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Transcript of Michael A. Hickner, Ph.D.

Date: January 9, 2026
Case: Shenzhen Tuozhu Technology Co., Ltd. -v- Stratasys, Inc. (PTAB)

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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SHENZHEN TUOZHU TECHNOLOGY CO., LTD.,

Petitioner,

v.

STRATASYS, INC.,

Patent Owner.

_____

Case IPR2025-00438

U.S. Patent No. 10,569,466

_____

Deposition of MICHAEL A. HICKNER, PH.D.

Conducted Virtually

Friday, January 9, 2026

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Pages: 1 - 146

Stenographically reported by: Judith E. Bellinger, RPR, CRR, CSR-TX CCR-WA, CCR-NM

Deposition of MICHAEL A. HICKNER, PH.D., conducted virtually.

Pursuant to notice, before Judith E. Bellinger, Registered Professional Reporter, Certified Realtime Reporter, and Notary Public in and for the State of Maryland.

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C O N T E N T S

PREVIOUSLY MARKED EXHIBITS

(Retained by counsel)

Previously Marked:

MICHAEL A. HICKNER, PH.D.,
being first duly sworn, was examined and testified as follows:
EXAMINATION BY COUNSEL FOR THE PATENT OWNER
BY MR. TATUM:
Q Please state your name for the record.
A Michael A. Hickner.
Q And, Dr. Hickner, because we're conducting a remote deposition today, we're not in the same room, I'm going to ask you a few questions about your environment, okay?
A Okay.
Q Do you have any materials, whether written or electronic, with you today?
A No, I just have the Zoom window pulled up on my computer.
Q And do you intend to open any materials during today's deposition, other than what I'm going to show you?
A No, I do not. The Zoom chat sharing of exhibits has been working, so that's fine with me.
Q And other than the Zoom chat that we're

using right now, do you have access to any other chat or messaging applications?

A No. Those are all closed on my computer.

Q Do you have access to any email applications at the moment?

A Those are closed as well.

Q And is there anyone else in the room with you today, Dr. Hickner?

A No, there is not.

Q Will you let us know if anyone enters the room during the course of this deposition?

A I will. I have a do-not-disturb sign on my door, but if there's an interruption, I'll let everyone know.

Q And have you been deposed before?

A Yes, I have.

Q And, approximately, how many times have you been deposed?

A Approximately, 20 times previously.

Q Just as a reminder, I will ask you questions today, and you're under oath to answer.

And your counsel may object, but you'll still have to answer my question.

Do you understand that?

A I understood the instructions.

Q And if you need a break at any point, please, just let us know, we can take a break, but I will ask that you answer my pending question before we take that break; is that okay?

A That sounds good to me.

Q And is there any reason that you cannot testify truthfully and to the best of your ability today?

A There's no reason. I can testify truthfully and to the best of my ability today.

Q And, Dr. Hickner, you're here today because you offered a declaration in support of the petition for inter partes review in IPR 2025-00438, right?

A That's correct, yes. I think that's the '466 patent.

Q And in that inter partes review, the petitioner is Shenzhen Tuozhu Technology Company

Limited, right?

A That's correct.

Q I'm uploading an exhibit into the chat.

Please let me know when you see that in front of you.

(Exhibit 1003 previously marked for identification and retained by counsel.)

A All right. Exhibit 1003 is up on my computer.

Q And Exhibit 1003 is a copy of your declaration in this IPR, right?

A That's correct.

Q Did you draft this declaration?

A Yes, I did.

Q Was there anyone else involved in the drafting of this declaration, other than you?

A I collaborated with counsel on drafting this declaration.

Q That's counsel at Fish & Richardson?

A That's correct.

Q Besides yourself and counsel at Fish & Richardson, did anyone else contribute to the work

or analysis for your opinions in this declaration?

A No.

Q Now, you see on page 1 of Exhibit 1003, there's a page number at the bottom, right?

A That's right. PDF page 1 in the software also has a numeral 1, right at the bottom.

Q If I refer to page numbers in Exhibit 1003 today, you'll understand that I'm referring to the page number on the bottom of the page there, right?

A That sounds good to me.

Q Approximately, how much were you paid for putting together this declaration?

A I spent about 15 to 18 hours on this declaration, and I'm paid an hourly rate, so, 450 dollars an hour times 15 or 18.

Q Did that 15 hours, I believe you said, did that include the time spent reviewing the references discussed in this declaration?

A The references were billed -- or the reference review or document review was billed

separately. And so, that was probably an additional eight to ten hours, I would say.

Q And in your declaration, you express opinions regarding United States Patent Number 10,569,466, right?

A That's correct.

Q I put into the chat what is labeled as Exhibit 1001.

Please let me know when you have it pulled up.

(Exhibit 1001 previously marked for identification and retained by counsel.)

A I have Exhibit 1001 pulled up, and that's the '466 patent.

Q You'll understand that if I refer to the '466 patent today that I'm talking about the patent shown in Exhibit Number 1001, right?

A I understand that, yes.

Q And do you understand the concept of a person of skill in the art?

A So in my declaration on -- or, sorry, in paragraph 19, I outline what a person of

ordinary skill in the art is and their qualifications.

Q Do you understand that the prior art has to be viewed from the perspective of a person of ordinary skill in the art?

A I understand that, and I wrote my declaration from that perspective of a person of ordinary skill in the art.

Q If, today, I refer to a POSITA, you'll understand that I'm referring to a person of ordinary skill in the art, right?

A That's correct. I'm comfortable with using the term "POSITA."

Q And in your declaration, you express opinions regarding claims 1 through 5, 7 through 13, and 16 through 20 of the '466 patent, right?

A That's correct.

Q I'd like to direct your attention, down in Exhibit 1001, to column 23. And specifically, where it starts with claim 1.

Please let me know when you're there.

A Yes, I'm there, column 33, starting

claim 1.

Q Do you see, in line 35, the limitation that begins "receiving a request from a client over a network to fabricate an object"?

A Yes. That looks like -- well, there's more in that limitation, but I see the start of that phrase on line 35.

Q What would a POSITA understand the term "client" to mean in the context of this claim?

A So, in the context of this claim, specifically, receiving a request from a client over a network, a POSITA would understand that there's -- receiving a request from some other, let's say, computer machine, like a print server or a controller, or some other thing doing the request, for example. And so, that receiving request from a client is, basically, there's a client requesting, over a computer network, to fabricate an object on the three-dimensional printer.

So the client is the thing making the request over the network.

Q Is the client separate from the three-dimensional printer?

A So, in this specific limitation, what's recited is receiving a request from a client over a network to fabricate an object on the three-dimensional printer.

So in my analysis, say, based on Menchik, in paragraph 137 of my declaration, the POSITA would have understood that the printing apparatus receives the printing file, printing parameters, other things from Menchik, from a controller or computing device, which is a client over the network.

And so, this limitation is talking about the request from the client over a network. And it doesn't -- and the request, of course, is fabricate an object on the three-dimensional printer. This specific limitation doesn't really talk about physical proximity separate or together, but there is this over the network -- or, sorry, over a network term, which a POSITA could understand how this client is networked to

the three-dimensional printer.

Q The '466 patent describes both a client and a controller, right?

A Yes, throughout the '466 patent, the terms "client" and "controller" is used. And so, they talked -- the '466 patent discusses both of those terms.

Q Does client mean the same thing as controller, in the context of the '466 patent?

A So in column 4, in the '466 patent, starting line 13, the patent states, the '466 patent states "Similarly, various functions described herein may be allocated between an onboard processor for the printer and a separate computer. All such computing devices and environments are intended to fall within the term controller or processor, as used herein, unless a different meaning is explicitly provided or otherwise clear from the context."

And so, the '466 talks about this term controller. And when it comes to client, the '466 patent also talks about client devices received

from one or more of the client devices.

So it talks about both terms, "controllers" and "client devices," in the '466 patent.

Q Does the term "client" mean the same thing as the term "controller" in the context of the '466 patent?

A So, in one of the sections in my declaration, paragraph 130, where I analyze this limitation, I say "Based on Menchik's explicit teachings, the 'computing platform' providing the printing file is an example of the controller external to the print apparatus. In accordance with the scope of this limitation advanced by the Patent Owner in the litigation, a POSITA would have understood that the printing file provided by the controller of the computing device," which is the client, "to the printing apparatus (three-dimensional printer) is a request to fabricate an object on the printing apparatus (three-dimensional printer)."

Q And just to be clear, I'm not asking

about some of your analysis of the prior art, we'll get to that in a moment. My question is just about what a POSITA would understand the terms in the '466 patent to mean.

And so, with that in mind, my question is, in the context of the '466 patent, would a POSITA understand that the terms "client" and "controller" mean the same thing, or is there some difference between them?

A So the '466 patent gives various examples of controller and client throughout the text. I didn't analyze, in the -- just in the context of '466, whether or not controller and client can be equated in some way or not. Just looking at the '466, the text talks about controllers and clients. But I would have to analyze further whether those terms can be interchangeable or not, in the context of '466.

In my initial analysis, I didn't consider whether those terms can be equated or not, just looking at the '466.

Q Are you able to perform that analysis

as you sit here today?

A So I've looked at these terms in the '466 patent, and the '466 patent does describe examples of those terms, both controller and client, but I don't have a complete analysis just confined to the '466.

Of course, I talk about clients and controllers in the context of other references in the prior art, but if we just wanted to confine the analysis to the '466, I would have to consider that further.

Q Understood. Turning your attention back to that limitation we were discussing, and that is at column 23, line 35.

Let me know when you have that in front of you.

A Yes, I'm there.

Q And you see it says "Receiving a request from a client over a network to fabricate an object."

What would a POSITA understand the term "request" to mean, in the context of this claim?

A So, the total limitation -- or the complete text of the limitation is "Receiving a request from a client over a network to fabricate an object on the three-dimensional printer. The three-dimensional printer coupled to a supply of a build material, including a tag that stores at least one property of the build material."

So a POSITA would understand that receiving a request means just what it says here. So receiving a request from a client, say, a thin client or other sort of computing device, over a computer network to fabricate an object on the three-dimensional printer.

So that's pretty plain language. A POSITA would understand, in the context of this patent, that receiving a request is some sort of network communication to fabricate an object from the client to the printer.

Q Would any transmission of data constitute a request or is a request something more specific?

A So a request is not any transmission of

data. A request is more specific than, let's say, as you said, any transmission of data, a request is something more specific than any transmission of data across the network.

Q Okay. So what constitutes a request, then?

A So the '466 patent doesn't define the term "request" in the specification of the patent, but, say, for instance, in paragraph 53 of my declaration, where I'm discussing one of the references, I say that a POSITA would have understood that in the context of this reference, Loughran, the transmission of a fabrication job, from the client to SFF system, or the 3D printer, is a request to fabricate the object defined by the fabrication job.

So that's one example of a request.

Q My question, again, is centered on the '466 patent and what a POSITA would understand in reading that patent.

And so, you mentioned that a request is something more specific than any transmission of

data. So my question is, what would a POSITA understand a request to mean, in the context of the '466 patent.

A So "request" is used a number of times as a term in the '466 patent. And so, in, let's say, column 16, line 41, the '466 patent states "As a non-limiting example, a remote client device may request an object to be printed on the network connected three-dimensional printer. The three-dimensional printer may have one or more supplies containing build material connected to one or more couplings. The client device may request the three-dimensional printer to transmit the data tag for one or more of the connected supplies for the determination of operational parameters for at least one of the connected supplies."

So here, "request" is used, and by example, a POSITA would understand what this means, in terms of the limitation that we're discussing, receiving a request from a client.

So reading through the '466 patent, a

POSITA could understand this limitation, receiving a request from a client over a computer network to fabricate an object on the three-dimensional printer.

Q You just read an example in which the remote client device may request an object to be printed on the network; is that right?

A That's correct. That was in column 16, starting line 41.

Q How would that request be made?

A So in this computer networked environment, a POSITA would understand the network communications between, say, a client and a 3D printer. And so, if we go down a little bit further in column 16, line 46, I also said "The client device may request the three-dimensional printer to transmit the data tag."

So in two instances of requests, in this column 16, lines 41 to, let's say, 48, there's two instances of a request, it's the request of an object to be printed over the network, and then the client device may request

the three-dimensional printer to transmit the data tag.

And so, in the second passage I read, line 46, in column 16, to 48, the format of this request is the client device may request the three-dimensional printer to transmit the data tag.

And so, in that instance of request, it's a request over the network, and then expecting a response, as implied by this language.

And so, in the first passage, starting line 41, a remote client device may request an object to be printed. And so, that is transmission of the request to print something, whereas, in the second instance, in this paragraph that I've been discussing, that's a request for transmission of data back.

And so, in a networked environment, between printers and controllers and computers, these requests come over the network, as described by this limitation.

Q So the request to go over the network

and then wherever they would arrive, they, essentially, ask the component there to do something; is that roughly right?

A I mean, in this limitation, so in 1B, it says "Receiving a request from a client over a network to fabricate an object on the three-dimensional printer."

So, clearly, the client, based on this language, the client is sending the request over a computer network to fabricate an object on the three-dimensional printer.

And then if we go back to my -- excuse me -- my example on column 16, again, lines 46 to 48, the client device may request the three-dimensional printer to transmit the data tag for one or more of the connected supplies.

And so, in that instance of a request, it's not requesting printing of an object, it's requesting data back from the printer.

Q In that last example, you mentioned a data tag. What would a POSITA understand the term "tag" to mean, in the context of the '466 patent?

A So in column 14 of the '466, starting lines 36, the specification says "The data tag 304 may be any device or combination of devices suitable for storing data relating to the build material 312. This tag [sic], for example, include a radio frequency identification tag, such as an active or passive RFID tag, an optically identifiable tag, such as a barcode, quick read," or QR code, "or the like, a magnetically identifiable tag, such as a magnetic swipe strip, or any other tag that can be automatically detected and correlated by the controller to identify information for the build material in the supply."

So the '466 gives a few different examples of this data tag.

Q Other than using data tags, could information about a build material in a system be transmitted over a network?

A Just in general?

Q Just in general.

A So just in general, say, in my own work

on 3D printing, we use a personal computer or an external computer to slice a model. And within that slicer program, as we call it, there's information about the build material in that slicer program. And that's transmitted over the network to the printer.

And so, that system, that we use in my lab, doesn't have a data tag. So it's entirely possible to transmit material -- or, sorry, transmit a data about a build material over a network in the absence of that tag.

Q I would like to direct your attention down a few lines, this will be column 23, and then starting at line 44, the limitation that begins "receiving one or more operational parameters from the client."

Do you see that?

A Yes. It says "Receiving one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer."

So, yes, I see that limitation. I'm

there.

Q What would a POSITA understand the term "operational parameter" to mean, in the context of the '466 patent?

A So if we look at column 15, line 17 of the '466 patent, the specification says "For example, the operational parameter may be at least one of an extruder temperature, a feed rate, a build platform temperature, a build volume, temperature, an infill requirement, a rafting requirement, a support structure requirement, a cooling requirement, or other operational parameter" that might be usefully -- "that might usefully be determined by the controller from the data stored in the data tag."

So this talks about, this passage talks about operational parameters and what they are in the context of the '466 patent.

Q Would it be fair to describe the operational parameter as printer control parameters?

A So, I didn't contemplate the term

"printer control parameters," but in my analysis of operational parameters, which is the term in the '466 patent, I discuss some examples saying, in paragraph 172, as I'm contemplating the Menchik reference, talking about optimum building parameters for building or supports, and the controller uses the data to determine printing parameters, operation parameters, building parameters, material parameters, and supply parameters. Collectively, those are operational parameters, including the amount of material of each type and color presently available in each cartridge.

So I didn't talk about the term "printing control parameters," and I don't think that is a term in the '466 patent.

Q Can you point me to any discussion in the '466 patent that would lead a POSITA to understand that the amount of material is an operational parameter?

A So in column 15, the paragraph starting line 11, but I'll just start reading from line 17,

which is the key part "The '466 states, for example, the operational parameter may be at least one of an extruder temperature, a feed rate, a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, a cooling requirement, or other operational parameter that might be usefully determined by the controller from the data stored by the data tag."

And so, this describes characteristics -- well, the sentence above says "described herein to determine at least one operational parameter for the three-dimensional printer based on at least one characteristic of the build material."

So that would connect the operational parameter, as we've been discussing, to characteristics of the build material for fabrication of the object, as cited in column 15, starting line 14.

Q Is it your opinion that characteristics of the build material, themselves, are operational

parameters?

A So it says right in the '466, column 15, starting, again, line 14 "described herein to determine at least one operational parameter for the three-dimensional printer based on at least one characteristic of the build material."

Q Is it your opinion that characteristics of the build materials, themselves, are operational parameters?

A So the '466 patent states, column 15, starting line 46, "As should be appreciated, the controller may use any combination of data from the data tag and a local or remote data store to determine the operational parameters."

And so, in this discussion, as it says, the controller uses any combination of data from a data tag or a local remote to determine operational parameters.

And so, the '466, in a lot of the examples, cites determination of operational parameters.

And I would have to consider this

connection between operational parameters, such as build platform temperature, feed rate, cooling parameters, build chamber heating parameters, and so forth, I'd have to think about -- you know, of course those parameters are derived from the build material type.

But I'd have to think about that, whether the build material type is an operational parameter. I think a POSITA understands that a build material type is just a name of a polymer, like PLA, ABS, something like that.

And that name of the build material type, that name is not an operational parameter because it's just a name. We could -- the POSITA could call it whatever they wanted. But within that name, there are these characteristics of the build material, where the controller can calculate operational parameters from that name.

Q As you sit here today, do you have an opinion on whether characteristics of the build material are, themselves, operational parameters?

A So characteristics of the build

material is a property of the material, melting temperature, something like that. You know, viscosity. And so, those -- a POSITA would understand those as characteristics of the build material.

An operational parameter, as the '466 says, can be determined from the characteristics of the build material. But I would have to think of an instance, or I'd have to do some more analysis where, like, a physical property or a characteristic of that build material, that are readily identifiable by what type of material it is, whether that can be used exactly as an operational parameter or, for instance, we have lots of rules of thumb for, say, thermal plastic printing, where the characteristics of the material might be melting temperature at 180 degrees Celsius. And our rule of thumb is that the operational parameter needs to be 30 degrees Celsius higher than the melting temperature.

And so, I'd have to think about an

example where the characteristic of the build material, for example, a physical property of the build material, can be used as an operational parameter.

I'd have to contemplate that a little bit more.

Q I would like to direct your attention, now, to column 24, and go down to claim 19 there.

Please let me know when you're there.

A Column 24, yeah. "A method comprising providing a three-dimensional printer," that starts claim 19.

Q Oh, apologies. I'll actually direct to claim 17. So that starts on line 47.

A 17, "the method of claim 1 further comprising," that's where we're at?

Q Correct.

A Yes, I'm there.

Q Can you see this claim 17 requires further comprising performing a diagnostic test to determine whether the one or more operational parameters is suitable for the three-dimensional

printer?

Do you see that?

A Yes, I do.

Q What would a POSITA understand the term "diagnostic test" to mean, in the context of the '466 patent?

A So just looking at the '466, in column 15, line 53, the specification states "In another aspect, the determination of operational parameters may include preliminary diagnostic tests, such as whether the diameter of the build material, size of a build material pellet, build material fluid viscosity, or the like is appropriate for the three-dimensional printer. Additional diagnostic test may be performed, such as whether the correct build material is provided on the supply, whether the correct color or color lot build material is on the supply, or any other appropriate preliminary diagnostic build material test used to determine as a threshold matter, whether a desired fabrication could be performed with the supply 302."

So the specification gives a couple of examples here about this diagnostic test, as referred to in claim 17.

Q The color of a build material is not an operational parameter; is that fair?

A So the color of a build material is, certainly, a characteristic of the build material, and we just discussed the correspondence between characteristic of build material, which is readily identifiable by its physical properties, and operational parameter. I mean, if we just wanted to talk about a plain-words example, there is no operational parameter, say, red, for a three-dimensional printer, that I know of, and red would be a color or a characteristic of the build material.

So that's one example that I think a POSITA could understand, that unless the color of a build material is connected to some other physical property, like melting point or viscosity, a POSITA could understand that the color of the build material really doesn't matter

if you're going to print that material. There's a lot of other physical properties of a build material that are much more important for determining these operational parameters.

Q Some of the opinions you provided in your declaration were based on a reference named Loughran; is that right?

A Yes, I know which reference you're referring to. And if Loughran is the correct pronunciation, I certainly know that reference.

Q I've put into the chat what is labeled as Exhibit Number 1004.

(Exhibit 1004 previously marked for identification and retained by counsel.)

Q Please let me know when you have it pulled up.

A I have 1004 up, and that's Loughran.

Q You'll understand today that if I refer to Loughran, that I'm talking about the reference shown in Exhibit Number 1004; is that fair?

A That's fair. I get that.

Q Can you explain where, in Loughran, the

printer reads data from a tag on a build material supply and then provides that tag data to a client over a network?

A So, as I say in paragraph 30 of my declaration, a couple sentences down, Loughran discloses that after the SFF system reads the material identifier tag, and that's in Exhibit 4 -- excuse me, Exhibit 1004, paragraphs 21 and 33, the SFF system sends the material identifier for the material to the client, as indicated by the letter C -- C 122, shown in Figure 1, and the client system may receive the unique material identifier of the material from the second SFF system, and that's in Exhibit 4, 28, and 38. And the remote client system 102 then parses the information regarding the materials for using it in the SFF fabrication job generation. That's in paragraph 43.

And so, this is discussed in the specification of -- or, sorry, in the text of Loughran. It's in various places, as I've cited in my declaration, but I think paragraph 47 of

Loughran discuss -- discusses this as well. The communication mechanism 506 receives the unique material identifier from the material container 110, containing the material, and that is presented to the second SFF system.

So there's discussion in Loughran about this idea of receiving a material and transmitting it to another part of the system.

Q What is an SFF system?

A So SFF is -- well, it's an acronym for solid free-form fabrication. It's a term of art that, really, is synonymous with 3D printing or additive manufacturing. So SFF is sort of a term of art acronym. And if you say SFF, people -- a POSITA, in general, would know that you're talking about 3D printing.

Q So is an SFF a 3D printer? Is that fair to say?

A I mean, you know, it depends how expansive you want to say, you know, is it just the hardware of the 3D printer or is an SFF system, say, a computer or print server, plus the

3D printers, or network group of 3D printers. I think an SFF system sort of implies that I could be more than just a 3D printer sitting on a desk.

So a POSITA, you know, depending on the context, a POSITA would understand if you're talking about, say, a print bureau or a print warehouse, or a manufacturing site, the SFF system might be network 3D printers, plus clients, plus lots of different things. Whereas, if you're talking to an undergraduate and you talk about the SFF system and point to a 3D printer on the desk, a POSITA would understand sort of what the discussion is about.

MR. BISENIUS: Counsel, we've been going for a bit over an hour. Now might be a good time for a break.

MR. TATUM: Sure. We can take a break now.

MR. BISENIUS: Reconvene at 20 past?

MR. TATUM: That works.

THE WITNESS: That works for me. Thank you.

(Recess taken from 11:11 a.m. to 11:19 a.m.)

BY MR. TATUM:

Q Dr. Hickner, in your previous answer, you said that a POSITA would understand that if you're talking about, say, a print bureau or a print warehouse, or manufacturing site, the SFF might be a network 3D, plus a lot of different things, like clients and controllers.

Did I get that right?

A I think we were talking about an SFF system. So, yeah, so that's right. So a system, SFF system could be a collection of 3D printers or again, as I said, if you're talking to an undergraduate in a lab, the SFF system might just be the 3D printer sitting right in front of them. So I think when you call it an SFF system, it depends on the context that a POSITA would understand what you're talking about.

Q And in that context that you just described, what would a POSITA understand to be the client versus the controller?

A So in the Exhibit 1004, Loughran talks about client devices in the context of what a client is. And then, if we look at something like Figure 1, where we have a second SFF system 102, first SFF system 104, the controller -- either of these could be clients, if there's requested info or something like that.

But in these second SFF system or first SFF system, there could be a controller that controls that system. And so, the 1004 reference, where Loughran doesn't really describe a controller separate from the SFF system, it really just discusses the client devices and the like with information, or with other client devices of users, things like that, in the Loughran patent.

Q Loughran teaches that the second SFF system can be automatically and dynamically adjusted using information retrieved from a material information server, right?

A Yes, I believe that's referred to in paragraph 24 of Loughran. It talks about this automatically and dynamically adjusted aspect of

Loughran.

Q And this is describing the printer in Loughran automatically and dynamically adjusting its own operational parameters; is that right?

A Yeah, I think in paragraph 24 of the reference, it states "The type and format of the information retrieved by the second SFF system, from the material information server, regarding the material, can vary. For instance, the information received by the second SFF system, regarding the material, may include information in a machine-readable format that is not readily understood by users and by which the second SFF system is automatically and dynamically adjusted for utilization with the material. Such information may include parameters of the material, including, but not limited to, melting temperature, storage temperature, minimum feature size, horizontal and vertical shrinkage rates, material lifetime interlayer delay time, and amount of UV light required per layer, among other parameters."

Q Are any of those parameters you just listed operational parameters, as a POSITA would understand the term in the '466 patent?

A So in paragraph 24, we were talking about the material information server, and in paragraph 25, Loughran, sort of halfway down the paragraph, says "Thus, the information retrieved from the material information server, which was discussed in paragraph 24, regarding the material, may be both information on which basis the second SFF system dynamically adjusts its own parameters for fabricating physical objects from the material, as well as information intended for user education. These parameters may include the operating temperature that the second SFF system needs to achieve to melt the material, the temperature that the second SFF system needs to maintain to store the material, the length of time to wait after one layer of the material has been fabricated before processing the next layer, and so on."

And so, this passage, in paragraph 25,

refers to both material parameters and operating parameters of where it says "these parameters may include the operating temperature."

Operating temperature is, certainly, an operating parameter.

Q And which items listed here would be material parameters, as opposed to operating parameters?

A So operating -- so just in regards to this reference, and I'm looking at this passage in paragraph 25, operating temperature is definitely an operating parameter. As it says near the bottom of paragraph 25, the temperature that the second SFF system needs to maintain to store the material, that's like a storage requirement, but that's an operating parameter of the SFF system for storage.

And then, this length of time to wait after one layer of the material has been fabricated for processing the next layer. So this wait time can be related to an operating parameter, where the printer or the SFF system

needs to pause, or something like that.

And so, these examples, at the bottom of 25, a POSITA would understand that in the context of operating parameters, these are temperatures and lengths of time that dictate how the SFF system operates.

Q And these are all parameters that are dynamically adjusted by the SFF system itself, right?

A So in paragraph 45 of the Loughran reference, it says, near the bottom of that column, paragraph 45, it says "The SFF mechanism can fabricate the physical object from the material since the parameters of the second SFF system are dynamically adjustable based on the information regarding the material retrieved from the material information server." And so, these parameters are particularly the parameters of the SFF mechanism.

So this reference, just looking at it on its own, talks about these dynamically adjustable parameters.

Q Does Loughran ever discuss a client transmitting to the printer a set of these parameters we've been discussing that are selected for use in controlling printer operation?

A So in paragraph 3 of the Loughran reference, it talks about client devices and updating SFF systems. And it says "Updating both the SFF systems of SFF fabricators, as well as client devices of users, can be a laborious process. Typically, the SFF systems and sometimes the client devices are hard coded with the information of the material such that the introduction of information regarding new materials into the systems and the devices is difficult to accomplish."

And so, this sentence is talking about client devices holding material information?

Q Does Loughran ever discuss a client transmitting to the printer a set of parameters that are selected for use in controlling printer operation?

A So in paragraph 12, just looking at

Loughran, it says halfway down the paragraph, or a little bit more than halfway, "In some embodiments of the invention, the first SFF system may be considered a client to the second SFF system, in that the first SFF system provides SFF jobs to the second SFF system, and the second SFF system fabricates these jobs."

So it talks about this client and fabrication of jobs in Loughran.

Q Does Loughran ever discuss a client transmitting, to the printer, a set of parameters that are selected for use in controlling printer operation?

A So in paragraph 43, Loughran states the first SFF system may -- the first SFF system further may verify the authenticity of the information that has been retrieved in the same manner as has been described in relation to the second SFF system, verifying the authentication of the information it receives, the first SFF system stores the new material identifiers in the second list, since they are now known to the first SFF

system, and stores the information regarding the materials of these identifiers that has been retrieved.

The first SFF system then parses the information regarding the materials for using it in SFF fabrication job generation. Periodically, the first SFF system, like the second SFF system, may update the stored information regarding the material of each material identifier in the first list and/or the second list so that the information remains current.

So this paragraph 43 talks about this issue of material information and updating the information on materials in these SFF systems.

Q Does Loughran ever discuss a client transmitting to the printer a set of parameters that are selected for use in controlling printer operation?

A So as I state in paragraph 63 of my declaration, Loughran discloses that the client system creates the CAD instructions for fabricating the object, in part, based on

information about the material, including operational parameters selected for use in controlling the operation of the three-dimensional printer or the SFF system when fabricating the object using the material.

And so, a POSITA would have recognized that based on this information from Loughran, it would be useful to have specific tailoring. As I say, a POSITA would have recognized that such specific tailoring of the fabrication job to the specific material provides, or at least renders obvious, operational parameters for use in controlling operation of the three-dimensional printer when fabricating the object with the build material.

Loughran also discloses that the materials from which SFF systems of SFF fabricators can fabricate physical objects can have different type of information. For example, melting temperature, storage temperature, et cetera.

And so, a POSITA would have found it

obvious that to tailor these jobs, operational parameters for use in controlling operation of the three-dimensional printer would have been advantageous.

Q Can you, please, point me to the disclosure in Loughran where a client transmits to the printer a set of parameters that are selected for use in controlling printer operation?

A So as I discussed in my previous answers, Loughran talks about transmission of material properties and updating material properties; that was in my previous answer.

And in my analysis of Loughran, like I've described in paragraph 63, it would have been obvious, based on -- obvious to a POSITA, that specific tailoring of these jobs would have required operational parameters for controlling operation of the three-dimensional printer.

So in Loughran's discussion of these material parameters, the next stop would have been obvious to a POSITA because the material parameters are connected to the operating

parameters. The material parameters that you're going to use in a printer are connected to the operating parameters of the printer.

Q Does Loughran, at any point, say that operational parameters are embedded in the fabrication job itself?

A So this is described in paragraph 43 of Loughran and, also, in my analysis, in paragraph 63, near the bottom. I say in my declaration, paragraph 63, Loughran's client system parses the information regarding the materials for using it in SFF fabrication job generation, a cite to paragraph 43. And I go on to say, "That is, Loughran's client system develops parameters for melting temperature, melting time, storage temperature, feature sizes and other aspects of the fabrication job based on the specific build material or materials being used in the fabrication process."

Q What is your support in Loughran for the final sentence that you just said?

A So in paragraph 37 of Loughran, it

states "The second SFF system parses the retrieved information regarding the material to, for instance, extract parameters regarding the material and dynamically adjust its own parameters based on parameters extracted. For example, if the information retrieved in Extensible Markup Language format, the second SFF system parses the XML-formatted information to extract the parameters regarding the material," so that's talking about the material, "contained therein. These parameters regarding the material are employed by the second SFF system to adjust its own parameters so that the physical objects can be properly fabricated from the material as can be appreciated by those of ordinary skill in the art."

So this material -- this paragraph, 37, connects the material parameters to the adjustment of the second SFF system, adjusts its own parameters so that the physical objects can be properly fabricated from the material.

So this is a connection between

material and these -- adjusting the parameters of the second SFF system.

Q The adjustments to the parameters of the second SFF system described in this paragraph are not contained in the fabrication job, right?

A So in paragraph 55 of Loughran, it says "The CAD software generates SFF fabrication job for fabrication from a specific material based on the information regarding that material, which has been received. The CAD software then sends the SFF fabrication job to the second SFF system over the network via the communication mechanism of the first SFF system."

So this connects specific material to a fabrication job.

Q The final sentence of paragraph 37, that you pointed us to, reads "The adjustment is dynamic in that it can occur while the second SFF system 104 is running without having to reboot the second SFF system 104 and can also occur without user intervention and involvement."

Do you see that?

A Yes, I do.

Q You would agree that if the adjustment is dynamic and can occur while the system is running, the information for that adjustment is not contained in the fabrication job that is sent to start the print, right?

A Oh, I see what you're saying. So once the job is sent, the second SFF system just does its own thing in dynamically adjusting without any other jobs being sent or anything like that.

Q In the dynamic adjustment that the second SFF system is doing, it's not based on information received in the fabrication job, right?

A So the adjustment -- this dynamic adjustment has to start somewhere. And so, that starting point is in the fabrication job. I mean, you know, there needs to be a job sent. You know, this sentence does say without user intervention, okay, so this is just the system working by itself. But the adjustment, at least in terms of thinking about dynamically adjusting parameters or

tuning parameters, a POSITA knows that you have to start from somewhere, and then adjust from there. And in Loughran, the adjustment is performed based on where the system starts from, which is specified in the job.

Q If the operational parameters were included in the fabrication job, why would any dynamic adjustments need to be made during the course of the job?

A So Loughran says, in paragraph 48, "The SFF mechanism is then able to dynamically adjust its parameters based on this information so that the physical objects can be fabricated from the material."

And so, this dynamic adjustment, as described by Loughran, talks about -- well, I mean, this is in paragraph 24 -- is automatically and dynamically adjusted for utilization with the material.

So this is the -- speaks to utilization of the material in the SFF system, where this dynamic adjustment is occurring.

Q And that dynamic adjustment is happening based on information received from the material information server, right?

A I mean, in one example, in paragraph 35, Loughran says the information regarding the material is then downloaded from the material information server, so that's certainly described in Loughran.

Q You'd agree that information obtained from a material information server and a fabrication job are different things, right?

A I mean, I think in plain language, just as you said, a POSITA would understand, you know, material information from a server is just material information that can be displayed, and then a fabrication job is what we've been talking about, in terms of a client requesting a 3D printer to print something that would be more akin to a fabrication job. So I think that they can be different things.

Q And you've identified some instances in Loughran where it describes dynamically adjusting

the printer parameters based on information received from a material information server, right?

A So most of the passages in Loughran talk about this material information server holding the parameters. I'd have to look more closely, if there's anywhere else regarding the material information (indiscernible), but in lots of examples, it does talk about dynamically adjusting its own parameters based on parameters extracted from the material information server.

Q And as you sit here today, are you aware of any passages of Loughran that instead describe determining the operational parameters, packaging them as part of the fabrication job, and then sending that to the printer?

A So in paragraph 43 in Loughran, halfway down, it does state, "The first SFF system then parses the information regarding the materials for using it in SFF fabrication job generation."

So this sentence talks about using information of the materials for SFF fabrication

job generation.

Q Is there any disclosure in Loughran that after parsing information regarding materials, operational parameters are then determined and included in a fabrication job that is, then, sent to another printer?

A So in paragraph 63, in my declaration, in the analysis of Loughran, I say that, halfway down the paragraph, "Loughran also discloses that; 'the materials from which SFF systems of SFF fabricators can fabricate physical objects can have different types of information, for example, melting temperature, storage temperature, minimum feature size, horizontal and vertical shrinkage rates, material lifetime, inter-layer delay time, and amount of ultraviolet light required per layer, among other types of information, can vary from material to material.'"

So that's in paragraph 2 of Loughran. And then, as we're discussing in paragraph 43, I go on to say in my analysis, "Loughran's client system parses the information regarding the

materials for using it in SFF fabrication job generation."

So that's the connection between the materials and how they're used, or the melting temperature, UV light required per layer, and the fabrication job generation.

Q Some of the opinions you provided in the declaration were based on a reference named Dubois; is that right?

A That's correct, yes.

Q I've put into the chat what is labeled as Exhibit Number 1005.

Please let me know when you have it pulled up.

A I have Exhibit 1005 pulled up, and that is the patent by Dubois.

Q You understand that if I refer to Dubois today that I'm talking about the reference shown in Exhibit 1005?

A Yes, I understand that.

Q Can you identify the passages in Dubois describing where the optimum values of printing

parameters are stored and/or determined?

A So in one instance of Dubois's discussing this is paragraphs 81 and 82. It says, starting in paragraph 81 at the bottom, "These ranges are determined in such a way that whatever the value of printing parameters select therein, the static properties desired for the object are satisfied under predetermined deposition conditions."

And then it goes on to say, in paragraph 82, "These ranges of parameters can originate from earlier investigations, can be stored in a database, and can be loaded during or prior to the slicing stage."

So that's talking about the parameters and storage in Dubois.

Q And where does this database sit in relation to the printer in Dubois?

A So in paragraph 148 of Dubois, it states "A computation unit, 198, adapted in particular to cut up 3D representation of the component to be produced into characteristics

objects has, as its input, said 3D representation. The product specification of the component parameterized in the form of digital data and is connected to a database 199. The database 199 contains all of the results."

So if we go look up at the figure for 198 and 199, which is Figure 6, it talks about the relation of the computational unit and the database. It really doesn't describe any sort of physical arrangement between the computation unit and the database, but it shows them sort of schematically, in that figure.

Q Does Dubois describe a remote CAD client selecting and sending printer control parameters to a printer over a network?

A So Dubois, as I say in my overview paragraph on -- sorry, in my declaration, in paragraph 32, Dubois describes a method and a device for producing three-dimensional multi-material components by inkjet printing of successive layers. So Dubois doesn't really talk about clients and networks, and things like that,

it's more concerned with this sort of production of a component by this 3D representation.

Q How would a POSITA have to change the system of Loughran to implement the teachings of Dubois that you point to?

A So as I say in paragraph 45 of my declaration, based on my knowledge and experience in the field, and my review of Loughran and Dubois, by the relatively late time frame leading up to 2012, it is clear that a POSITA would have been motivated to implement Loughran's SFF system, based on the suggestions of Dubois to include additional functionality of sending the fabrication job from the CAD client, using CAD information that includes printing parameters concerning the state of characteristics of the materials for purposes of achieving several known benefits that all articulate in further detail below.

"Such an implementation of Loughran's system, based on the teachings of Dubois, would have enabled to resulting system to complete each

fabrication job based on CAD information with the optimal set of material parameters. A POSITA would have also been motivated to make this predictable combination to provide a 3D printing method in which the 3D printer would readily identify and correct printing errors," such as I detail below.

And so, then I go into the reasons that a POSITA would make this combination, and none of those reasons include modifying Loughran's functionality. It's really incorporating Dubois' teaching into Loughran.

Q How would a POSITA incorporate Dubois' teaching into Loughran without modifying any of Loughran's functionality?

A So in paragraph 46, I continue "As I discussed above, Loughran's client computer sends fabrication job through the network to the SFF printer. These fabrication jobs include CAD information, and the POSITA would have" been beneficially -- "and a POSITA would have beneficially applied Dubois's suggestions to the

system of Loughran such that the CAD information additionally includes operational parameters, as suggested by Dubois. As such, in the resulting system, the SFF printer receives information that is specific to an individual fabrication job, such that the fabrication job is conducted using 'optimum values of printing parameters, such as a function of the nature of materials, the characteristics of the printer, and deposition conditions.'"

And that refers to paragraph 148 in Dubois.

I go on to say "It is apparent from Dubois's teachings that 'the quality of the object to be produced depends on all the related parameters which are representative of the nature of the materials used, the properties of the printer, and the computer-aided design.'"

And so, this is where it's beneficial to combine Dubois' teachings into the system of Loughran.

Q In the combination you proposed, how

would Loughran's remote CAD client retain the characteristics and deposition condition inputs that Dubois uses to determine optimum values?

A Can you ask that question again, please?

Q Sure. In the combination you proposed of Loughran and Dubois, how would Loughran obtain -- strike that.

In the combination of Loughran and Dubois, how would Loughran's remote CAD client obtain the printer characteristics and deposition condition inputs that Dubois uses to determine optimum values?

A So in Loughran's system, if you look -- or in Loughran's reference, if you look at Figure 1, the components of the system are all networked together. And so, given the network nature of Loughran in this SFF system, a POSITA would have understood how these different components communicate with one another.

And so, I think through the network, this information could be passed, for instance,

the -- just as you said, information concerning operating parameters from Dubois could have been passed through the network to be obtained by one of the components of the SFF system from Loughran.

Q Dubois relies on printer characteristics and deposition condition inputs to determine its optimum values, right?

A So, for instance, in paragraph 28 of Dubois -- sorry, I lost my place. In paragraph 28 of Dubois, it says "Establishing a spatial and temporal sequencing law for the print path for said print layers and for said discrete spatial trajectories as a function of the objects, their relative three-dimensional arrangement, and the characteristics of the printer in order to optimize the process of depositing each print layer."

So that connects characteristics of the printer to these optimal parameters.

Q If you want to scroll down to paragraph 148 and then read the final sentence there, and let me know when you've done so.

A Yes, I've read the final sentence in paragraph 148.

Q In paragraph 148 of Dubois, describes that the choice of optimum values of printing parameters are a function of the nature of the materials, the characteristics of the printer, and the deposition conditions, right?

A Yes, I see that. That's the last sentence in paragraph 148.

Q And your proposed combination of Loughran and Dubois would import these optimum values into the combined system, right?

A So, as I said in paragraph 45 of my declaration, a POSITA would have been motivated to implement Loughran's SFF system based on the suggestions of Dubois to include additional functionality of sending the fabrication job from the CAD client, using CAD information that includes parameters concerning the state or characteristics of the materials for purposes of achieving several known benefits, which I state below.

Q In the following paragraph you state, "As such, in the resulting system, the SFF printer 104 receives information that is specific to an individual fabrication job such that the fabrication job is conducted using optimum values of printing parameters," and then it goes on, and you're quoting Dubois there, correct?

A That's correct. That's paragraph 48 in Dubois.

Q And as we just discussed, those optimum values of printing parameters are determined as a function of the nature of the materials, the characteristics of the printer, and the deposition conditions, right?

A Yes. That's what Dubois says.

Q So then my question is, in the combination you propose, how would Loughran's remote CAD client obtain the printer characteristics and deposition condition inputs that Dubois uses to determine the optimum values?

A So as I responded previously, in Figure 1 of Loughran, the SFF -- the second SFF

system, first SFF system, those are all networked together. And so, information can be passed between those units of Loughran through the network, including the information that Dubois indicates in paragraph 148.

Q Can you describe that information flow in your proposed combination?

A Oh, like a physical example? So taking Figure 1 from Loughran and then modifying it in a way to sort of pictorially show the combination?

Is that what you're asking for?

Q What I'm trying to understand is how your proposed combination, that puts Loughran and Dubois together, would work, essentially.

And so, whatever data flow needs to happen between printer and (indiscernible) CAD client, that's what I'm asking about.

What is the data flow in your proposed combination?

A So I didn't propose -- in my analysis, I didn't propose a specific data flow or a specific arrangement of components between

Loughran and Dubois. But I did analyze, in paragraph 48, I say "Loughran and Dubois are directed towards highly similar subject matter, three-dimensional printing, and then in light of these similarities, a POSITA would have possessed ample skill to successfully implement the combination as I've described it above."

So I didn't -- I didn't propose a physical arrangement or a data flow, or anything like that. But because Loughran and Dubois are talking about very similar subject matter, it would be apparent to a POSITA to implement this combination. And such an implementation of Loughran's SFF jobs and SFF system, based on Dubois's suggested techniques, would have been merely the application of known techniques to a known system, ready for improvement to yield predictable results.

Based on my knowledge and experience in this field and my review of Loughran and Dubois, I'm confident a POSITA would have recognized that this modification would have yielded predictable

results and required only routine adjustments to the software to provide the additional functionality disclosed by Dubois, and as such, a POSITA would have had a reasonable expectation of success in making such modifications.

So I didn't propose a schematic. I didn't propose an example. But my analysis of Loughran and Dubois and the combination and expectation of success is detailed in paragraph 48 of my declaration.

Q So you contend that the combination of Loughran and Dubois would yield predictable results. But as you sit here today, you're not able to describe what that predictable result would be?

MR. BISENIUS: Sorry. Objection. Form.

A So, as I say in paragraph 47 of my analysis, as such, a POSITA would have recognized that implementing Loughran's system, based on the suggestions of Dubois to include the additional printing parameters disclosed by Dubois, based on

the identified material used in the fabrication job, in Loughran's SFF fabrication job information, would have provided for optimal use of the various functions of the printer based on the nature of the materials in the printer.

As such, a POSITA would have recognized the benefits of including printing parameters concerning the state or characteristics of the material, along with the CAD information in Loughran's fabrication jobs to improve the system.

So it's clear that the Loughran system would have been improved by modification with Dubois' suggested techniques. I didn't provide a network analysis or an information flow example, or anything like that, but because these references are talking about a very similar subject matter, as I say in my declaration in paragraph 48, a POSITA would have recognized that this modification would have yielded predictable results and required only routine adjustments to the software to provide the additional functionality disclosed by Dubois. And as such, a

POSITA would have a reasonable expectation of success in making such modifications.

So because we're in a networked environment of Loughran, it's within a POSITA's understanding to rearrange the components of that network or dictate the information flow based on what Loughran shows in Figure 1.

Q So it's your testimony that a POSITA would just inherently understand how to rearrange any components or any information flow, as long as it's within a networked environment?

A So we've been talking about Loughran, how would that modification of Loughran occur?

So Figure 1 in Loughran shows this networked environment. We've also been talking about 3D printers and clients, and it's routine for a POSITA to be able to modify software. I mean, that was performed often in the early 2010s, and, as I say, by the late time frame of 2012, which I used in my analysis, that printer software and how printers were connected to computers, and how print servers were connected to printers, I

mean, that was all known by a POSITA at this time.

And so, modification of Loughran's Figure 1, in order to include the teachings of Dubois, a POSITA would have understood how to do that because the networking of printers and computers, like I said, was a well-known -- a well-known activity at this time, in 3D printing.

Q Why wouldn't a POSITA simply incorporate Dubois' optimum values on Loughran's printer, just like Loughran dynamically adjusts its operational -- or its parameters based on the material information from the material identification server?

A Oh, so you're proposing to take these optimum values from Dubois and just put them into the information server in Loughran, rather than in a networked environment?

Or I don't necessarily understand exactly what you want to do.

Q That's okay. We can come back to that.

What specific deficiency in Loughran does Dubois allegedly solve, given that Loughran

already teaches obtaining material information and dynamically adjusting the printer?

A So as I say in my analysis in paragraph 47, "As expressly discussed by Dubois, it is important to control the nature of the materials in the printer in order to provide materials having the property required for printing and to use the various functions of the printer optimally." That's discussed in Dubois. "As such, a POSITA would have recognized that implementing Loughran's system based on the suggestions of Dubois to include the additional printing parameters disclosed by Dubois, based on the identified material used for the fabrication job in Loughran's SFF fabrication job information, would have provided for optimal use of the various functions of the printer based on the nature of the materials in the printer. As such, a POSITA would have recognized the benefits of using printing parameters concerning the state or characteristics of the materials along with the CAD information in Loughran's fabrication jobs to

improve the system." A POSITA would have also -- would also have recognized that including the functionality for correcting printing errors, which we haven't talked about, describe by Dubois in the system of Loughran, would have resulted in optimal outcomes by allowing the resulting system to correct for such identified errors.

And so, Loughran can still do its job of dynamically adjusting while Dubois -- Dubois' teaching is providing these optimum parameters and, also, this additional functionality of errors, as we talked about.

Q So in your proposed combination of Loughran and Dubois, that system is still dynamically adjusting its parameters for operation, based on information received from a material identification server?

A I mean, I think that Loughran's automatically and dynamically adjusting still could be incorporated in this. All that Dubois is doing is providing these optimal parameters and additional parameters not described by Loughran.

But that doesn't prevent Loughran's system from still dynamically adjusting based on -- based on Loughran's disclosure.

Q In your proposed combination, what happens where one of the optimum parameters from Dubois is the same as one of the parameters that Loughran is dynamically adjusting, based on information received from the material identification server?

A I mean, I'd have to think about how exactly Dubois -- if we're just talking about the material information server from Loughran, like I said, I'd have to think about the exact arrangement or information flow, but, of course, some printing parameters, like, say, you know, extrusion temperature, or something like that, I think that those parameters, that are both discussed by Dubois and Loughran, yeah, I don't think there's a conflict between those systems discussing similar parameters.

And this would come out in the implementation, where the network arrangement and

information flow would have to be worked out by a POSITA in order to make this combination. I don't think there's any conflict there.

Q But as you sit here today, you've not considered or worked out the implementation of this network arrangement and information flow to ensure that there would not be a conflict there?

A Yeah, as I said in my declaration, in paragraph 48, Loughran and Dubois are directed towards highly similar subject matter. And so, a POSITA is familiar with this networked environment. A POSITA would have the skill to modify software or to implement Loughran based on Dubois' suggested techniques.

And so, that was a very common activity in the late aughts or early 2010. I mean, we, in my own work, networked printers all the time and modify software, and did things that were similar in sort of the implementation to what I described in my analysis of the combination of Loughran and Dubois. So that would be well within a POSITA's understanding of how to do that.

Q As you sit here today, you've not considered or worked out the implementation of this network arrangement and information flow to ensure that there would not be a conflict in the combination of Loughran and Dubois, right?

A What I did was, I analyzed the -- Loughran and Dubois, and I analyzed the expectation of success that a POSITA would have. But I didn't propose, in my declaration, I didn't propose a new network arrangement or I didn't propose an information flow.

I could perform that analysis, if asked, based on a POSITA's knowledge at the time. But I did not perform that detailed analysis in my declaration.

MR. BISENIUS: Counsel, we've been going about an hour and a half since the last break. Would now be an okay time to take a break?

MR. TATUM: Yeah. We can take a break now.

MR. BISENIUS: Should we reconvene on the hour?

MR. TATUM: That works fine.

THE WITNESS: That works for me.

(Recess taken from 12:48 p.m. to 12:59 p.m.)

BY MR. TATUM:

Q Dr. Hickner, how did you determine whether a reference was analogous art to the '466 patent.

A So, when I was looking for prior art, of course, I considered the priority date of the '466 patent, and as I understand, the term analogous art really refers to prior art in the same field, say, solid free-form fabrication, as we talked about, or 3D printing or additive manufacturing or, in some cases, a lot of information from, say, machining or 2D printing has also been used in 3D printing or additive manufacturing.

So in order to determine analogous art or prior art in the references in the same field, I relied on my experience with additive manufacturing and the development of additive

manufacturing, in terms of what information sources are drawn upon that have helped to build up the additive manufacturing ecosystem.

Q You said when you were looking for prior art? Did you identify the references asserted in this IPR or did somebody else?

A So I collaborated with counsel on the declaration for this IPR, and I found some references, counsel suggested some references.

But I evaluated all the references, in terms of prior art for this IPR.

Q Which references did you find?

A I didn't denote which references I found. I'd have to look back at my notes. I don't recall the specific ones I found versus ones that were suggested to me. I don't have that information with me right now.

But as I said, I identified some references, counsel identified some. But evaluated all of the prior art references and analyzed them in my declaration.

Q Some of the opinions you provided in

your declaration were based on a reference named Jazayeri, right?

A That's correct, yes.

Q I've put in the chat what is labeled as Exhibit Number 1010.

Please let me know when you have that pulled up.

(Exhibit 1010 previously marked for identification and retained by counsel.)

A Yes, I have Exhibit 1010, Jazayeri, pulled up on my computer.

Q And you understand that if I refer to Jazayeri today that I'm talking about the reference shown in Exhibit Number 1010, right?

A I understand that, yes.

Q Now, in your declaration you represent Ground 1B, which includes Jazayeri, as an alternative to Ground 1A, to the extent Loughran's fabrication job is not, itself, a request; is that right?

A So in paragraph 93 of my declaration, I discuss this Ground 1B, which talks about the

combination of Loughran, Dubois, and Jazayeri. And so, my prior analysis of Ground 1A holds, and I incorporate the teachings of Jazayeri, specifically in regards to the claims as I discussed in Ground 1B.

Q Other than claim element 1b, your analysis for Ground 1B is identical to Ground 1A; is that right?

A So, as I say in paragraph 93 of my declaration, "As such, I incorporate my prior analysis of Ground 1A into Ground 1B." And "The predictable implementation of Jazayeri's suggestion does not disturb the aspects of Loughran and Dubois mapped to the other claim elements," outside of 1b.

Q So other than claim element 1b your element to Ground 1B are identical to Ground 1A, right?

A Yes, that's what paragraph 93 says.

Q I would like to direct your attention down to paragraph 94. And you'll see the second sentence there says "To the extent that Loughran's

SFF fabrication job is not considered a request to fabricate an object on the three-dimensional printer, a POSITA would have found it obvious and beneficial" for the system -- for the SFF system 104 to receive a request prior to receiving the SFF fabrication job, based on the additional suggestions of Jazayeri.

Do you see that?

A Yes, I do.

Q Is it your opinion that Loughran's fabrication job already constitutes a request to fabricate an object on the three-dimensional printer?

A So in my analysis of claim 1b, in paragraph 53, I say that "Loughran also discloses that the client sends a request to fabricate an object on the three-dimensional printer to the first SFF system." For example, Loughran's SFF system three-dimensional printer may also be referred to as an SFF server system that receives SFF fabrication jobs from client, such as client system 102, and fabricates SFF jobs received from

the client system 102.

So a POSITA would have understood that, in this context, the transmission of a fabrication job from the client system to SFF system is a request to fabricate the object defined by the fabrication job.

Q If that's the case, then why does Ground 1B need Jazayeri at all?

A So my analysis on this, with Jazayeri, is described in paragraphs 94 and 95 of my declaration. And in 94, I say, "As I discussed above in Ground 1A, element 1b, Loughran's SFF system may also be referred to as an SFF server that receives SFF fabrication jobs from clients, such as the client system 102 and fabricates SFF jobs received from the client system," and that's described in Loughran.

And so, I added this extra ground, or I added the Jazayeri modification, as described in paragraph 94, to the extent that Loughran's SFF fabrication job is not considered a request to fabricate an object on the three-dimensional

printer, which is Loughran's SFF system 104. A POSITA would have found it obvious and beneficial for the SFF system to receive a request prior to receiving the SFF fabrication job, based on the additional suggestions of Jazayeri.

And I go on in my analysis, in paragraph 95, to say "For example, Jazayeri describes a print server, including an application manager that receives 'a print request over a network from an application executing on a device,' which includes 'virtually any computing device from which a user may wish to execute a print job, such as a laptop or desktop computer, a netbook, tablet computer, smartphone, or any device which may store, have access to data which the user may desire to print.'"

So this modification, as I go on to say in paragraph 96, multiple reasons would have prompted a POSITA to apply the teachings of Jazayeri to the system of Loughran, as modified Dubois, such that the resulting system includes the functionality of the Jazayeri print server as

a part of Loughran's system.

Q Jazayeri describes document printing print characteristics, like paper size, orientation, and number of copies, right?

A I think some of those characteristics are described in paragraph 36. I focused on the print server part of Jazayeri, but Jazayeri alludes to those characteristics that you just stated, yes.

Q And you cite Jazayeri's paragraph 36 in paragraph 95 of your report, right?

A So in paragraph 95 of my report, I start, "For example, Jazayeri describes a print server, including an application manager that receives 'a print request over a network from an application executing on a device,' which includes 'virtually any computing device from which a user may wish to execute a job, such as a laptop or desktop computer, a netbook, a tablet computer, a smartphone, a camera, or any device which may store or have access to data which the user may desire to print' and executes an application

'which provides the user with a rendering of data which the user may wish to print.'"

And so, that's in Jazayeri, the abstract, paragraphs 8 through 10, 19 through 21, and 36 as well, the citation that we're talking about.

Q Can you, please, point me to the paragraph, or paragraphs, in Jazayeri that teach that a three-dimensional printer, as opposed to a print server, receives a request?

A So in Jazayeri, I focused on the print server and print request functionality of Jazayeri. For instance, in paragraph 66 it states "In the example of Figure 2, a print request may be received at a server over a network and from an application executing on a device. For example, as described above, the application manager may receive a print request from a user of the application, executing on the device or of the application executing on the application server or of the application of the device. The print request may be received over the network using an

API that is common to the application."

So I really focused on the print server and request of Jazayeri in my modification.

Q As you sit here today, can you identify any place in Jazayeri where it talks about receiving a request from a client over a network to fabricate an object on a three-dimensional printer?

A So as we discussed before, in 3D printing, there's been lots of information used from related fields, like printing, like machining, which uses G code, things that really inform the development of 3D prints. And so, in my description of Jazayeri, and how I used this reference, in paragraph 35, I said "Jazayeri generally 'relates to printing.'" In Figure 1, Jazayeri shows a print server which provides printing capabilities over a network to a device which includes virtually any computing device from which a user may wish to execute a print job.

And so, I used the print server and printing-related functionality of Jazayeri to

modify the 3D printer or the SFF system of Loughran with Dubois' modification as well.

Q I understand, Dr. Hickner, that you've taken some of these references and done things with them or have your interpretations of them.

My question is much more narrow, and it is, as you sit here today, can you identify any place in the Jazayeri document where it talks about receiving a request from a client over a network to fabricate an object on a three-dimensional printer?

A So in the abstract of Jazayeri, it states "A print server may include an application manager configured to receive a print request over a network from an application executing on a device and configured to provide, over the network, a print dialogue to user of the application. The print dialogue configured to provide for a selection of at least one printer associated with the user account of the user and thereafter receive a selected printer from the selection."

So Jazayeri uses printer because it relates, in general, to printing.

Q You'd agree that Jazayeri explicitly talks about 2D printing in some places, right?

A In some places of Jazayeri, say, in paragraph 36, it talks about color versus black and white, paper size, orientation, number of copies. And so, there -- those are characteristics of, let's say, 2D printing. But as I said before, in the development of 3D printing technology, there's been lots of drawing from machining, printing. In fact, we use -- in my lab, we use a DLP chip, which is a type of 2D print chip in order to stack three-dimensional layers. And so, Jazayeri is focused on printers in general, but does provide some examples of things that are important to 2D printing, if you want to put it that way.

Q Is there any place in Jazayeri where it mentions three-dimensional printing?

A There's only mention of printing in Jazayeri. It doesn't explicitly say

three-dimensional printing.

Q What is the '466 patent's field of endeavor?

A So in my declaration, in paragraph 26, I say "The '466 patent describes 'methods and systems for the automatic detection and acquiring of three-dimensional printer build material characteristics.'" So the field of endeavor is really discussing printer build material characteristics and 3D printers.

Q Jazayeri is not directed to 3D printing or build material characteristics, right?

A Jazayeri's directed towards printing and print servers and print jobs, and that is analogous to how we understand networked 3D printers. I mean, Jazayeri is -- does say a print server request over the network. So it talks about printing in general.

Q What is the problem addressed by the '466 patent?

A So in the abstract of the '466 patent, the patent, the abstract says "A supply of build

materials, such as the spool or cartridge, is instrumented with the data tag that includes information about the build material. A three-dimensional printer can read the information from the tag and determine how to use the build material during the fabrication of a three-dimensional object."

And then in the background of the patent, after the figures, it says, "In general, three-dimensional printers use build material of various type and configuration to print three-dimensional objects. In order to properly process the build material through the three-dimensional printer, a printer extruder for the fabrication of an object, the three-dimensional printer controller may need at least a basic set of characteristics of the build material to determine operation. There remains a need for methods and systems for the automatic detection and acquiring of three-dimensional printer build material characteristics."

And then it goes on to state the

summary in the claim.

So that describes the problem that the '466 patent is addressing.

Q Can you describe how Jazayeri's print server paradigm would be integrated into Loughran's SFF job submission architecture?

A So as I state in paragraph 96 of my declaration, "Multiple reasons would have prompted a POSITA to apply the teachings of Jazayeri to the system of Loughran (as modified by Dubois) such that the resulting system includes the functionality of Jazayeri print server as part of Loughran's SFF system. This would have included implementing Loughran's system to include the functionality of an application manager for receiving a print request over the network from a client device, providing the client with the print dialogue or other user interface for the user to select an available printer, and then receiving a print job designate the selected printer from the client device to achieve several known benefits," as I talk about below. "The resulting system

would have enabled Loughran's SFF system to receive a print request over the network from a client device and respond by providing the client with a dialogue to select any available printer. A POSITA would have been motivated to combine Loughran's and Jazayeri's teachings to provide this functionality for multiple reasons," as I state further in my analysis.

Q Can you describe, practically and functionally, how the combined system of Loughran and Dubois would change when you implement the teachings of Jazayeri?

A So Loughran, let's take Figure 1 for instance, Loughran already talks about material information server, Loughran discusses CAD server.

So integrating the suggestion of Jazayeri for a print server, while I didn't formulate a new block diagram, or anything like that, as we talked about before, based on Figure 1 of Loughran, because of this networked environment, it's well within a POSITA's knowledge to implement things like print servers, as

suggested by Jazayeri.

And, again, I didn't work out the block diagram. I didn't propose a network architecture or network flow, but a POSITA would have been motivated to implement this print server for Jazayeri, based on my analysis of this combination.

Q You pointed to Figure 1 of Loughran. When you add in the print server from Jazayeri, do you remove any components? Do you add the print server and connect it somewhere else in this diagram?

I'm trying to understand how a POSITA would actually implement the combination that you're suggesting.

A So I didn't work out, again, the details of how I would modify, say, Figure 1, for instance, of Loughran to put in this print server.

But as I discussed in paragraph 97 of my analysis in the declaration, applying Jazayeri's suggestion to Loughran would provide an ability for, virtually, any application running on

any device within the network to communicate with the cloud print service to, thereby, print to any printer, which is also in communication with the cloud print service. Consequently, users may benefit from increased printing option and abilities. As such, the predictable application of Jazayeri's teachings to the Loughran-Dubois system would have resulted in a system that allowed the user of the client system to select from the various different types of three-dimensional printers, based on the requirements of a given fabrication job.

Additionally, a POSITA would have recognized that such a selection of an appropriate three-dimensional system for a given fabrication job could have beneficially been performed automatically by the client system.

So because of this networked environment of Loughran, a POSITA would have understood how to integrate the teachings of Jazayeri into a schematic of Loughran's system, for example, Figure 1.

Q Do you cite any record evidence to support your conclusion that a POSITA would have understood how to integrate the teachings of Jazayeri into a schematic Loughran system, for example, Figure 1?

A So based on my knowledge of a POSITA's skills, and the information available to a POSITA on networked environment -- networked environment of 3D printers, which were common at this time, my analysis indicates that a POSITA would have had ample skill to successfully incorporate Jazayeri's suggested teachings into Loughran's networked environment of 3D printers and, thus, would have reasonably expected success achieving the combination.

Like I said, we networked 3D printers all the time, starting in 2010 and onward, when I started working with 3D printers in my lab. So that was a common occurrence in 3D printing before 2012.

Q Other than your own experiences, you do not cite any record evidence to support your

conclusion that a POSITA would have understood how to integrate the teachings of Jazayeri into schematic for Loughran's system, for example, Figure 1, right?

A So are you talking about, like, a network analysis textbook, or, like, a schematic of how different printers and print servers and clients are configured in a network?

Are you talking about a reference to something like that?

Q Just any sort of evidence in the record that would support your conclusion, other than your own experiences and opinions as to what a POSITA would know at that time.

A So as I said in my declaration, in paragraph 19, "In rendering the opinions set forth in this declaration, I was asked to consider the patent claims and the prior art through the eyes of a person of ordinary skill in the art as of the effective filing date of the '466 patent." So this is the POSITA that we've been talking about.

And I concluded October 29th, 2012, as

the effective filing date. So that's in my declaration.

And so, I go on to say that a POSITA relating -- in paragraph 20, a POSITA relating to the technology of the '466 patent would have had at least, one, a bachelor's degree in mechanical engineering, computer engineering, material science, or related field, and, two, at least two years of research or industry experience in 3D printer or materials used for 3D printer.

And so, based on a POSITA's qualifications, as discussed in paragraph 20, engineers and people working with 3D printers, as I talk about in the detailed qualifications, they all have knowledge of the network environment of 3D printers, print servers, how to accomplish this sort of networked environment.

I think that's all included in the understanding of a POSITA.

Q I would like to direct your attention back to the '466 patent and, specifically, column 23, line 64 through 67. That's claim 5.

A Okay. I'm there at claim 5.

Q Okay. And you see that claim 5 requires receiving a selection of one of the first build material and the second build material from the client for use in fabricating the object using the three-dimensional printer?

A Yes, I see what claim 5 says.

Q And you understand that claim 5 depends on claim 4, which, itself, depends on claim 3?

A That's how I understand this to be constructed, claim 5 says "the method of claim 4," claim 4 says "the method of claim 3," and so, that builds on one another, as you just described.

Q So you understand that claim 5 requires that there's two different build material supplies, each with a tag, that the printer provides tag data from both supplies to the client, and that the printer ultimately receives a selection from the client of one of those two build materials, right?

A I mean, claim 4 says "The method of claim 3 further comprising providing data from the

first tag and the second tag to the client over the network."

So that's talking about the tag and the client.

"The data including at least one property of the first build material and second build material."

So that covers tag and properties of the build material.

And then claim 5 says "The method of claim 4, further comprising receiving a selection of one of the first build material and the second build material from the client for use in fabricating the object using the three-dimensional printer."

So that -- claim 4 sort of provides the discussion of the tag and the properties. And then claim 5 talks about selection of one of the first build material and second build material for the client for use in fabricating the object using the three-dimensional printer. That's what the claims say.

Q What passages in Loughran or Dubois do you rely on to satisfy claim 5?

I'll withdraw that question. Let me ask it in a better way.

Dr. Hickner, if you'd turn to your expert report at paragraph 78, and let me know when you're there.

A Okay. So I'm at paragraph 78 of my report, and that's under the section where I discuss claim 5.

Q And do you see here, in this first sentence, you say "A POSITA would have understood that a slice specifies a selection of build material for use in printing the layer of the multi-material component"?

A Yes, I see what I've written there in paragraph 78.

Q What reference do you rely on to reach that conclusion?

A Uh, my PDF viewer just crashed. Let me get back to Dubois. Apologies.

Q Of course.

A So in Dubois, in paragraph 61, and in paragraph 77 of my declaration, I say, "In Dubois, 'cutting up the 3D of the component to be produced involves cutting up the 3D representation of the component to be produced by ink-jet printing into characteristic objects defined by a set of geometric properties and physico-chemical properties taken in combination.'"

So this passage in Dubois really speaks to this sentence in paragraph 78, that based on Dubois, a POSITA would have understood that a slice-specified selection of a build material for use in printing the layer of the multi-material component.

So the layer is geometric, as talked about in Dubois, and then the build material is these physicochemical properties of Dubois.

And so, a POSITA would understand that sort of nomenclature of Dubois. And then I bring in this reference from Napadensky, which discloses that division of the virtual object is done in order to enable a signing of different modeling

materials or modeling material combination or structures to different regions.

And so, this is what Dubois is talking about, in terms of these different objects, as both the geometry and the material properties.

Q Napadensky is not part of the asserted Ground 1A or Ground 1B combination, right?

A No Napadensky is not part of the -- of the combination, but I used Napadensky to interpret what Dubois is talking about, in terms of these sets of geometric and physicochemical properties, as used in the language of Dubois.

Q Dubois doesn't talk about receiving data from tags, though, right?

A So Dubois doesn't address tags. It talks about, say, in paragraph 40, Dubois says "The present invention also relate to a device for storing a material for device for production by ink-jet type printing." It talks about this database that we discussed before. But there's no mention of something like a tag or an RFID in Dubois.

Q For Grounds 1C, 1D, 3G, and 3H, you add KISSlicer to the combinations for claim 5, right?

A No, I'm just looking through to verify what you said. But, yes, I do use KISSlicer in some of my grounds. That's correct.

Q KISSlicer is a user guide, right?

A So the reference that I cited, in regards to KISSlicer, is the user guide PDF. But KISSlicer, itself, is a piece of software that we would refer to as a slicer, in sort of term of art of 3D printing. So KISSlicer is a piece of software, but of course the user guide is my reference because that explains how the software works.

Q And for purposes of this IPR, are you relying so just the user guide or also functionality otherwise in the software of KISSlicer?

A So I relied on the user guide because that's the cited reference in my declaration. And the way that I understand KISSlicer, we've used -- or I've used lots of different slicers in my 3D

printing research. And so, KISSlicer has all of the functionality that I would have expected a slicer, at this time, to have. I mean, there were a number of different slicing softwares, like, Slic3r with a 3, S-L-I-C-3-R, there was SFACT, there was Netfabb, but the user guide is what I used as my reference, and that really informed me, in terms of the functionality of the KISSlicer software itself being -- sort of having the functionality that slicing programs at the time had.

Q KISSlicer doesn't mention receiving information about build materials from data tags, right?

A Can you send me the KISSlicer reference? I don't have it in front of me. I only have our exhibits up. But I'm happy to look at that reference, if you want to pass it over.

Q Sure thing. I've just added what has been marked as Exhibit 1018 into the chat, if you want to pull that up.

(Exhibit 1018 previously marked for

identification and retained by counsel.)

A Okay. So I have Exhibit 1018, KISSlicer Quick-Start Guide, in front of me.

Q And in the quick-start guide, KISSlicer doesn't talk about data tags or anything like that. KISSlicer does talk about selection of materials. So in the KISSlicer settings dialogue, say, on the bottom of page 3, where the user guide is talking about how the software works, under the materials selection, there's different materials that are available in the KISSlicer software.

And if you look at the bottom of that page, it specifically says "select your material from one of the default options, and for the moment, keep the default settings."

Do you see that?

A Yes. I see that sentence in the user guide.

Q And this is describing that KISSlicer's material selection, that you pointed out there, as default settings for different materials, right?

A Yes. That seems to be what it

indicates. Where it says, you know, select your material from one of the default options, and that's shown in this drop down box, in the figure above. So I think that -- well, that is how KISSlicer, at least, incorporates a number of default materials.

Q And KISSlicer doesn't say anything about being able to automatically receive information from a data tag about a material and have that update in the software, right?

A So KISSlicer talks about these default materials, and it also says, at the bottom of page 3, "In case you already have a working temperature profile for your material, update it accordingly."

That update, where you can adjust the parameters, it doesn't say whether that update is automatic. As we said, it doesn't talk about the tag. But it does talk about the ability to update a working temperature, which would be part of the printer settings that you'd need to print that material. So KISSlicer does have the ability to

change the default parameters.

Q And KISSlicer shows that a user would do that by adjusting some of these boxes we see on the screen in Figure 3, right here, right?

A I mean, it does say -- the quick-start guide says "In case you already have a working temperature profile for your material, update it accordingly."

It doesn't say whether that's a plug it in the boxes or calculate something. But I think in lots of these slicer programs, there were automatic calculations. But there were also boxes like this. I mean, I don't have the software in front of me, where you could change things like the temperature profile on a user basis. I mean, KISSlicer sort of just says update it accordingly. It doesn't talking about, necessarily, the mechanics of how that's done.

Q You can put KISSlicer away.

MR. BISENIUS: Counsel, if we're switching references, now might be a good time for a break.

MR. TATUM: Yep. I think that's a good idea.

THE WITNESS: I just want to add that I'm on East Coast time, and it's 3:00.

So I would be looking for a little bit longer break, whether it's this one or the next one, but any time. I just need, like, 30 minutes to grab a quick sandwich or something. So whether that's now or in an hour, I'm fine with whatever.

MR. TATUM: Of course. Why don't we take a 30-minute break now so you can do that, if that works for everybody, and then you can come back after.

MR. BISENIUS: Sure.

THE WITNESS: Great. I appreciate that.

MR. TATUM: Yeah.

(Recess taken from 2:00 p.m. to 2:30 p.m.)

BY MR. TATUM:

Q Dr. Hickner, some of the opinions you provided in your declaration were based on a

reference named Devos, right.

A That's correct, yes.

Q I've put into the chat what is labeled as Exhibit 1008. Please let me know when you have it pulled up.

A Yeah, so I have 1008 pulled up, and that's Devos, the patent by Devos.

Q I would like to take you to paragraph 32 of Devos.

Let me know when you have that in front of you.

A Okay. I've got paragraph 32 in front of me.

Q And do you see the final sentence of paragraph 32 that reads "The system can also use the data encoded in or on the memory mechanism 146 to determine certain operating parameters, such as, for example, print speed, drop volume per voxel, color maps, dry time needed after build completion, shrink or expansion size, adjustment factors, powder settling coefficients, e.g., to determine whether powder supports need to be

included and, if so, how much, minimum allowable layer thickness, et cetera"?

A Yes, I see that last sentence that you just read.

Q What is a powder settling coefficient?

A So a powder settling coefficient, this is the only place in Devos where it discusses this powder settling coefficient. And that's a term of art in additive manufacturing when powders are involved.

And so, these powders settle. And powder settling coefficients are used in additive manufacturing to understand how powders settle. And you can formulate a powder settling coefficient using different mathematical expressions. But whenever you're using powders in additives these powder settling coefficients can be computed.

Q And powder settling coefficients describe how the powder settle; is that right?

A Yes, so in general, in additive manufacturing, let's say, for example, you're

interested in layer-by-layer, powder-based process, in that case, the powder settling coefficient would describe the settling of powders when they're spread in the bed. So, for example, if you're going to do powder additive and you set the layer height in the machine to 300 microns, and then what powder is laid down in the additive layer-by-layer process, even though you set the machine to 300 microns, based on the characteristics of the powder, which is incorporated in a powder settling coefficient, you might not get a 300-micron layer thick of powder.

And so, you can compute the coefficient, which is a characteristic of the build material that describes how the powder settles compared to the set layer height.

So it's a property of whatever powder you're interested in, and you can formulate that coefficient using a couple different strategies.

Q And do you know what values or units powder settling coefficients would have?

A So, in one formulation of a powder

settling coefficient, you have, let's say if you're using height, or units of length, you have length divided by length, which gives you a unit-less powder settling coefficient. And so, usually, these coefficients, whether it's a powder settling coefficient, or some other compaction coefficient, if you will, it's usually height divided by height, which has the engineering units of length divided by length. So the coefficient is formally unit-less when you compute it.

Q Does Devos ever disclose generating a printer setting or requirement that configures the printer to fabricate support structures as part of the build?

A So, in the sentence that we're discussing in paragraph 32, it says "To determine certain operating parameters, such as, for example, print speed, drop volume per voxel, color maps, dry time needed after build completion, shrink or expansion size, adjustment factors, powder settling coefficient, e.g., to determine whether powder supports need to be included and,

if so, how much support minimum allowable layer thickness, et cetera."

So it's talking about the connection between operating parameters and this powder settling coefficient and support requirement, and how much support.

Q You said that the powder settling coefficient is a function of the powder used; is that right?

A So the powder settling coefficient, it can depend on the type of powder. It can also depend on, say, the spreading speed or the characteristics of the printer.

In this case, Devos is saying, the system can also use the data encoded in or on the memory mechanism to determine certain operating parameters. And so, it's really, in this list of properties, where powder settling coefficient is, that is referring to data encoded in are on the memory mechanism.

And so, this powder settling coefficient, it really has to be determined

experimentally. And so, as I said, the type of powder, powders settle differently depending on how fast they're spread. It could be a function of other characteristics of the machine. And so, the powder settling coefficient really includes a mixture of different things. One of which is the type of powder that you're using.

Q Would a POSITA understand a powder settling coefficient to be an operational parameter, as described in the '466 patent?

A So as I say in paragraph 113 of my declaration, "Based on Devos's disclosure of determining operating parameters, including powder settling coefficient to determine whether and how much powder supports are needed, a POSITA would have found it obvious and straightforward to implement Devos's system to determine an operating parameter specifying whether and how much powder supports are needed. Indeed, based on the expressed disclosure of Devos, that a powder settling coefficient is used to 'determine whether powder supports need to be included and, if so,

how much support,' would have indicated to a POSITA that the system would need to generate a parameter indicating 'how much support' material to be used in fabricating the object. A POSITA would have recognized that this parameter provides the claim support structure requirement."

Q Yes or no, would a POSITA understand a powder settling coefficient to be an operational parameter, as described in the '466 patent?

A So in the '466 patent, in column 15, starting line 17, it -- the '466 patent states "For example, the operational parameter may be at least one of an extruder temperature, a feed rate, a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, a cooling requirement, or other operational parameter that might" be -- "that might usefully be determined by the controller from the data stored in the data tag."

So that connects operational parameter to support structure requirement and discusses

other operational parameters that might be useful in this build process.

Q Yes or no, would a POSITA understand a powder settling coefficient to be an operational parameter, as described in the '466 patent?

A So looking at the '466 patent, it discusses powder, say, in column 18, line 56, it says "Build material may be any size or combination of sizes, ranging from a fine powder to relatively large sphere."

So '466 does not talk about powder settling coefficients, but it does talk about these parameters and powder. So a POSITA that's using powder would have an understanding of powder settling coefficients.

Q And I'd ask you to just listen to my question and answer it as asked. Yes or no, would a POSITA understand a powder settling coefficient to be an operational parameter, as described in the '466 patent?

MR. BISENIUS: Objection. Asked and answered.

A Oh, you want a simple yes-or-no answer to that question?

Q Are you able to provide a yes-or-no answer to that question?

A I provided my response. I mean, we're talking about, you know, complicated details of additive manufacturing and powders. And so, I provided a response to that. It's not a simple yes-or-no answer.

Q So just to be clear, as you sit here today, you are not able to answer, yes or no, whether a POSITA would understand a powder settling coefficient to be an operational parameter?

A I've provided my response, and I could perform further -- if you wanted me to boil it all down to a yes or no, I could do that analysis, but I haven't done it. I've given you my response to this question.

Q Are you able to perform that analysis right now and boil it down to a yes or no?

A So I've given my response and analysis

at this time.

Q Can you identify, in Devos, where Devos provides technical details for how a POSITA could implement a support structure requirement based on a powder settling coefficient?

A So Devos discusses this issue of powder settling coefficient, for example, to determine whether powder supports need to be included, and if so, how much support. There's no technical detail in Devos as to how that's done. But at this time, or the time of the '446, 2012 and earlier, there was a lot of technology and know-how around using powders, supports being required, how to fabricate supports, how to determine if you need supports. And so, Devos doesn't discuss those technical details in particular. But just like a POSITA understands powder settling coefficients and how to formulate those coefficients, and different ways to mathematically determine those coefficients, a POSITA would understand this issue of determine whether powder supports need to be included, and

if so, how much support. But there's no technical detail or equations, or anything like that, in Devos that discusses the details.

Q Some of the opinions you provided in your declaration were based on a reference named Menchik; is that right?

A That's correct. Menchik or Menchik, that's correct.

Q I've put in the chat what has been labeled as Exhibit 1009. Please let me know when you have that pulled up.

(Exhibit 1009 previously marked for identification and retained by counsel.)

A I have it pulled up Exhibit 1009. This is the patent by Menchik.

Q Can you point me to any paragraph where Menchik discloses a client, distinct from the printer, that receives tag data from the printer over a network?

A So, as I discuss in paragraph 128 of my declaration, Menchik's controller 105 may include, for example, a processor 110, a memory unit 115,

software code 120, and a communications unit 125, and that's described in paragraph 21 of Menchik.

Menchik describes an embodiment where a separate unit, such as a personal computer or workstation, may provide some control or data storage capability. Communication unit 12 may, for example, enable transfer of data and instructions between controller 105 and printing apparatus 140, and/or between controller 105 and one or more cartridge apparatuses 180 or cartridge arrays 190. And that's still from paragraph 21 in Menchik.

I go on to say, "Specifically, controller 105 may be located outside of printing apparatus 100. Controller 105 may be located outside of printing system 100 and may communicate with printing system, for example, over a wire and/or using wireless communications." That's discussed in paragraph 24 of Menchik.

"Controller 105 may be included within, or may include, a computing device, such as a personal computer or a desktop computer, a mobile

computer, a laptop computer, a server computer, or workstation (and thus part or all of the functionality of controller 105 may be external to the 3D printer system). Thus, based on Menchik's teachings here, the controller 105 can operate as a computing device that communicates with the printing apparatus over a network."

Q You mentioned a controller 105. Menchik also references a separate computing platform that can provide a printing file.

In your view, is the controller 105 and the computing platform the same thing, as described in Menchik, or are they something different?

A So in paragraph 26 in Menchik, this issue is described, paragraph 26 says "Controller 105 may be implemented using any suitable combination of hardware and/or software. In some embodiments, controller 105 may include, for example, a processor, a memory and software or operating instructions. Processor 110 may also include conventional devices such as a central

processing unit, microprocessor, a computer on a chip, a microcontroller, et cetera. Memory 115" maybe -- "may include conventional devices such as random access memory, read-only memory, or other storage devices and may include mass storage, such as A CD-ROM or hard disk. Controller 105 may be included within or may include a computing device such as the personal computer, a desktop computer, a mobile computer, a laptop computer, a server computer, or workstation and, thus, part or all of the functionality of controller 105 may be external to the 3D printer system 100. Controller 105 may be of other configurations and may include other suitable components."

Q Do you see the preceding paragraph number 25?

A Yes, I do. I'm at 20 -- paragraph 25 of Menchik.

Q And do you see that one says "In some embodiments, a printing file or other collection of print data may be prepared and/or provided and are programmed, for example, by computing platform

connecting to 3D printing system 100"?

A Yes, I see that.

Q And my question to you is, in your analysis, are you equating computing platform, in this sentence, with controller 105 in the following paragraph or are they different?

A So in paragraphs 25 and 26, if you look at both of those, paragraph 25 starts "In some embodiments, a printing file or other collection of print data may be prepared and/or provided in our program, for example, by a computing platform connected to a 3D printing system 100."

So if we go look at the figure, which is Figure 1, there's a 3D printing system 100 that's specified with an arrow, that's just talking about the entire system. And in paragraph 25, where it says "A printing file or other collection of print data prepared or provided in a program by computing platform," that computing platform is not labeled with a number like 3D print system in 100.

And then if we look at paragraph 26, it

says "Controller 105 may be implemented using any suitable combination of hardware and/or software."

So 105, the controller, is noted, in Figure 1, as its own box. And then paragraph 26 goes on to say that "Controller 105 may be of other configurations and may include other suitable components." It can be -- you know, "controller 105 may be included within or may include a computing device such as a personal computer, a desktop computer," et cetera. So 25 and 26 talk about this other computing platform. 25 leaves it open.

I mean, it doesn't identify a box, in this case, by a computing platform connected to the 3D printer system, which it talks about. But controller is certainly identified. And so, I think these are just providing some examples, or as this patent says, in some embodiments, it's providing a couple different examples as to how this would work.

Q How is the computing platform in 25 different from the controller described in

paragraph 26?

A So as I say in paragraph 130 of my declaration, based on Menchik's explicit teachings, the computing platform providing the printing file is an example of the controller 105 external to the printing apparatus 140. In accordance with the scope of this limitation, advanced by the patent owner in the litigation, a POSITA would have understood that the printing file provided by the controller of the computing device, which is the client, to the printing apparatus, three-dimensional printer, is a request to fabricate an object on the printing apparatus or three-dimensional printer.

So in my analysis of Menchik's teachings, I say the computing platform is an example of the controller. I don't think all the different examples in Menchik are alliterated, but in these paragraph 25 and 26, I state that this is an example of the -- or the computing platform providing the printing file is an example of the controller.

Q You mentioned, "in accordance with the scope of this limitation advanced by Patent Owner in the litigation."

What is the scope of this limitation advanced by Patent Owner in the litigation?

A So that comes from the preliminary Patent Owner response, which I don't have in front of me. And so, I'd have to go review that document in order to give you a definitive answer on scope.

Q You understand, Dr. Hickner, that you submitted this declaration prior to the Patent Owner's preliminary response in this matter, right?

A Yes. I understand that.

Q So how could this be referring to Patent Owner's preliminary response, if you submitted this before that was ever filed?

A I believe I misspoke. I mean, I had the patent, I had the '466 patent in front of me when I prepared this declaration. So the limitations discussed in the patent are what I'm

referring to.

Q But doesn't this sentence say "in accordance with the scope of this limitation advanced by Patent Owner in the litigation"?

What litigation is this referring to?

A So when I prepared this declaration, it was for the IPR of U.S. Patent Number, you know, 10,569,466, and so the '466 patent. So this sentence, the litigation is referring to this IPR.

Q And at the point that you are served this declaration, had Patent Owner ever taken a position in this IPR on the scope of this limitation?

A So of course I had the '466 patent and its claims and the limitations to those claims, and that's how I performed my analysis.

I'm not sure I understand the question, in terms of what you're asking, because I had the patent, and I evaluated the claims and limitations. That's what I did in my declaration.

Q I'm just simply trying to understand why you included this extra language here, that's

not included for most limitations, where you specifically call out the scope of the term as advanced in the litigation?

And if you don't know the answer to that, that's okay. I'm just trying to understand the reasoning behind your report.

A I don't have a specific answer to that question. I would have to consider that question further.

Q What operational parameters, received from the client and selected for use in controlling operations of the printer during fabrication, does Menchik disclose?

A Sorry. Can you ask that question again?

Q What operational parameters, received from the client and selected for use in controlling the operations of the printer during fabrication, does Menchik disclose?

A So are you referring to limitation 1f or specific language from the '466 patent? I apologize, the question is long, so I just want to

get the right response for you.

But if you'd refer me to specific language as written, I can give you a response.

Q Sure. In relation to limitation 1f, which requires receiving, from the client, operational parameters, in your discussion and analysis of Menchik, what do you contend are the operational parameters that meet that claim?

A Ah, okay. I understand now.

So in paragraph 35 of Menchik, one example of this discusses various data storage, and it says "Memory chip may, for example, store and/or record information relating to the material stored within the cartridge, for example, the type of building material in the cartridge bag, the material's color, manufacturing date, optimal operation parameters, e.g., recommended jetting temperature, optimum building parameter, e.g., for billing or support, and material parameters, for example, viscosity and/or surface tension at the recommended temperature."

So in this example of where it

discusses operation parameters in paragraph 35, it refers to an example of a recommended jetting temperature.

Q Are there any other operational parameters disclosed in Menchik?

A So, as I say in my declaration, this is in paragraph 136 of Menchik [sic], but this is described in paragraph 48 of the reference, itself, "'The printer controller may also compute the expected order and quantity of uptake and deposition of each type of material into the printing apparatus, for the printing or construction of a given object.' This provides yet another example of selecting the claimed one or more operational parameters."

Then I go on, in Figure 6 or partial cutout of Figure 6, on the top op page 116, "In another example, Menchik describes that the printer control may compute, based on the materials required for printing a given object, supply parameters for the material in each cartridge."

Q You provide opinions regarding claim 17 under Grounds 1E, 1F, 3E, and 3F, right?

A I'm just looking to verify all those grounds, but, yes, I provided opinions on claim 17.

Q What is the diagnostic test you rely on in Menchik for satisfying claim 17?

A So, as I say in my declaration, in paragraph 174, a POSITA would have also understood that calculating whether a cartridge contains enough material to complete the print jobs specified in the printing file is a diagnostic test to determine whether or not the operating manager, the amount of material required, is suitable for the printing apparatus to complete the job.

And if you look at paragraph 47 of -- excuse me, 46 in Exhibit 1009, it says "According to some embodiments of the present invention, a method is provided to monitor and calculate the amount of building material required for printing a particular object or series of objects."

And so, this calculation, as I say in my declaration, is a diagnostic test to determine whether the operational parameter, the amount of material required, is suitable for the printing apparatus to complete the job.

Q In your opinion, does the printer also include the building material storage?

A Are you talking about in Menchik, specifically?

Q Let's start with Menchik.

Is it your opinion that the building material supplies there are part of the 3D printer, as opposed to a separate component?

A So if we look at Figure 1 of Menchik, it has this label of the controller and the 3D printer, et cetera. And, also, this cartridge array. So this cartridge array is where the materials are, and then, they go through the flow diagram, through the valve matrix, and then, eventually, arrive at the printing head.

So in this type of printing, you know, it doesn't really say whether the cartridge array

is a box inside the printer. I've seen examples where the material supply for the printer is sort of its own box, if you will, that's connected by hoses, to the box that houses the printing head. I think that there can be a number of different configurations or ways to think about Figure 1. And there are examples of printers out there where, say, the raw materials are stored, like, right underneath the printing tray.

So I think there can be a number of different configurations for where the materials sit in relation to the printing function.

Q When the material supply, you said sort of its own box that's connected to the box that houses the print head, do you still consider that material supply to be part of the printer?

A So if we just look at Menchik in Figure 1, starting paragraph 20, Menchik says, "Figure 1 is a block diagram of a 3D printer system 100 according to an exemplary embodiment of the present invention. A 3D printer system 100 may include, for example, a controller 105,

printing apparatus 140, and one or more three-dimensional modeling material supply sources, such as cartridge apparatuses 180 or cartridge arrays 190. In a typical configuration, a set of cartridge apparatuses outside of the cartridge arrays is not used with a separate cartridge array, but such a configuration is within the scope of the invention."

So I think that Menchik is describing one example of this configuration where the cartridge array 190 is holding the materials. And then the printer 140 is -- it's a different box in Figure 1.

Now, when this is built as a machine, I've seen the material supply, let's say, 190, which is the cartridge array, the materials, be a different box connected by hoses, or some other method, to the printing box 140. I've seen the cartridge array sitting underneath the printing box 140.

I think that Menchik is just giving an example of how these different components can be

configured. But in my own 3D printing work, I've seen the configurations done differently, depending on the exact materials and the cartridge array, and what the printer looks like, et cetera. It can be done multiple ways.

Q Does Menchik provide any error message in response to the diagnostic test that you had identified?

A So in paragraph 53 of Menchik, it says "According to some embodiments at block 635, if controller 105 determines that the amount and/or type of material in one or more cartridges 250 requires replacement, controller 105 may, for example, transmit an alert message to one or more system operators."

And so, this alert message, and we talked before about determining the amount or type of material as a diagnostic test, transmitting an alert message is an error message or a message saying that the amount or type of material in one of the cartridges requires replacements.

So that's stated in paragraph 53 of

Menchik.

Q Is the type of material an operational parameter?

A So we were discussing previously what characteristics of materials may or may not be operational parameters. A type of material is really a name, like PLA or ABS, or liquid or solid, you know, so it's not necessarily an engineering variable, the way we've named types of materials.

Now, properties of the material, those are what matter for the operational parameters. But type of material is sort of the general -- a general term, just noting, you know, is the type PLA? Is the type ABS? And that, in and of itself, doesn't give the detailed information that one would need for operational parameters such as temperatures, or something like that. There needs to be a further -- well, the material name or type of material doesn't give all of the characteristics of the material needed.

Q And that would be the same for the

amount of the material as well?

A So in terms of amount of material, that cuts much more to the operational parameter because the system knows how much material is going to be needed for a given build. So I think, you know, type of material, a lot of materials are just named generically. But amount of material really gets to the fact of how large the build volume is going to be.

Q So would a POSITA understand that the amount of material on the spool, for instance, or in the material supply, is an operational parameter of the printer?

A So as I say in paragraph 174 in my declaration, "Based my knowledge and experience in the field and my view of Menchik and Dahlin," another reference, "a POSITA would have understood that the amount of modeling material, support liquid, or combination of modeling and support materials required for printing are given three-dimensional object." So this is amount of modeling material, which could be the amount of

filament on the spool, as cited in Menchik paragraph 48, "is an operational parameter used in controlling operation of the three-dimensional printer when fabricating an object with the material."

Q So is it your opinion that the amount of modeling or support material needed to do the job is an operational parameter, or is it your opinion that the amount of material on the spool, or in supply is an operating parameter?

A So in paragraph 48, Menchik says "At block 615 the printer controller may compute, for example, the amount of modeling material, support liquid, or combination of modeling and support materials required for printing a given three-dimensional object."

That paragraph 48 in Menchik is what I cited in paragraph 174 of my declaration that says "Based on my knowledge in the field and my review of Menchik and Dahlin, a POSITA would have understood that the amount of modeling material, support liquid, or combination of modeling and

support material required for printing a given three-dimensional object is an operational parameter used in controlling operation of the three-dimensional printer when fabricating the object with a material."

MR. TATUM: All right. I can pass the witness.

THE WITNESS: Sorry, Rick, you're muted.

MR. BISENIUS: Thank you. I just have a few questions, Dr. Hickner.

EXAMINATION BY COUNSEL FOR THE PETITIONER

BY MR. BISENIUS:

Q In addition to this IPR proceeding involving the '466 patent, you've provided written opinions for a few other proceedings between these two parties, Stratasys and Bambu; is that correct?

A That's correct, yes.

Q Some of those other proceedings are IPR proceedings; is that correct, involving other patents?

A That's correct, yes.

Q Have you also provided written opinions regarding the District Court litigation between these two parties?

A Yes, I have.

Q When you refer to "the litigation" in your declaration, in this proceeding, are you referring to that District Court litigation?

A So this -- this declaration was prepared for the IPR. And so, that's the -- this IPR declaration is the substance of my opinion for the IPR.

I guess I would have to --

Q I can direct you to an example.

In paragraph 53 of your declaration, if you could turn to that, I want to talk about the portion that's on page 45.

A Okay. I'm on paragraph 53, but I'm scrolled down to page 45.

Q In the last sentence here you state, "In accordance with the scope of this limitation advanced by Patent Owner in the litigation, Loughran's SFF fabrication job corresponds to a

request to fabricate an object on the three-dimensional printer."

Do you see that sentence?

A Yes, I do.

Q And so, my question was, when you refer to "the litigation" here, are you referring to the District Court litigation between the parties?

A So when I was working on these IPRs, there was also -- or on this IPR declaration, there was also a discussion of a District Court litigation. And so, that's the term I used here.

I really -- I don't have a better answer for that, but I was certainly aware of the District Court litigation as I was preparing this IPR declaration.

MR. BISENIUS: No more questions. I'll pass the witness.

MR. TATUM: No further questions.

MR. BISENIUS: All right. Thanks for getting us out on time on a Friday.

MR. TATUM: I did my best.

THE STENOGRAPHER: I just need the

orders on the record.

MR. BISENIUS: I don't need anything on my side.

THE STENOGRAPHER: And, Mr. Tatum, I think you have a standing order.

MR. TATUM: Perfect. Thank you.

(Off the record at 3:44 p.m.)

CERTIFICATE OF REPORTER - NOTARY PUBLIC

I, Judith E. Bellinger, Certified Stenographer and Notary Public within and for the State of Maryland do hereby certify:

That MICHAEL A. HICKNER, PH.D., the witness whose deposition is hereinbefore set forth, as 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, Shenzhen Tuozhu Technology Co., Ltd., was represented by counsel at the deposition.

I further certify that the deposition of MICHAEL A. HICKNER, PH.D., occurred remotely on Friday, January 9, 2026, commencing at 9:58 a.m. CST to 3:44 p.m CST.

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 and affixed my notarial seal this 12th day of January, 2026.

My Commission Expires: November 3, 2028

Judith E. Bellinger

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THE STATE OF MARYLAND

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