

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re <i>Inter Partes</i> Review of:	:	I hereby certify that this
U.S. Patent No. 9,135,737	:	correspondence is being
	:	electronically filed per 37 CFR
Issued: September 15, 2015	:	§ 42.6(b)(1) with the U.S. Patent and
	:	Trademark Office via EFS-Web on
Named Inventor: Pershing	:	<u>2/8/2016</u> .
	:	
Patentee: Eagle View Technologies, Inc.	:	Typed or printed name of person
	:	signing this certificate
Filed: August 1, 2014	:	
	:	<u>Melissa C. Hunte</u>
Title: CONCURRENT DISPLAY	:	
SYSTEMS AND METHODS FOR	:	Signature
AERIAL ROOF ESTIMATION	:	<u>Melissa C. Hunte</u>

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Patent Trial and Appeal Board
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,135,737

Dear Commissioner:

Pursuant to 35 U.S.C. §§ 311-319 as amended by the Leahy-Smith America Invents Act, Xactware Solutions, Inc. ("Xactware") respectfully petitions for *Inter Partes* Review of United States Patent No. 9,135,737, which issued September 15, 2015, to Pershing from an application filed on August 1, 2014 (the "'737 Patent"). A copy of the '737 Patent is attached hereto and made a part hereof as XACTWARE EXHIBIT 1001.

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LIST OF EXHIBITS

- XACTWARE EXHIBIT 1001: U.S. Patent No. 9,135,737 to Pershing issued on September 15, 2015
- XACTWARE EXHIBIT 1002: Power of Attorney
- XACTWARE EXHIBIT 1003: Publication by Hsieh, entitled “Design and Evaluation of a Semi-Automated Site Modeling System,” Carnegie Mellon, November 1995 (“Hsieh”).
- XACTWARE EXHIBIT 1004: Publication by Avrahami et al., entitled “Extraction of 3D Spatial Polygons Based on the Overlapping Criterion for Roof Extraction from Aerial Images,” International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences, August 29-30, 2005 (“Avrahami”).
- XACTWARE EXHIBIT 1005: Publication by Applicad, entitled “Product Bulletin – November 2002: Key features of our Roofing Software,” November 2002 (“Applicad”).
- XACTWARE EXHIBIT 1006: Publication by Perlant et al., entitled “Scene Registration in Aerial Image Analysis,” Digital Mapping Laboratory, School of Computer Science, Carnegie Mellon University, Pittsburgh PA, 1990 (“Perlant”).
- XACTWARE EXHIBIT 1007: Declaration of Harold Schuch (“Schuch Decl.”).

I. INTRODUCTION

Xactware Solutions, Inc. (“Xactware” or “Petitioner”) respectfully petitions for *inter partes* review of Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36 of U.S. Patent No. 9,135,737 to Pershing which issued September 15, 2015 (the “’737 Patent”), and which is attached as Xactware Exhibit 1001.

II. REAL PARTY-IN-INTEREST

The real party-in-interest is Xactware Solutions, Inc., which is wholly owned by Insurance Services Offices, Inc., which itself is wholly owned by Verisk Analytics, Inc.

III. RELATED MATTERS

Petitioner notes that a lawsuit is pending in the United States District Court for the District of New Jersey, and is captioned *Eagle View Technologies, Inc., and Pictometry International Corp. v. Xactware Solutions, Inc., and Verisk Analytics, Inc.*, Civil Action No. 2:15–cv–07025 (hereinafter “the Lawsuit”). The Lawsuit was filed on September 23, 2015, wherein Eagle View Technologies, Inc. (“Eagleview”) and Pictometry International Corp. (“Pictometry”) alleges infringement of nine (9) patents including the ’737 Patent. Specifically, the Lawsuit alleges infringement of U.S. Patent Nos. 8,818,770, 8,825,454, 8,823,732, 8,542,880, 8,209,152, 8,170,840, 8,078,436, 9,129,376, and 9,135,737. Petitions

for *inter partes* review of the asserted claims of each of these patents are also being filed on this date.

IV. GROUNDS FOR STANDING AND ELIGIBILITY

Xactware certifies that the '737 Patent is eligible for *inter partes* review, and that Xactware is not barred or estopped from requesting an *inter partes* review challenging the patent claims on the grounds identified herein. The Complaint in the Lawsuit was served on October 8, 2015 for all patents-in-suit except U.S. Patent Nos. 9,129,376, and 9,135,737, which were served on November 30, 2015. Xactware thus certifies that this *inter partes* review petition is not being filed more than one year after being served with a complaint alleging infringement of the '737 Patent. Xactware further certifies that it has not filed a civil action challenging the validity of any claim of the '737 Patent. Xactware certifies that estoppel does not prohibit this review. Additionally, Xactware notes that the '737 Patent is not a patent described in Section 3(n)(1) of the Leahy-Smith America Invents Act. Therefore, Xactware certifies that this *inter partes* review petition is timely filed

V. LEAD AND BACK-UP COUNSEL

Xactware designates lead counsel and back-up counsel as follows:

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VI. SERVICE INFORMATION

Please address all correspondence to Lead Counsel at the address provided in Section V above. Xactware consents to e-mail service of all papers in this proceeding.

VII. FEE INFORMATION

The Commissioner is authorized to charge all fees due to Deposit Account No. 503571, including but not limited to \$9,000 upon the filing of this petition, and if institution is ordered, an additional \$14,400 upon institution. If any additional and/or other fees are due from Xactware, or if any credit is due, the Commissioner is authorized to charge/credit Deposit Account No. 503571.

VIII. POWER OF ATTORNEY

A suitable Power of Attorney is attached hereto at Xactware Exhibit 1002.

IX. SPECIFIC IDENTIFICATION OF THE CHALLENGES TO THE CLAIMS OF THE '737 PATENT

Xactware respectfully petitions for *inter partes* review of Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36 of the '737 Patent, and respectfully requests that the Board find the same invalid. Xactware identifies the specific statutory grounds

under 35 U.S.C. § 103 on which each of the challenged claims is based, and the patents and/or printed publications relied upon for each ground, as follows:

- Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36 of the '737 Patent are unpatentable as obvious under 35 U.S.C. § 103 over Hsieh in view of Applicad.
- Claim 10 is unpatentable as obvious under 35 U.S.C. § 103 over Hsieh in view of Applicad and in further view of Perlant.
- Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36 of the '737 Patent are unpatentable as obvious under 35 U.S.C. § 103 over Avrahami in view of Applicad.
- Claim 10 is unpatentable as obvious under 35 U.S.C. § 103 over Avrahami in view of Applicad and in further view of Perlant.

The earliest claimed priority date for the '737 Patent is Provisional Application No. 61/197,904, filed on Oct. 31, 2008, and the foregoing references relied upon for the grounds of rejection were published or otherwise publicly available more than one year before the earliest claimed priority date.

X. OVERVIEW OF THE '737 PATENT

The '737 Patent generally describes systems and methods for determining roof measurement information based on one or more aerial images of a roof of a building. *See, e.g.*, '737 Patent, 1:7-11; 1:55-2:11; *see also* Schuch Decl., ¶ 33. In

particular, the '737 Patent discloses that generating a 3D model “is based at least in part on a correlation between at least two of the aerial images of the building.” *See, e.g.,* '737 Patent 4:30-32; *see also* Schuch Decl., ¶ 34. With regard to Figures 6B and 6C, the '737 Patent teaches that “[a]s the operator specifies roof sections as described with respect to FIG. 6B, the roof estimation system concurrently displays the specified roof features in one or more of the other images displayed by the user interface screen.” *See, e.g.,* '737 Patent 14:16-20; *see also* Schuch Decl., ¶ 35. The '737 Patent discloses that the system can determine “the corresponding feature automatically, such as by employing on one or more image processing techniques used to identify vertexes, edges, or other features of the roof.” *See, e.g.,* '737 Patent 4:59-61; *see also* Schuch Decl., ¶ 36.

XI. CLAIM CONSTRUCTION

In an *inter partes* review proceeding, “[a] claim in an unexpired patent shall be given its broadest reasonable construction in light of the specification of the patent in which it appears.” 37 C.F.R. § 42.100(b). Hence, all claim terms should be construed in accordance with the broadest reasonable interpretation (“BRI”) in view of the specification from the perspective of one of ordinary skill in the art. Xactware addresses the claim construction of specific claim terms below, and, any terms not provided with a specific construction below should be construed in

accordance with the BRI in view of the specification, and their ordinary and customary meaning to one of ordinary skill in the art.

A. “wire frame”

Petitioner submits that under a BRI, the term “wire frame” as used in the ’737 Patent is a type of model of an object represented by lines. This is consistent with the specification of the ’737 Patent. *See, e.g.*, ’737 Patent, 13:40-43; 13:63-65 (“FIGS. 6A-6D illustrate the construction of a three dimensional wire frame model of a building roof, based on the specification of roof features by an operator. . . . As shown in FIG. 6B, the image portion 608 includes the building roof 407, drawing tool 610, and wire frame 611.”). Furthermore, one of ordinary skill in the art understands “wire frame” to mean a type of model of an object represented by lines. *See* Schuch Decl., ¶ 37.

B. “reference grid”

Petitioner submits that a BRI of the term “reference grid” as used in the ’737 Patent is a data structure to which one or more images are registered. This is consistent with the specification of the ’737 Patent. *See, e.g.*, ’737 Patent, 9:57-62; FIGS. 4A-4F (“By registering multiple images to the reference grid, an operator may indicate a roof feature on an image (such as a roof edge), which may then be translated from the coordinate system of the image to the coordinate system of the reference grid, for purposes of including of the indicated feature in the 3D

model.”). Furthermore, a reference grid would be understood by one of ordinary skill in the art to mean a data structure which maintains a correspondence between one or more aerial images and a 3D model. *See* Schuch Decl., ¶ 38.

XII. THE PATENT CLAIMS ARE INVALID UNDER 35 U.S.C. § 103

Xactware respectfully submits that Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36 of the '737 Patent are unpatentable under 35 U.S.C. § 103 as specifically demonstrated in the following claim charts (claim elements are labeled for cross-referenced claims using the following notation: *1.P* (preamble of Claim 1), *1.5* (element 5 of Claim 1), etc.):

A. Table 1: Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36 of the '737 Patent are Unpatentable as Obvious Under 35 U.S.C. § 103 over Hsieh in view of Applicad

Photogrammetry is the science of making measurements from photographs including, among other things, measuring distances between objects and determining shapes. An overview of the history of photogrammetry is provided in the Schuch Decl., ¶¶ 16-29.

Hsieh discloses an automated and semi-automated site modeling system that can model roofs having a plurality of planar roof sections using one or more aerial images. *See, e.g., Hsieh*, 1-71; Abstract; *see also* Schuch Decl., ¶ 42. More specifically, the system provides the ability to construct and manipulate three-dimensional building models and line drawings using multiple images. *See, e.g.,*

Hsieh, Abstract, p. 1. The semi-automated site modeling system can require user input to supply the automated processes. *See, e.g., Hsieh*, p. 1.

To model roofs in Hsieh the user measures the roof of a building in one aerial image by outlining the roof in that aerial image. The system then detects peaks, edges, and other roof features in the image, and generates a full three-dimensional (3D) model of the building (including the roof). The system also projects the 3D model onto other aerial images of the building. *See, e.g., Hsieh*, p. 6; *see also* Schuch Decl., ¶ 44. The projection of the 3D model on the other images can occur as line drawings. *See, e.g., Hsieh*, p. 10; *see also* Schuch Decl., ¶ 44.

In Hsieh, the building measurement process is broken down into a verification component, an object matching component, and an edge estimation component. *See, e.g., Hsieh*, p. 10; *see also* Schuch Decl., ¶ 45. The verification component verifies the existence of an object in an image. *See, e.g., Hsieh*, p. 10. The object matching component generates a set of hypotheses for the location of the object in the image. *See, e.g., Hsieh*, p. 13. The edge estimation component generates a set of possible edge hypotheses for the model edge. *See, e.g., Hsieh*, p. 13. Multi-image roof matching could be used to generate a set of roof hypotheses by triangulating building hypotheses from at least two images. *See, e.g., Hsieh*, p. 20.

Hsieh discloses using an automated process to determine the height of the building and to correct the location of the building in other images (related to multi-image matching processes). *See, e.g., Hsieh*, pp. 6-7; *see also* Schuch Decl., ¶ 46. More specifically, Hsieh discloses estimating the peak edge of a peak roof building and building height. *See, e.g., Hsieh*, p. 14. Further, Hsieh discloses achieving good three-dimensional measurements by locating a projected object in several images. *See, e.g., Hsieh*, p. 16.

Hsieh discloses a process of displaying a first line drawing overlaid on a first aerial image and a second line drawing overlaid on a second aerial image. *See, e.g., Hsieh*, pp. 6, 10, 13, 29; *see also* Schuch Decl., ¶ 50. The user can modify the first line drawing overlaid on the first aerial image. *See, e.g., Hsieh*, pp. 2, 68; Figure 5; *see also* Schuch Decl., ¶ 50. Hsieh discloses that in response to the user changing a feature of the first line drawing, the corresponding feature on the second line drawing is changed. *See, e.g., Hsieh*, pp. 10-14, 68; Figures 4-5; *see also* Schuch Decl., ¶ 51. The output of the system of Hsieh is a 3D wireframe representation of the building. *See Hsieh* Figure 1(d); *see also* Schuch Decl., ¶ 52.

Applicad discloses a system for generating three-dimensional roof models and reports thereof. *See, e.g., Applicad*, p. 1-45; *see also* Schuch Decl., ¶ 53. The system uses a computer aided design system to draw or import a roof or wall outline in three dimensions. *See, e.g., Applicad*, pp. 2, 4. Roof models can be

imported using various file formats (e.g., drawing exchange format (.dxf)) or from a scanned image or bitmap. *See, e.g., Applicad, pp. 4 and 6; see also Schuch Decl., ¶ 57.*

The system of Applicad allows for generating and modifying of a three-dimensional roof model or line drawing, including the change of pitch of roof planes. *See, e.g., Applicad, pp. 7-14; see also Schuch Decl., ¶ 54.* The software updates areas and lengths as new features are inserted and/or modified. *See, e.g., Applicad, p. 13; see also Schuch Decl., ¶ 54.*

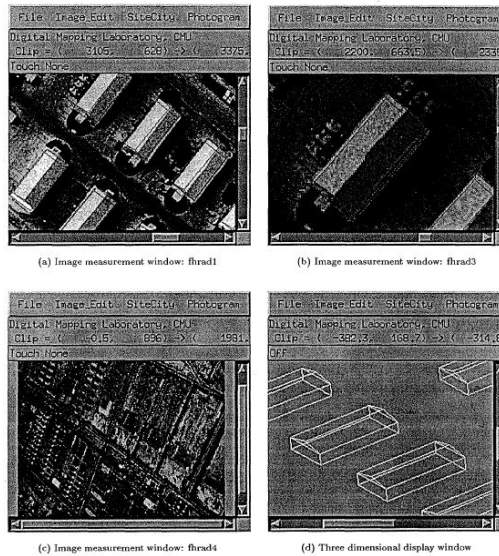
From the 3D drawing, the software automatically calculates the necessary roofing material to generate a detailed quote. *See, e.g., Applicad, p. 2; see also Schuch Decl., ¶ 55.* Further, users can generate user-defined forms (e.g., custom forms) which could include quotations and drawings, and extract desired information. *See, e.g., Applicad, pp. 2, 39-40, 42; see also Schuch Decl., ¶ 55.* Accordingly, the system of Applicad can be used to generate a report, including a top plan view of a three-dimensional model or line drawing, measurement information of the roof (e.g., roof pitch, height, etc.), among various other types of information. *See, e.g., Applicad, p. 40; see also Schuch Decl., ¶ 55.*

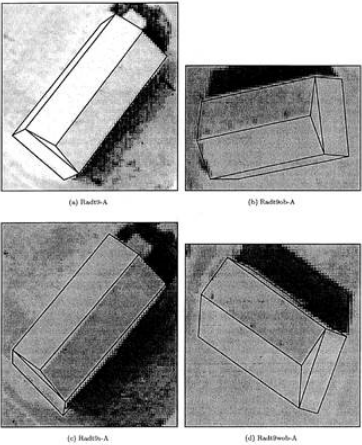
A person of ordinary skill in the art would have combined the roof reporting functionality of Applicad with the line drawing matching features of Hsieh. *See*

Schuch Decl., ¶ 56. In fact, Applicad discloses the ability to import roof models from other systems. *See, e.g., Applicad*, p. 4.

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [<i>Italics Type</i>]
1. [1.P] A computer-implemented method in a roof estimate report system including at least one processor and a memory coupled to the at least one processor, the method comprising:	<u>Hsieh</u> discloses a system/method for generating a roof estimation report including at least one processor and memory. <i>See, e.g., Hsieh</i>, Abstract (“This paper describes the design and evaluation of SiteCity, a semi-automated building extraction system integrating photogrammetry, geometric constraints, image understanding and user interface. . . . SiteCity gives human operators the ability to construct and manipulate three dimensional building objects using multiple images.”); Introduction, pp. 1-2 (“SiteCity uses rigorous photogrammetric principles and multiple images to accurately determine 3D locations of objects, such as buildings or roads in the scene. . . . Three windows (Figure 1(a), 1(b), 1(c)) are used for the image measurements and are called image windows.”). <i>See also Hsieh</i>, p. 71 (“SiteCity uses these methods to integrate image understanding algorithms into an interactive system for extracting three dimensional building models using multiple images. These automated algorithms are unobtrusively integrated and reduce the complexity of the measurement tasks. SiteCity allows the user to measure building points on multiple images using a simple graphical interface. These building points are triangulated to estimate the three-dimensional position and precision, and constrained according to the geometric model. Complex building objects can be constructed by applying geometric constraints on several primitive components. The current system allows us to measure a large variety of building types.”) (emphasis added). Since the system of <u>Hsieh</u> executes on a computer,

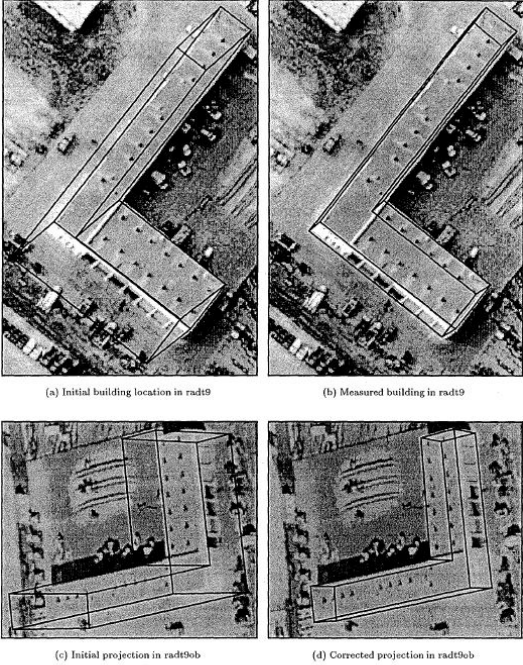
Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <i>Applicad</i> [Italics Type]
	<u>Hsieh</u> discloses the use of a processor and a memory. <i>See, e.g., Hsieh</i> , Abstract (“This paper describes the design and evaluation of SiteCity, a semi-automated building extraction system integrating photogrammetry, geometric constraints, image understanding and user interfaces. Existing automated building extraction systems often produce mixed results and it is clear that human intervention is required to correct mistakes from fully automated systems. SiteCity gives human operators the ability to construct and manipulate three dimensional building objects using multiple images.”). <i>See also Hsieh</i> , p. 5 (“A fast algorithm will reduce the idle time of the user. A robust algorithm should not be affected by differences in scenes, images, object types, and users. Of the two criteria, robustness should be more important. Advances in computer hardware will make some slow algorithms practical. An unreliable algorithm will remain so regardless of hardware and should not be integrated into an interactive system.”). A system performing complex automated photogrammetric processes on a computer thus discloses a memory and processor in order to carry out its function.
[1.1] displaying, by the at least one processor of the roof estimate report system, a plurality of aerial images of a roof at the same time, each of the aerial images providing a different view, taken from a different angle of the same roof;	<u>Hsieh</u> discloses a method for displaying a plurality of aerial images of a roof at the same time where the images provide a different view, taken from a different angle of the same roof. <i>See, e.g., Hsieh</i> , p. 2 (“A snapshot of SiteCity is shown in Figure 1. Three windows (Figure 1(a), 1(b), 1(c)) are used for the image measurements and are called image windows. The fourth window (Figure 1(d)) displays the 3D position of the measured object and is the <i>site window</i> . Each image window has an identical graphical user interface in which a variety of menus provide support for measurement and modification

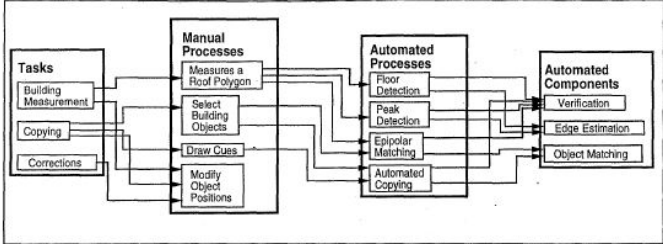
Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	Hsieh [Block Type] in view of <i>Applicad</i> [Italics Type]
	of image features. Image features are triangulated to form 3D objects which are displayed in the site window for verification and visualization.”);  (a) Image measurement window: fhrad1 (b) Image measurement window: fhrad3 (c) Image measurement window: fhrad4 (d) Three dimensional display window Figure 1: Snapshot of SiteCity p. 20 (“Multi-Image Roof Matching (MIRM)[:] After the user measures a roof outline, this method takes the roof outline and performs the epipolar matching of the roof on other images and generates a set of roof hypotheses in each of the images. For each roof hypothesis in an image, peak edge and floor detection processes are used to determine a set of possible building hypotheses in that image.”). <i>See also</i> Hsieh, Figure 17 (showing aerial images of the same roof providing different views of the roof, taken at different angles).

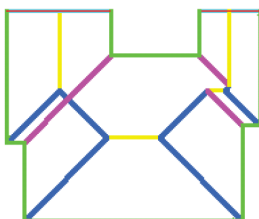
Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	 Figure 17: Scene 1 - Radh-A
[1.2] displaying, by the at least one processor of the roof estimate report system, respective line drawings representing features of the roof, the respective line drawings overlying a first and a second aerial image of the plurality of aerial images of the roof, the line drawing overlying the first aerial image of the roof having features in common with the line drawing overlying the second aerial image of the roof;	<u>Hsieh</u> discloses a method for displaying line drawings representing features of a roof on a first and a second aerial image on a single display, where the line drawing in the first aerial image has features in common with the line drawing in the second aerial image of the roof. <i>See, e.g., Hsieh</i>, p. 6 (“The building model has a default height dimension of 30 meters, and is projected to all images and object space using a DEM to determine the elevation of building floor.”); p. 10 (“When a 3D object is projected to an image, some of the edges might not be visible due to the viewing geometry. Therefore, before any verification is attempted, the hidden lines of the object in the image are first removed from consideration. The result is a two dimensional line drawing of the expected visible edges of the object in the image, and the problem reduces to matching this 2D line drawing to the image.”) (emphasis added); p. 13 (“Given a projection of a 3D object to the image, the goal is to find instances of the projection of this object in the image, similar to the 2D object matching problem described in [27; 8; 46].”); p. 29 (“World to Image Projection: This method projects the triangulated 3D object to all images. The 3D objects should project to the

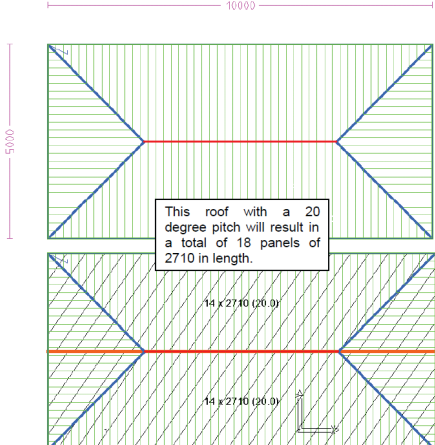
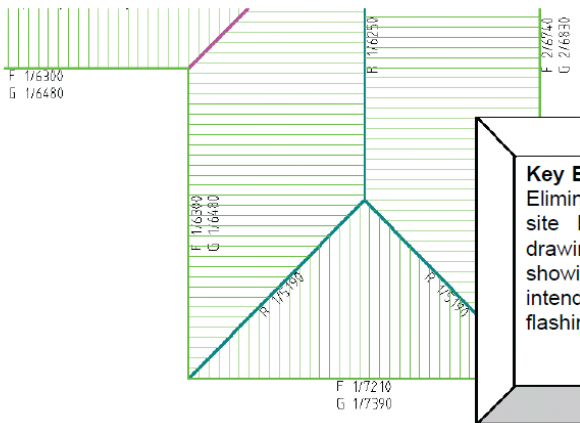
Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	appropriate locations in the images.” (emphasis added). Additionally, Figure 17 shown (reproduced above) illustrates line drawings overlaid on first and second aerial images from the 3D model, the line drawings having features in common with one another.
[1.3] in response to user input, changing, by the at least one processor of the roof estimate report system, the line drawing representing a feature of the roof that overlies the first aerial image of the roof;	<u>Hsieh</u> discloses a method for changing a line drawing of a first aerial image in response to a user input. The image measurement windows (discussed above in connection with Figure 1 of <u>Hsieh</u>) allow a user to change the line drawings as needed in order to better indicate building features. <i>See, e.g., Hsieh</i>, p. 2 (“A snapshot of SiteCity is shown in Figure 1. Three windows (Figure 1(a), 1(b), 1(c)) are used for the image measurements and are called image windows. . . . Each image window has an identical graphical user interface in which a variety of menus provide support for measurement and modification of image features.”) (emphasis added). <i>See Hsieh</i>, Figure 1 (reproduced above) which shows the line drawings overlaid on the aerial image after the measurement has taken place. <i>See also Hsieh</i>, pp. 19-20 (“After the user measures a roof outline, this method takes the roof outline and performs the epipolar matching of the roof on other images and generates a set of roof hypotheses in each of the image.”); p. 31 (“A building is measured in SiteCity by measuring the vertices of the building in images.”); p. 36 (“A building is measured by locating the image positions of building vertices in all available images and a measurement is the image position of a building vertex in an image.”).
[1.4] in response to the changing, making corresponding changes, by	<u>Hsieh</u> discloses a method for changing a feature in the second line drawing that corresponds to the feature changed in the first line drawing by the user.

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
the at least one processor of the roof estimate report system, to the line drawing overlying the second aerial image; and	Indeed, when the user delineates roof features in the first image measurement window of the system, the system creates a building “hypothesis” which it then displays on the other views of the building in the other windows – in so doing, the system of <u>Hsieh</u> displays a second line drawing in another aerial view that is in response to the user’s measurements made in the first aerial view (i.e., measurements made in the first measurement window). <i>See, e.g., Hsieh</i>, pp. 6-9 and Figure 4 (reproduced below). Figure 4(a) shows the first line drawing overlaid on the first aerial image and Figure 4(c) shows the second line drawing overlaid on the second aerial image. Figure 4(b) shows the first line drawing changed based on a user input. <i>See, e.g., Hsieh</i>, p. 6 (“[T]he next task is to measure the floor position (Figure . . . 4(b))”). Figure 4(d) is the second line drawing changed based on the user input and change made to the first drawing. <i>See, e.g., p. 7</i> (“The final task is to correct the location of the building in other images (See Figure . . . 4(d)).”).

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	 (a) Initial building location in radt9 (b) Measured building in radt9 (c) Initial projection in radt9b (d) Corrected projection in radt9b Figure 4: Correcting building delineations The user can modify the first line drawing, thus causing the system to automatically update the second line drawing based on the change in the first line drawing by way of the manual and automated processes shown in Figure 5. See <u>Hsieh</u>, Figure 5 (showing that the user can “Draw Cues” and “Modify Object Positions” which then feed into the automated components responsible for projecting line drawings on the aerial images). See also <u>Hsieh</u>, p. 10 (“The result is a two dimensional line drawing of the expected visible edges of the object in the image, and the problem reduces to matching this 2D line drawing to the image.”) (emphasis added).

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	 Figure 5: Control Process Flow of SiteCity See also <u>Hsieh</u>, p. 68 (“[U]ser tasks are . . . modifications of measured object, measurements of a new point, and deletions. . . . The majority of the user tasks are modification tasks, which means that the user spends most of his/her time moving points around. This is consistent with the user interface of SiteCity. Recall from Section 3 that a building is measured by measuring the roof points in one image, followed by modifications of the corner points of the hypothesized building in all images.”) (emphasis added).
[1.5] generating and outputting a roof estimate report using a report generation engine, wherein the roof estimate report includes numerical values for corresponding slope, area, or lengths of edges of at least some of a plurality of planar roof sections of the roof, wherein the generated roof estimate report is provided for repair and/or constructing the roof structure of the building.	The <u>Applicad</u> system calculates slope, area, and lengths edges of the plurality of planar roof sections. See, e.g., <u>Applicad</u>, p. 4 (“By using the command <i>Digitise Outline</i> we can then move the cursor to the extremities of the wall outline, by “snapping” to those points, and after entering the pitch or slope of the roof and the eave offset from the wall, the roof is generated automatically, resulting in an accurate and fast method of working out the areas and lengths.”); p. 10 (“Often, with multi-hipped roofs, it is quite a time consuming process to work out the necessary areas and lengths. With our software this can be achieved in seconds.”); p. 13 (“The important thing to remember here is the fact that the software is constantly updating the areas and lengths when inserting new features, so there is no need to manually have to add a length of new ridge everytime a new dormer is inserted for instance.”).

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	Hsieh [Block Type] in view of <i>Applicad</i> [Italics Type]
	<i>Applicad</i> discloses generating a roof estimate report with drawings. See, e.g., <i>Applicad</i>, p. 2 (“All of our products utilise a CAD (computer aided design) system . . . to draw up the roof or wall outline accurately in 3 dimensions, and then, from that 3D drawing, the software automatically calculates the amount of material to cover the roof or wall, along with all the necessary flashings. The result of this is the production of a detailed quotation breakdown, and the ability to generate your own user-defined forms These forms include quotations, labour pay summaries, order forms for your suppliers, invoices and drawings.”). <i>Applicad</i> can process models generated by other software packages. See, e.g., <i>Applicad</i>, p. 4 (“Importing Roof or Building outlines from another CAD system . . . CAD drawings can be saved in various different file formats, and our software supports most of these, but the most common form is the .dxf format (drawing exchange format).”). The reports could include any type of drawings, including a top plan view annotated with numerical values. See, e.g., <i>Applicad</i>, p. 40 (the report includes a top plan view of the model with the numerical value of the roof pitch).
	Applicad Roofing 123 Church St Hawthorn 03 9810 3100 03 9810 3200 Home 2 A/C/V: Home 1 Date: November 2002 Job No Customer Address Site address Phone: Mobile: Fax Builder name: Phone  Road Pitch 20.0 Height 5300 Rafter CTS 600 Eaves 0 Gable Finish For the supply and installation of: Roof K15 1000 L.P. Steel, Galvalume - Painted Ridge BWP Ridge capping, Mountain Blue Fascia Metal fascia, Tones Blue Gutter O-Gee Gutter, Ebony Valley Not Included Barge Rake Flashing, Off white Batten Not Included Insulation Not Included Downpipes Not Included Curved Roof Not Included

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	See, e.g., <u>Applicad</u>, p. 28 (illustrating a top plan view of a roof annotated with lengths of 5000 and 10000 and a pitch of 20).  See also <u>Applicad</u>, p. 25 (illustrating a top plan view of a roof annotated with lengths of ridges and edges).  These annotated drawings could include slope, area, and length. See, e.g., <u>Applicad</u>, p. 35 (“Eliminate the need to make any manual calculations with pen and paper. You can present all information required for the quote using our software.” (emphasis added)); p. 42 (“You can also customize the reports to suit your business, so you can . . . tailor the quote to extract certain information as required.” (emphasis added)). Further, as shown in the figures

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	<i>above, these drawings could include two more types of indicia for different types of roof properties (e.g., one color for roof edges, another color for ridges, numbers for lengths, parentheses for pitch, etc.).</i> <i><u>Applicad</u> discloses software that is primarily used for roof repair and construction, e.g., providing roof estimates and quotes. See, e.g., <u>Applicad</u>, pp. 2, 3, 33-40, and 42. In this regard, <u>Applicad</u> specifically notes that “the software automatically calculates the amount of material to cover the roof.... The result of this is the production of a detailed quotation breakdown, and the ability to generate your own user-defined forms to present to your customers....” See <u>Applicad</u>, p. 2.</i>
8. The method of claim 1 wherein the first image provides a first perspective view of the roof of the building and the second image provides a second perspective view of the roof of the building.	<u>Hsieh</u> discloses a method wherein the first image provides a first perspective view of the roof of the building and the second image provides a second perspective view of the roof of the building. See <u>Hsieh</u> , Figures 1 and 17 (reproduced above).
9. The method of claim 1 further comprising: transmitting roof measurement information based at least in part on the change of the line drawing representing a feature of the roof that overlies the first aerial image of the roof.	<u>Hsieh</u> transmits, within the various components of the system, roof measurement information based at least in part on the change of the line drawing representing a feature of the roof that overlies the first aerial image of the roof. See, e.g., <u>Hsieh</u> , pp. 19 (“After the user measures the corner points for the roof, the floor detection process is invoked to established the structure and location of the building object in the image. The floor of the building is assumed to be on the ground. The length of the vertical edges in the image are converted to meters in object space. Since the roof position differs from the ground only in elevation, the height measurement

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	allows us to construct the building structure in the local coordinate system. The peak edge detection process is invoked if the building is a peak roof building.”); p. 20 (“After the user measures a roof outline, this method takes the roof outline and performs the epipolar matching of the roof on other images and generates a set of roof hypotheses in each of the images. For each roof hypothesis in an image, peak edge and floor detection processes are used to determine a set of possible building hypotheses in that image. Three-dimensional building hypotheses are generated by triangulating building hypotheses from at least two images.”).
10. The method of claim 1 further comprising: displaying a marker operable to specify a point on an image; receiving, via the marker, an indication of a point on the first aerial image; and registering, based on the received indication of the point, the aerial image to a reference grid corresponding to a three-dimensional model of the roof.	<u>Hsieh</u> discloses a method wherein a marker is displayed to specify a point on an aerial image and based on the received indication of the point, the method registers the aerial image to a reference grid corresponding to the three-dimensional model. <i>See, e.g.</i> , p. 20 (“After the user measures a roof outline, this method takes the roof outline and performs the epipolar matching of the roof on other images and generates a set of roof hypotheses in each of the images. For each roof hypothesis in an image, peak edge and floor detection processes are used to determine a set of possible building hypotheses in that image. Three-dimensional building hypotheses are generated by triangulating building hypotheses from at least two images.”). Therefore, <u>Hsieh</u> discloses a marker operable to specify a point on the image because the user measures the outline of a roof, which then allows the system to find the same building in all of the images. Because the system of <u>Hsieh</u> uses memory and coordinates the various views (e.g., through triangulation), it includes a reference grid which permits such processes to occur. <i>See</i> Schuch Decl. ¶ 49.

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
16. A non-transitory computer-readable storage medium, having computer executable instructions stored thereon that, when executed by at least one computer processor, cause the at least one processor to enable a computing system to generate a roof estimate report for a building having a roof, by performing a method comprising:	<u>Hsieh</u> : See discussion with respect to element 1.P of Claim 1 of Table 1.
overlaying a line drawing on corresponding locations of a roof feature of the roof on first and second aerial images of the roof, wherein the first aerial image provides a first view of the roof of the building and the second aerial image provides a second view of the roof of the building;	<u>Hsieh</u> : See discussion with respect to elements 1.1 and 1.2 of Claim 1 of Table 1.
in response to changes in the line drawing overlaid on the first aerial image, displaying corresponding changes to the line drawing overlaid on the second aerial image; and	<u>Hsieh</u> : See discussion with respect to elements 1.3 and 1.4 of Claim 1 of Table 1.
generate and output a roof estimate report using a report generation engine,	<u>Applicad</u> : See discussion with respect to element 1.5 of Claim 1 of Table 1.

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
wherein the roof estimate report includes numerical values for corresponding slope, area, or lengths of edges of at least some of a plurality of planar roof sections of the roof, wherein the generated roof estimate report is provided for repair and/or constructing the roof structure of the building.	
19. The non-transitory computer-readable storage medium of claim 16 further comprising: displaying the roof feature in the first aerial image at a first time; and displaying the roof feature in the second aerial image at a second time that is within two seconds of the first time.	<u>Hsieh</u> discloses a method wherein displaying the respective line drawing overlying the first aerial image occurs at a first time and displaying the respective the line drawing overlying the second aerial image occurs at a second time that is within two seconds of the first time. <i>See, e.g., Hsieh</i>, p. 10 (“The goal of the verification component is to verify the existence of a hypothesized building object in an image. . . . [B]efore any verification is attempted, the hidden lines of the object in the image are first removed from consideration. The result is a two dimensional line drawing of the expected visible edges of the object in the image, and the problem reduces to matching this 2D line drawing to the image.”). This process occurs in multiple aerial images. <i>See, e.g., Hsieh</i>, p. 20 (“Multi-Image Roof Matching (MIRM)[:] After the user measures a roof outline, this method takes the roof outline and performs the epipolar matching of the roof on other images and generates a set of roof hypotheses in each of the images.”). <i>See also Hsieh</i>, p. 5 (“A fast algorithm will reduce the idle time of the user. A robust algorithm should not be affected by differences in scenes, images, object types, and

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	users. Of the two criteria, robustness should be more important. Advances in computer hardware will make some slow algorithms practical. An unreliable algorithm will remain so regardless of hardware and should not be integrated into an interactive system.”). The method in <u>Hsieh</u> displays the second line drawing after the first line drawing because the method is implemented on a computer, and therefore cannot occur simultaneously due to sequential clock cycles of the computer’s processor. Moreover, the features are displayed within two seconds of each other because the processor will perform the above operations quickly. It is a mere matter of design choice to add/reduce processing power to allow the line drawings to be displayed at the desired time intervals.
22. The non-transitory computer-readable storage medium of claim 16 wherein the method is performed iteratively, and the method further comprising: providing an operator with an interactive model generation experience.	<u>Hsieh</u> discloses a computing system wherein the roof estimation modules includes an interactive roof modeling user interface. <i>See, e.g., Hsieh</i> , p. 71 (“In this paper, methods and criteria for designing and integrating automated processes in an interactive environment are presented. SiteCity uses these methods to integrate image understanding algorithms into an interactive system for extracting three dimensional building models using multiple images.”) (emphasis added). <i>See also Hsieh</i> , Figure 13 (a flow chart detailing the iterative process from 1 to n).
25. The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: modifying a three dimensional model of the roof based at least on the	<u>Hsieh</u> discloses a method for modifying a three dimensional model of the roof based at least on the modification of the line drawing overlaid on the first aerial image. <i>See, e.g., Hsieh</i> , p. 20 (“After the user measures a roof outline, this method takes the roof outline and performs the epipolar matching of the roof on other images and generates a set of roof hypotheses in each of the images. For each roof

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
modification of the line drawing overlaid on the first aerial image.	hypothesis in an image, peak edge and floor detection processes are used to determine a set of possible building hypotheses in that image. Three-dimensional building hypotheses are generated by triangulating building hypotheses from at least two images.”). The method in <u>Hsieh</u> allows a user to make corrections and input further parameters to modify the 3D model. <i>See, e.g., Hsieh</i> , p. 1 (“Based on these inputs, automated processes produce a site model, and finally, users correct mistakes in that site model.”). <i>See also Hsieh</i> , Figure 5 (showing a flow chart of the process which is an interactive process allowing the user to update the 3D model); p. 68 (“The majority of the user tasks are modification tasks, which means that the user spends most of his/her time moving points around. This is consistent with the user interface of SiteCity. Recall from Section 3 that a building is measured by measuring the roof points in one image, followed by modifications of the corner points of the hypothesized building object in all images. ”) (emphasis added).
26. A computer-implemented method in a roof estimate report system including a computer system and a memory coupled to the computer system, the method comprising:	<u>Hsieh</u> : <i>See</i> discussion with respect to element 1.P of Claim 1 of Table 1.
changing, by the computer system of the roof estimate report system, a line in a first line drawing representing a feature of a roof that overlies a first	<u>Hsieh</u> : <i>See</i> discussion with respect to elements 1.1, 1.2 and 1.3 of Claim 1 of Table 1.

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
aerial image of the roof;	
changing, by the computer system of the roof estimate report system, a line in a second line drawing that corresponds to the same feature in the first line drawing that was changed, the change in the second line drawing being made by the computer system in response to the change that was made in the first line drawing; and	<u>Hsieh</u> : See discussion with respect to elements 1.1, 1.2, 1.3 and 1.4 of Claim 1 of Table 1.
generating and outputting a roof estimate report using a report generation engine, wherein the roof estimate report includes numerical values for corresponding slope, area, or lengths of edges of at least some of a plurality of planar roof sections of the roof, wherein the generated roof estimate report is provided for repair and/or constructing the roof structure of the building.	<u>Applicad</u> : See discussion with respect to element 1.5 of Claim 1 of Table 1.
27. The method of claim 26 wherein the roof feature is at least one of: a ridgeline of the roof, a valley of the roof, a rake edge of the roof, an eave	<u>Hsieh</u> discloses a method wherein the indicated feature is at least one of: a point on the roof, a section of the roof, a ridgeline of the roof, a valley of the roof, a rake edge of the roof, an eave of the roof, a hip ridge of the roof, an edge of a section of the roof, and a corner of a section of the roof. See, e.g.,

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
of the roof, a hip ridge of the roof, and an edge of a section of the roof.	<u>Hsieh</u> , Figures 1, 4, 8, 9, and 17. As can be seen from those Figures, various roof features are delineated, including ridgelines and edges of roof sections.
28. The method of claim 26 further comprising displaying the second line drawing after the first line drawing has been displayed.	<u>Hsieh</u> : See discussion with respect to Claim 19 of Table 1.
31. The method of claim 26 further comprising: displaying the second line drawing overlying the second aerial image at a later time, after the displaying of the first line drawing overlying the first aerial image of the roof on the display.	<u>Hsieh</u> : See discussion with respect to Claim 19 of Table 1.
33. The method of claim 26 wherein the first image provides a first oblique view from a first compass bearing of the roof of the building, and the second image provides a second oblique view from a second compass bearing of the roof of the building.	<u>Hsieh</u> discloses a method wherein the first image provides a first oblique view from a first compass bearing of the roof of the building and the second image provides a second oblique view from a second compass bearing of the roof of the building. See <u>Hsieh</u> , Figures 1 and 17 (reproduced above), which show that the images are taken from various directions (each of which inherently has its own compass direction or “bearing”).
34. The method of claim 26 further comprising: displaying roof measurement information on the same display concurrently with the first	<u>Hsieh</u> : See discussion with respect to element 1.1 of Claim 1 of Table 1. <u>Applicad</u> : See discussion with respect to element 1.5 of Claim 1 of Table 1.

Claims 1, 8-10, 16, 19, 22, 25-28, 31, and 33-36	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
line drawing being displayed.	
35. The method of claim 34 wherein the step of displaying roof measurement information comprises: displaying the roof measurement information in a location that overlays the first line drawing itself.	<u>Hsieh</u> : See discussion with respect to element 1.1 of Claim 1 of Table 1. <i>Applicad</i> : See discussion with respect to element 1.5 of Claim 1 of Table 1.
36. The method of claim 26 further comprising: displaying a wire frame model of the roof in isolation from any images of the roof.	<u>Hsieh</u> discloses a method for displaying a wire frame model of the roof in isolation from the other images. See, e.g., <u>Hsieh</u> , FIGS. 1 and 2.

It would have been obvious to a person of ordinary skill in the art to include an annotated roof report, as taught by Applicad, with the line drawing matching features of Hsieh for easy and effective communication of roof measurement results to a user. Accordingly, there is a rationale for supplementing the teachings of Hsieh by those of Applicad under each of M.P.E.P. §§ 2143(I)(A), (C), (G).

Under M.P.E.P. § 2143(I)(A), a person of ordinary skill in the art would have found it obvious to incorporate the roof reporting functionality of Applicad with the line drawing matching features of Hsieh as doing so would be combining prior art elements according to known methods to yield predictable results. Together, Hsieh and Applicad disclose the claim elements discussed in the claim

chart above. *See, e.g.*, M.P.E.P. § 2143(I)(A)(1). A person of ordinary skill in the art could have combined the elements as claimed by electronically importing the line drawings of Hsieh into the roof reporting system of Applicad, as disclosed in Applicad. *See, e.g.*, Applicad, p. 4 (“Importing Roof or Building outlines from another CAD system . . . CAD drawings can be saved in various different file formats, and our software supports most of these, but the most common form is the .dxf format (drawing exchange format).”); *see also, e.g.*, M.P.E.P. § 2143(I)(A)(2). A person of ordinary skill in the art would have recognized that the results of the combination were predictable, as Applicad would function as originally intended and designed after the line drawings of Hsieh has been imported. *See, e.g.*, M.P.E.P. § 2143(I)(A)(3).

Under M.P.E.P. §§ 2143(I)(C), a person of ordinary skill in the art would have found it obvious to incorporate the roof reporting functionality of Applicad with the line drawing matching features of Hsieh as doing so would amount to using known techniques to improve similar devices in the same way. Petitioner submits that Hsieh is the base device that was known in the art. Applicad improves the system of Hsieh by providing roof reporting functionality. *See, e.g.*, Applicad, p. 3 (“Our software works off the basis of drawing the roof up on the screen, using a series of easy-to-use menus. . . . Because our software sits on top of a very powerful 3 dimensional CAD package, we can utilize various tools to

enable the drawing of the roof and checking the result, before submitting to a bid.”). One of ordinary skill in the art could have applied the functionality of Applicad in the base device of Hsieh with predictable results. *See, e.g.*, M.P.E.P. § 2143(I)(C)(3).

Under M.P.E.P. §§ 2143(I)(G), a person of ordinary skill in the art would have found it obvious to incorporate the roof reporting functionality of Applicad with the line drawing matching features of Hsieh, as Applicad provides a teaching, suggestion, or motivation to do so. In support of this rejection, Petitioner submits that Applicad suggests importing roof models from other systems. *See, e.g.*, Applicad, p. 4 (“Importing Roof or Building outlines from another CAD system . . . CAD drawings can be saved in various different file formats, and our software supports most of these, but the most common form is the .dxf format (drawing exchange format).”); *see also* M.P.E.P. § 2143(I)(G)(1). Further, there was a reasonable expectation of success that Applicad would be able to provide the roof measurement functionality using a line drawing generated by the teachings of Hsieh. *See, e.g.*, M.P.E.P. § 2143(I)(G)(2).

Petitioner further notes that the format of a roof report is a mere matter of design choice, and should be afforded no patentable weight. *See e.g.*, M.P.E.P. § 2144.04(I) citing *In re Seid*, 161 F.2d 229, 73 USPQ 431 (CCPA 1947) (“The court found that matters relating to ornamentation only which have no mechanical

function cannot be relied upon to patentably distinguish the claimed invention from the prior art.”).

B. Table 2 – Claim 10 of the ’737 Patent is Unpatentable as Obvious Under 35 U.S.C. § 103 over Hsieh in view of Applicad and in further view of Perlant

Perlant discloses a system for scene registration in aerial image analysis. *See, e.g., Perlant*, p. 481-92. Perlant teaches a system where a marker is displayed on an aerial image to specify a point or part of the image. *See, e.g., Perlant*, p. 482, FIG. 2. Based on the points selected on the aerial image, the system of Perlant will register the aerial images to a reference grid. *See, e.g., Perlant*, p. 482, FIG. 4; *see also* Schuch Decl., ¶ 66. The reference grid in Perlant corresponds to a 3D model of the aerial images and is used to help facilitate 3D model generation. *See, e.g., Perlant*, p. 490; *see also* Schuch Decl., ¶ 68. A person of ordinary skill in the art would have found it obvious to combine the scene registration process in Perlant with the three-dimension roof generation of Hsieh. *See* Schuch Decl., ¶ 70. In fact, Perlant discloses the ability to augment 3D model generation by scene registration in aerial images. *See, e.g., Perlant*, p. 485.

Claim 10	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type] in further view of <u>Perlant</u> [Underline Type]
10. The method of claim 1 further comprising: displaying a marker operable to specify a point	<u>Hsieh</u> and <u>Applicad</u> disclose all the limitations found in Claim 1. <u>Hsieh</u> : <i>See</i> discussion with respect to elements 1.1-1.4 of Claim 1 of Table 1.

Claim 10	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type] in further view of <u>Perlant</u> [Underline Type]
on an image; receiving, via the marker, an indication of a point on the first aerial image; and registering, based on the received indication of the point, the aerial image to a reference grid corresponding to a three-dimensional model.	<u>Applicad</u>: See discussion with respect to element 1.5 of Claim 1 of Table 1. <u>Perlant</u> discloses displaying a marker operable to specify a point on an image and receiving, via the marker, an indication of a point on the first aerial image. See, e.g., Perlant, p. 482 (“The classical method to select corresponding points is by the manual identification of landmark points in stereo imagery. . . . We chose to manually select shadow corners since these points were the focus of our experimentation in automatic landmark detection.”). See also FIG 2, which shows selection of various points in the image. FIG. 2. (a) Manual selection of points (left image) with coarse registration. (b) Manual selection of points (right image) with coarse registration. <u>Perlant</u> discloses registering, based on the received indication of the point, the aerial image to a reference grid corresponding to the three-dimensional model. See e.g., Perlant, p. 482 (“We begin the process of fine registration with the coarse registration described in the previous section. . . . To get the parameters of the isometric transformation, we need to select points in the same plane that, when transformed, preserve their relative distances with the images. Problems with the accuracy of point selection lead us to use more points than necessary to determine the transformation between the two images. However, on some images this model was

Claim 10	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type] in further view of <u>Perlant</u> [Underline Type]
	<u>not flexible enough to account for the variations to our ideal sensor model. As a result, we developed a polynomial transformation up to the third order, adjusted by least squares to fit the selected corresponding points.”); FIG. 4 (Figure 4 shows the results of the fine registration in a reference grid using selected shadow points).</u> FIG. 4. (a) Left image of the fine registration. (b) Right image of the fine registration. <u>Perlant also discloses that the reference grid corresponds to the 3D model. See, e.g., Perlant, pp. 488-90 (“The correspondence of a point feature visible in the left and right image of a stereo pair can be used to generate the three-dimensional description of that point in the scene. . . . Using stereo display techniques, we can generate a three-dimensional segmentation that allows us to represent the structure of each building in the scene.”) (emphasis added). Therefore, the reference grid corresponds to the 3D model because it is the mechanism by which the model is created, in combination with matched multiple images. In other words, since the reference grid links two aerial images together, and since the linked images are used to create the 3D model, the grid thus corresponds to the model.</u>

A detailed overview of Hsieh and Applicad, as well as an in-depth analysis regarding motivation to combine has been provided in Section XII(A), *supra*. It

would have been obvious to a person of ordinary skill in the art to register aerial images to a reference grid, as taught by Perlant, with the system of Hsieh to create a system where aerial images are registered and a 3D model is modified or generated based on the images registered to the reference grid. Accordingly, there is a rationale for supplementing the teachings of Hsieh by those of Perlant under each of M.P.E.P. §§ 2143(I)(A), (C), (G).

Under M.P.E.P. § 2143(I)(A), a person of ordinary skill in the art would have found it obvious to incorporate the registration functionality of Perlant with the line drawing matching features of Hsieh as doing so would be combining prior art elements according to known methods to yield predictable results. Together, Hsieh and Perlant disclose the claim elements discussed in the claim chart above. *See, e.g.*, M.P.E.P. § 2143(I)(A)(1). A person of ordinary skill in the art could have combined the elements as claimed by registering aerial images to a reference grid and then modifying or generating a 3D model based on the images in the reference grid. *See, e.g.*, M.P.E.P. § 2143(I)(A)(2). A person of ordinary skill in the art would have recognized that the results of the combination were predictable, as Hsieh would function as originally intended and designed. *See, e.g.*, M.P.E.P. § 2143(I)(A)(3).

Under M.P.E.P. §§ 2143(I)(C), a person of ordinary skill in the art would have found it obvious to incorporate the registration functionality of Perlant into

the three-dimensional and line drawing matching features of Hsieh as doing so would amount to using known techniques to improve similar devices in the same way. Petitioner submits that Hsieh is the base device that was known in the art. Perlant improves the system of Hsieh by registering images that are used in the system of Hsieh to a reference grid. One of ordinary skill in the art could have applied the functionality of Perlant in the base device of Hsieh with predictable results. *See, e.g.*, M.P.E.P. § 2143(I)(C)(3).

Under M.P.E.P. §§ 2143(I)(G), a person of ordinary skill in the art would have found it obvious to incorporate the registration functionality of Perlant with the three-dimensional modeling and line drawing matching features of Hsieh, as Perlant provides a teaching, suggestion, or motivation to do so. In support of this rejection, Petitioner submits that Perlant suggests registering images to a reference grid to augment the process of modifying three-dimensional models and matching line drawings. *See e.g.*, Perlant, p. 485 (“We describe three scene analysis tasks that require or support scene registration. These tasks are matching structures derived by monocular analysis of overlapping imagery, traditional stereo matching using area-based and feature-based matching techniques, and the construction of a three-dimensional image to present matching results to a human using a stereo display monitor.”); *see also* M.P.E.P. § 2143(I)(G)(1). Further, there was a reasonable expectation of success that Perlant would be able to provide the

registration functionality using a three-dimensional model generated by the teachings of Hsieh. *See, e.g.*, M.P.E.P. § 2143(I)(G)(2).

C. Table 3: Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36 of the '737 Patent are Unpatentable Under 35 U.S.C. § 103 over Avrahami in view of the Applicad

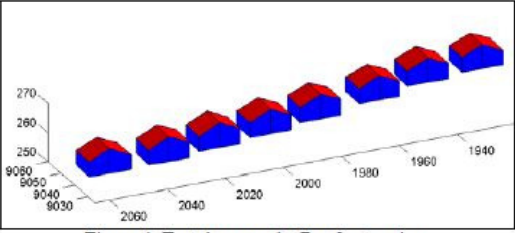
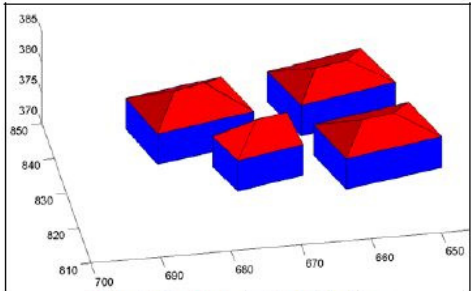
Avrahami discloses a semi-automated site modeling system that can model roofs having a plurality of planar roof sections using one or more aerial images. *See, e.g.*, Avrahami, pp. 43-48, Introduction, p. 43; *see also* Schuch Decl., ¶ 60. The system of Avrahami is semi-automatic and extracts three-dimensional spatial polygons from a pair of aerial images. *See, e.g.*, Avrahami, Abstract, p. 43.

To generate a line drawing of a roof model, a user manually points to the center of a well-defined area in a first image. *See, e.g.*, Avrahami, Introduction, p. 43; *see also* Schuch Decl., ¶ 61. The system then segments the area and extracts a bounded polygon in the first image. *See, e.g.*, Avrahami, Introduction, p. 43; *see also* Schuch Decl., ¶ 61. The segmentation process utilizes region growing methods, a flood fill operator, and other operators directed to edges. *See, e.g.*, Avrahami, Left image operations, p. 44; *see also* Schuch Decl., ¶ 61.

Then the system calculates an estimated height and transformation of the initial point in the second image. *See, e.g.*, Avrahami, Introduction, p. 43; *see also* Avrahami, Approximate average height, p. 44-45; Schuch Decl., ¶ 62. The system then segments the area and extracts a bounded polygon in the second image by

transferring the seed point and using the same process as those that were used for the first image. *See, e.g., Avrahami*, Introduction, p. 43; *see also Avrahami*, Right image operations, p. 45; Schuch Decl., ¶ 62. The system then matches the polygons across the first and second images using homologous points. *See, e.g., Avrahami*, Introduction, p. 43; *see also Avrahami*, Left and Right polygon matching, p. 45; Schuch Decl., ¶ 62. In particular, the system utilizes an iterative method for maximal matching between the two polygons by sliding the left polygon in the direction of the epipolar line in the right image space until the polygons achieve a maximum overlap in the right image space. *See, e.g., Avrahami*, Left and Right polygon matching, p. 45; *see also* Schuch Decl., ¶ 63.

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
1. [1.P] A computer-implemented method in a roof estimate report system including at least one processor and a memory coupled to the at least one processor, the method comprising:	<u>Avrahami</u> discloses a system/method for generating a roof estimation report including at least one processor and memory. <i>See, e.g., Avrahami</i>, Introduction, p. 43 (“Generating 3D city models . . . requires combination of the CAD and GIS systems where the spatial data must be stored in such a way that it can be queried and presented. . . . Joining the two systems can bring about the storage of 3D layers and the formulation of more complex queries for spatial analysis. . . . The algorithm consists of . . . [c]alculation of the estimated height. . . . [T]he proposed method . . . provides us with the detailed roof structure.”). <u>Avrahami</u> also discloses a report where the roof is modeled on a coordinate graph or plane. <i>See Avrahami</i>, Section 5, p. 46 (“The system enables . . . automatic extraction of the 3D roof in a local

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	coordinate system.”); FIGS. 4 and 6. Therefore, <u>Avrahami</u> discloses a system which creates a report of the roof dimensions because the local coordinate system can easily be converted to actual measurements given the parameters of the camera in which the aerial images were taken.  Figure 4. Test Area no. 1 - Roof extraction  Figure 6. Test Area. 2 - Roof extraction <u>Avrahami</u> discloses the computing system/method requiring a memory and processor. <i>See, e.g., Avrahami</i>, Introduction, p. 43 (“The algorithm consists of several consecutive stages: 1) manual pointing to the center of a well-defined area in the left image space by an operator. This stage defines the algorithm as semi-automatic and from here on the process is fully automatic. 2) Segmentation of the area and extraction of its bounding polygon in the left image space. 3) Calculation of the estimated height and transformation of the initial pointing to the right image space. 4) Segmentation of the area and extraction of its bounding polygon in the right image space. 5) An iterative process which matches both polygons followed by extraction of the spatial polygon.”). <i>See also Avrahami</i>, Section 5, Implementation and Experiments, p. 46 (“[A] semi-

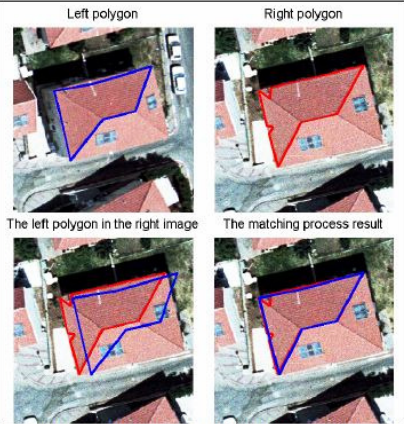
Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	automatic system for performing extraction from aerial images was developed using the MATLAB® environment”). An algorithm of this nature requires a memory and processor to function and the MATLAB® program also requires the use of memory and a processor.
[1.1] displaying, by the at least one processor of the roof estimate report system, a plurality of aerial images of a roof at the same time, each of the aerial images providing a different view, taken from a different angle of the same roof;	<u>Avrahami</u> discloses a method for displaying a plurality of aerial images of a roof at the same time where the images provide a different view, taken from a different angle of the same roof. <i>See, e.g., Avrahami</i>, Abstract, p. 43 (“This study presents algorithms for semi-automatic 3D spatial polygon extraction from a pair of colored aerial images with a known external model solution.”) (emphasis added); FIG. 1 shows two images of the same roof taken at different angles which are used to generate a 3D model. The left image shows the side of the building in an oblique view (the left side of the building can be seen in the left image) and the right image shows the roof from top plan view (where no side of the building can be seen). <i>See also Avrahami</i>, FIG. 3. Figure 1. Result of the iterative matching process between the polygons in the right image space <i>See also Avrahami</i>, p. 46 (“Once the merging process occurs in one image, it must also be performed correspondingly in the other image. This case is very common and mainly caused by the different viewing

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
[1.2] displaying, by the at least one processor of the roof estimate report system, respective line drawings representing features of the roof, the respective line drawings overlying a first and a second aerial image of the plurality of aerial images of the roof, the line drawing overlying the first aerial image of the roof having features in common with the line drawing overlying the second aerial image of the roof;	angles of the aerial camera.”). <u>Avrahami</u> discloses a method to display line drawings representing features of a roof on a first and second aerial image where the line drawing in the first aerial image have features in common with the line drawing of the second aerial image. <i>See, e.g., Avrahami</i>, Section 1, p. 43 (“The algorithm consists of several consecutive stages: . . . 2) Segmentation of the area and extraction of its bounding polygon in the left image space. . . . 4) Segmentation of the area and extraction of its bounding polygon in the right image space. 5) An iterative process which matches both polygons followed by extraction of the spatial polygon.”); Section 3.1, P. 44, Left image operations (“The purpose of this stage is to extract the area which was pointed out by the operator (the seed point) in the left image space (segmentation). . . . Following this process, the raster feature is converted to vector data using simplification methods, line adjustment and intersection with the outcome being an extracted polygon.”); Section 3.3, p. 45, Right image operations (“After calculating average polygon height, it is possible to transfer the first seed point to the homologous point in the right image. . . . At the end of this process we obtain two polygons – one in the left image and one in the right image.”). Figure 1 (shown below) illustrates the line drawings overlaid on two aerial images taken from different views since the left image shows the side of the building in an oblique view (the left side of the building can be seen in the left image) and the right image shows the roof from top plan view (where no side of the building can be seen).

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	Figure 1. Result of the iterative matching process between the polygons in the right image space Figure 1 shows that the line drawings overlaid on the aerial images have features in common.
[1.3] in response to user input, changing, by the at least one processor of the roof estimate report system, the line drawing representing a feature of the roof that overlies the first aerial image of the roof;	<u>Avrahami</u> discloses a method to change a line drawing of a first aerial image in response to a user input. See e.g., <u>Avrahami</u>, Section 4, p. 46, Roof Extraction (“In order to extract the roof of a building, the roof planes composing it must be extracted first. The proposed algorithm consists of three main stages: 1) Manual pointing - seed points (in 2D) to the centre area (in a typical radiometric point) of each roof plane in the left image space.”). The user interface in <u>Avrahami</u> is interactive: every time a user points to a seed point of a plane of a roof, the system automatically generates a polygon outline of a roof plane corresponding to the point where the user places the seed point. Portions of Figure 1 and 5 shown below illustrate how the line drawing of the same roof is changed in response to user input.

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	Left polygon  The left polygon in the right image Line drawing in Fig. 1 Updated Line drawing in Fig. 5
[1.4] in response to the changing, making corresponding changes, by the at least one processor of the roof estimate report system, to the line drawing overlying the second aerial image; and	<u>Avrahami</u> discloses changing a line drawing in a second aerial image based upon changes made by the user to a first line drawing on a first aerial image. In particular, when a user points to a seed point in the first image, the system generates a “left” polygon (a first line drawing) in the left image, and then finds a corresponding “right” polygon (a second line drawing) in the right image. <i>See, e.g., Avrahami</i>, Section 3.5, p. 45, Left and Right polygon matching (“[F]or each point in the left polygon we can find the corresponding homologous point in the right polygon by intersecting the epipolar line and the right polygon. . . . [A]n iterative method for maximal matching between the two polygons was developed. The matching process between both polygons is based on the well-known optimization model called “adjustment by conditions” (Cooper, 1987). The unknowns in this model are the heights of each point in the left polygon. The conditional equation (Equation 1) demands that after the left polygon is “transferred” to the right polygon (using height) maximum overlap (minimum difference between the interior and exterior areas) is created between the polygons in the right image space. First, the points in the left polygon are assigned the estimated average height, which was calculated previously. With each iteration these heights of points in the left polygon are

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	updated until the conditional equation is optimized. During the iterations the left polygon “slides” in the direction of the epipolar line in the right image space. The “slide” rate is not constant because it depends on the varying height of each point. The iteration (“sliding”) process stops when the polygons achieve maximum overlap in the right image space.”). <i>See also</i> <u>Avrahami</u>, Section 3.3, p. 45, Right image operations (“After calculating average polygon height, it is possible to transfer the first seed point to the homologous point in the right image in two steps: transferring to local coordinates and from these to the right image space. It is performed by using the co-linear equation. From here on, the segmentation process around this point can be applied in the same way as in the left image. At the end of this process we obtain two polygons – one in the left image and one in the right image.”); Section 3.5, p. 45, Left and Right polygon matching (“During the iterations the left polygon “slides” in the direction of the epipolar line in the right image space. The “slide” rate is not constant because it depends on the varying height of each point. The iteration (“sliding”) process stops when the polygons achieve maximum overlap in the right image space.”); Section 3.4.1, p. 45 (“In line (a) the left polygon is transferred (by the co-linear equation) to the right image space using the average estimated height (which was calculated in sec. 3.2).”). Figure 1, shown below, illustrates the above process of changing the line drawing in the second aerial image based on a change in the line drawing of the first aerial image.

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	 Figure 1. Result of the iterative matching process between the polygons in the right image space
[1.5] generating and outputting a roof estimate report using a report generation engine, wherein the roof estimate report includes numerical values for corresponding slope, area, or lengths of edges of at least some of a plurality of planar roof sections of the roof, wherein the generated roof estimate report is provided for repair and/or constructing the roof structure of the building.	The <u>Applicad</u> system calculates slope, area, and lengths edges of the plurality of planar roof sections. See, e.g., <u>Applicad</u>, p. 4 (“By using the command <i>Digitise Outline</i> we can then move the cursor to the extremities of the wall outline, by “snapping” to those points, and after entering the pitch or slope of the roof and the eave offset from the wall, the roof is generated automatically, resulting in an accurate and fast method of working out the areas and lengths.”); p. 10 (“Often, with multi-hipped roofs, it is quite a time consuming process to work out the necessary areas and lengths. With our software this can be achieved in seconds.”); p. 13 (“The important thing to remember here is the fact that the software is constantly updating the areas and lengths when inserting new features, so there is no need to manually have to add a length of new ridge everytime a new dormer is inserted for instance.”). <u>Applicad</u> discloses generating a roof estimate report with drawings. See, e.g., <u>Applicad</u>, p. 2 (“All of our products utilise a CAD (computer aided design) system . . . to draw up the roof or wall outline accurately in 3 dimensions, and then, from that 3D drawing, the software automatically calculates the amount of material to cover the roof or wall, along with all the necessary flashings. The result of this is

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	<i>the production of a detailed quotation breakdown, and the ability to generate your own user-defined forms These forms include quotations, labour pay summaries, order forms for your suppliers, invoices and drawings.”).</i> <i><u>Applicad</u> can process models generated by other software packages. See, e.g., <u>Applicad</u>, p. 4 (“Importing Roof or Building outlines from another CAD system . . . CAD drawings can be saved in various different file formats, and our software supports most of these, but the most common form is the .dxf format (drawing exchange format).”).</i> <i>The reports could include any type of drawings, including a top plan view annotated with numerical values. See, e.g., <u>Applicad</u>, p. 40 (the report includes a top plan view of the model with the numerical value of the roof pitch).</i> <i>See, e.g., <u>Applicad</u>, p. 28 (illustrating a top plan view of a roof annotated with lengths of 5000 and 10000 and a pitch of 20). See also, <u>Applicad</u>, p. 25 (illustrating a top plan view of a roof annotated with lengths of ridges and edges).</i> <i>These annotated drawings could include slope, area, and length. See, e.g., <u>Applicad</u>, p. 35 (“Eliminate the need to make any manual calculations with pen and paper. You can present all information required for the quote using our software.” (emphasis added)); p. 42 (“You can also customize the reports to suit your business, so you can . . . tailor the quote to extract certain information as required.” (emphasis added)). Further, as shown in the figures above, these drawings could include two more types of indicia for different types of roof properties (e.g., one color for roof edges, another color for ridges, numbers for lengths, parentheses for pitch, etc.).</i>

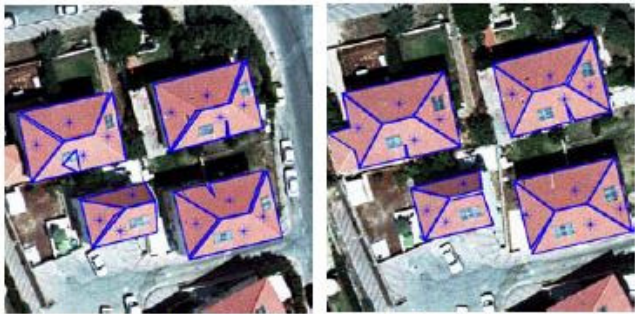
Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	<i>Applicad</i> discloses software that is primarily used for roof repair and construction, e.g., providing roof estimates and quotes. See, e.g., <u>Applicad</u>, pp. 2, 3, 33-40, and 42. In this regard, <i>Applicad</i> specifically notes that “the software automatically calculates the amount of material to cover the roof.... The result of this is the production of a detailed quotation breakdown, and the ability to generate your own user-defined forms to present to your customers....” See <u>Applicad</u>, p. 2.
9. The method of claim 1 further comprising: transmitting roof measurement information based at least in part on the change of the line drawing representing a feature of the roof that overlies the first aerial image of the roof.	<u>Avrahami</u> transmits roof measurement information based at least in part on the change of the line drawing representing a feature of the roof that overlies the first aerial image of the roof. See, e.g., <u>Avrahami</u>, Introduction, p. 43 (“Generating 3D city models . . . requires combination of the CAD and GIS systems where the spatial data must be stored in such a way that it can be queried and presented. . . . Joining the two systems can bring about the storage of 3D layers and the formulation of more complex queries for spatial analysis. . . . The algorithm consists of . . . [c]alculation of the estimated height. . . . [T]he proposed method . . . provides us with the detailed roof structure.”). <u>Avrahami</u> also discloses transmitting roof measurement information on a coordinate graph or plane. See, e.g., <u>Avrahami</u>, Section 5, p. 46 (“The system enables . . . automatic extraction of the 3D roof in a local coordinate system.”); FIGS. 4 and 6. Therefore, <u>Avrahami</u> discloses a system which transmits roof measurement information because the local coordinate system can easily be converted to actual measurements given the parameters of the camera in which the aerial images were taken.

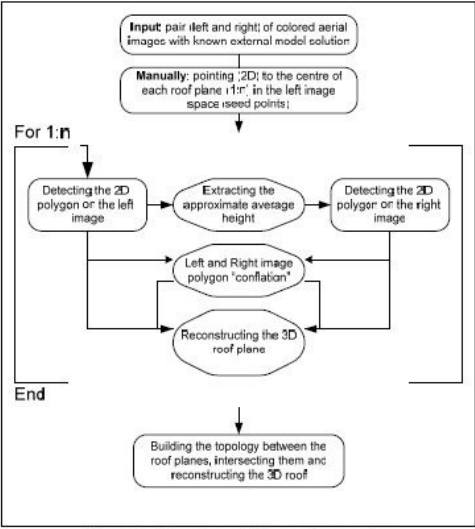
Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	Figure 4. Test Area no. 1 - Roof extraction Figure 6. Test Area. 2 - Roof extraction The various models generated by <u>Avrahami</u> are transmitted to a computer display for display to a user of the system, and the models include roof measurement information.
10. The method of claim 1 further comprising: displaying a marker operable to specify a point on an image; receiving, via the marker, an indication of a point on the first aerial image; and registering, based on the received indication of the point, the aerial image to a reference grid corresponding to a three-dimensional model of the roof.	<u>Avrahami</u> discloses a method wherein a marker is displayed to specify a point on an aerial image. <i>See e.g.</i>, <u>Avrahami</u>, Section 4, Roof Extraction, p. 46 (“The proposed algorithm consists of three main stages: 1) Manual pointing - seed points (in 2D) to the centre area (in a typical radiometric point) of each roof plane in the left image space.”). <u>Avrahami</u> also discloses a method wherein based on the received indication of the point, the method registers the aerial image to a reference grid corresponding to the three-dimensional model. <i>See e.g.</i>, <u>Avrahami</u>, Section 5, p. 47 (“Figures 4 and 6 present the extracted roofs in a local coordinate system in Test Areas 1 and 2, correspondingly.”). Furthermore, Figure 5 shows the aerial images having a received indication of a point on them. Figure 6 shows the reference grid and the correspondence between the aerial images and the three dimensional models.

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	Figure 5. Test Area 2 - Initial extraction in the images space Figure 6. Test Area. 2 - Roof extraction Since the model in FIG. 6 (and its associated reference grid (local coordinate system)) are built using the aerial images of FIG. 5, the aerial images of FIG. 5 are therefore tied (registered) to a reference grid.
16. A non-transitory computer-readable storage medium, having computer executable instructions stored thereon that, when executed by at least one computer processor, cause the at least one processor to enable a computing system to generate a roof estimate report for a building having a roof, by performing a method comprising:	<u>Avrahami</u>: See discussion with respect to element 1.P of Claim 1 of Table 3.
overlaying a line drawing	<u>Avrahami</u>: See discussion with respect to elements

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
on corresponding locations of a roof feature of the roof on first and second aerial images of the roof, wherein the first aerial image provides a first view of the roof of the building and the second aerial image provides a second view of the roof of the building;	1.1 and 1.2 of Claim 1 of Table 3.
in response to changes in the line drawing overlaid on the first aerial image, displaying corresponding changes to the line drawing overlaid on the second aerial image; and	<u>Avrahami</u> : See discussion of elements 1.3 and 1.4 of Claim 1 of Table 3.
generate and output a roof estimate report using a report generation engine, wherein the roof estimate report includes numerical values for corresponding slope, area, or lengths of edges of at least some of a plurality of planar roof sections of the roof, wherein the generated roof estimate report is provided for repair and/or constructing the roof structure of the building.	<u>Applicad</u> : See discussion of element 1.5 of Claim 1 of Table 3.
19. The non-transitory computer-readable storage medium of claim	<u>Avrahami</u> discloses a method wherein displaying the respective line drawing overlying the first aerial image occurs at a first time and displaying the

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
16 further comprising: displaying the roof feature in the first aerial image at a first time; and displaying the roof feature in the second aerial image at a second time that is within two seconds of the first time.	respective the line drawing overlying the second aerial image occurs at a second time that is within two seconds of the first time. <i>See, e.g., Avrahami</i> , Section 3.3, Right image operations (“After calculating average polygon height, it is possible to transfer the first seed point to the homologous point in the right image in two steps: transferring to local coordinates and from these to the right image space. It is performed by using the co-linear equation. From here on, the segmentation process around this point can be applied in the same way as in the left image. At the end of this process we obtain two polygons – one in the left image and one in the right image.”). The method in <u>Avrahami</u> displays the second line drawing after the first line drawing because the method is implemented on a computer, and therefore cannot occur simultaneously due to sequential clock cycles of the computer’s processor. Moreover, the features are displayed within two seconds of each other because the processor will perform the above operations quickly. It is a matter of design choice to add/reduce processing power to allow the line drawings to be displayed at the desired time intervals.
22. The non-transitory computer-readable storage medium of claim 16 wherein the method is performed iteratively, and the method further comprising: providing an operator with an interactive model generation experience.	<u>Avrahami</u> discloses a computing system wherein the roof estimation modules includes an interactive model generation experience. <i>See, e.g., Avrahami</i> , Section 1, Introduction, p. 42 (“The algorithm consists of several consecutive stages: 1) manual pointing to the center of a well-defined area in the left image space by an operator. . . . In the proposed method, the operator needs to point at every distinct planar part of the roof in the left image space (2D).”); <i>see also</i> Section 4, Roof Extraction, p. 46 (“The proposed algorithm consists of three main stages: 1) Manual pointing - seed points (in 2D) to the centre area (in a typical radiometric point) of each roof plane in the

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	left image space.”). FIG. 5 shows the interactive modeling user interface where the operator can specify planar parts of the roof using seed points:  Figure 5. Test Area 2 - Initial extraction in the images space
25. The non-transitory computer-readable storage medium of claim 16 wherein the method further comprises: modifying a three dimensional model of the roof based at least on the modification of the line drawing overlaid on the first aerial image.	<u>Avrahami</u> discloses a method for modifying a three-dimensional model of the roof based on the modification of the line drawing in the first aerial image. <i>See, e.g., Avrahami</i>, Section 1, Introduction, p. 43 (“In the proposed method, the operator needs to point at every distinct planar part of the roof in the left image space (2D). For each pointing, a specific roof plane is automatically extracted. The intersection of these planes provides us with the detailed roof structure.”); <i>see also</i> Section 4, Roof Extraction (“The proposed algorithm consists of three main stages: 1) Manual pointing - seed points (in 2D) to the centre area (in a typical radiometric point) of each roof plane in the left image space. 2) An automatic process for extraction of the roof planes for each seed point is performed. 3) Topology between the planes is built, the planes are intersected and the outcome is a 3D roof.”) (emphasis added). FIG. 2 is a flow chart of the process which shows that for each received indication 1 through n, the process continually reconstructs the 3D roof plane based on the changes to the line drawing:

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	 Figure 2. Flowchart of the roof extraction
26. A computer-implemented method in a roof estimate report system including a computer system and a memory coupled to the computer system, the method comprising:	<u>Avrahami</u>: See discussion with respect to element 1.P of Claim 1 of Table 3.
changing, by the computer system of the roof estimate report system, a line in a first line drawing representing a feature of a roof that overlies a first aerial image of the roof;	<u>Avrahami</u>: See discussion with respect to elements 1.1, 1.2 and 1.3 of Claim 1 of Table 3.
changing, by the computer system of the roof estimate report system, a line in a second line drawing that corresponds to the same feature in the first line	<u>Avrahami</u>: See discussion with respect to elements 1.1, 1.2, 1.3 and 1.4 of Claim 1 of Table 3.

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
drawing that was changed, the change in the second line drawing being made by the computer system in response to the change that was made in the first line drawing; and	
generating and outputting a roof estimate report using a report generation engine, wherein the roof estimate report includes numerical values for corresponding slope, area, or lengths of edges of at least some of a plurality of planar roof sections of the roof, wherein the generated roof estimate report is provided for repair and/or constructing the roof structure of the building.	<u>Applicad</u> : See discussion with respect to element 1.5 of Claim 1 of Table 3.
27. The method of claim 26 wherein the roof feature is at least one of: a ridgeline of the roof, a valley of the roof, a rake edge of the roof, an eave of the roof, a hip ridge of the roof, and an edge of a section of the roof.	<u>Avrahami</u> discloses a method wherein the feature is at least one of: a point on the roof, a section of the roof, a ridgeline of the roof, a valley of the roof, a rake edge of the roof, an eave of the roof, a hip ridge of the roof, an edge of a section of the roof, and a corner of a section of the roof. See, e.g., <u>Avrahami</u> , Section 1, Introduction (“In the proposed method, the operator needs to point at every distinct planar part of the roof in the left image space (2D). For each pointing, a specific roof plane is automatically extracted.”); Section 3.1 (“The purpose of this stage is to extract the area which was pointed out by the operator (the

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
	seed point) in the left image space (segmentation).”) (emphasis added). Furthermore, Figure 1, partially shown below, illustrates that the operator may select a section of the roof: The left polygon in the right image As can be seen from the image above, various roof features (including roof edges, ridges, etc.) are delineated by the polygon.
28. The method of claim 26 further comprising displaying the second line drawing after the first line drawing has been displayed.	<u>Avrahami</u> : See discussion with respect to Claim 19 of Table 3.
31. The method of claim 26 further comprising: displaying the second line drawing overlying the second aerial image at a later time, after the displaying of the first line drawing overlying the first aerial image of the roof on the display.	<u>Avrahami</u> : See discussion with respect to Claim 19 of Table 3.
34. The method of claim 26 further comprising: displaying roof measurement information concurrently with the first	<u>Avrahami</u>: See discussion with respect to element 1.1 of Claim 1 of Table 3. <u>Applicad</u>: See discussion with respect to element 1.5 of Claim 1 of Table 3.

Claims 1, 9-10, 16, 19, 22, 25-28, 31, and 34-36	<u>Avrahami</u> [Block Type] in view of <u>Applicad</u> [Italics Type]
line drawing being displayed.	
35. The method of claim 34 wherein the step of displaying roof measurement information comprises: displaying the roof measurement information in a location that overlays the first line drawing itself.	<u>Avrahami</u> : See discussion with respect to element 1.1 of Claim 1 of Table 3. <u>Applicad</u> : See discussion with respect to element 1.5 of Claim 1 of Table 3.
36. The method of claim 26 further comprising: displaying a wire frame model of the roof in isolation from any images of the roof.	<u>Applicad</u> : See discussion with respect to element 1.5 of Claim 1 of Table 3.

It would have been obvious to a person of ordinary skill in the art to include an annotated roof report, as taught by Applicad, with the system of Avrahami for easy and effective communication of roof measurement results to a user. Accordingly, there is a rationale for supplementing the teachings of Avrahami by those of Applicad under each of M.P.E.P. §§ 2143(I)(A), (C), (G).

Under M.P.E.P. § 2143(I)(A), a person of ordinary skill in the art would have found it obvious to incorporate the roof reporting functionality of Applicad with the line drawing matching features of Avrahami as doing so would be combining prior art elements according to known methods to yield predictable results. Together, Avrahami and Applicad disclose the claim elements discussed in

the claim chart above. *See, e.g.*, M.P.E.P. § 2143(I)(A)(1). A person of ordinary skill in the art could have combined the elements as claimed by electronically importing the line drawings of Avrahami into the roof reporting system of Applicad, as disclosed in Applicad. *See, e.g.*, Applicad, p. 4 (“Importing Roof or Building outlines from another CAD system . . . CAD drawings can be saved in various different file formats, and our software supports most of these, but the most common form is the .dxf format (drawing exchange format).”); *see also, e.g.*, M.P.E.P. § 2143(I)(A)(2). A person of ordinary skill in the art would have recognized that the results of the combination were predictable, as Applicad would function as originally intended and designed after the line drawings of Avrahami has been imported. *See, e.g.*, M.P.E.P. § 2143(I)(A)(3).

Under M.P.E.P. §§ 2143(I)(C), a person of ordinary skill in the art would have found it obvious to incorporate the roof reporting functionality of Applicad with the line drawing matching features of Avrahami as doing so would amount to using known techniques to improve similar devices in the same way. Petitioner submits that Avrahami is the base device that was known in the art. Applicad improves the system of Avrahami by providing roof reporting functionality. *See, e.g.*, Applicad, p. 3 (“Our software works off the basis of drawing the roof up on the screen, using a series of easy-to-use menus. . . . Because our software sits on top of a very powerful 3 dimensional CAD package, we can utilize various tools to

enable the drawing of the roof and checking the result, before submitting to a bid.”). One of ordinary skill in the art could have applied the functionality of Applicad in the base device of Avrahami with predictable results. *See, e.g.*, M.P.E.P. § 2143(I)(C)(3).

Under M.P.E.P. §§ 2143(I)(G), a person of ordinary skill in the art would have found it obvious to incorporate the roof reporting functionality of Applicad with the line drawing matching features of Avrahami, as Applicad provides a teaching, suggestion, or motivation to do so. In support of this rejection, Petitioner submits that Applicad suggests importing roof models from other systems. *See, e.g.*, Applicad , p. 4 (“Importing Roof or Building outlines from another CAD system . . . CAD drawings can be saved in various different file formats, and our software supports most of these, but the most common form is the .dxf format (drawing exchange format).”); *see also* M.P.E.P. § 2143(I)(G)(1). Further, there was a reasonable expectation of success that Applicad would be able to provide the roof measurement functionality using a line drawing generated by the teachings of Avrahami. *See, e.g.*, M.P.E.P. § 2143(I)(G)(2).

Petitioner further notes that the format of a roof report is a mere matter of design choice, and should be afforded no patentable weight. *See e.g.*, M.P.E.P. § 2144.04(I) citing *In re Seid*, 161 F.2d 229, 73 USPQ 431 (CCPA 1947) (“The court found that matters relating to ornamentation only which have no mechanical

function cannot be relied upon to patentably distinguish the claimed invention from the prior art.”).

D. Table 4 – Claim 10 of the ’737 Patent is Unpatentable as Obvious Under 35 U.S.C. § 103 over Avrahami in view of Applicad and in further view of Perlant

A person of ordinary skill in the art would have found it obvious to combine the scene registration process in Perlant with the line drawing matching features of Avrahami. *See* Schuch Decl., ¶ 70. One of ordinary skill in the art would combine Perlant with Avrahami for the same reasons as one would combine Hsieh with Perlant as discussed in **Section XII, B**, *supra*, e.g., Avrahami is the base device, and Perlant improves this device with registration functionality and the result would be predictable:

Claim 10	<u>Hsieh</u> [Block Type] in view of <u>Applicad</u> [Italics Type] in further view of <u>Perlant</u> [Underline Type]
10. The method of claim 1 further comprising: displaying a marker operable to specify a point on an image; receiving, via the marker, an indication of a point on the first aerial image; and registering, based on the received indication of the point, the aerial image to a reference grid corresponding to the three-dimensional model.	<u>Avrahami</u> discloses all the limitations found in elements 1.P-1.4 of Claim 1 of Table 3. <u>Avrahami</u>: <i>See</i> discussion with respect to Claim 1 of Table 3. <u>Applicad</u> discloses elements 1.5 of Claim 1 of Table 3. <u>Applicad</u>: <i>See</i> discussion with respect to elements 1.5 of Claim 1 of Table 3. <u>Perlant</u> discloses a method for Scene Registration in Aerial Image Analysis. <u>Perlant</u>: <i>See</i> discussion with respect to Claim 10 of Table 2.

XIII. CONCLUSION AND FEE AUTHORIZATION

For the reasons discussed hereinabove, Xactware has demonstrated a likelihood of prevailing with respect to at least one claim of the '737 Patent. Accordingly, Xactware respectfully petitions that the Board institute an *inter partes* review of all claims of the '737 Patent.

The Commissioner is authorized to charge the fee as set forth in 35 U.S.C. § 312(a) and 37 CFR §§ 42.100(a), 42.103(a), and 42.15(a), e.g., \$23,400.00, to Deposit Account No. 503571. If any additional and/or other fees are due in connection with the submission of this Request, or if any credit is due, the Commissioner is hereby authorized to charge and/or credit them to Deposit Account No. 503571.

2/8/2016
Dated

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XIV. CERTIFICATE OF SERVICE

I hereby certify that true and complete copies of this Request for *Inter Partes* Review of United States Patent No. 9,135,737, including this Certificate of Service, and including all Exhibits as identified below, have been served on SEED INTELLECTUAL PROPERTY LAW GROUP PLLC by mailing same on February 8, 2016, via First Class Mail (Express Mail), postage prepaid to SEED INTELLECTUAL PROPERTY LAW GROUP PLLC, 701 FIFTH AVE., SUITE 5400, SEATTLE, WA 98104.

- Enclosure – Cover Letter; and
- Request for *Inter Partes* Review of United States Patent No. 9,135,737, including Exhibits 1001-1007 attached thereto, namely, the following:

XACTWARE EXHIBIT 1001: U.S. Patent No. 9,135,737 to Pershing issued on September 15, 2015

XACTWARE EXHIBIT 1002: Power of Attorney

XACTWARE EXHIBIT 1003: Publication by Hsieh, entitled “Design and Evaluation of a Semi-Automated Site Modeling System,” Carnegie Mellon, November 1995 (“Hsieh”).

XACTWARE EXHIBIT 1004: Publication by Avrahami et al., entitled “Extraction of 3D Spatial Polygons Based on the Overlapping Criterion for Roof Extraction from Aerial Images,” International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences, August 29-30, 2005 (“Avrahami”).

XACTWARE EXHIBIT 1005: Publication by Applicad, entitled "Product Bulletin – November 2002: Key features of our Roofing Software," November 2002 ("Applicad").

XACTWARE EXHIBIT 1006: Publication by Perlant et al., entitled "Scene Registration in Aerial Image Analysis," Digital Mapping Laboratory, School of Computer Science, Carnegie Mellon University, Pittsburgh PA, 1990 ("Perlant").

XACTWARE EXHIBIT 1007: Declaration of Harold Schuch ("Schuch Decl.")

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