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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MEDIT CORPORATION

Petitioner

v.

3SHAPE A/S

Patent Owner

Case No. IPR2023-01313

Patent 9,629,551

PATENT OWNER'S PRELIMINARY RESPONSE

TABLE OF CONTENTS

	<u>Page</u>
I. INTRODUCTION	1
II. STATEMENT OF THE PRECISE RELIEF REQUESTED	2
III. BACKGROUND OF THE '551 PATENT	2
A. The '551 Patent	2
B. The Previous IPRs	8
IV. CLAIM CONSTRUCTION	9
A. The preambles of independent Claims 1, 23, and 25 are limiting	10
B. “excluded volume in space where no surface can be present in both the first 3D representation and the second 3D representation”	10
V. ARGUMENT	10
A. Petitioner fails to demonstrate a reasonable likelihood of success that Petitioner would prevail with respect to at least one of the claims challenged in Ground 1	11
1. Newcombe and Hähnel do not disclose or suggest determining an excluded volume (Elements 1c and 1d)	11
a. Newcombe does not disclose or suggest determining an excluded volume	11
i. The mere existence of an empty space in Newcombe does not satisfy determining an excluded volume	12
ii. Petitioner overlooks the District Court’s construction requiring an excluded volume in space that is “common to both” first and second 3D representations	14

iii.	Petitioner fails to explain how Newcombe’s technique involves determining an excluded volume	18
b.	Hähnel fails to cure the deficiencies of Newcombe concerning Elements 1c and 1d.....	22
2.	Newcombe and Hähnel do not disclose or suggest that the portion of the surface in the 3D representation is disregarded in the generation of the virtual 3D model if the portion is located in space in the excluded volume (Elements 1e and 1f)	23
a.	Newcombe does not disclose or suggest that the portion of the surface is disregarded in the generation of the virtual 3D model.....	24
b.	A POSITA would not have had reason to modify Newcombe by disregarding the outlying points in the generation of the virtual 3D model.....	29
3.	Independent Claims 23 and 25.....	32
B.	Petitioner fails to demonstrate a reasonable likelihood of success that Petitioner would prevail with respect to at least one of the claims challenged in Ground 2	33
C.	Petitioner fails to demonstrate a reasonable likelihood of success that Petitioner would prevail with respect to at least one of the claims challenged in Ground 3	35
1.	Herbst does not disclose or suggest determining an excluded volume (Elements 1c and 1d).....	35
a.	The mere existence of an empty space in Herbst does not satisfy determining an excluded volume.....	36
b.	Petitioner overlooks the District Court’s construction requiring an excluded volume in space that is “common to both” first and second 3D representations	38

c.	Petitioner fails to explain how Herbst’s technique involves determining an excluded volume	41
2.	Herbst does not disclose or suggest that the portion of the surface in the 3D representation is disregarded in the generation of the virtual 3D model if the portion is located in space in the excluded volume (Elements 1e and 1f)	42
3.	Independent Claims 23 and 25.....	44
D.	Petitioner fails to demonstrate a reasonable likelihood of success that Petitioner would prevail with respect to at least one of the claims challenged in Ground 4	44
E.	The Petition should be denied under §325(d)	46
F.	The Petition should be denied under §314(a)	49
VI.	CONCLUSION.....	51

APPENDIX A – LIST OF EXHIBITS

CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. §42.24

CERTIFICATE OF SERVICE

TABLE OF AUTHORITIES

Cases	Page(s)
<i>3Shape A/S v. Medit Corp.</i> , Civ. Action No. 6:22-cv-00443 (W.D. Tex.).....	9
<i>Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH</i> , IPR2019-01469, Paper 6 (PTAB Feb. 13, 2020).....	48, 49
<i>Align Tech., Inc. v. 3Shape A/S</i> , IPR2018-00195, Paper 7 (PTAB May 24, 2018)	8
<i>Align Tech., Inc. v. 3Shape A/S</i> , IPR2018-00195, Paper 9 (PTAB Sep. 12, 2018).....	8, 9
<i>Align Tech., Inc. v. 3Shape A/S</i> , IPR2018-00196, Paper 6 (PTAB May 24, 2018)	8, 9
<i>Align Tech., Inc. v. 3Shape A/S</i> , IPR2018-00196, Paper 8 (PTAB Sep. 12, 2018).....	8
<i>Belden Inc. v. Berk-Tek LLC</i> , 805 F.3d 1064 (Fed. Cir. 2015)	21, 34, 45
<i>In re Magnum Oil Tools Int’l, Ltd.</i> , 829 F.3d 1364 (Fed. Cir. 2016)	20
<i>Sotera Wireless, Inc. v. Masimo Corp.</i> , IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020)	49, 50, 51
 Statutes	
35 U.S.C. §102.....	50
35 U.S.C. §103.....	50
35 U.S.C. §311	10
35 U.S.C. §313.....	10
35 U.S.C. §314(a)	2, 10, 49, 51
35 U.S.C. §325(d)	<i>passim</i>

Rules

37 C.F.R. §42.65	22, 42
37 C.F.R. §42.100(b)	9
37 C.F.R. §42.108(c).....	10
37 C.F.R. §42.207(b)	1

I. INTRODUCTION

Patent Owner, 3Shape A/S (“3Shape” or “Patent Owner”), submits this Patent Owner’s Preliminary Response to the Petition for *Inter Partes* Review (“Petition” or “Pet.”) filed by Medit Corporation (“Medit” or “Petitioner”) against U.S. Patent No. 9,629,551 (EX1001, “the ’551 Patent”). This paper is timely filed pursuant to 37 C.F.R. §42.207(b) and the Notice of Filing Date Accorded to Petition and Time for Filing Patent Owner Preliminary Response (Paper 4).

Petitioner fails to establish a reasonable likelihood that it would prevail with respect to any challenged claim of the ’551 Patent for at least three reasons.

First, Petitioner fails to demonstrate that the cited art discloses or suggests steps of determining a first excluded volume and second excluded volume as recited in the challenged claims. The mere existence of an empty space in the art does not satisfy the claimed steps of determining an excluded volume. Petitioner overlooks the District Court’s construction requiring an excluded volume in space that is “common to both” first and second 3D representations.

Second, Petitioner fails to demonstrate that the cited art discloses or suggests that the portion of the surface is disregarded in the generation of the virtual 3D model, as recited in the challenged claims. In stark contrast with the claimed disregarding steps, the cited art expressly seeks to use data attributed to moving objects to generate a segmented object in the model.

Third, substantially the same art and argument were previously considered by the Office in failed IPRs and thus the Petition should be denied under Section 325(d).

II. STATEMENT OF THE PRECISE RELIEF REQUESTED

Patent Owner requests that the Board deny institution of the Petition with respect to all challenged claims and all asserted grounds. A full statement of the reasons for the relief requested is set forth in Sections III-VI below.

III. BACKGROUND OF THE '551 PATENT

A. The '551 Patent

The '551 Patent discloses methods for detecting a movable object in a location, when scanning a rigid object in the location by means of a 3D scanner for generating a virtual 3D model of the rigid object. EX1001, 1:6-9.

At the time of the claimed invention,¹ dentists substituted physical dental impressions with scanning patients' teeth with a handheld 3D scanner to obtain a virtual 3D model of the teeth. EX1001, 1:26-28. This substitution enabled a more efficient workflow for dentists. However, a frequent problem associated with this new technique was the capture of movable objects, such as the patient's cheeks,

¹Petitioner alleges that the earliest effective filing date attributable to the '551 Patent is July 15, 2011. Pet., 1-2. Patent Owner reserves the right to demonstrate one or more of the claims of the '551 Patent is entitled to an earlier effective filing date.

tongue, or the dentist's instruments or fingers. *Id.*, 1:31-37. Patent Owner developed the technology of the '551 Patent in response to, *e.g.*, the need to distinguish between movable objects and rigid objects (*e.g.*, teeth) when scanning for obtaining a virtual 3D model of the rigid object. *Id.*, 2:26-30.

Claims 1, 23, and 25 of the '551 Patent are in independent form. Independent Claim 1 is reproduced below:

1. A method for detecting a movable object in a location, when scanning a rigid object in the location by means of a 3D scanner for generating a virtual 3D model of the rigid object, wherein the method comprises:

providing a first 3D representation of at least part of a surface by scanning at least part of the location;

providing a second 3D representation of at least part of the surface by scanning at least part of the location;

determining for the first 3D representation a first excluded volume in space where no surface can be present in both the first 3D representation and the second 3D representation;

determining for the second 3D representation a second excluded volume in space where no surface can be present in both the first 3D representation and the second 3D representation;

if a portion of the surface in the first 3D representation is located in space in the second excluded volume, the portion of the surface in the first 3D representation is disregarded in the generation of the virtual 3D model, and/or

if a portion of the surface in the second 3D representation is located in space in the first excluded volume, the portion of the surface in the second 3D representation is disregarded in the generation of the virtual 3D model.

An exemplary method for detecting a movable object is shown in Figures 14a) to 14e) of the '551 Patent, where a movable object of the second representation is present in the excluded volume of the first representation.

Figure 14a) shows an example of acquiring a first 3D representation 1416 of a surface of an object. A first scan volume 1411 in space (indicated by dotted vertical lines) is related to the first representation. A first excluded volume 1421 corresponds to the first scan volume 1411.

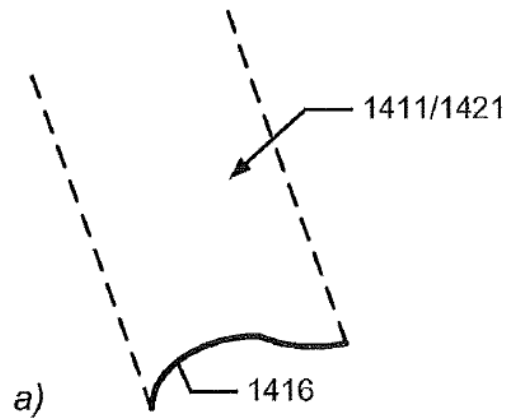


Figure 14a) of the '551 Patent

EX1001, 25:28-37.

Figure 14b) shows an example of acquiring a second 3D representation 1417 of a surface of an object. A second scan volume 1412 in space (indicated by dotted vertical lines) is related to the second representation. A second excluded volume 1422 corresponds to the second scan volume 1412. The second 3D representation 1417 comprises two parts 1417a and 1417b. The part 1417b is located between the part 1417a and the scanner (not shown), which is arranged somewhere at the end of the scan volume.

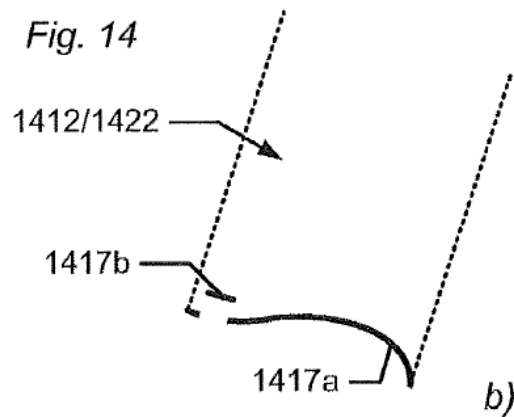


Figure 14b) of the '551 Patent

Id., 25:38-47.

Figure 14c) shows an example where the first representation 1416 and the second representation 1417 are aligned/registered, such that the corresponding parts of the representations are arranged in the same location. Some of the part 1417a of the second representation is aligned/registered with the first representation. The part 1417b cannot be aligned/registered with the first representation 1416, since there is no corresponding surface portions between the surface 1416 and the surface 1417b.

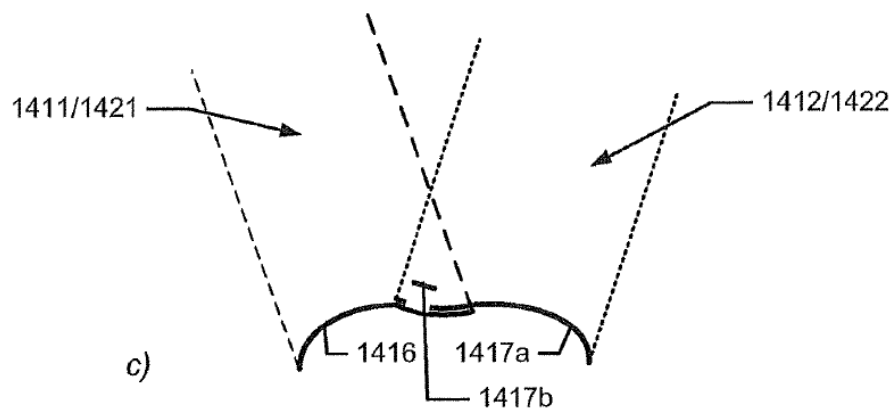


Figure 14c) of the '551 Patent

Id., 25:55-63.

FIG. 14d) shows an example where the overlapping common scan volume 1440 of the first representation 1416 and the second representation 1417 is indicated as a shaded area. The surface portion 1417b of the second representation is located in the overlapping common scan volume 1440, and the surface portion 1417b of the second representation 1417 is therefore located in the excluded volume 1421 of the first representation 1416, and part 1417b must therefore be a movable object, which is only present in the second representation.

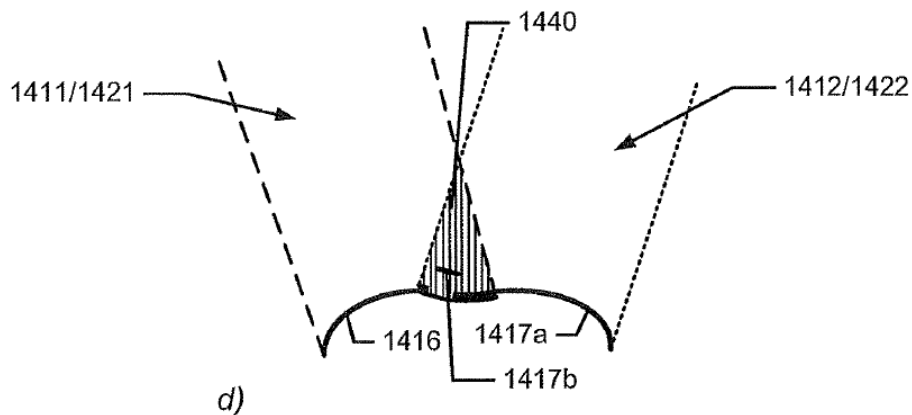


Figure 14d) of the '551 Patent

Id., 25:64-26:6.

FIG. 14e) shows an example of the resulting virtual 3D surface 1419, where the surface portion 1417b is disregarded in the generation of the virtual 3D model, so the virtual 3D model comprises the first representation 1416 and the part 1417a of the second representation 1417.



Figure 14e) of the '551 Patent

Id., 26:14-18.

B. The Previous IPRs

The claims of the '551 Patent were unsuccessfully challenged in two previous IPRs.² In the previous IPRs, the PTAB rejected the petitioner's attempt to read out of the claims the additional requirements relating to the claimed "excluded volume":

Patent Owner disputes this construction, in part, because Petitioner's proposed construction does not take into account the larger claim recitation "excluded volume in space where no surface can be present in both the first 3D representation and the second 3D representation." Prelim. Resp. 13. We agree with Patent Owner. Particularly, as recited in claim 1, an "excluded volume" is not merely "a scan volume, or a sub-volume of the scan volume, where no surface of the scan object is present"; instead, claim 1

² See *Align Tech., Inc. v. 3Shape A/S*, IPR2018-00195, Paper 7 (PTAB May 24, 2018) (institution denied), Paper 9 (Sep. 12, 2018) (rehearing denied); *Align Tech., Inc. v. 3Shape A/S*, IPR2018-00196, Paper 6 (PTAB May 24, 2018) (institution denied), Paper 8 (Sep. 12, 2018) (rehearing denied).

recites “determining for the first 3D representation *a first excluded volume in space where no surface can be present in both the first 3D representation and the second 3D representation*”. [Emphasis in original.]

IPR2018-00195, Paper 9 at 5-6. *See also* IPR2018-00196, Paper 6 at 5-6. As explained below, Petitioner in this case overlooks the same elements in its analysis of the claims that were overlooked in the previous failed IPRs. Specifically, while Petitioner purports to adopt the District Court’s claim construction which sets forth additional requirements relating to the claimed “excluded volume”, Petitioner again cites art which does not satisfy the claimed steps of determining an excluded volume “in space where no surface can be present in both the first 3D representation and the second 3D representation” among other features, as explained below.

IV. CLAIM CONSTRUCTION

The standard for claim construction in *inter partes* review is the “ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. §42.100(b). Certain claim terms were construed by the District Court in the Related Litigation, discussed below.³

³ The Related Litigation is *3Shape A/S v. Medit Corp.*, Civ. Action No. 6:22-cv-00443 (W.D. Tex.).

A. The preambles of independent Claims 1, 23, and 25 are limiting

In the Related Litigation, the District Court construed the preambles of independent Claims 1, 23, and 25 as limiting. EX1011, 2. Petitioner asserts that it has applied the District Court’s construction for purposes of the Petition. Pet., 10.

B. “excluded volume in space where no surface can be present in both the first 3D representation and the second 3D representation”

In the Related Litigation, the District Court construed this term recited in Claims 1, 23, and 25 to mean “excluded volume in space that is common to both the first and second 3D representations where no surface from either of the 3D representations should be present.” EX1011, 2. The District Court adopted Patent Owner’s construction. Petitioner asserts that it has applied the District Court’s construction for purposes of the Petition. Pet., 10.

Petitioner fails to demonstrate a reasonable likelihood of success under the District Court’s constructions (which Petitioner has adopted for purposes of the Petition) or any other construction.

V. ARGUMENT

The Director may not authorize an *inter partes* review to be instituted unless the Director determines that the information presented in the petition filed under 35 U.S.C. §311 and any response filed under 35 U.S.C. §313 show that there is a reasonable likelihood that the Petitioner would prevail with respect to at least one of the claims challenged in the petition. 35 U.S.C. §314(a); 37 C.F.R. §42.108(c).

Petitioner fails to demonstrate a reasonable likelihood of success with respect to any challenged claim and any ground presented in the Petition for at least the reasons discussed below. Accordingly, the PTAB should deny institution of the Petition.

A. Petitioner fails to demonstrate a reasonable likelihood of success that Petitioner would prevail with respect to at least one of the claims challenged in Ground 1

Petitioner fails to demonstrate a reasonable likelihood that Petitioner would prevail with respect to any claim challenged in Ground 1 based on Newcombe and Hähnel for at least the following reasons.

1. Newcombe and Hähnel do not disclose or suggest determining an excluded volume (Elements 1c and 1d)

Newcombe does not disclose or suggest determining an excluded volume and Hähnel does not cure the deficiencies of Newcombe.

a. Newcombe does not disclose or suggest determining an excluded volume

Petitioner fails to demonstrate that Newcombe discloses or suggests determining an excluded volume for at least three reasons. First, the mere existence of an empty space in Newcombe does not satisfy determining an excluded volume. Second, Petitioner overlooks the District Court’s construction requiring an excluded volume in space that is “common to both” representations. Third, Petitioner fails to explain how Newcombe’s technique involves determining an excluded volume.

i. The mere existence of an empty space in Newcombe does not satisfy determining an excluded volume

Claim 1 recites “determining for the first 3D representation a first excluded volume in space where no surface can be present in both the first 3D representation and the second 3D representation” (Element 1c) and “determining for the second 3D representation a second excluded volume in space where no surface can be present in both the first 3D representation and the second 3D representation” (Element 1d). Newcombe has no disclosure or suggestion of determining a first and second excluded volume as claimed.

Petitioner asserts that the “empty space” between the camera and the stationary objects in Figure 1 of Newcombe constitutes an excluded volume:

A POSITA at the time the '551 patent was filed would further understand that all the obtained depth images for the location that *do not* correspond to a surface within the background of the location would collectively constitute an excluded volume.... For example, a POSITA would have understood that the empty space shown in Figure 1, shown below, between camera 102 and the stationary objects in the room would constitute an excluded volume for the first 3D representation, according to the court’s construction. [Pet., 24-25.]

Figure 1 of Newcombe is reproduced below:

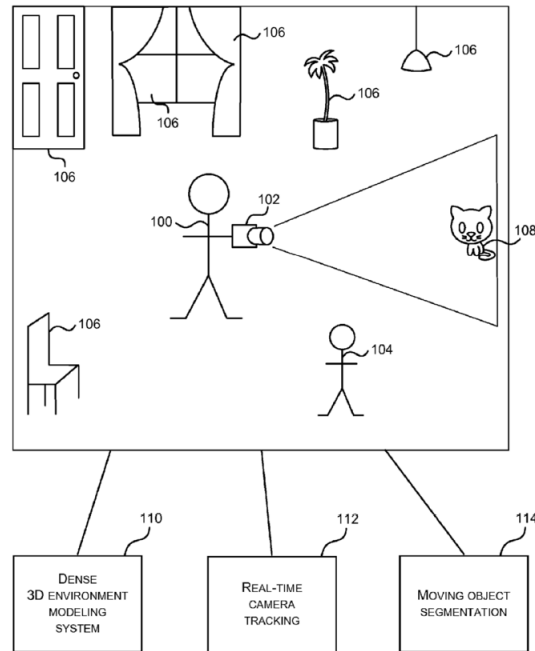


Figure 1 of Newcombe

Even if the “empty space” between the camera and stationary objects in Figure 1 of Newcombe constitutes an excluded volume, Claim 1 requires the steps of *determining* a first excluded volume and *determining* a second excluded volume. That is, Claim 1 does not merely require the existence of an excluded volume, but rather requires a method for detecting a movable object,⁴ which comprises steps of determining first and second excluded volumes. Petitioner offers no explanation as to how Newcombe discloses or suggests “determining” first and second excluded volumes as a part of a method for detecting a movable object as is required by Claim

⁴ The District Court construed the preamble of Claim 1 as limiting. *See* Section IV.A.

1, particularly in view of the fact that the preamble is limiting. At best, ***Petitioner in its Petition*** attempts to determine an excluded volume in Newcombe’s disclosure by pointing out the existence of an “empty space” in Figure 1. Newcombe, however, does not disclose that its technique involves any such determination of a first excluded volume and a second excluded volume. Petitioner’s expert Dr. Foroosh merely repeats the same assertions in the Petition without providing further explanation. EX1003, ¶112.

ii. Petitioner overlooks the District Court’s construction requiring an excluded volume in space that is “common to both” first and second 3D representations

Furthermore, the Petition does not address the District Court’s construction.⁵ In view of the District Court’s construction (*see* Section IV.B.), Claim 1 requires (1) determining for the first 3D representation a first excluded volume in space that is common to both the first and second 3D representations where no surface from either of the 3D representations should be present, and (2) determining for the second 3D representation a second excluded volume in space that is common to both the first and second 3D representations where no surface from either of the 3D representations should be present. The Petition fails to address the District Court’s

⁵ Petitioner has applied this construction for purposes of the Petition. Pet., 10.

construction which requires determining an excluded volume in space *that is common to both the first and second 3D representations*. This is true for at least three reasons.

One, Petitioner asserts that in Newcombe, “*all* the obtained depth images for the location that *do not* correspond to a surface within the background of the location would *collectively* constitute an excluded volume.” Pet., 24-25 (emphasis added). *See also id.* (“the empty space shown in Figure 1 ... would constitute an excluded volume for the first 3D representation”). The Petition cites the Foroosh Declaration which further explains that “*all* spaces within the obtained 3D depth images for the location that do not correspond to a surface within the background of the location would *collectively* constitute an excluded volume”. EX1003, ¶112 (emphasis added). Clearly, the theory advanced in the Petition is that *all* of the empty spaces in Newcombe’s depth images *collectively* correspond to the excluded volume. However, the aggregate of “all” of the empty spaces in Newcombe’s depth images does not correspond to the claimed excluded volume which specifically pertains to space that is *common* to both the first and second 3D representations. Even if Newcombe provided a teaching of determining the “collective” aggregate of “all” the empty spaces in Newcombe’s depth images (it does not), Petitioner fails to demonstrate that the resulting aggregate corresponds to the claimed excluded

volume in space that is common to both the first and second 3D representations. Indeed, it does not.

Two, Petitioner asserts that in Newcombe, the excluded volume for the first 3D representation is determined merely from the single representation shown in Figure 1. Pet., 25 (“the empty space shown in Figure 1 ... would constitute an excluded volume for the first 3D representation”). However, the District Court’s construction unequivocally requires determining an excluded volume in space that is common to *both the first and second 3D representations*. Petitioner fails to explain how an excluded volume in space that is common to both the first and second 3D representations is somehow determined merely from a single representation (Figure 1 of Newcombe) as Petitioner alleges. Petitioner then asserts that in Newcombe, the excluded volume is “the space beyond the distance threshold where any observed points will be deemed outliers” and that such space “is also necessarily common to both depth images, because points in both images are required to define the threshold distance and compare the corresponding Euclidean distance between the source and destination points”. Pet., 29-30. Petitioner fails to explain how defining a distance threshold for two three-dimensional images somehow involves determining for the first 3D representation a first excluded volume in space that is common to both the first and second 3D representations where no surface from either of the 3D representations should be present. And again, Petitioner merely asserts the

existence of a space that is purportedly common to both images without explaining how Newcombe discloses or suggests “determining” the excluded volume as required by the claims.

Three, Petitioner’s faulty assertion that the aggregate of all the empty spaces in Newcombe’s images is the same as the claimed excluded volume in space that is common to both the first and second 3D representations is exacerbated by the fact that Claim 1 requires determining both *first and second* excluded volumes which are distinct elements recited in Claim 1 (Elements 1c and 1d). Petitioner makes no attempt at explaining how both first and second excluded volumes are determined in Newcombe. Again, Petitioner seeks to determine the aggregate of all the empty spaces in Newcombe’s images collectively, but this would only result in a single excluded volume. Claim 1, however, requires determination of a first excluded volume and a second excluded volume. Thus, even if the aggregate of empty spaces could be considered a first excluded volume, Petitioner fails to explain how Newcombe’s technique involves another distinct step of determining for the *second* 3D representation a *second* excluded volume in space that is common to both the first and second 3D representations, as recited in Claim 1.

iii. Petitioner fails to explain how Newcombe’s technique involves determining an excluded volume

Petitioner asserts that Newcombe discloses “a volume outside a predefined threshold distance” that satisfies the claimed excluded volume:

As is also discussed above, Newcombe discloses that points corresponding to surfaces are identified as outliers if they are in *an excluded volume (i.e., in a volume outside a predefined threshold distance)*, or as corresponding points if they are not. [Pet., 31 (emphasis added).]

Newcombe teaches that the excluded volume determined by the compatibility test – i.e., the space beyond the distance threshold where any observed points will be deemed outliers corresponding to non-rigid objects.... [Pet., 29-30.]

Petitioner and its expert Dr. Foroosh fail to provide any explanation as to why Newcombe’s threshold *distance* somehow results in determining an excluded *volume* as claimed. Petitioner and its expert Dr. Foroosh fail to explain how Newcombe’s use of a threshold distance in its compatibility test satisfies “determining ... a first excluded volume.” Newcombe is merely concerned with measuring the *distance* between points—not determining an excluded *volume* as claimed.

Petitioner asserts that Newcombe’s compatibility test measures a distance between two surface points in two depth images and determines whether the two points are within a threshold distance:

This understanding of Newcombe by a POSITA is supported by the reference’s disclosure of the performance of compatibility tests to determine whether *points in two depth images* are corresponding points, which can be attributed to rigid objects, or are outliers, which can be attributed to moving objects. [Pet., 26.]

As described by Newcombe, *the first compatibility test relies on defining a threshold distance for a measurement between points in two 3D depth images* – i.e., a “source point” in a previous depth image and a “destination point” in a current depth image. *Id.* at 8:3-33. As Newcombe explains, “[i]f the destination point is too far away from the source point, then it is considered to be an outlier (i.e. noncorresponding)” *Id.* at 8:33-35. Newcombe further explains that “outliers” or “outlying points” refer to “points in the depth image where something has changed since the previous depth image” and “can be caused by dynamic or non-rigid objects.” *Id.* at 9:26-29. [Pet., 26.]

As is also discussed above, Newcombe discloses that *points corresponding to surfaces* are identified as outliers if they are in an excluded volume (i.e., in a volume outside

a predefined threshold distance), or as corresponding points if they are not. [Pet., 31.]

Without explanation, Petitioner and its expert assert that use of a distance threshold somehow constitutes determining an excluded volume in space. But a distance threshold between two points is just that—a *distance* value. Petitioner and its expert fail to provide any explanation as to how Newcombe’s measurement of a *distance* between points on surfaces in two images somehow involves determination of an excluded *volume*. Petitioner asserts that the empty space between the camera and object constitutes an excluded volume but does not explain how Newcombe’s technique involves determining the excluded volume of such empty space based on the threshold distance. Petitioner cannot satisfy its burden by employing “mere conclusory statements” as is the case here, but “must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016). Petitioner fails to do so here.

Further, Petitioner has not explained why a POSITA would have had reason to modify Newcombe to determine an excluded volume. Petitioner asserts that Newcombe’s compatibility test “*can* be used to determine an excluded volume” (Pet., 26) but fails to provide any reason why a person *would* have modified Newcombe to determine the excluded volume. Petitioner fails to meet its burden. *See, e.g.,*

Belden Inc. v. Berk-Tek LLC, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (“[O]bviousness concerns whether a skilled artisan not only could have made but would have been motivated to make the combinations or modifications of prior art to arrive at the claimed invention.”). A POSITA would not have had reason to modify Newcombe to determine an excluded volume because Newcombe teaches that its technique of using a distance threshold between two points is sufficient, as explained above.

As noted above, Petitioner asserts that the excluded volume in Newcombe is “a volume outside a predefined threshold distance.” Pet., 31. But as explained above, the mere existence of an empty space does not amount to steps of determining first and second excluded volumes. Further, Newcombe discloses measuring a distance between points and does not employ a threshold distance for the purpose of determining a volume—much less a volume “in space that is common to both the first and second 3D representations” according to the construction adopted in the Petition. Rather, as explained above, Newcombe’s technique identifies dynamic objects by measuring the distance between two points (a source point and a destination point) on two surfaces to determine if the distance is within a predefined distance threshold. EX1005, 8:3-35. In fact, Newcombe discloses that its technique “does not add substantial additional computational complexity” and seeks to avoid such additional computational complexity. EX1005, 1:30-36, 1:49-65. Petitioner

does not explain why a POSITA would have had reason to modify Newcombe given this disclosure.

Petitioner's expert Dr. Foroosh parrots the same conclusory assertions in the Petition without offering any explanation as to how an excluded volume would have been determined based on the threshold distance. Nor does Dr. Foroosh articulate any reason why a POSITA would have had reason to determine an excluded volume in the first instance. Dr. Foroosh's testimony should be given no weight. 37 C.F.R. §42.65 ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.").

b. Hähnel fails to cure the deficiencies of Newcombe concerning Elements 1c and 1d

Newcombe does not disclose or suggest determining first and second excluded volumes as explained above. Petitioner does not assert that Hähnel cures this deficiency of Newcombe. Petitioner does not rely on Hähnel in support of Petitioner's theory concerning Elements 1c and 1d. Pet., 24, 28 (no reliance on Hähnel concerning Elements 1c and 1d). More specifically, concerning Elements 1c and 1d, Petitioner relies on Newcombe alone, alleging that "Newcombe teaches this element". Pet., 24, 28. Petitioner relies on Hähnel to address Elements 1e and 1f. Pet., 30, 33. More specifically, concerning Elements 1e and 1f, Petitioner relies on Newcombe in combination with Hähnel, alleging that "Newcombe in view of Hähnel teaches this element". *Id.* Petitioner asserts:

Specifically, a POSITA would have been motivated to incorporate Hähnel's teaching of filtering dynamic objects into Newcombe's method for segmenting moving objects from the background of a 3D depth image, because doing so would allow for the creation of more accurate 3D maps and models, pursuant to Hähnel's teachings. [Pet., 20.]

Thus, even if Hähnel would have been combined with Newcombe to address Elements 1e and 1f in the manner alleged by Petitioner, the alleged combination does not address the deficiencies of Newcombe concerning Elements 1c and 1d.⁶

2. Newcombe and Hähnel do not disclose or suggest that the portion of the surface in the 3D representation is disregarded in the generation of the virtual 3D model if the portion is located in space in the excluded volume (Elements 1e and 1f)

Newcombe and Hähnel do not disclose or suggest that the portion of the surface in the 3D representation is disregarded in the generation of the virtual 3D model if the portion is located in space in the excluded volume. Petitioner fails to demonstrate that a POSITA would have had reason to modify Newcombe by disregarding the outlying points in the generation of the virtual 3D model.

⁶ Further, Petitioner fails to demonstrate that Elements 1e and 1f would have been obvious over Newcombe in view of Hähnel as discussed in Section V.A.2.

a. Newcombe does not disclose or suggest that the portion of the surface is disregarded in the generation of the virtual 3D model

Independent Claim 1 recites “if a portion of the surface in the first 3D representation is located in space in the second excluded volume, the portion of the surface in the first 3D representation is disregarded in the generation of the virtual 3D model” and/or “if a portion of the surface in the second 3D representation is located in space in the first excluded volume, the portion of the surface in the second 3D representation is disregarded in the generation of the virtual 3D model”. Petitioner fails to demonstrate that Newcombe discloses or suggests this feature.

Petitioner asserts that Newcombe’s technique involves identifying outlying data points “which correspond to moving objects.” Pet., 30. Newcombe expressly discloses that the outlying points are not discarded and teaches advantages of using such outlying points in generating the 3D model:

However, rather than discarding the outlying points, these are stored and provided as input to the object segmentation system. The outlying points indicate points in the depth image where something has changed since the previous depth image. Such a change can be caused by dynamic or non-rigid objects giving rise to different depth measurements. In one example, the object segmentation can simply segment 428 all the outlying points and label these as foreground objects in the depth image. *This provides a very rapid segmentation of the depth image*

that uses very little additional computation over that performed for the camera tracking anyway. [Emphasis added.]

EX1005, 9:24-34.

Newcombe relates to a segmentation operation that differentiates individual objects in the environment. EX1005, 1:19-22. Newcombe discloses that one or more outlying points are detected that do not correspond between the two depth images, and the image elements at these outlying points are labeled as belonging to the moving object. EX1005, 1:58-62. Whereas Claim 1 calls for disregarding the portion of the surface located in the excluded volume in the generation of the virtual 3D model, however, Newcombe does not seek to disregard the outlying points in the generation of the model. Rather, Newcombe expressly discloses that the segmented moving objects form a part of the model that can be manipulated by the user. *See, e.g.,* EX1005, 3:6-14 (“the person 104 or cat 108 can move, and hence are segmented as foreground moving objects and differentiated from background objects Such as the door and window.... This can, for example, allow objects to be segmented and included in the game-play of a gaming system.”). *See also id.*, 9:24-26 (“However, rather than discarding the outlying points, these are stored and provided as input to the object segmentation system.”).

Petitioner asserts that Newcombe teaches that the segmented moving objects may be subsequently “removed or omitted” from the scene and that this satisfies the claimed “disregarding”:

Newcombe’s disclosure that segmented objects may be “separately processed as desired,” as well as the disclosure of the various ways that segmented moving objects may be processed, including with respect to the “removal from the scene” and or being “deliberately ignored,” would be understood by a POSITA to teach that these objects, which includes the surfaces of the objects, may be “disregarded” or otherwise removed or omitted from a virtual 3D model generated according to the methods disclosed by Newcombe. [Pet., 32.]

Even if Newcombe discloses that the segmented moving objects are subsequently ignored or removed from the scene, the outlying points in Newcombe are not discarded but rather are used to generate the 3D model as explained above. EX1005, 9:24-34. That Newcombe also teaches that the segmented moving objects of the generated 3D model may then be manipulated in the scene (removed, ignored) does not change the fact that Newcombe uses the outlying points in the generation of the 3D model.

Specifically, Petitioner cites Newcombe’s disclosure that segmented objects may be “separately processed as desired.” Pet., 32. However, such “separate

processing” does not involve disregarding data in the generation of a 3D model. Rather, Newcombe’s “separate processing” pertains to objects within the generated 3D model that have already been generated and “labeled”:

The real-time camera tracking system 112 provides input to the dense 3D modeling system, in order to allow individual depth images to be built up into an overall 3D model. The moving-object segmentation system 114 can also provide input to the dense 3D model, such that objects in the 3D model are segmented and labeled....

The moving-object segmentation system 114 detects foreground objects and labels them in the depth map, enabling these objects to be separately processed as desired. [EX1005, 3:28-53.]

Petitioner asserts that Newcombe’s disclosure of “removal from the scene” satisfies the claimed “disregarding.” Pet., 32. However, Newcombe discloses that the “removal from the scene” is of an object of the already-generated 3D model:

The creation of a dense 3D model of a segmented objects can be performed in a number of ways. In a first example, after the outliers have been detected (as described above), ***the outlying points are integrated into a separate 3D volume in memory*** if they lie in front of a surface along the camera ray when compared to the previous depth image (which can itself be generated from the dense 3D model as noted above). This technique enables an ICP

algorithm *to track the segmented object once it has been sufficiently integrated into the separate 3D volume*, and provides good performance for new objects that are added into the scene. In a second example, after the outliers have been detected (as described above), *every voxel in the dense 3D model within the camera's frustum (i.e. not only the front faces which the camera sees) is projected into the current depth map*. If a given voxel gets projected to an outlier and if the depth value of the outlier is larger than the depth value of the projected voxel, then the segmentation system knows that the voxel is part of a moved object (because it suddenly sees a depth point behind the voxel). This technique enables objects to be instantly segmented upon removal from the scene, and performs well for moved objects. [EX1005, 11:3-27 (emphasis added).]

Newcombe's "removal from the scene" disclosure has to do with *visualization* of the moving object, not disregarding input data for purposes of *generating* the virtual 3D model as claimed. At a minimum, Petitioner had the burden of explaining how Newcombe's "removal from the scene" disclosure satisfies disregarding input data for purposes of generating the virtual 3D model, but failed to do so.

Petitioner asserts that Newcombe's disclosure of "deliberately ignored" satisfies the claimed "disregarding." Pet., 32. However, Newcombe discloses the following:

Once a segmented object has been identified, this information can be used to control further aspects of the operation of the system. For example, certain objects can be arranged to directly interact within a computer game environment, whereas others can be deliberately ignored.
[EX1005, 11:49-53.]

Newcombe’s “deliberately ignored” disclosure has to do with *interaction with the object within a computer game environment*, not disregarding input data for purposes of *generating* the virtual 3D model as claimed. At a minimum, Petitioner had the burden of explaining how Newcombe’s “deliberately ignored” disclosure satisfies disregarding input data for purposes of generating the virtual 3D model, but failed to do so.

b. A POSITA would not have had reason to modify Newcombe by disregarding the outlying points in the generation of the virtual 3D model

Petitioner asserts that Hähnel cures the above-described deficiency of Newcombe. Petitioner asserts that “Hähnel teaches that moving objects (i.e., dynamic objects), can lead to serious errors in mapping a location” and “Hähnel further teaches that these moving objects can be reliably filtered out to obtain accurate models of a location.” Pet., 33. However, a POSITA would not have had reason to modify Newcombe in view of Hähnel. This is true for at least three reasons.

First, disregarding outlying points would have been contrary to Newcombe’s intended purpose and principle of operation. As explained above, Newcombe expressly teaches not to discard the outlying points in the generation of the 3D model. Instead, Newcombe teaches storing the outlying points and providing same as input to the object segmentation system. EX1005, 9:24-28. Modifying Newcombe to disregard the outlying points would have been contrary to Newcombe’s intended purpose and principle of operation of using outlying points to create segmented models of the moving objects. *See, e.g.,* EX1005, title (“Moving Object Segmentation....”), 3:1-14.

Second, Petitioner fails to explain how the filtering achieved by Hähnel’s algorithm would have been realized in Newcombe. Petitioner asserts that Hähnel teaches that “moving objects can be reliably filtered out to obtain accurate models of a location.” Pet., 33. Hähnel teaches that the filtering of dynamic aspects—*i.e.*, the advantage Petitioner seeks to realize in Newcombe’s technique—is achieved using the algorithm described in Hähnel:

In practical experiments we demonstrate that ***our algorithm can reliably filter*** out dynamic aspects and yields accurate models of the environment. ***A further advantage of our algorithm*** is that the filtered data can be extracted from the rest of all measurements. This way, we can obtain accurate textured 3d models of dynamic objects.
[EX1007, 1 (emphasis added).]

Figure 7 shows the map generated by *our algorithm*. As the figure illustrates, the spurious measurements (indicated by grey/orange dots) have been filtered out completely. Additionally, the alignment of the scans is more accurate. [EX1007, 5 (emphasis added).]

Petitioner does not even attempt to explain how the filtering achieved by Hähnel's algorithm would have been realized in Newcombe's segmentation technique. Hähnel expressly distinguishes its technique from the type disclosed by Newcombe. Whereas Petitioner asserts that Newcombe's technique compares two points from two images as described above, Hähnel's algorithm "does not rely on any pre-defined features" but rather "considers every measurement individually and estimates a posterior about whether or not this data item has been generated by a dynamic object." EX1007, 1. At a minimum, Petitioner had the burden of explaining how Newcombe's technique would have been modified to realize the advantages of Hähnel's algorithm given that Petitioner relies on such advantages as reason to combine the art, but Petitioner failed to do so.

Third, Newcombe seeks to avoid "substantial additional computational complexity" (EX1005, 1:63-65), whereas Hähnel discloses that its algorithm involves solving an equation of "enormous complexity":

Unfortunately, maximizing this equation is also not trivial since it involves a solution to a high-dimensional state estimation problem. *To deal with the enormous*

complexity of the problem, many researchers phrase it as an incremental maximum likelihood process [19, 10]. The key idea of incremental approaches is to calculate the desired sequence of poses and the corresponding maps by maximizing the marginal likelihood of the t -th pose and map relative to the $(t - 1)$ -th pose and map.

EX1007, 4. Thus, a POSITA would not have sought to implement Hähnel's complex algorithm in Newcombe's technique. At a minimum, Petitioner had the burden of explaining why a POSITA would have sought to combine Newcombe and Hähnel in spite of such teachings, but failed to do so.

Like Element 1e, Element 1f recites that "the portion of the surface ... is disregarded in the generation of the virtual 3D model". Newcombe does not disclose Element 1f for at least the reasons discussed above concerning Element 1e. Petitioner's argument concerning Element 1f is substantially the same as Element 1e (*see* Pet., 33-35) and is deficient for at least the reasons discussed above.

3. Independent Claims 23 and 25

Petitioner relies on its argument concerning Claim 1 in its challenges to independent Claims 23 and 25. Pet., 43-47. The challenges of independent Claims 23 and 25 are similarly deficient. For at least the reasons discussed above with respect to Elements 1c and 1d of Claim 1 (*see* Section V.A.1.), Petitioner fails to demonstrate that the cited art discloses or suggests Elements 23c and 23d of Claim

23 and Element 25c of Claim 25. For at least the reasons discussed above with respect to Elements 1e and 1f of Claim 1 (*see* Section V.A.2.), Petitioner fails to demonstrate that the cited art discloses or suggests Elements 23e and 23f of Claim 23 and Element 25d of Claim 25. Thus, Petitioner fails to satisfy its burden with respect to Claims 23 and 25.

B. Petitioner fails to demonstrate a reasonable likelihood of success that Petitioner would prevail with respect to at least one of the claims challenged in Ground 2

Petitioner fails to demonstrate a reasonable likelihood that Petitioner would prevail with respect to any claim challenged in Ground 2 based on Newcombe, Hähnel, and McQueston for at least the following reasons.

Petitioner fails to satisfy its burden with respect to Ground 1 (Newcombe and Hähnel) as explained above. Petitioner relies on McQueston for purportedly disclosing features of dependent Claims 2-5, 18, and 19. McQueston does not cure the above-described deficiencies of Newcombe and Hähnel and Petitioner makes no such allegation. Nor does Petitioner provide any reason why a person would have combined McQueston with Newcombe and Hähnel to somehow arrive at the above-described missing features. The PTAB already determined that McQueston fails to disclose determining an excluded volume (a feature missing from Newcombe-Hähnel, as explained above) in the previous failed IPRs challenging the '551 Patent. In an attempt to avoid discretionary denial under Section 325(d) and distinguish its

Petition from the previous failed IPRs, Petitioner in its Petition does not rely on McQueston to address the features of the independent claims, and instead relies on McQueston for purportedly disclosing features of dependent Claims 2-5, 18, and 19.

Without explanation, Petitioner asserts that “[a] POSITA would understand that the depth imaging and object segmentation of Newcombe, *could be* integrated into a dental scanning apparatus, like that described by McQueston.” Pet., 21 (emphasis added). That a POSITA purportedly “could” modify the art to arrive at the claimed combination of features is not sufficient. *See, e.g., Belden*, 805 F.3d at 1073. Petitioner cites paragraphs 247-250 of the Foroosh Declaration for support. Pet., 20. However, Dr. Foroosh merely parrots the contents of the Petition without providing any further explanation, underlying facts, or data to support his conclusions.

Petitioner asserts that “[a] POSITA would be motivated to apply the imaging and modeling techniques and components of Newcombe in view of Hähnel to the intraoral environment of McQueston *to achieve the stated goal of McQueston* — minimizing the interference of dental objects with the three-dimensional model of the teeth being imaged or measured.” Pet., 21 (emphasis added). However, McQueston already provides a 3D scanning technique to achieve its own purported goal relating to dental imaging. The Petition merely relies on McQueston to provide the “intraoral environment” and deliberately avoids any reliance on the actual 3D

scanning technique described in McQueston—all in an attempt to avoid discretionary denial under Section 325(d) in view of the previous failed IPRs. Petitioner fails to articulate a reason why a POSITA reading Newcombe/Hähnel would have turned to McQueston to achieve the stated goal articulated in McQueston, only to use the technique described in Newcombe/Hähnel instead of McQueston. Nor does Petitioner explain why a POSITA would have had reason to apply Newcombe’s technique (which, as discussed above, seeks to model moving objects as segmented objects) to McQueston’s technique which instead “exclude[s] certain scan results from processing and display.” EX1008, Abstract.

C. Petitioner fails to demonstrate a reasonable likelihood of success that Petitioner would prevail with respect to at least one of the claims challenged in Ground 3

Petitioner fails to demonstrate a reasonable likelihood that Petitioner would prevail with respect to any claim challenged in Ground 3 based on Herbst for at least the following reasons.

1. Herbst does not disclose or suggest determining an excluded volume (Elements 1c and 1d)

Petitioner fails to demonstrate that Herbst discloses or suggests determining an excluded volume for at least three reasons. First, the mere existence of an empty space in Herbst does not satisfy determining an excluded volume. Second, Petitioner overlooks the District Court’s construction requiring an excluded volume in space

that is common to both representations. Third, Petitioner fails to explain how Herbst's technique involves determining an excluded volume.

a. The mere existence of an empty space in Herbst does not satisfy determining an excluded volume

As noted above, Claim 1 recites “determining for the first 3D representation a first excluded volume in space where no surface can be present in both the first 3D representation and the second 3D representation” (Element 1c) and “determining for the second 3D representation a second excluded volume in space where no surface can be present in both the first 3D representation and the second 3D representation” (Element 1d). Herbst has no disclosure or suggestion of determining a first and second excluded volume as claimed.

Similar to its assertions concerning Newcombe, Petitioner asserts that the empty space in Figure 6A of Herbst that is not occupied by the table, the objects on the table, or any other surface constitutes an excluded volume:

A POSITA at the time the '551 patent was filed would understand Herbst to teach that the empty space between the scanner and the surface, where no 3D point on any surface is detected, is excluded from the 3D surfel representation of the corresponding scan visit, and therefore the empty space for each scanning visit would constitute an excluded volume for the 3D representation of that scanning visit. [Pet., 52.]

[A] POSITA would have understood Herbst to teach that, according to Herbst's probabilistic model, the empty space shown in Figure 6(a) below – i.e., the space in the scene that is not occupied by the table, the objects on the table, or any other surface – would constitute an excluded volume for the first 3D representation. [Pet., 53.]

Figure 6A of Herbst is reproduced below:

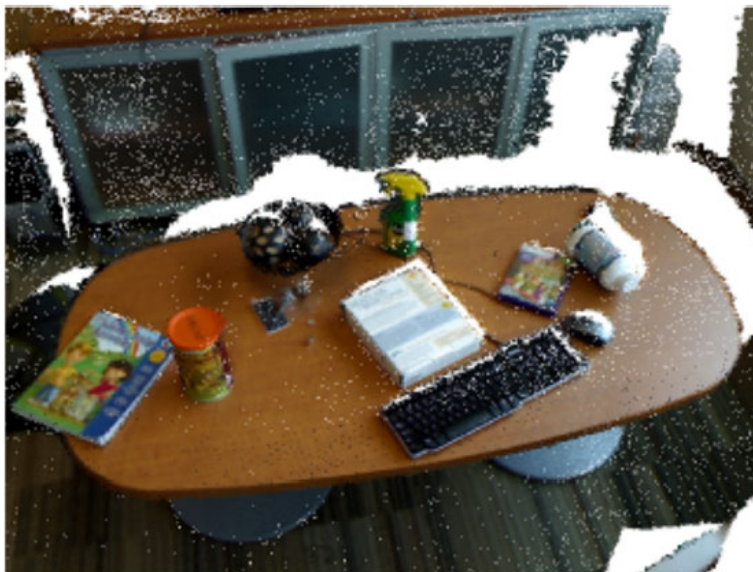


Figure 6A of Herbst

Even if the empty space that is not occupied by the table, the objects on the table, or any other surface constitutes an excluded volume, Claim 1 requires the steps of *determining* a first excluded volume and *determining* a second excluded volume. That is, Claim 1 does not merely require the existence of an excluded volume, but rather requires a method for detecting a movable object which comprises steps of determining first and second excluded volumes, as explained above. Petitioner offers

no explanation as to how Herbst discloses “determining” first and second excluded volumes as a part of a method for detecting a movable object as is required by Claim 1. At best, *Petitioner in its Petition* attempts to determine an excluded volume in Herbst’s disclosure by pointing out the existence of an “empty space.” Herbst, however, does not disclose that its technique involves any such determination of a first excluded volume and a second excluded volume. Petitioner’s expert Dr. Foroosh merely repeats the same assertions in the Petition without providing further explanation. EX1003, ¶¶264-268.

b. Petitioner overlooks the District Court’s construction requiring an excluded volume in space that is “common to both” first and second 3D representations

Furthermore, the Petition does not address the District Court’s construction. As explained above, in view of the District Court’s construction (*see* Section IV), Claim 1 requires (1) determining for the first 3D representation a first excluded volume in space that is common to both the first and second 3D representations where no surface from either of the 3D representations should be present, and (2) determining for the second 3D representation a second excluded volume in space that is common to both the first and second 3D representations where no surface from either of the 3D representations should be present. The Petition fails to address the District Court’s construction which requires determining an excluded volume in

space *that is common to both the first and second 3D representations*. This is true for at least three reasons.

One, Petitioner asserts that “*all* empty space in these respective 3D representations [Fig. 6(a) and Fig. 6(d) of Herbst] that is not occupied by a surface would *collectively* constitute an excluded volume”. Pet., 55 (emphasis added). Clearly, the theory advanced in the Petition is that *all* of the empty space in Herbst’s 3D representations *collectively* correspond to the excluded volume. However, the aggregate of “all” of the empty space in Herbst’s 3D representations does not correspond to the claimed excluded volume which specifically pertains to space that is *common* to both the first and second 3D representations. Even if Herbst provided a teaching of determining the “collective” aggregate of “all” the empty space in Herbst’s 3D representations (it does not), Petitioner fails to demonstrate that the resulting aggregate corresponds to the claimed excluded volume in space that is common to both the first and second 3D representations. Indeed, it does not.

Two, Petitioner asserts that in Herbst, the excluded volume for the first 3D representation is determined merely from a single representation. Pet., 52 (“therefore the empty space for each scanning visit would constitute an excluded volume for the 3D representation of that scanning visit”). However, the District Court’s construction unequivocally requires determining an excluded volume in space that is common to *both the first and second 3D representations*. Petitioner fails to

explain how an excluded volume in space that is common to both the first and second 3D representations is somehow determined merely from a single representation (*i.e.*, “the empty space for each scanning visit” according to Petitioner) as Petitioner alleges.

Three, Petitioner’s faulty assertion that the aggregate of all the empty space in Herbst’s 3D representations is the same as the claimed excluded volume in space that is common to both the first and second 3D representations is exacerbated by the fact that Claim 1 requires determining both ***first and second*** excluded volumes which are distinct elements recited in Claim 1 (Elements 1c and 1d). Petitioner makes no attempt at explaining how both first and second excluded volumes are determined in Herbst. Again, Petitioner seeks to determine the aggregate of all the empty spaces in Herbst’s representations collectively, but this would only result in a single excluded volume. Claim 1, however, requires determination of a first excluded volume and a second excluded volume. Thus, even if the aggregate of space could be considered a first excluded volume, Petitioner fails to explain how Herbst’s technique involves another distinct step of determining for the ***second*** 3D representation a ***second*** excluded volume in space that is common to both the first and second 3D representations, as recited in Claim 1.

c. Petitioner fails to explain how Herbst's technique involves determining an excluded volume

Herbst is not concerned at all with determining an excluded volume in space that is common to both the first and second 3D representations. Nor does Herbst have any recognition of determining an excluded volume for the purpose of disregarding surfaces that are located in such excluded volume in the generation of the virtual 3D model. Rather, Herbst seeks to determine the probability that a surfel has moved by determining “the difference between its measured depth and its expected depth value,” as Dr. Foroosh recognizes. EX1003, ¶270. Petitioner and its expert Dr. Foroosh fail to provide any explanation as to why determining a difference between a measured depth and an expected depth value somehow involves determining an excluded volume as claimed. At a minimum, Petitioner had the burden of explaining how determining differences in depth constitutes determining an excluded volume, but Petitioner failed to do so.

Petitioner asserts that the empty space between the scanner and the surface (Pet., 52) in Herbst constitutes an excluded volume but does not explain how Herbst's technique involves determining the excluded volume of such empty space based on differences in depth as purportedly disclosed by Herbst.

Petitioner's expert Dr. Foroosh parrots the same conclusory assertions in the Petition without offering any explanation as to how an excluded volume would have been determined based on the threshold distance. Nor does Dr. Foroosh articulate

any reason why a POSITA would have had reason to determine an excluded volume in the first instance. Dr. Foroosh's testimony should be given no weight. 37 C.F.R. §42.65 ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.").

2. Herbst does not disclose or suggest that the portion of the surface in the 3D representation is disregarded in the generation of the virtual 3D model if the portion is located in space in the excluded volume (Elements 1e and 1f)

Independent Claim 1 recites "if a portion of the surface in the first 3D representation is located in space in the second excluded volume, the portion of the surface in the first 3D representation is disregarded in the generation of the virtual 3D model" and/or "if a portion of the surface in the second 3D representation is located in space in the first excluded volume, the portion of the surface in the second 3D representation is disregarded in the generation of the virtual 3D model". Petitioner fails to demonstrate that Herbst discloses or suggests this feature.

Petitioner alleges that Herbst discloses removing moveable objects from the virtual 3D model and that this removal satisfies the claimed "disregarding":

Herbst further teaches that once all of the moveable objects have been detected, the two 3D representations can be merged *into a single virtual 3D model from which all of the moveable objects are removed* using Herbst's disclosed methods and probabilistic model. [Pet., 54.]

Even if Herbst discloses removing the moveable objects from the virtual 3D model as Petitioner alleges, this does not change the fact that the surfel identified as having a high probability of motion is used in the generation of the virtual 3D model and is not disregarded. That Herbst also teaches that the moveable objects of the already-generated virtual 3D model may then be removed for visualization purposes does not change the fact that the surfel is used in the generation of the virtual 3D model.

Herbst discloses that the purpose of its technique is to “detect changes between two 3-D maps” and “tells us how likely each surface element is to have moved between two scenes”. EX1006, Abstract, 1. Whereas Claim 1 calls for disregarding the portion of the surface located in the excluded volume in the generation of the virtual 3D model, Herbst does not seek to disregard the surface elements that are likely to have moved between two scenes. Rather, Herbst expressly discloses identifying such moved surfels for the purpose of segmenting them and including them in the generation of the model. *See, e.g.*, EX1006, 1 (“We improve on previous segmentation efforts by identifying surface patches likely to have moved between two scenes”), 7 (“We have described a method to determine movable parts of a scene based on differencing with another scene.”).

Like Element 1e, Element 1f recites that “the portion of the surface ... is disregarded in the generation of the virtual 3D model”. Herbst does not disclose Element 1f for at least the reasons discussed above concerning Element 1e.

Petitioner's argument concerning Element 1f is substantially the same as Element 1e and is deficient for at least the reasons discussed above.

3. Independent Claims 23 and 25

Petitioner relies on its argument concerning Claim 1 in its challenges to independent Claims 23 and 25. Pet., 69-72. The challenges of independent Claims 23 and 25 are similarly deficient. For at least the reasons discussed above with respect to Elements 1c and 1d of Claim 1 (*see* Section V.C.1.), Petitioner fails to demonstrate that the cited art discloses or suggests Elements 23c and 23d of Claim 23 and Element 25c of Claim 25. For at least the reasons discussed above with respect to Elements 1e and 1f of Claim 1 (*see* Section V.C.2.), Petitioner fails to demonstrate that the cited art discloses or suggests Elements 23e and 23f of Claim 23 and Element 25d of Claim 25. Thus, Petitioner fails to satisfy its burden with respect to Claims 23 and 25.

D. Petitioner fails to demonstrate a reasonable likelihood of success that Petitioner would prevail with respect to at least one of the claims challenged in Ground 4

Petitioner fails to demonstrate a reasonable likelihood that Petitioner would prevail with respect to any claim challenged in Ground 4 based on Herbst and McQueston for at least the following reasons.

Petitioner fails to satisfy its burden with respect to Ground 3 (Herbst) as explained above. Petitioner relies on McQueston for purportedly disclosing features

of dependent Claims 2-5, 18, and 19. McQueston does not cure the above-described deficiencies of Herbst and Petitioner makes no such allegation. The PTAB already determined that McQueston fails to disclose determining an excluded volume (a feature missing from Herbst as explained above) in the previous failed IPRs challenging the '551 Patent. In an attempt to avoid discretionary denial under Section 325(d) and distinguish its Petition from the previous failed IPRs, Petitioner in its Petition does not rely on McQueston to address the features of the independent claims, and instead relies on McQueston for purportedly disclosing features of dependent Claims 2-5, 18, and 19.

Without explanation, Petitioner asserts that “[a] POSITA would understand that the imaging and modeling techniques and devices of Herbst could be integrated into a dental scanning apparatus, like that described by McQueston.” Pet., 22. That a POSITA purportedly “could” modify the art to arrive at the claimed combination of features is not sufficient. *See, e.g., Belden*, 805 F.3d at 1073. Petitioner cites paragraphs 379-382 of the Foroosh Declaration for support. Pet., 21. Dr. Foroosh merely parrots the contents of the Petition without providing any further explanation, underlying facts, or data.

Petitioner asserts that “[a] POSITA would be motivated to apply the RGB-D imaging techniques and components of Herbst to the intraoral environment of McQueston *to achieve the stated goal of McQueston* — minimizing the interference

of dental objects with the three-dimensional model of the teeth being imaged or measured.” Pet., 22 (emphasis added). However, McQueston already provides a 3D scanning technique to achieve its own purported goal relating to dental imaging—again, which Petitioner avoids relying on for purposes of this Petition in view of the failed IPRs. Petitioner fails to articulate a reason why a POSITA reading Herbst would have turned to McQueston to achieve the stated goal articulated in McQueston, only to use the technique already described in Herbst instead of McQueston. Nor does Petitioner explain why a POSITA would have had reason to apply Herbst’s technique (which seeks to model the moving objects) to McQueston’s technique which instead “exclude[s] certain scan results from processing and display.” EX1008, Abstract.

E. The Petition should be denied under §325(d)

Newcombe and McQueston were previously considered in IPRs challenging the ’551 Patent. Specifically, the McQueston Patent cited in the Petition corresponds to the McQueston Publication which was previously presented in an IPR challenging the ’551 Patent that was denied institution.⁷ See Pet., 75 (conceding that the

⁷ The McQuestion Publication (U.S. 2013/0335417) was presented in IPR2018-00195 challenging the ’551 Patent and corresponds to the McQueston Patent cited in this IPR.

McQueston Patent cited in this IPR is “closely related” to the McQueston Publication previously presented in the IPR). Thus, Newcombe and McQueston are the same or substantially the same prior art previously presented to the Office.

Furthermore, Petitioner admits that Newcombe, Hähnel, and Herbst—*i.e.*, the documents cited in the grounds of this Petition other than the previously considered McQueston—are relied on for substantially the same disclosures as McQueston, except that McQueston is closer because it purportedly relates to intraoral imaging.

Petitioner states:

McQueston describes a similar, if not identical, problem [as Newcombe, Hähnel, and Herbst] albeit in the context of intraoral imaging....

As with Newcombe in view of Hähnel, McQueston teaches using laser range finding for distance measurements underlying the three-dimensional tooth modeling....

Likewise, as with the depth imaging described by Newcombe, McQueston teaches that imaging techniques may be incorporated into the three-dimensional modeling of the teeth....

As with Herbst, McQueston teaches using laser range finding for distance measurements underlying the three-dimensional tooth modeling....

Likewise, as with the RGB-D depth imaging described by Herbst, McQueston teaches that imaging techniques may be incorporated into the three-dimensional modeling of the teeth.... [Pet., 20-22.]

Thus, the citation of Newcombe, Hähnel, and Herbst in the Petition in addition to McQueston constitute substantially the same art and argument previously considered in the failed IPRs of the '551 Patent, and therefore does not justify institution. Further, Petitioner does not articulate any error in the Patent Office's prior consideration of McQueston, much less explain how Newcombe, Hähnel, and Herbst are somehow closer to the challenged claims than the previously considered McQueston. *Advanced Bionics* requires such an explanation of Patent Office error, but Petitioner offers none. In fact, the nature of the grounds proposed in the Petition suggest that the previously considered McQueston reference is closer to the art cited in this IPR because while McQueston expressly discloses intraoral imaging, Newcombe, Hähnel, and Herbst do not.

In addition, as noted above, Petitioner overlooks the same elements in its analysis of the claims that were overlooked in the previous failed IPRs. Specifically, while Petitioner purports to adopt the District Court's claim construction which requires additional requirements relating to the claimed "excluded volume", Petitioner again cites art which does not satisfy the claimed steps of determining an excluded volume in space that is common to both the first and second 3D

representations where no surface from either of the 3D representations should be present. *See, e.g.*, Sections V.A.1. and V.C.1.

Petitioner asserts that the PTAB should overlook the Patent Office's prior consideration of McQueston because it occurred in connection with an IPR proceeding that was denied institution. Pet., 75-76. However, *Advanced Bionics* states that art previously presented "during *any* proceeding, including prior AIA proceedings" is relevant to the §325(d) inquiry and does not limit the inquiry to AIA proceedings with final written decisions, as Petitioner contends. *Advanced Bionics*, 10 (emphasis in original). Thus, the Office's prior consideration of McQueston in the previous IPRs is relevant to the §325(d) inquiry and constitutes basis for discretionary denial.

F. The Petition should be denied under §314(a)

Petitioner waited until August 18, 2023 to file this Petition, one day before the bar date arising from service of the Complaint in the Related Litigation. EX2001; *see also* EX2002. Petitioner's only argument in response to the *Fintiv* issue is that it has made a stipulation pursuant to *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020). Pet, 74. However, Petitioner's stipulation substantially differs from the language expressly provided in the Director's Interim Procedure and *Sotera*. Petitioner states:

Petitioner hereby stipulates that, should the Petition be granted, Petitioner will not pursue in the district court the

same grounds that are raised or could have reasonably
been raised in this Petition pursuant to *Sotera*.... [Pet., 74.]

Unlike the Director’s Interim Procedure and *Sotera*, Petitioner’s stipulation does not include the “any grounds”/“any other ground” language. *See* Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation, June 21, 2022 at 3 (“the PTAB will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents a stipulation not to pursue in a parallel proceeding the same grounds ***or any grounds*** that could have reasonably been raised before the PTAB.”); *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020) (“The stipulation states that if the PTAB institutes inter partes review, Petitioner ‘will not pursue in [the District Court] the specific grounds [asserted in the inter partes review], ***or on any other ground*** . . . that was raised or could have been reasonably raised in an IPR....’”) (emphases added). Confusingly, Petitioner in its stipulation omits the “any grounds”/“any other ground” language but maintains the “could have reasonably been raised” language, resulting in the statement that Petitioner will not pursue “the same grounds that . . . could have reasonably been raised.” The Director’s Interim Procedure and *Sotera* decision are clear as to what is needed for a *Sotera* stipulation, and Petitioner’s stipulation falls short of this. Petitioner in the Related Litigation advances additional invalidity grounds under Sections 102 and 103 based on patents and printed

publications beyond the grounds presented in the Petition, and Petitioner's stipulation does not state that Petitioner will not pursue in a parallel proceeding the same grounds *or any grounds* that could have reasonably been raised before the PTAB. Given Petitioner's equivocating stipulation, Petitioner might attempt to pursue grounds that would otherwise be foreclosed by a proper *Sotera* stipulation. This is precisely the type of judicial inefficiency that the PTAB seeks to avoid in *Fintiv* and *Sotera*. The Petition should be denied under Section 314(a).

VI. CONCLUSION

Petitioner fails to demonstrate that any of the challenged claims of the '551 Patent are unpatentable. Thus, the Petition should be denied.

Respectfully submitted,

Date: January 2, 2024

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APPENDIX A - LIST OF EXHIBITS

Exhibit No.	Description
1001	U.S. Patent No. 9,629,551 (“the ’551 patent”)
1003	Declaration of Hassan Foroosh, Ph.D. (“Foroosh Declaration”)
1005	U.S. Patent No. 8,401,225 (“Newcombe”)
1006	Herbst, Evan, Peter Henry, Xiaofeng Ren, and Dieter Fox. “Toward Object Discovery and Modeling via 3-D Scene Comparison.” <i>2011 IEEE International Conference on Robotics and Automation</i> (vol. 3, pp. 2623-2629). 7 vols. Piscataway, NJ: IEEE, ©2011 (“Herbst”)
1007	Hähnel, Dirk, Rudolph Triebel, Wolfram Burgard, and Sebastian Thrun. “Map Building with Mobile Robots in Dynamic Environments.” <i>2003 IEEE International Conference on Robotics and Automation</i> (vol. 2, pp. 1557-1563). 3 vols. (“Hähnel”)
1008	U.S. Patent No. 9,245,374 (“McQueston”)
1011	Order on Claim Construction, <i>3Shape A/S v. Medit Corp.</i> , Case No. 22-CV-00443-ADA-DTG, Dkt. No. 76 (W.D. Tex. May 2, 2023)
2001	Complaint filed on May 2, 2022 in <i>3Shape A/S v. Medit Corp.</i> , Civ. Action No. 22-cv-00443 (WDTX)
2002	Joint Notice of Unopposed Extension of Time for Defendant to Answer or Otherwise Respond to Plaintiff’s Complaint filed on September 8, 2022 in <i>3Shape A/S v. Medit Corp.</i> , Civ. Action No. 22-cv-00443 (WDTX)

CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. §42.24

I hereby certify that the word count for the foregoing Patent Owner's Preliminary Response totals 10,711 words, excluding the parts which are exempted by 37 C.F.R. §42.24(a).

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing **PATENT OWNER'S PRELIMINARY RESPONSE and EXHIBITS 2001-2002** are being served on counsel for Petitioner by electronic mail this 2nd day of January, 2024 as follows:

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