 Q Doctor, do you recognize this document?

9 A Yeah. That looks like typical data from a
10 lens, prescription data.

11 Q Do you know which lens this prescription
12 data is for?

13 A No. It says "Matsusaka example 19," okay.

14 Q Did you produce this document?

15 A This one?

16 Q Yes.

17 A I don't think I put in my declaration the
18 prescription data. I'm not sure, but I have it.

19 Q I guess my question is did you create this
20 document?

21 A Yeah. Every lens I look at, this is a
22 readily available tool, and 90 percent of the time

1 I will look at it.

2 Q But do you know whether this particular
3 exhibit was one that you generated from your Zemax
4 program?

5 A That I did?

6 Q Yes.

7 A I don't know. I don't recall. I cannot
8 tell. It says -- it looks like familiar
9 terminology on the top in terms of the folders,
10 Kops laptop. Yeah, so it looks like it was on my
11 laptop, yes.

12 Q Can we just zoom in on that top portion
13 there?

14 A Yeah, Kops laptop is my laptop, yeah.

15 Q What's shown there looks to be a file with
16 an extension .zos.

17 Do you see that?

18 A Yes.

19 Q This is as you say a typical Zemax output
20 file?

21 A Prescription.

22 Q Prescription?

1 A Yes.

2 Q Do you see on the second line of the file
3 name it says "12_11_2022 Matsusaka example 19
4 preferred."

5 Do you see that?

6 A Yes.

7 Q What does "preferred" mean?

8 A Oh, what does preferred means? Preferred
9 means very simply that I put the numbers in. And
10 the performance is good so that I believe this
11 model is correct. Many times when you put the
12 lens in, you have typos and stuff like that and
13 you immediately see that the performance is not
14 right.

15 So then you wonder, then you go ahead,
16 make sure all your aspherics are in place,
17 everything is correct. And when it comes out
18 right, namely the beams are -- the system is of
19 high quality, all the field points are focused as
20 they should on the image, then you have a high
21 degree of confidence that your model is correct
22 and fits the one in the patent.

1 Q Did you run any other -- withdrawn.

2 Let's go to -- still on the first page.

3 If you see under the third line under "General
4 Lens Data," it says "System Aperture"?

5 A Yeah.

6 Q And it says "Image Space F/#=3."

7 A Uh-huh.

8 Q What is that?

9 A Every lens has an F number like on your
10 camera, and that's all it is. Same thing as your
11 new camera, F3 lens.

12 Q Did you enter that number into Zemax?

13 A Did I enter it?

14 Q Yes.

15 A No, I did usually something different,
16 which is I know the size of the stop because
17 Matsusaka somewhere in his system, I think he
18 has -- let's see. I know if I had Matsusaka here.
19 Matsusaka tells you where the stop is; it's quite
20 obvious from the figure. So you can tell the
21 problem, you figure out what is the size of the
22 bundle of rays going through, fit it so that it

1 goes through the stop and the size that is given.
2 So basically -- so then you aperture every surface
3 in your system by asking that it will have what's
4 called a floating aperture. Take the aperture
5 from the stop, go through whole train and then you
6 know what is the aperture at each specific
7 surface. That's how you size the elements, okay.
8 So that's usually the best way to do that, not to
9 force the F number but to go with the floating
10 aperture.

11 The reason is that especially in very high
12 angle systems, the F number effectively is
13 changing with the field, and you don't want the
14 program to force a certain F number everywhere.

15 Q So the F number that came up here was one
16 that was generated by Zemax through --

17 A Sorry, sorry. It was done as you see
18 early on. I don't remember exactly if I did a
19 floating thing and then checked what the F number
20 is and then told her, okay, try F3, but different
21 ways of doing it. The end result should be that
22 the lens that you get has the same performance as

1 claimed by the patent, all the beams at all the
2 angles with the field that is specified focused at
3 the image. That's a big indication because if
4 there's any mistake, any typo, anything, say, in
5 aspherics or in curvature or in glass choice, the
6 image will not be good over all the whole field.
7 It's a necessary and sufficient condition that all
8 your numbers are right to get the model to be
9 believable.

10 Q Do you know if the F number given here of
11 three matches what Matsusaka listed for example
12 19?

13 A He somewhere gives the numbers. I don't
14 remember offhand.

15 Q Oh, go back to Exhibit 1005, please. I'll
16 get you a page number. It's on Page 99 on the
17 right-hand column where it says "Various types of
18 data" there.

19 A Uh-huh.

20 Q Scroll down. Yes.

21 Do you see the F number given there?

22 A 2.828.

1 Q Yes.

2 A Okay.

3 Q So Zemax rounded it?

4 A I don't know if it rounded it. I don't
5 recall exactly, but it really doesn't matter much.
6 I can run it again and ask the program to do F
7 2.282 [sic], but again, it also depends on how he
8 did it. What really counts, the physical thing
9 that counts is the size of the stop. All the rays
10 have to go through the stop. The F number is a
11 number usually used for the on axis, for the on
12 axis beam.

13 As I said, if you go off axis, the
14 effective F number may change on you. So they
15 have an optics, first order, third order, fifth
16 order designs, and some of the numbers are first
17 order. And what really counts is the stop size
18 and so forth. But I'm saying the model will work.
19 If I want to change the F number to F3, it will
20 work fine. It's a small change. It's not
21 indicative of anything.

22 Q While we're on this exhibit, if you hook

1 under the F number, it gives a half angle field of
2 view for example 19.

3 Do you see that?

4 A Yes.

5 Q It's given as 104.183.

6 A 104, yeah, uh-huh.

7 Q Did you use that number when modeling this
8 lens in Zemax?

9 A Yes, I did. I looked at 104. In some
10 cases I looked at 100. I don't remember what I
11 put at the end. The idea was to show something
12 that is 100 and more or something like that, but
13 basically he can go to 104. And I think I looked
14 at 104 based on my image there. It goes quite
15 away above 90; but I don't remember exactly.

16 Q Can we go back to Exhibit 1018.

17 This is -- at the bottom of the first
18 page, I think it's eight lines up where it says
19 "Maximum Radial Field."

20 Do you see that?

21 A Yeah. There, I put 100, yeah, uh-huh.

22 Q Why would you use 100 and not the full

1 104?

2 A Why? Because it's a prettier image,
3 more -- sometimes Zemax when they do drawings,
4 they scale it, okay. You have a beam coming from
5 infinity, and it comes at more than 90 degrees,
6 there is an automatic scaling factor on the
7 drawings which blows it up -- sorry. Diminishes
8 the image. So by putting 100, I get a pretty
9 image which then can be easily compared size-wise
10 to the patent.

11 But you can take the same model, run it at
12 100, 101, 104, or at the different F numbers;
13 these are minor variations. And if you get the
14 good performance at 100 or 104 or at F3, it seems
15 the model is fine. And the model is used not
16 necessarily for matching the F numbers of the
17 field. Of course, you have to be above 100 to
18 make your point. But it's mostly concerned with
19 the issue of distribution curves, distortion, and
20 magnification zones.

21 And for that, you only care about,
22 especially for these kind of items, the position

1 of the central beam, okay, which is not
2 affected -- or the behavior of the distribution
3 function is not affected by the F number at all
4 and affected on the field only in the sense that
5 if you do 100, you don't get all the way to 104,
6 you run it at 104 and you get the image
7 distribution all the way to 104.

8 Q If we go to Page 3 of this document.
9 There at the bottom.

10 So starting here, this is the aspheric
11 terms for each of the lens elements given in
12 Matsusaka?

13 A Yeah.

14 Q The r^2 , r^4 , r^6 , r^8 , those are the
15 aspheric coefficients?

16 A Right.

17 Q Did you enter these exactly as they are
18 shown in Matsusaka's example 19?

19 A Religiously.

20 Q If you go to the next page, please, Page 4
21 of Exhibit 1018, Surface 7, for example, you see
22 there is given an aperture and a maximum radius.

1 Do you see that?

2 A Yeah.

3 Q Where did these values come from?

4 A All the aspheric terms are from the
5 Matsusaka tables.

6 Q Can we go back to Exhibit 1005.

7 Where in Matsusaka does it give the
8 maximum radius of 1?

9 A Where in Matsusaka it gives the radius?

10 Q Yes.

11 A He doesn't give the radius. The program
12 basically finds the radius.

13 Q So this isn't a value you entered?

14 A Yes.

15 Q How does the program -- I'm sorry, go
16 ahead.

17 A Those numbers -- okay. When you size
18 components, they can come up -- if you choose,
19 say, a different F number, they may come up a
20 little bit different. If you choose a different
21 stop size, it might come a little different, the
22 radius of the element. But these numbers here are

1 basically -- how would I say that? -- they are a
2 property of the surface, okay. So you don't have
3 to give a "calibration" radius for them. They
4 are -- how would I say? -- absolute, okay.

5 And it's not true for other kind of
6 aspheric terms, I agree. There are other terms, Q
7 forms and others where you have -- where the
8 validity of the aspheric terms depends on your
9 choice of a reference size.

10 Not so for this operations called, say,
11 their operations. They -- you can put them in,
12 and if you change the size of the beam going
13 through a certain aperture and the aperture was
14 1.2 and now it's 1 or .9, it doesn't change the
15 terms. The terms are not a function of any
16 reference number, okay. So you use the same
17 aspheres no matter what F number or field you use.
18 It's a property of the surface.

19 So I don't need a number on the aspherics,
20 and that's why he doesn't put them.

21 MR. HOLT: I think we've been going for
22 about an hour. It doesn't have to be a break

1 right away. I'm going to have to use the restroom
2 here shortly.

3 MR. MURRAY: We can take a break now.
4 That's fine.

5 MR. HOLT: Great. Thank you so much.

6 MR. MURRAY: Yes, absolutely. Say ten
7 minutes.

8 MR. HOLT: Yes, sounds good. Thank you.

9 (A recess was had.)

10 MR. MURRAY: Mr. Merlo, could we put back
11 up Exhibit 1018?

12 BY MR. MURRAY:

13 Q Doctor, I want to ask you about -- you
14 said the maximum radius, for example, that you see
15 there at Surface 7, that's something that Zemax
16 itself figures out based on the other data you put
17 in; was that correct?

18 A Yes, I have to go and look specifically at
19 7 and see what's in there. Yeah, sometimes we put
20 in numbers for the apertures. Anyway, whatever
21 number is there doesn't change the coefficients,
22 okay. So I don't remember exactly where this one

1 came from. I have to go and look at the Zemax
2 file.

3 Q The floating aperture, did I recall that
4 you said that was something that you did select
5 when modeling the lens?

6 A That's a natural thing to do when you try
7 to model a given lens. The best thing is not
8 to -- you can do a couple of things. You can use
9 the F numbers provided in this case, what you
10 said, 2.8 or whatever, but as I said, if you force
11 the program to do an F 2.8, it will tend to do an
12 F 2.8 also on off-axis points, very large angles
13 and so forth which is not physical.

14 So the best thing is to go to the physical
15 thing. The physical thing which limits the beam,
16 the F number and everything all over the place is
17 the stop size. And Matsusaka clearly tells you
18 where the stop is. And so you tell the program
19 that's the stop use, and for every other surface
20 in the system, use the aperture called floating
21 aperture and scale yourself up.

22 So then the program will say, okay, at

1 Surface 1, I need -- the beam is only 3-millimeter
2 wide and it comes at 90 degrees, so the surface of
3 Surface 1 should be 5-millimeter radius or
4 something like that. So the program calibrates
5 itself to fit the field and the floating aperture
6 derived from the stop to size up the elements.

7 Q Can we go to Exhibit 1005, please.

8 And the stop information in Matsusaka is
9 provided in the table at the bottom of the
10 left-hand column on Page 99; is that right?

11 A Yeah, Surface 7.

12 Q Right, that's a stop. Radius is infinity
13 because it's planar, right?

14 A Yes.

15 Q And the D, what does the D refer to?

16 A The distance to Surface 8.

17 Q Where is the information about the size of
18 the stop?

19 A I don't recall. I have to go and look at
20 it, but it could well be that if I didn't find it
21 in the patent, I would then go to the figure and
22 size it up from the figure. It's a possibility.

1 I don't remember what I did back in -- a couple of
2 months back.

3 Q When you say "size it up for the figure,"
4 you would measure the size?

5 A Yeah. We know the total track, so that's
6 a reference, and we can check that the image size
7 is according to what you said, 2.1, or you can
8 take the image size. And then, yeah, here is the
9 total and so forth. And then, yeah, just check
10 how big it is. If you go to the figure that he
11 has on the front page of the patent --

12 Q Why don't we go to Figure 23?

13 A Okay, 19.

14 Q It's on Page 23 --

15 A Okay.

16 Q -- coincidentally enough. Okay.

17 A Yeah, so you have Surface 7 over there,
18 okay.

19 Q Designated by r7?

20 A This is the stop, yes. And all the beams
21 have to go through this surface and this size.
22 All the beams from whatever angle have to go

1 through this surface, okay. So a good way to
2 start is to say, okay, this is the stop. I can
3 tell what the radius -- what the diameter of the
4 stop is. We can usually to put a little bit of a
5 rim on the surface for the mechanical guides to
6 hold it. It can be, say, 10 percent, 5 percent,
7 10 percent of the aperture and you get a very good
8 measure for the stop size.

9 Also to notice that when I said the stop
10 size is effective for all fields, this is in a
11 well-designed system which Matsusaka is and the
12 '120 where they are trying to avoid vigenère. So
13 really they force all the beams to go and use the
14 full stop, in this case r_7 . And as I show later,
15 some other programs do not aim at no vigenère, no
16 obscuration at high field of view of the, if you
17 want, increase of the F number at higher field
18 view and to correct from the F. Here, it's not
19 done.

20 So we have a good idea of this lens. And
21 at the end of the day, Zemax will produce a figure
22 for the lens and performance, most important

1 thing, performance over all the fields, and when
2 these two agree, you know that you are in good
3 shape. You have the right model.

4 Q Can we go back to Exhibit 1018 and back to
5 Page 1. Right there is good.

6 Right about the middle of the page, there
7 is a field that says "Z Pupil Shift"?

8 A Yeah.

9 Q It gives a value of minus 1.278417.

10 What does that note?

11 A Okay. This is a very high-angle system.
12 In a regular low-angle -- low-angle -- mid-angle
13 systems, you have stop in the middle somewhere in
14 the lens and you have an entrance pupil and you
15 have an exit pupil, right, the images of the stop
16 on the input, on the object size and on the image
17 size, okay. How does the program work? They
18 start from the field point, 60-degree of axis, and
19 they shoot rays into the lens, okay.

20 And they want at the end of the day to hit
21 the center of the stop. How do they know? What
22 is the direction from far away? What is the angle

1 that they have to aim this beam when it goes into
2 the lens so that it will come out right, will come
3 out at the center from whatever angle at the
4 center of the stop.

5 And sometimes you have to find out when
6 the entrance pupil is, and they say use that, but
7 shift it. And the entrance -- it could be also in
8 the exit, but that helps the program find the
9 right direction to trace the beam. Otherwise --
10 well, it can always do something like iterate, try
11 it out, but it helps.

12 In these high systems, it's very common
13 that there are shifts on the entrance pupil and on
14 the exit pupil. Not just shift, also change of
15 magnification of the pupil which, by the way,
16 affect illuminations; but that's a different item.
17 So this is just -- it's not something I put. It's
18 something that, as you see, automatically
19 calculated shifts on. So the program is looking
20 for where the hell do I send those beams so that
21 they go through the center of the stop.

22 Q And you answered my next question which

1 was so this was a Zemax calculated value --

2 A Yes, you have the option of telling it
3 just do your iterations or find out shifts that
4 will make life easier, yeah.

5 Q So what data from Matsusaka did you
6 actually input into Zemax?

7 A Oh, the important stuff. Curvatures,
8 gaps, distances, the D value that you showed, and
9 glasses, these are the main thing. The second
10 level is the aspheric terms. The glasses are
11 given as what's called model glass. Namely, they
12 don't give you the exact glass. They give you the
13 exact glass but not all the information. Only two
14 main parameters for the glass, what is the index
15 and what is the dispersion. What is the what's
16 called the Abbe number.

17 And this is expressed usually as a six
18 number -- six-digit number. The first three
19 digits are what comes after the 1. Like 585 means
20 1.585 index, and the next three numbers in the
21 model that he gives are the Abbe number. Like if
22 it says 386, I know it's the Abbe number 38.6.

1 It's not the exact glass, but it's the model
2 glass.

3 Now, when we go to production, of course,
4 you have to give real glasses, and there is a
5 certain tweaking where you change from the model
6 glass to the real glass. But in patent literature
7 and patent -- in the examples given in lens
8 patents, you do the model glass invariably almost.

9 Q So --

10 A So all of these numbers are given. Glass
11 would be in this case very important, the aspheric
12 terms.

13 Q So we have the surface curvatures, the
14 distance --

15 A Uh-huh.

16 Q -- the index and Abbe numbers for each
17 glass, the aspheric terms.

18 A Yes.

19 Q Is there anything else you had to input
20 into Zemax to model the lens?

21 A Well, yes. They give you the field, and
22 then they give you the Matsusaka. Matsusaka gives

1 you also his image size, and you have to make
2 sure -- you don't have to put it in. You just
3 make sure that when you run his angle, that your
4 image size is close enough to his image size and
5 then you know that you are right. That's all
6 there is. It's a painstaking effort because most
7 of the time, it's done manually, typing in all
8 those numbers and hope that you don't make a
9 mistake there.

10 Q I'm sure. So everything else in this
11 document Exhibit 1018, then, aside from what
12 you've mentioned you input was generated
13 automatically by Zemax; is that correct?

14 A Yes, I have to go item by item and make
15 sure I'm correct and go back to my files and make
16 sure I didn't put -- again, create some
17 assumption, could be. But whatever the --
18 whatever I did seems to have been justified at the
19 end.

20 Q What kind of assumptions do you think you
21 would have had to make?

22 A Like I mentioned that the F number, okay,

1 I'm quite sure I put the stop and not the F number
2 but could be that I put it in. I have to check.
3 It doesn't make that much difference for the
4 introduction of this ground because the main idea
5 here is to concentrate on the performance in terms
6 of magnification zones, positions of the chief
7 ray, the center of the beam and the linearity
8 issues or nonlinearity issues.

9 Q Could we go back to Exhibit 1005 and back
10 to Page 99 and the table at the bottom left-hand
11 column there which is the surface data.

12 And you see there it lists -- there's an
13 object plane, an image plane and then 15 surfaces?

14 Do you see that?

15 A Object and image and 15, Surface 15.

16 Q There are 15 surfaces --

17 A Yeah.

18 Q Yeah.

19 And then can we go back to 1018, bottom of
20 Page 2.

21 Here we have the surface data summary from
22 your Zemax model, and "OBJ" there under "Surface"

1 would be the object plane, correct?

2 A Yes.

3 Q And if we scroll down to the next page, we
4 have at the bottom there, "IMA" is the image
5 plane?

6 A Yes.

7 Q So in between there are 16 surfaces?

8 A Yeah.

9 Q What is that?

10 A Probably the definition of the object.

11 You can see that the stop is shown on the
12 Surface 8 in my case, and in his case, I think it
13 was 7. So let's go and see what about -- usually
14 it's in the object. Go back to the object. Some
15 problems define it zero; some define it just as 1.

16 All the surfaces are there, which one we
17 use for zero or 1. So probably that's the case.
18 Zemax calls the object zero, and he may call it 1.
19 We can go and see what he did.

20 Q So if you look at Surface 1 there, you
21 have a radius of 20.

22 Do you see that?

1 A Yes.

2 Q And a thickness of 1.

3 Do you see that?

4 A Yeah.

5 Q If we go back to 1005, Surface 1 is not
6 radius 20, distance 1.

7 A You're talking about the thickness of the
8 first surface?

9 Q Correct.

10 A I'm going to go back and look at --

11 Q Is there a way to put these side by side
12 at all?

13 Are you able to see that?

14 A Let's see. That does seem strange. Let
15 me check the real source which is my Zemax. Just
16 a minute.

17 I don't see the image. Is it still
18 shared?

19 Q Yes.

20 A Why don't I see that? Oh, here it is.

21 I looked at my Zemax file. It's perfectly
22 agreeing with Matsusaka with a .9 and everything.

1 I can share my screen and show you. So my
2 question is what are we looking here.

3 Oh, the .9 seems to be on Surface 2 and
4 the 10.286 is there. Okay. I got it. Okay.

5 This is what's called the dummy surface
6 initially that I inserted. I don't recall right
7 now why, but it has no optical power, no index,
8 nothing. Many times we put it to verify the field
9 angle because Zemax -- all kind of reasons, but
10 the point is you can say that Matsusaka lens
11 starts at Surface 2 that will answer your surface
12 numbers.

13 So you see surface No. 2 has a range of
14 curvatures 10.286 and thickness of .9 and index
15 1.83. Okay. And this shows on the list that you
16 have, it's Surface 2, not Surface 1, okay.

17 Q Right. Yes.

18 A And also note that Surface 1 is positioned
19 somewhere 1 millimeter away and all that, but it
20 has no glass; that's why we call it a dummy
21 surface. So dummy surface are put in for all kind
22 of reasons, but they're not really effective in

1 the design.

2 I don't recall exactly why I put it in.
3 Sometimes you just put dummy surfaces -- yeah, I
4 know why I put it in. For the drawing. Namely, I
5 cannot draw rays from -- yeah, that's what it was.
6 I cannot draw the rays from the object. It's an
7 infinity. I have to either start at the first
8 surface, but then you don't see the incoming beam
9 and how it is bent, you see.

10 So what you do is you put the dummy
11 surface in front of it. It's a finite surface
12 distance that the drawing will contain. But what
13 do you do when you go above 90 degrees? It's a
14 problem. So if you go back to the drawings -- I
15 think I put the drawing of my model in my
16 declaration, right?

17 Q Could we go to Exhibit 1003, Page 50.

18 A What page is that? Yeah, here.

19 Q You should see it on the screen. Is this
20 it?

21 A Yeah. So you see my problem is how to
22 show array coming from above 90 degrees, okay,

1 bending at the front surface. I don't want to
2 show it starting at the front surface. So I put a
3 dummy surface. You see this one?

4 Q Uh-huh?

5 A And that's what you see there. And I tell
6 the program to just don't show me for infinity, I
7 cannot take it. Show me from this dummy surface.
8 And because it's curved, it can intersect this
9 beam coming at more than 90 degrees. Okay. So
10 the explanation is dummy surface, I put in
11 intentionally for purpose of getting a nice
12 drawing. It's relatively I would say common
13 technique.

14 Q Now, you didn't model relative
15 illumination for Matsusaka's example 19, correct?

16 A Modeling -- no, at the time, but after
17 your preliminary report where you said Kessler
18 didn't show blah blah blah, MTFs and illumination,
19 I said well, why not? I can do that. I didn't
20 think it's necessary basically. And the reason is
21 all I tried to do is to show magnification
22 changes.

1 And, yes, if you have magnification
2 changes, it follows that you'll have some changes
3 on illumination, but I didn't show it. But since
4 you said so, I went back to my models available
5 and asked Zemax give me MTFs, and they did. And
6 then I said to Zemax, okay, what about
7 illumination? Okay.

8 So now I do have for the asking both the
9 illumination which shows a very compensated
10 situation, namely, we show that in this system in
11 Matsusaka, S in the figures there, you can very
12 much say that the illumination distribution from
13 the axis goes up as you go away from the field in
14 contradiction to the usual falloff. And then you
15 can say that this shows that it was in part
16 compensated and so forth by the magnification
17 built into it. So, yeah, I didn't show then, but
18 if you want to, I don't know if my lawyer will
19 allow, but I looked at it, too.

20 Q But to confirm, you didn't include that in
21 your original declaration?

22 A No, because that was really a crucial part

1 of what we tried to show there and, yeah. And the
2 MTFs, too, we looked at that. And I produced
3 MTFs, and you can interpret them either way you
4 want, including the way the claim says it does,
5 partly compensated and so forth. Because the way
6 the claim is written concerning MTF, it's in the
7 broadest -- too broad terminology. What is MTF?
8 We don't know really.

9 MTF is a two-dimensional function. And
10 '120 itself says the MTF is dependent on the
11 spacial frequencies to a very large degree. But
12 yet the MTFs they showed was -- in Figure 506
13 there had only sagittal, tangential and very
14 limited field and no mention of spacial frequency.
15 So it's relatively easy to produce a lens at the
16 certain spacial frequency which you show whatever
17 you want.

18 So anyway, I have the MTF curves for
19 Matsusaka and the illumination distribution, and
20 same is true for Kim. The ground 3.

21 Q But for all those curves, you didn't
22 generate any of those until after Apple filed its

1 preliminary response, correct?

2 A True. Anyway, I had them in for the
3 asking, and you could still look at that mainly
4 because the issue of MTF is so broad that I think
5 it's well covered. What really was meant maybe is
6 resolution, and resolution was mentioned
7 otherwise, and I showed resolution and degree.
8 That's a good measure of resolution, one of the
9 measures.

10 And for illumination, I was -- since I had
11 to show zones and I did show zones and zones go
12 with illumination. So, yeah. You're right.

13 MR. MURRAY: Can we open Exhibit 1006.

14 (A certain document was marked Kessler
15 Deposition Exhibit 1006 for
16 identification, as of 10/12/2023.)

17 BY MR. MURRAY:

18 Q Is this the Kim reference?

19 A Let me read it first. I have no idea. I
20 have the authorized translation that I used.

21 MR. MURRAY: Let's open Exhibit 1007,
22 then.

1 (A certain document was marked Kessler
2 Deposition Exhibit 1007 for
3 identification, as of 10/12/2023.)

4 BY MR. MURRAY:

5 Q I wanted to use 1006 because I think the
6 numbers are actually more clear, but we can use
7 1007.

8 So do you recognize this document?

9 A I think so. If you show the lens -- yeah.

10 Q Could you scroll down, Mr. Merlo. Keep
11 going. Keep going.

12 A Oh, yes, that looks more familiar, this
13 kind of things.

14 Q So this is the translation of the Kim
15 reference that you relied upon in your
16 declaration; is that correct?

17 A Yes, I think so.

18 Q And you see there are three lens
19 embodiments?

20 A Yes.

21 Q And in your declaration, you say that all
22 three lenses show certain claims are anticipated

1 or obvious; is that right?

2 A Yes, the last claim about a ratio of 2
3 between the TTL and the image, less than 2. And
4 Matsusaka doesn't do less than 2, so we brought
5 Kim who has less than 2 TTL to image, yes. I
6 think I chose 1, embodiment 1.

7 Q Right. That was my next question. You
8 modeled embodiment 1 in Zemax for the information?

9 A Yes, yes.

10 Q And then did you model either of
11 embodiments 2 or 3?

12 A I don't recall. I have to go back to my
13 notes and see. I think I started with 1 and it
14 was fine, so I didn't do the others; but I cannot
15 vouch for that.

16 Q But models of embodiments 2 and 3 don't
17 appear in your declaration as filed?

18 A Right, right.

19 MR. MURRAY: Could we open Exhibit 1019,
20 please.

21 (A certain document was marked Kessler
22 Deposition Exhibit 1019 for

1 identification, as of 10/12/2023.)

2 BY MR. MURRAY:

3 Q Do you recognize this document?

4 A It looks like it. I don't remember
5 actually giving to you the prescription, did I?

6 Q This is what was filed in the case.

7 A Okay. I didn't remember that part of it.
8 Okay. Didn't show in my declaration here, so I
9 don't know. Okay, so, yeah. It looks like
10 embodiment 1.

11 Q You'll see as with Exhibit 1018, there is
12 a file name at the top.

13 Do you see that?

14 A Yes.

15 Q And this one says "1_12_2023 Hyun lens."
16 H-y-u-n. Is that the same lens as Kim?

17 A Yeah.

18 Q And then "model example 1 latest.ZOS."

19 Do you see that?

20 A Yeah.

21 Q What does latest mean?

22 A Latest -- okay, to tell you the truth, you

1 run and you find out that it doesn't perform over
2 the image. You go back to the curvature and
3 indices and aspherics and verify again that you
4 got it right. And then you find two that you have
5 a typo. You go again and again until you say
6 that's it. That's what it is.

7 There's a whole succession of attempts,
8 maybe three, five, whatever -- I have to look at
9 my files -- until you get a typo-less -- I mean,
10 as you know, the aspheric terms can be quite
11 hairy.

12 Q Oh, yes, I'm very familiar.

13 And we assume for the Kim embodiment, you
14 input the same types of data that you did formats?

15 A Yes, same methodology, yes, yes.

16 Q So all the other numbers produced in this
17 document would have been generated automatically
18 by Zemax based on the information you input?

19 A I cannot say all. I'd have to go number
20 by number and verify what did I do. It's very
21 easy to turn off and on different features and
22 tell a program you do it, I do it and whatever, so

1 I have to go and check.

2 Like here, it seems like I did let the
3 program calculate focus shifts which is -- pupil
4 shifts which is common in those systems, yeah, but
5 I cannot vouch when I did what.

6 Q Can we scroll down to Page 2, please.

7 Actually a little lower. That's good.

8 Here we have the surface data summary
9 again for the Kim lens; is that correct?

10 A Yeah.

11 Q If we scroll down to Page 3, we see it
12 lists 14 surfaces between the object and image
13 planes; is that right?

14 A Uh-huh, okay.

15 Q Can we go back to Exhibit 1007. Yeah,
16 see, this is why. Can we go to 1006. And if we
17 scroll down --

18 A I actually did the same thing. I got the
19 numbers from the cleaner copy.

20 Q Yes, that's much better. You'll see here
21 there are 12 surfaces?

22 A Yeah. I think it's the same thing. I

1 used a dummy for the drawing purposes.

2 Q I think that's right, except we have a
3 difference of two surfaces this time.

4 A Uh-huh.

5 Q So if we could do a similar thing and put
6 this side by side with Exhibit 1019.

7 A Yeah. I don't see anything. Is something
8 shared now?

9 Q I think he's working on it. There we go.

10 A Okay.

11 Q You had it. Scroll back down.

12 I think you're correct that Surface 1 is
13 probably a dummy surface with the rays of 2 and
14 thickness of 1.

15 A Which I put in, yes.

16 Q Right, because Surface 2 seems to match
17 Surface 1 in the --

18 A Yes.

19 Q Let's start at the stop where that clearly
20 matches.

21 Now, we take Surface 6 on Exhibit 1019 and
22 look at Surface 5 in Exhibit 1006, they appear to

1 match, correct?

2 A Yeah.

3 Q Surface 7 matches the radius but not the
4 thickness?

5 A Which surface, 10?

6 Q 7.

7 A 7?

8 Q Yes. 7 matches the radius for Surface 6
9 in Exhibit 1006, but not the thickness.

10 A They are talking about thicknesses, okay,
11 let's see.

12 Q So looking at 1019, Surface 7 has a
13 negative .85763 radius?

14 A Right.

15 Q And that matches Surface 6 in
16 Exhibit 1006.

17 Do you see that?

18 A Just a minute.

19 Q Surface 7 in 1019 has a thickness of .001.

20 A Yeah.

21 Q Whereas Surface 6 in 1006 has a thickness
22 of .02222.

1 A .222 is on Surface 8 on the left side and
2 on Surface 10 on the right.

3 That's what you're talking about?

4 Q No. .0222 is Surface 6 on the left side,
5 and on the right side for what should be --

6 A Oh, oh. It doesn't matter. I mean, .001
7 plus .021 is .022, right. And this is a distance
8 in the air, right, so what's the problem?

9 Q Why is it split like that?

10 A Well, because I added another -- I added a
11 dummy. You see, it has no index, nothing. And so
12 basically point -- let's see, just a minute. .85,
13 distance .01, and minus point -- it looks like a
14 dummy to me. I have to -- because it has no
15 glass, so I have to go and check why I put a dummy
16 there. But it doesn't matter. The distance, the
17 total distance is .022 when you combine the two.

18 Sometimes you put dummies, additional
19 surfaces. This is one micron distance, right.
20 When you have, say, doublets, for example, and the
21 program wants to find out what -- like you see 7
22 and 8 constitute a doublet, and if I don't tell

1 Zemax -- if I use 7 and 5 surface after surface,
2 Zemax makes assumptions as to the lens must be
3 having a barrel which is smooth and cylindrical.
4 That's usually the first assumption, okay.

5 And if I want to say no, no, no, the first
6 surface, the crown versus the flint have different
7 sizes, don't draw in the fact that they have a
8 common surface on the sizes, then I put another
9 surface in there and Zemax says, okay, that's
10 where the first one remains and 1 micron later,
11 the second one starts, it's all ways to make the
12 program understand something about the sizes,
13 okay. We add dummies left and right, so I
14 wouldn't read too much in it.

15 The fact that the end result looks like
16 the model that you want to -- the lens you want to
17 model and that the beams are focused everywhere,
18 that 99 percent that you are already there, you
19 got all the S's right, all the information right,
20 you got a model that will work.

21 Q Now, because 7 and 8 combined to make
22 Surface 6 on the left, so that means Surface 9

1 corresponds to Surface 7 on the left, correct?

2 I'm sorry, Surface 9 in your data should
3 correspond to Surface 7 in Kim?

4 A Yes.

5 Q So if you see on Surface 9 on the
6 right-hand side, you have the radius matches
7 2.18749, right?

8 A Yeah.

9 Q And the thickness matches .69376, correct?

10 A A thickness of --

11 Q Surface 9.

12 A On the left?

13 Q On the right, sorry, on the right.

14 A 2.1, yeah, that's like 8 -- his distance
15 on Surface 7, yes.

16 Q And then going forward, now you have the
17 index of refraction for the glass on the
18 right-hand side as 1.620410, correct?

19 A Which shows Surface 7 on the left, yes.

20 Q Right. Now look at the Abbe number. The
21 Abbe number on the right is 44.46.

22 Do you see that?

1 A Yes.

2 Q But on the left for Surface 7, you have an
3 Abbe number of 60.32.

4 A Uh-huh.

5 Q Is this a typo?

6 A Could be and it will be hard to find
7 because it will not affect -- it will affect the
8 dispersion, right, so the green and red may be a
9 little bit bigger spots than the -- the blue and
10 red may be a little bigger spots than the green.
11 But as it is for Kim on the analysis, I think I
12 used -- no, no, I also showed the -- I think I
13 showed the spot diagrams and they came out nice.

14 I have to check, but it might be a
15 difference in the dispersion. But it seems like
16 it didn't affect anything, you're right. It looks
17 like it's 44.46 here. Strange. I have to check
18 also my model and see if that's correct.

19 Q You don't have to do that.

20 Let's go back to your declaration,
21 Exhibit 1003.

22 A Yes.

1 Q And Page 118. Do you see at the top of
2 Page 118, you have a plot there?

3 A Yes.

4 Q How did you generate this plot?

5 A Oh, I ran my program, the Kim model, and
6 basically a couple of points along the curve,
7 those fill points that you see. Those fill points
8 I checked where is the spotted image, where is the
9 center of the beam, where is the chief ray at the
10 image, okay, and the location of it. And then I
11 plotted location of the chief ray at the image,
12 millimeters on the left versus the fielding
13 degrees.

14 And then I plotted a linear curve and,
15 yes, I have some freedom as to where it can be
16 because basically if I move it up and down, I
17 basically change a reference. But this is
18 supposed to depict the model, what it would be if
19 the system was -- had linear distribution curve.
20 So on the left it's part of the --. So I ran the
21 positions at the image, and then I basically made
22 some assumption as to a pixel size and showed

1 those curves, okay.

2 Q Okay. So for the blue curve, you said you
3 found the chief ray location at those field
4 angles?

5 A Yes.

6 Q Is it customary for have error bars in
7 that kind of data?

8 A Error bars?

9 Q Yes.

10 A Error bars? This is a -- it's not a
11 measurement system. It's quite a deterministic
12 system. I mean, the error bars will go when I go
13 into production and don't get the thing right.
14 There's no statistical analysis. It's very
15 deterministic. I shoot a ray through a certain
16 lens and find out where it hits, then I change the
17 angle a little bit.

18 And because, remember, we have to do
19 pixels per degree. So it's a derivative, right.
20 So that I do in Excel, okay. I take the number
21 from Zemax, put them there, and if I'm correct, I
22 run it again at 1 degree offset, took the

1 differences, assumed a certain reasonable pixels
2 or it could be anything, and plotted. The main
3 thing is to compare the two, okay.

4 Q So this wasn't -- so you had to do an
5 extra step of putting data into Excel to get this
6 curve?

7 A Yeah, that's from my Excel sheet, and the
8 information as to position of the beams is from
9 Zemax. I could have written a zip EL or DLL to
10 have Zemax produce it, but writing the DLL was
11 taking me more time than just taking the number
12 and do the DLLing myself, that's it.

13 So that's what it is. It's a derivative
14 of the beam position at different field angles of
15 the image and some reasonably chosen pixel to show
16 it in terms of pixels. I could have shown it in
17 terms of other terms, too, okay; in millimeters,
18 microns, whatever, yeah.

19 Q So how exactly did you get the red line?
20 What was the calculation there?

21 A In a f-theta lens, in a linear distributed
22 curve, the position is, of course, F times theta.

1 And all I have to do is shoot an F . Now, I can
2 take the F directly from the program or I can
3 choose a certain F , because what the program does
4 it gives me the F , the focal length which is first
5 order. It's good for small angles.

6 We had large angles, magnification
7 changes. First order assumptions can fall off.
8 But the distribution is still linear, some number,
9 F times θ . But it's up to me to choose a good
10 F , so it can fall somewhere in between for
11 comparison.

12 Q And then you did the derivative again to
13 get that line?

14 A Yeah, basically, yes. In an F θ it's
15 always the same.

16 Q Right. In Paragraph 196 below that plot,
17 it planes that the areas/zones were the blue curve
18 is above the red curve, those are areas of
19 increased magnification with respect to the linear
20 targeted resolution.

21 Do you see that?

22 A Uh-huh, yes.

1 Q And the converse is true with the blues
2 below the red; that is a decreased magnification?

3 A Uh-huh.

4 Q And then looking at the plot, we have an
5 area of increased magnification from near the
6 center to I'd say about 40 degrees?

7 A Yeah.

8 Q Why doesn't this curve start at zero, by
9 the way?

10 A Which one?

11 Q Either one. Either.

12 A I mean, we have resolution -- oh, why does
13 it start all the way at zero?

14 Q Why doesn't it start at zero --

15 A Oh.

16 Q -- on the X axis?

17 A I don't remember. I guess I could have
18 started from zero. It's probably because the way
19 I did it, I have the field points at certain
20 intervals and then I need the derivative. So what
21 is the derivative? One field point minus another.
22 So maybe the other curve started at zero and then

1 the derivative, I have to start either at zero or
2 1. I don't think it's an important point, but I
3 could have done it either way.

4 Q And then after 40 degrees, you have an
5 area of decreased magnification; is that right?

6 A Yeah, compared to the linear, yeah.

7 Q Let's go to Page 98.

8 And here we have a similar plot for
9 Matsusaka, correct, example 19?

10 A Yeah.

11 Q So using the same rules, we have a
12 decreased magnification area from center to about
13 40 degrees?

14 A Uh-huh.

15 Q And then you have an increased
16 magnification between 40 until somewhere around
17 90 degrees I would say, right?

18 A Right.

19 Q And then after that, you have another
20 decreased magnification area until 100 degrees; is
21 that right?

22 A Yes.

1 Q Ground 1 in your declaration focuses on
2 the Thibault article; is that right?

3 A Right.

4 Q And you didn't do a plot similar to this
5 one here on Page 98 for Thibault; is that right?

6 A Right, mostly because he doesn't provide
7 me the lens for me to do that. However, to
8 compensate for that, he provides his curves which
9 is nice.

10 Q But was there a linear curve in the
11 Thibault article?

12 Withdrawn.

13 Q Does the Thibault article have in its plot
14 something akin to the red line in your plot here
15 on Page 98?

16 A I think the whole paper is about it. I
17 don't know.

18 MR. MURRAY: Can we open Exhibit 1001.

19 (A certain document was marked Kessler
20 Deposition Exhibit 1001 for
21 identification, as of 10/12/2023.)

22 BY MR. MURRAY:

1 Q You recognize this document, correct?

2 A '120, yes.

3 Q Can we go to -- I think it's on the last
4 page, 11, Claim 1.

5 And specifically if we look at the last
6 clause that starts "A nonlinear targeted
7 resolution."

8 Do you see that?

9 A Sure.

10 Q It says second line up from the bottom in
11 that left-hand column, it starts: "The lower or
12 higher object magnification being used to
13 compensate at least in part for a lower image
14 quality due to at least one of a drop of relative
15 illumination or a drop of MTF in a zone of the
16 image," correct?

17 A Right.

18 Q Let's go up to Column 3. I think it's two
19 pages back. Around Line 18 on the left.

20 So Line 18 on the left, it starts
21 "Figure 6."

22 Do you see that?

1 A Yes.

2 Q That uses similar language to the claim,
3 right, where it says: "An example of a targeted
4 resolution curve used to at least partially
5 compensate the relative illumination or at least
6 partially compensate the MTF according to certain
7 embodiments of the present invention."

8 Do you see that?

9 A Yes.

10 Q This is referring to Figure 6 in the
11 drawings, correct?

12 A Yeah.

13 Q If we go to next page, Column 6 starting
14 around Line 13, you see it uses the word
15 "compensate" several times here.

16 Do you see that?

17 A Yeah.

18 Q This is discussion again about Figure 6;
19 is that correct?

20 A Relative illumination seen in Figure 4.

21 Q Right. So this is discussing Figure 6 in
22 combination with Figures 4 and 5; is that fair?

1 A Oh, Figure 6 shows the example -- yeah.

2 Q If we go down a little bit to the
3 description of Figure 7.

4 A Yes.

5 Q The word "compensate" doesn't appear
6 anywhere in this discussion of Figure 7, does it?

7 A Doesn't look like it.

8 Q Is there extra down below a little bit?
9 Can you scroll down a little more.

10 So just to confirm, because that paragraph
11 also refers, I think, to Figure 7.

12 A What are you looking at now?

13 Q Whether the word "compensate" appears in
14 the description of Figure 7.

15 You've gone too far, too far, too far.
16 That's good. That was perfect. Right there.

17 It starts now on the right-hand column at
18 the top of the page where it says "Figure 7" --

19 A Okay.

20 Q -- all the way down to line about 61. And
21 "compensate" does not appear in that passage,
22 correct?

1 A Uh-huh, I don't see it, okay.

2 MR. MURRAY: Subject to any redirect, I
3 have no further questions for the witness.

4 MR. HOLT: If you give me just a couple of
5 minutes to take a look through my notes.

6 MR. MURRAY: Sure. Do you want to go off
7 the record for a few minutes?

8 MR. HOLT: Yeah, let's go off the record
9 for -- maybe take five and come back.

10 MR. MURRAY: Five minutes, that's fine.

11 MR. HOLT: Thank you.

12 (A recess was had.)

13 MR. HOLT: No redirect.

14 MR. MURRAY: You have no redirect? Okay.

15 Thank you, Dr. Kessler, for your time. I
16 really appreciate it, and have a good rest of your
17 day. Thank you.

18 (Deposition concluded at 10:34 a.m. CST.)

19

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21

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1 CERTIFICATE OF COURT REPORTER - NOTARY PUBLIC

2 I, Theresa A. Vorkapic, Certified
3 Shorthand Reporter No. 084-2589, CSR, RMR, CRR,
4 RPR, and a Notary Public in and for the County of
5 Kane, State of Illinois, the officer before whom
6 the foregoing deposition was taken, do hereby
7 certify that the foregoing transcript is a true
8 and correct record of the testimony given; that
9 said testimony was taken by me and thereafter
10 reduced to typewriting under my direction; that
11 reading and signing was not requested; and that I
12 am neither counsel for, related to, nor employed
13 by any of the parties to this case and have no
14 interest, financial or otherwise, in its outcome.

15 IN WITNESS WHEREOF, I have hereunto set my
16 hand and affixed my notarial seal this 19th day of
17 October, 2023.

18 My commission expires November 6, 2023.

19 

20 _____
21 THERESA A. VORKAPIC

22 NOTARY PUBLIC IN AND FOR ILLINOIS

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