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Paper 67
Entered: July 26, 2017

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICROSOFT CORPORATION,
Petitioner,

v.

BRADIUM TECHNOLOGIES LLC,
Patent Owner.

Case IPR2016-00449
Patent 8,924,506 B2

Before BRYAN F. MOORE, BRIAN J. McNAMARA, and MINN CHUNG, *Administrative Patent Judges.*

CHUNG, *Administrative Patent Judge.*

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

In this *inter partes* review, instituted pursuant to 35 U.S.C. § 314, Microsoft Corporation ("Petitioner") challenges the patentability of claims 1–21 (the "challenged claims") of U.S. Patent No. 8,924,506 B2 (Ex. 1002, "the '506 patent"), owned by Bradium Technologies LLC ("Patent Owner"). The Board has jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. With respect to the grounds instituted in this trial, we have considered the papers submitted by the parties and the evidence cited therein. For the reasons discussed below, we determine Petitioner has shown by a preponderance of the evidence that claims 1–21 of the '506 patent are unpatentable.

A. Procedural History

On January 11, 2016, Petitioner filed a Petition (Paper 1, "Pet.") requesting *inter partes* review of claims 1–21 of the '506 patent. Patent Owner filed a Preliminary Response (Paper 8, "Prelim. Resp."). On July 27, 2016, we instituted an *inter partes* review of claims 1–21 of the '506 patent based on the following specific ground (Paper 9, "Dec. on Inst.," 44).

Claims Challenged	Statutory Basis	References
1–21	§ 103(a)	Reddy[1] and Hornbacker[2]

[1] Ex. 1004, M. Reddy, Y. Leclerc, L. Iverson, N. Bletter, *TerraVision II: Visualizing Massive Terrain Databases in VRML*, IEEE Computer Graphics and Applications, Vol. 19, No. 2, 30–38, IEEE Computer Society, March/April 1999 ("Reddy").

[2] Ex. 1003, WO 99/41675 (Aug. 19, 1999) ("Hornbacker").

After institution of trial, Patent Owner filed a Patent Owner Response (Paper 17, "PO Resp.")[3] and a confidential version (Paper 16), to which Petitioner filed a Reply (Paper 31, "Pet. Reply"). Subsequently, Petitioner moved to exclude (Paper 42) certain exhibits submitted by Patent Owner; Patent Owner opposed (Papers 49 (confidential) and 50 (public)); and Petitioner replied (Paper 52). Patent Owner also moved to exclude (Paper 44) certain evidence introduced by Petitioner; Petitioner opposed (Paper 46); and Patent Owner replied (Papers 55 (confidential) and 56 (public)). Petitioner and Patent Owner filed Motions to Seal their confidential information. Papers 15, 18, 48, 54. In addition, Patent Owner filed a Motion for Observations on certain cross-examination testimony of Dr. William R. Michalson (Paper 41, "Obs."), to which Petitioner filed Responses (Paper 45, "Obs. Resp.").

A combined oral hearing in this proceeding and IPR2016-00448 was held on April 18, 2017. Transcripts of the hearing have been entered into the record as Papers 61 ("Hrg. Tr." (public)) and 62 ("Confidential Hrg. Tr." (confidential)).

B. Related Proceedings

According to Petitioner, the '506 patent and two other patents in the same family, U.S. Patent Nos. 7,139,794 B2 ("the '794 patent") and 7,908,343 B2 ("the '343 patent"), are being asserted by Patent Owner in the following litigation: *Bradium Techs. LLC v. Microsoft Corp.*, 1:15-cv-

[3] Unless otherwise indicated, we refer to public (including redacted) Papers and Exhibits.

00031-RGA, filed on January 9, 2015 in the District of Delaware. *See* Pet. 1. The '506 patent was also the subject of IPR2015-01435, in which *inter partes* review was not instituted. In related proceedings before the Board, we instituted *inter partes* reviews of various claims of the '343 patent in Case IPR2016-00448 and certain claims of the '794 patent in Case IPR2015-01432. In addition, we instituted an *inter partes* review of various claims of U.S. Patent No. 9,253,239 B2 in Case IPR2016-01897.

II. THE '506 PATENT

A. Described Invention

The '506 patent describes an image distribution system for retrieving high-resolution or large-scale images from a network image server over a limited-bandwidth communications channel for display on client devices, where a user may navigate over the images displayed on the client device by controlling a viewing frustum placed over the displayed images. *See* Ex. 1002, Abstract; col. 1, ll. 29–34; col. 5, ll. 31–59. The retrieval of large-scale or high-resolution images is achieved by selecting, requesting, and receiving update image parcels relative to an operator or user controlled image viewpoint. *See id.* at Abstract; col. 3, ll. 50–59. In an embodiment, when the viewing frustum is changed by user navigation commands, the client device determines the priority of the image parcels to be requested from the server "to support the progressive rendering of the displayed image," and the image parcel requests are placed in a request queue to be issued in priority order. *See id.* at col. 7, ll. 50–65.

On the server side, high-resolution source image data is pre-processed by the image server to create a series of derivative images of progressively lower resolution. *See id.* at col. 6, ll. 7–12. Figure 2 of the '506 patent is reproduced below.

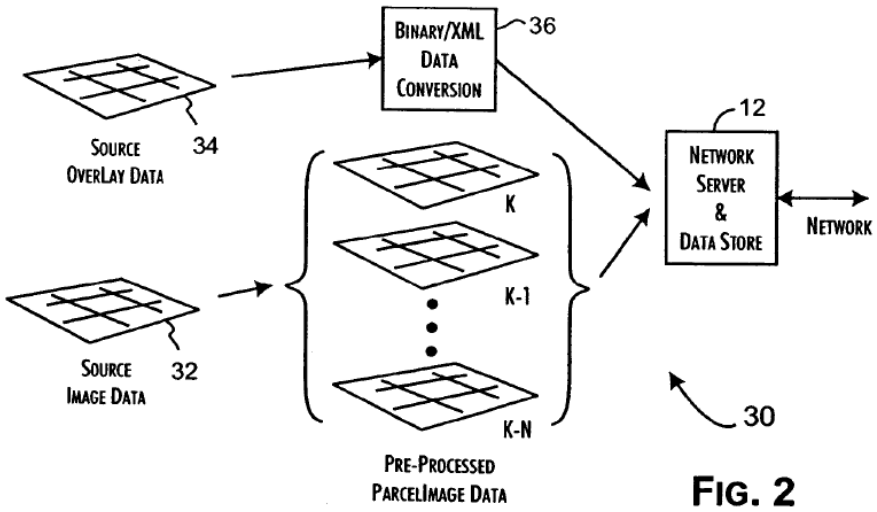

FIG. 2

Figure 2 depicts preparation of pre-processed image parcels at the network image server. *See id.* at col. 4, ll. 60–63; col. 5, ll. 60–63; col. 6, ll. 7–10. As illustrated in Figure 2, source image data 32 is pre-processed to obtain a series $K_{1\text{-}N}$ of derivative images of progressively lower image resolution. *Id.* at col. 6, ll. 10–12. Initially, the source image data—i.e., the series image K_0—is subdivided into a regular array of image parcels of a fixed byte size, e.g., 8K bytes. *Id.* at col. 6, ll. 12–17. In an embodiment, the resolution of a particular image in the series is related to the predecessor image by a factor of four while, at the same time, the array subdivision is also related by a factor of four, such that each image parcel of the series images has the same fixed byte size, e.g., 8K bytes. *Id.* at col. 6, ll. 17–22.

In another embodiment, the image parcels are compressed by a fixed ratio—for example, the 8K byte parcels are compressed by a 4-to-1 compression ratio such that each image parcel has a fixed 2K byte size. *Id.* at col. 6, ll. 23–28. This allows each image parcel to fit into a single network data packet, which improves data delivery and avoids the transmission latency and processing overhead of managing image parcel data broken up over multiple network data packets. *See id.* at col. 8, ll. 15–22.

B. Illustrative Claim

Of the challenged claims, claims 1, 8, and 15 are independent. Claim 1 is illustrative of the challenged claims and is reproduced below:

> 1. A method of retrieving large-scale images over network communications channels for display on a limited communication bandwidth computer device, said method comprising:
>
> issuing, from a limited communication bandwidth computer device to a remote computer, a request for an update data parcel wherein the update data parcel is selected based on an operator controlled image viewpoint on the computer device relative to a predetermined image and the update data parcel contains data that is used to generate a display on the limited communication bandwidth computer device;
>
> processing, on the remote computer, source image data to obtain a series $K_{1\text{-}N}$ of derivative images of progressively lower image resolution and wherein series image K_0 being subdivided into a regular array wherein each resulting image parcel of the array has a predetermined pixel resolution wherein image data has a color or bit per pixel depth representing a data parcel size of a predetermined number of bytes, resolution of the series $K_{1\text{-}N}$ of derivative images being related to that of the source

> image data or predecessor image in the series by a factor of two, and said array subdivision being related by a factor of two such that each image parcel being of a fixed byte size;
>
> receiving said update data parcel from the data parcel stored in the remote computer over a communications channel; and
>
> displaying on the limited communication bandwidth computer device using the update data parcel that is a part of said predetermined image, an image wherein said update data parcel uniquely forms a discrete portion of said predetermined image.

III. CLAIM CONSTRUCTION

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *see Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (upholding the use of the broadest reasonable interpretation standard as the claim construction standard to be applied in an *inter partes* review proceeding). Under the broadest reasonable interpretation standard, and absent any special definitions, claim terms generally are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art, in view of the specification. *In re Translogic Tech. Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Only those terms which are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

In our Decision on Institution, we applied the ordinary and customary meaning to the terms not expressly construed. Dec. on Inst. 11. We determined that the term "mesh" in claims 8 and 15 required no further construction. *Id.* Consistent with our Decision in *Microsoft Corp. v. Bradium Tech. LLC*, Case IPR2015-01434, slip op. at 9 (PTAB Dec. 23, 2015) (Paper 15, Decision Denying Institution), which involved the '343 patent, we construed the term "data parcel" to mean *data that corresponds to an element of a source image array*, as the broadest reasonable interpretation of that term. Dec. on Inst. 10–11. Neither party proposed constructions for any other claim terms. *Id*. at 11.

In the Patent Owner Response, Patent Owner proposes that for the term "image parcel" we adopt our construction of that term from related case, *Microsoft Corp. v. Bradium Tech. LLC*, Case IPR2015-01432, slip op. at 10 (PTAB Dec. 23, 2015) (Paper 15, Decision on Institution) as "an element of an image array, with the image parcel being specified by the X and Y position in the image array coordinates and an image set resolution index." PO Resp. 9–10. Petitioner does not oppose this construction and Patent Owner's proposed construction is consistent with the usage of the term in the '506 patent. Therefore, we apply Patent Owner's proposed construction in this proceeding.

"Limited Bandwidth Communications Channel"

Patent Owner further proposes that we construe the term "limited bandwidth communications channel" to mean "a wireless or narrowband communications channel." *Id*. at 10. Patent Owner states that a person of

ordinary skill would have understood that a limited bandwidth communications channel refers to the communications channel itself, not the device receiving the data parcels. *Id*. Acknowledging that the term is not defined in the Specification of the '506 patent, Patent Owner argues that the Specification indicates that the inventors considered narrowband and wireless communication channels as the limited bandwidth channels. *Id*. at 10–11 (citing Ex. 1002, col. 1, ll. 29–34). Patent Owner contends that wireless networks are a form of limited bandwidth communications channel as disclosed in the '506 patent, which contemplates performance on wireless devices in describing its preferred embodiment of four concurrent threads. *Id.* at 11–12 (citing Ex. 1002, col. 3, ll. 13–15, col. 8, ll. 50–53).

Petitioner notes that both parties' experts agree that another way to say "limited bandwidth" is to use the term "narrowband." Pet. Reply 1. Petitioner further notes that the '506 patent Specification does not state that limited bandwidth communication channels must be wireless, just that wireless conditions may result in limited bandwidth. *Id.* (citing Ex. 1002, col. 3, ll. 12–14; Ex. 1016, Declaration of Dr. William R. Michalson In Support Of Petitioner's Reply ("Michalson Reply Decl.") ¶¶ 19–20). Petitioner further notes the deposition testimony of inventor Isaac Levanon that limited bandwidth channels can be limited by the amount of users. *Id*. at 2 (citing Ex. 1019, Transcript of Deposition of Isaac Levanon ("Levanon Dep. Tr.") at 40:18–41:10).

The term "limited bandwidth communications channel" is not limited to a wireless channel, nor does it imply the cause of the limited bandwidth. Thus, the term "limited bandwidth communications channel" requires no

special construction. We apply its ordinary meaning, i.e., a communications channel whose bandwidth is limited.

"Limited Communication Bandwidth Computer Device"

Patent Owner proposes that we construe the term "limited communication bandwidth computer device" to mean "a small client for example, smaller, typically dedicated function devices often linked through wireless network connections, such as PDAs, smartphones, and automobile navigation systems." PO Resp. 13 (citing Ex. 1002, col. 5, ll. 36–40; Ex. 2003, Declaration of Dr. Peggy Agouris ("Agouris Decl.") ¶¶ 37–43). Patent Owner asserts that the '506 patent supports this proposed construction because it describes a number of preferred embodiments whose goal is to provide a client system viable on small clients, i.e., a device constrained to very limited network bandwidths either through direct technological constraints (a limited bandwidth communications channel, as Patent Owner proposes construing that term) or through indirect constraints imposed on relatively high-bandwidth channels by high concurrent user loads. *Id.* at 13–14.

Petitioner contends that the Specification's identification of a need for a system that supports small clients and efficiently utilizes low to very low bandwidth connections does not support Patent Owner's attempt to limit the term "limited communication bandwidth computer device" based on processing power or device size. Pet. Reply 2. According to Petitioner, the '506 patent describes problems with computational requirements of prior art transmission methods separately from those of limited network bandwidths,

and a person of ordinary skill would not conflate processing power or device size with bandwidth. *Id.*

The Specification characterizes mobile computing devices, such as smart phones and person digital assistants (PDAs) as small clients and states that such small clients typically have restricted performance processors with limited memory that cannot support extensive graphics abstraction layers and are insufficient for conventional client based visualization systems. Ex. 1002, col. 2, ll. 49–57; col. 2, l. 64–col. 3, l. 11. The Specification does not connect directly these restricted performance parameters with a computer device having a limited communication bandwidth. The Specification also states that "small clients are generally constrained to generally to very limited network bandwidths particularly when operating under wireless conditions," noting that such conditions "may exist due to either the direct technological constraints dictated by the use of a low bandwidth data channel or indirect constraints imposed on relatively high-bandwidth channels by high concurrent user loads." *Id.* at col. 3, ll. 12–25. This portion of the Specification concerns communication channel and network issues, rather than the computing device. Thus, we agree with Petitioner that Patent Owner's proposed construction conflates communication channel and computer device issues, and consequently decline to adopt Patent Owner's proposed construction. Instead, we apply the plain and ordinary meaning and construe this term to refer to a communications device that has a limited communication bandwidth.

IV. ANALYSIS OF PETITIONER'S PRIOR ART CHALLENGES

A. Relevant Principles of Law

To prevail in challenging Patent Owner's claims, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). "In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring inter partes review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (citing *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1326–27 (Fed. Cir. 2008)) (discussing the burden of proof in *inter partes* review).

The sole ground on which we instituted *inter partes* review is Petitioner's challenge to clams 1–21 as obvious under 35 U.S.C. § 103(a) over the combination of Reddy and Hornbacker. A claim is unpatentable under § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in

evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Petitioner cannot satisfy its burden of proving obviousness by employing "mere conclusory statements." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

B. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious at the time it was made, 35 U.S.C. § 103 requires us to determine the level of ordinary skill in the pertinent art at the time of the invention. *Graham*, 383 U.S. at 17. "The importance of resolving the level of ordinary skill in the art lies in the necessity of maintaining objectivity in the obviousness inquiry." *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991).

The person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). In determining the level of one with ordinary skill in the art, various factors may be considered, including the types of problems encountered in the art, prior art solutions to those problems, the sophistication of the technology, rapidity with which innovations are made, and educational level of active workers in the field. *Id*. In a given case, one or more factors may predominate. *Id.* In addition, we are guided by the level of ordinary skill in the art reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d. 1350, 1355 (Fed. Cir. 2001). Generally, it is easier to establish obviousness under a higher level of ordinary skill in the art. *Innovention Toys, LLC v. MGA Entm't, Inc.*,

637 F.3d 1314, 1323 (Fed. Cir. 2011) ("A less sophisticated level of skill generally favors a determination of nonobviousness . . . while a higher level of skill favors the reverse.").

Relying upon the Declaration of Dr. William R. Michalson (Ex. 1005, "Michalson Decl."), Petitioner asserts that, at the time of the priority date of the '506 patent, a person of ordinary skill in the art for the technology disclosed in the '506 patent would have had a Master of Science or equivalent degree in electrical engineering or computer science, or alternatively a Bachelor of Science or equivalent degree in electrical engineering or computer science, with at least 5 years of experience in a technical field related to geographic information system or the transmission of digital image data over a computer network. Pet. 11 (citing Ex. 1005 ¶¶ 27–31).

Patent Owner cites the Declaration of Dr. Peggy Agouris (Ex. 2003) and asserts that a person of ordinary skill in the art would have had at least a Bachelor of Science or equivalent degree in electrical engineering or computer science. PO Resp. 9 (citing Ex. 2003 ¶¶ 16–18). In addition, Patent Owner argues that the education levels of the listed inventors for the '506 patent indicate that no master's degree is required. *Id.*

Patent Owner's argument against a master's degree is unpersuasive because "[t]he actual inventor's skill is irrelevant" to the level of skill of a hypothetical person of ordinary skill in the art. *Standard Oil Co. v. Am. Cyanamid Co.*, 774 F.2d 448, 454 (Fed. Cir. 1985). Nonetheless, the parties' definitions are not necessarily inconsistent because Dr. Agouris opines that a person of ordinary skill in the art at the time of the invention

would have had at least two years of experience in image and graphics processing including developing, designing, or programming client-server software for computer networked environments beyond a bachelor's degree. Ex. 2003 ¶ 17. First, we do not perceive any meaningful difference between the parties' definitions of the technical field of the required experience. Second, the parties do not argue, nor do we find, that the difference between two and five years of experience by a person of ordinary skill in the art would impact the obviousness inquiry in any way in this proceeding. Based on the foregoing, we determine that a person of ordinary skill in the art at the time of the invention of the '506 patent would have had a Bachelor of Science or equivalent degree in electrical engineering or computer science as well as two to five years of experience in a technical field related to geographic information system or the transmission of digital image data over a computer network.

C. Asserted Ground of Obviousness of Claims 1–21 over the Combination of Reddy and Hornbacker

1. Introduction

Petitioner cites Reddy as teaching a system for retrieving massive terrain data sets using a client, such as a personal computer (PC) that can be implemented with a plug-in for a standard browser, i.e., the VRML (Virtual Reality Markup Language) browser plug-in. Pet. 18–19, 26–27. According to Petitioner, Reddy allows the user to browse on-line geographic information in standard VRML, thereby providing compatibility with different sources, and enables access for a standard personal computer, such

as a laptop over the worldwide web (WWW), instead of a specialized high-speed network. *Id.* at 15–16 (citing Ex. 1004 ¶¶ 9, 31, 39, 48).

Petitioner cites Hornbacker as using graphical web browsers on client systems to view large images divided into tiles. Pet. 27–28 (citing Ex. 1003, Abstract, 6:20–7:1, 13:28–14:11, 14:26–28). According to Petitioner, like Reddy, Hornbacker addresses similar technical issues as those addressed in the '506 patent, i.e., network and system performance problems in accessing large image files from a network file server. *Id.* at 19–20. The '506 patent states, "As well recognized problem with such conventional systems could be that full resolution image presentation may be subject to inherent transfer latency of the network." Ex. 1002, col. 1, ll. 52–55. Petitioner cites Hornbacker as teaching methods of dividing large data sets into tiles, compressing those tiles, and requesting the appropriate tiles over a network. Pet. 15.

Patent Owner contends that Reddy fails to disclose several of the elements recited in the claims, including the "limited bandwidth computer device" and the "limited bandwidth communications channel" recited in independent claims 1, 8, or 15, and that a person of ordinary skill would not select Reddy when considering a bandwidth limited situation because Reddy discloses a high bandwidth communications channel and a device requiring extensive software to be loaded onto the user computer. PO Resp. 18–20. Patent Owner contends that Hornbacker also does not disclose several claim elements including selecting the defined data parcel to provide for a progressive resolution enhancement of the defined image, as recited in independent claims 8 and 15. *Id.* at 18–19.

Patent Owner contends that a person of ordinary skill would not have been motivated to cure Reddy's deficiencies by combining its teachings with those of Hornbacker because (i) Hornbacker is directed document processing for GIS applications having very different technical constraints than those of Reddy, and (ii) Reddy uses specialized client-based image software to pre-compute tiles and share them among clients with the goal of real-time "fly over" system performance, so that low resolution tiles can reside in the memory of a client and be accessed as necessary, whereas Hornbacker avoids such client based software by using HTTP requests to a server that creates tiles on demand in a server based, computationally intensive process unsuitable for real-time processing. *Id.* at 20–21.

Patent Owner further contends that objective considerations demonstrate that the claimed subject matter is not obvious under 35 U.S.C. § 103(a). *Id.* at 52–61.

Our Decision on Institution analyzed Petitioner's challenges and the Patent Owner Preliminary Response in the context of claim elements designated by Petitioner (e.g., 1.A, 1.B, 15.A, 15.B). For consistency, we use the same claim element designations in this Decision. Independent claim 1 and claims 2–7 that depend from claim 1 are drawn to a method. Independent claim 8 and claims 9–14 that depend from claim 8, as well as independent claim 15 and claims 16–21 that depend from claim 15, are drawn to an apparatus.

2. Scope and Content of the Prior Art

a. Overview of Reddy

Reddy "aim[s] to enable visualization of near photographic 3D models of terrain that can be on the order of hundreds of gigabytes," allowing users to select dynamically particular sets of geo-referenced data. Ex. 1004 ¶¶ 2, 10. Reddy implements its functionality in a standard VRML browser for downloading over the World Wide Web, using Java scripting to extend VRML's base functionality and the External Authoring Interface to provide application-specific management of a virtual geographic environment. *Id.* ¶¶ 9, 10. Reddy also discloses a custom terrain visualization package (TerraVision II) that can browse standard VRML data structures. *Id.* ¶ 9. Although TerraVision II is not required to view the content, its specialized browser level optimizations "offer increased efficiency and seamless interaction with the terrain data." *Id.* ¶¶ 9, 48.

Recognizing that the time to download and render a terrain model would prohibit real time interaction, Reddy employs level of detail (LOD) techniques to change a model's complexity based on selection criteria, such as distance from the viewpoint or projected screen size. *Id.* ¶¶ 12–13. Reddy uses a tiled pyramid representation to provide a view dependent technique that can vary the degree of simplification relative to the current viewpoint using a hierarchical data structure (such as a quad tree), without requiring access to the entire high resolution version of the data set (as that would limit viewing to data sets that can fit within a user's local storage). *Id.* ¶ 14. Reddy's pyramid model provides a multiresolution hierarchy for a data set in which an original image, e.g., a 1024 x 1024 image, can be down

sampled at lower resolutions, e.g., 512 x 512 pixels, 256 x 256 pixels, and 128 x 128 pixels. *Id.* ¶ 15. Each image is then segmented into rectangular tiles, each tile having the same pixel dimensions. *Id.* Using this approach, a tile at a given pyramid level maps onto four tiles on the next higher level, such that at each higher resolution area, the tiles cover half the geographic area of the previous level. *Id.* Reddy states that its tiled image representation "optimize[s] the amount of data transferred over a network" because "we need only fetch and display for the region that the user is viewing, and only at sufficient resolution for the user's viewpoint." *Id.* ¶ 17.

Reddy employs terrain tile files (that describe actual elevation and image texture data), feature files (that describe objects such as building and roads in a geographic areas), tree files (that implement part of the multiresolution hierarchy), and geotile files (that contain links to all data within a single tile). *Id.* ¶¶ 18, 19, 22. To implement the multi-resolution hierarchy, a tree file initially loads a single geotile. *Id.* ¶ 19. When a ProximitySensor recognizes a user's approach, the geotile is replaced with four higher resolution tree files that in turn inline geotiles for the four quad tree children, using Reddy's QuadLOD feature (instead of VRML's Inline node). *Id.* ¶¶ 19, 21. Except for extending the tree for higher resolution, the hierarchy of tree files need to be generated only one time. *Id.*

A user browses terrain data using a standard VRML plug-in for Internet browsers, such as Internet Explorer. *Id.* ¶ 31. Reddy discloses using a Java applet running in the Internet browser and communicating with the VRML plug-in to traverse a scene graph of a loaded terrain and modify the switch node settings in each geotile file to select different data sets, as

well as modified inline nodes that expose the inlined VRML file. *Id.* ¶¶ 31–32. This approach makes it possible to inspect and modify any part of the VRML scene. *Id.* Noting that the three standard navigation default types in VRML are walk, examine, and fly, Reddy discloses three additional specialized functions to navigate a large geographic database: (i) terrain following (to deal with earth curvature), (ii) altitude based velocity (to achieve a constant pixel flow across a screen), and (iii) active maps (a Java applet that manages a map display using a ProximitySensor placed around the entire scene to project a 3D geocentric coordinate onto the map, allowing users to ascertain their location). *Id.* ¶¶ 35–37.

TerraVision II is a custom VRML browser specifically designed to optimize navigation of Reddy's VRML databases. *Id.* ¶ 39. TerraVision II has the following advantages over a standard VRML browser: (i) visibility culling using a fast quad-tree search of the multiresolution hierarchy (*id.* ¶ 41), (ii) level of detail improvement using projected screen size to decide when to reduce terrain detail considering such factors as display size and the angle at which the user views the terrain (*id.* ¶ 42), (iii) techniques to address discontinuities resulting from adjacent tiles of different resolutions (*id.* ¶ 43), (iv) maintenance of a low resolution terrain representation and a progressive coarse-to-fine algorithm to load and display new data, using lower resolution tiles if higher resolution data has yet to arrive, providing continuous interaction with the scene (*id.* ¶ 44), (v) tile caching to reduce the need to read and parse data for recently visited regions (*id* ¶ 45), and (vi) extrapolation to predict a user's future moves based on current flightpath and prefetch relevant tiles for immediate rendering (*id.* ¶ 46). As noted above,

however, TerraVision II is not required to view Reddy's VRML data sets. *Id.* ¶ 47.

b. Overview of Hornbacker

Hornbacker discloses a computer network server that provides image view data to client workstations using graphical web browsers to display the view of the image from a server. Ex. 1003, Abstract. According to Hornbacker, network and system performance problems that previously existed when accessing large image files from a network are eliminated by tiling the image view so that the computation or transmission of the image can be done in incremental fashion. *Id.* Viewed tiles are cached on the client to further reduce network traffic. *Id.* Hornbacker discloses that by tiling and caching, relatively small amounts of data need to be transmitted when the user selects a new view of an image already received and viewed. *Id.* at 13:17–21. The image view server disclosed in Hornbacker further provides that the data transfer size remains constant even if the size of the view image is increased. *Id.* at 14:11–12.

3. Discussion — Differences Between the Claimed Subject Matter and the Prior Art

a. Independent Claim 1

(1) Element 1.A

Petitioner identifies as claim element 1.A the limitation that recites, "issuing, from a limited communication bandwidth computer device to a remote computer, a request for an update data parcel." Pet. 29. Petitioner cites Reddy as teaching geographic data divided into tiles, each of which is

an element of the source image array. *Id.* (citing Ex. 1004 ¶¶ 14–18, 22, 24, 41–46, Figs. 1, 3). Petitioner cites Hornbacker as likewise teaching an image divided into tiles. *Id.* (citing Ex. 1003, Abstract, 3:10–27, 6:13–19, 7:26–8:6, 8:30–9:28, 10:24–28, 12:24–13:10). Noting that Reddy discloses that tiles may be retrieved by URL, as "geotiles" that contain links to terrain tiles such as satellite, aerial, and map imagery, Petitioner contends that a person of ordinary skill would understand Reddy discloses a geographic browser sending requests to a server (remote computer) to retrieve geotiles containing URL links to imagery files. *Id*. at 29–30 (citing Ex. 1004 ¶¶ 19, 20, 21, 22, 26, 52, Fig. 3; Ex. 1005 ¶¶ 140, 141). Petitioner further asserts that Reddy teaches requesting an "update data parcel," as claimed, because Reddy discloses that the tiles are retrieved based on the user's selected view and that the user computer need only fetch and display data for the region that the user is viewing, i.e., the specified data for the appropriate resolution and location based on the user's viewpoint, in the form of image tiles corresponding to an element of the image array. *Id.* at 30 (citing Ex. 1004 ¶¶ 3, 10, 14–17, 31, 34–38, 42, 44–46, Figs. 1, 5).

Petitioner cites Hornbacker as teaching that the tiles on the server may be located via URL requests that identify a tile by characteristics, such as resolution, or location. *Id.* at 31 (citing Ex. 1003, Abstract, 3:10–27, 5:16–25, 6:13–19, 7:26–8:6, 8:30–9:28, 10:24–28, 12:24–13:10). Citing the Declaration of Dr. Michalson, Petitioner argues that a person of ordinary skill facing the problem identified by Reddy would look to the solution taught by Hornbacker to identify tiles by URL based on coordinates and other viewing characteristics. *Id*. (citing Ex. 1005 ¶¶ 136–143).

Petitioner asserts that Reddy teaches that a client for retrieving massive terrain data sets can be implemented on a laptop machine, a purportedly limited communication bandwidth computer device, which makes the system particularly useful in "military mission planning . . . emergency relief efforts, and other distributed time-critical conditions." *Id.* at 27 (citing Ex. 1004 ¶ 48). Petitioner further asserts that Reddy teaches that the tiling employed by Reddy's system enables a user to visualize a scene utilizing a much smaller amount of downloaded data than the full-resolution underlying image. *Id.* (citing Ex. 1004 ¶ 16). Relying upon the testimony of Dr. Michalson, Petitioner argues that a person of ordinary skill in the art would have recognized that a goal of Reddy is enabling access to large databases of mapping information under conditions of limited bandwidth, like those that would be encountered in a military or emergency response scenario. *Id.* (citing Ex. 1005 ¶ 132). Petitioner further asserts that Hornbacker specifically teaches that the tiled view format allows the size of view tiles to be shrunk to as little as 512 bytes, and viewed using a "low bandwidth 28.8 kilobaud modem network" with "much lower demand on the network connection." *Id.* at 28 (citing Ex. 1003, 6:20–7:1, 13:28–14:11). Petitioner also argues Hornbacker teaches that the client may be implemented on a notebook computer, palm-top computer, or television. *Id.* (citing Ex. 1003, 14:16–28).

Patent Owner asserts that Reddy does not disclose a "limited communication bandwidth computer device," as recited in independent claims 1 and 15, and incorporated into dependent claims 2–7 and 16–21. PO Resp. 26. In a related argument, Patent Owner also contends that Reddy

does not disclose a "limited bandwidth communications channel," as recited in independent claims 8 and 15, and incorporated into dependent claims 9–14 and 16–21. *Id*. at 24. In its "limited bandwidth" arguments, Patent Owner asserts that Reddy does not disclose the operation of TerraVision II on a "small client" (*id.* at 26) or on a device with a narrowband or wireless connection or any other relatively low bandwidth network connection (*id.* at 24). According to Patent Owner, Reddy only discloses the use of TerraVision II on a conventional, fixed-site computer system with a high bandwidth network connection. *Id.* at 26–27. Patent Owner contends that Petitioner mischaracterizes Reddy as teaching that its browsing system may be implemented on a laptop computer (*id.* at 27) or that the laptop operates over a limited bandwidth communications channel, such as a wireless or narrowband connection (*id.* at 24). According to Patent Owner, Reddy mentions that a laptop is capable of viewing VRML data with a standard VRML browser, but not with TerraVision II. *Id.* at 24 (citing Ex. 2066 (Digital Earth Visualization System ("Digital Earth")) pp. 4–5 as contrasting TerraVision running on a fast graphics workstation with accessing data via a standard browser).

Although Reddy states that "TerraVision II can be implemented on a graphics workstation connected to a gigabit-per-second ATM network with a high speed disk servers for fact response times," Reddy also states "[h]owever, TerraVision II can also be implemented on a PC connected to the Internet, or a standard VRML browser on a laptop machine can be used to browse the same data." Ex. 1004 ¶ 48. Patent Owner emphasizes that this passage from Reddy states only that TerraVision II can be implemented

on a high-speed network or PC connected to the Internet, neither of which Patent Owner would characterize as a limited communication bandwidth computer device. PO Resp. 27. Patent Owner further notes that paragraph 48 of Reddy states that a laptop can use VRML, but makes no mention of a laptop using TerraVision or the functionalities of TerraVision on which Petitioner relies, such as in-memory terrain representation at low resolution. *Id.* In its Motion for Observations, Patent Owner points to deposition testimony from Dr. Michalson as allegedly supporting Patent Owner's arguments regarding the use of a VRML browser and TerraVision II on a laptop computer, including, Patent Owner's argument that the laptop disclosed by Reddy views VRML data with a standard VRML browser, but not with TerraVision II. *See* Obs. Nos. 5–12.

Petitioner responds that Patent Owner ignores the teachings in paragraph 48 of Reddy to use the disclosed geographic image viewing functionality on a laptop in situations such as military applications or disaster response scenarios. Pet. Reply 3 (citing Ex. 1004 ¶ 48). According to Petitioner, these teachings would suggest to a person of ordinary skill in the art to access the geographic data of Reddy in bandwidth-limited situations. *Id.* (citing Ex. 1016, Michalson Reply Decl. ¶¶ 42–43). Further, Petitioner argues that the subject matter Patent Owner cites from Digital Earth also discloses that some of TerraVison's features that provided advantages over a standard VRML browser "could be implemented for a standard VRML browser through the use of various Java scripts embedded in the scene or running externally to the browser." *Id.* at 5 (citing Ex. 2066, 4). In its Response to Patent Owner's Motion for Observations, Petitioner

argues that Patent Owner's Observation Nos. 5–12 are misleading, incomplete, and/or irrelevant. Obs. Resp. 5–12.

As discussed above in Section III (Claim Construction), we determine that the term "limited communication bandwidth computer device" is not limited to a small client, such as PDAs, smartphones, or automobile navigation systems. As also discussed in the same section, a "limited bandwidth communications channel" is not limited to a wireless channel. Based on the complete record, we are persuaded that Reddy and Hornbacker, each reference individually or in combination, teach or suggest using a limited communication bandwidth computer device to access data or retrieve data parcels over a limited bandwidth communications channel. We are persuaded that Reddy's use of tiling to access and visualize terrain data from a client on a laptop in military or emergency response scenarios teaches or suggests this feature. We are not persuaded by Patent Owner's argument that the functionalities of TerraVision cannot be used on a laptop because Reddy explicitly states "TerraVision II is not required to view the VRML terrain data sets; it simply increases browsing efficiency. Any standard VRML browser can interact with these data." Ex. 1004 ¶ 47. Having considered Patent Owner's observations on the cross-examination testimony of Dr. Michalson (Obs. Nos. 5–12) and Petitioner's responses (Obs. Resp. Nos. 5–12), as well as the underlying testimony of Dr. Michalson (Ex. 2078), we are not persuaded that anything in the cited testimony of Dr. Michalson contradicts or overrides this express disclosure in Reddy.

Accordingly, based on the foregoing discussion and based on the complete record, we are persuaded that Reddy and Hornbacker, each

reference individually or in combination, teach or suggest "issuing, from a limited communication bandwidth computer device to a remote computer, a request for an update data parcel," as recited in claim 1.

(2) Element 1.B

Petitioner identifies as claim element 1.B the limitation that recites, "wherein the update data parcel is selected based on an operator controlled image viewpoint on the computer device relative to a predetermined image." Pet. 31. Petitioner cites Reddy's disclosure of a system that enables a user to view geographic information or imagery downloaded over the web using a 2D pan-and-zoom display or 3D simulated viewpoint chosen by the user operator, in which tiles of appropriate resolution are selected based on the user's proximity to the tile in question. *Id*. (citing Ex. 1004 ¶¶ 2–3, 13–17, 19–22, 29, 38, 42–46, Figs. 1, 4, 5). Petitioner presents evidence that a person of ordinary skill would recognize these teachings disclose that update data parcels (terrain tiles) are selected based on an operator controlled image viewpoint relative to a predetermined image, i.e., the source imagery/map data that the user is viewing. *Id.* at 31–32 (citing Ex. 1004 ¶ 3; Ex. 1005, Michalson Decl. ¶ 144). Petitioner further cites Hornbacker as teaching that URLs containing the zoom level and location of a tile offer advantageous way to request tiles. *Id.* at 32. Patent Owner does not dispute explicitly Petitioner's contentions concerning claim element 1.B.

Based on the complete record, we are persuaded that Petitioner has demonstrated sufficiently that Reddy by itself or in combination with Hornbacker teaches "the update data parcel is selected based on an operator

controlled image viewpoint on the computer device relative to a predetermined image," as recited in claim 1, because Reddy teaches selecting terrain tiles based on the user perspective relative to the source imagery (or map data) the user is viewing.

(3) Element 1.C

Petitioner identifies as claim element 1.C the limitation that recites "the update data parcel contains data that is used to generate a display on the limited communication bandwidth computer device." Pet. 32. Petitioner cites both Reddy and Hornbacker as systems that are directed to visualizing map data or image data tiles retrieved over the Internet to form an image on the browser at the client device. *Id.* (citing Ex. 1004 ¶ 3; Ex. 1003, Abstract). Patent Owner does not dispute explicitly Petitioner's contentions concerning claim element 1.C.

Based on the complete record, we are persuaded that Petitioner has demonstrated sufficiently that Reddy and Hornbacker, individually or in combination, teach "the update data parcel contains data that is used to generate a display on the limited communication bandwidth computer device," as recited in claim 1, because the tiles retrieved over the Internet in Reddy and Hornbacker are used to form an image that is displayed to the user.

(4) Element 1.D

Petitioner identifies as claim element 1.D the limitation that recites "processing, on the remote computer, source image data to obtain a series $K_{1\text{-}N}$ of derivative images of progressively lower image resolution." Pet. 32.

Petitioner cites the disclosure in Reddy that satellite and aerial imagery is processed into a multi-resolution pyramid of images (derivative images) by repeatedly down-sampling the image to lower resolution at each level. *Id.* at 32–33 (citing Ex. 1004 ¶¶ 14–17, 19–21, 24, 42, Fig. 1). Petitioner further notes that Reddy discloses the required terrain data may be either precomputed off-line or generated "on the fly" by parsing the URL path name to generate the necessary VRML data. *Id*. at 33 (citing Ex. 1004 ¶ 52; Ex. 1005 ¶¶ 149–151). Petitioner cites Hornbacker as disclosing view tiles generated at a server by an image tiling routine that divides a given image into a grid of smaller images, which are further computed for distinct resolutions. *Id.* According to Petitioner, in Hornbacker the view tiles may either be preprocessed at the server (pre-cached) or newly computed in response to a request. *Id.* (citing Ex. 1003, 3:22–27, 5:3–8, 5:16–6:19, 6:20–7:25, 8:30–9:28, 10:3–10, 11:19–28, 12:21–13:10, 13:26–14:6; Ex. 1005 ¶ 152). Citing the Declaration of Dr. Michalson, Petitioner argues that a person of ordinary skill would consider the detailed teachings in Hornbacker about how on-demand processing of map information could be implemented either in advance or on the fly, and would recognize that the tiling pipeline on the server (remote computer) of Hornbacker is an advantageous way to prepare a series of geographically-linked images in the pyramid described by Reddy. *Id.* (citing Ex. 1005 ¶ 152). We are persuaded by Petitioner's argument and evidence that Reddy's disclosure of satellite and aerial imagery processed into a multi-resolution pyramid of images, as well as Hornbacker's disclosure of view tiles generated at a server, teaches claim element 1.D.

Patent Owner does not dispute explicitly Petitioner's contentions regarding the teachings of Reddy with respect to claim element 1.D. In the context of dependent claims 7, 14, and 21, Patent Owner argues that Hornbacker does not teach or suggest generating a series of derivative images. PO Resp. 38. Patent Owner argues that Hornbacker does not teach or suggest a series of derivative images because the Hornbacker server computes view tiles upon request for a specific resolution requested by the end user client and creates only the tiles needed for the view. *Id.*

Patent Owner's argument is unavailing, as Petitioner notes that nothing in the claims precludes processing tiles on demand. Pet. Reply. 14–15.

Patent Owner acknowledges Hornbacker's disclosure that precomputation can proceed for alternative view scales by the background view composer operating at low priority after a maximum number of view tiles is computed at the current scale. PO Resp. 38 (citing Ex. 1003, 11:9–18). According to Patent Owner, this disclosure expresses a capability in Hornbacker, but does not imply a series of derivative images would be created, as claimed. *Id*. Patent Owner argues that custom tile creation in Hornbacker is incompatible with a series of K1-N derivative images and that it "would not make sense" for Hornbacker to create an entire series of derivative images based on parameters requested by a single user, for example, with a specific angle, that cannot be used by others. *Id.* at 38–39 (citing Ex. 2003, Agouris Decl. ¶¶ 96–97; Ex. 1003, 9, 16, 18).

Patent Owner's attempts to distinguish over Hornbacker are not persuasive because, as Petitioner points out, Patent Owner mischaracterizes

optional embodiments as limitations of Hornbacker and ignores embodiments that do not use rotation angle. Pet. Reply 15 (citing Ex. 1003, 8:30–9:19). Hornbacker discloses uniquely identifying a view tile with a URL through a combination of storage location and view tile naming, such that uniqueness between images of each scale view is established by a naming convention and by having a separate subdirectory in the tile cache for each image. Ex. 1003, 8:30–9:4. Each view tile is named uniquely using a scale and tile number, with the tile number representing a tile row, image tile width and tile column. *Id.* at 9:4–15. Hornbacker discloses other view attributes, such as rotation angle, as ones that "may be encoded in the view storage tile location or in the view tile name." *Id.* at 9:20–25. Therefore, we agree with Petitioner that Hornbacker's disclosure of its optional use of operator specific parameters does not show tile creation in Hornbacker is incompatible with generating a series of $K_{1\text{-}N}$ derivative images.

Accordingly, based on the foregoing discussion and based on the complete record, we are persuaded that Reddy and Hornbacker, individually or in combination, teach or suggest "processing, on the remote computer, source image data to obtain a series $K_{1\text{-}N}$ of derivative images of progressively lower image resolution," as recited in claim 1.

(5) Elements 1.E and 1.F

Petitioner identifies as claim element 1.E the limitation that recites, "wherein series image K_0 being subdivided into a regular array," and as claim element 1.F the limitation that recites, "wherein each resulting image parcel of the array has a predetermined pixel resolution." Pet. 34. As to

claim element 1.E, Petitioner cites the disclosure in Reddy of a tiled pyramid in which each level is segmented into an array of tiles so that each tile at a given level maps onto four tiles at the next higher level, i.e., original image K_0 (the bottom image in Fig. 1(a) of Reddy) is subdivided into an array of 8 x 8 tiles, and the next two levels are subdivided into regular arrays of 4 x 4 and 2 x 2 tiles. *Id.* (citing Ex. 1004 ¶¶ 12–16). As to claim element 1.F, Petitioner cites Reddy's disclosure that all tiles have the same pixel dimensions, e.g., 128 by 128 pixels, and Hornbacker's disclosure that tiles are preferably fixed at 128 x 128 pixel image files to allow more efficient use of the caching mechanism and for identifying and locating tiles. *Id.* (citing Ex. 1004 ¶¶ 15–16, Fig. 1; Ex. 1003, 6:20–7:25, 13:26–14:6). Petitioner notes that this disclosure is similar to the teachings in the '506 patent at column 6, lines 12–15. *Id.* (citing Ex. 1005 ¶ 154). Thus, Petitioner has provided sufficient evidence to determine that the references disclose claim elements 1.E and 1.F. Patent Owner does not dispute explicitly Petitioner's contentions that the references disclose claim element 1.E or 1F.

Accordingly, based on the complete record, we are persuaded that Reddy by itself or in combination with Hornbacker teaches the limitations identified by Petitioner as claim elements 1.E and 1.F.

(6) Element 1.G

Petitioner identifies as claim element 1.G the recitation that "image data has a color or bit per pixel depth representing a data parcel size of a predetermined number of bytes." Pet. 35. Petitioner cites Reddy as teaching

the use of known imagery formats that a person of ordinary skill would recognize as having a fixed bit or pixel depth. *Id*. (citing Ex. 1004, p.31 sidebar; Ex. 1005 ¶¶ 155–159). Petitioner further contends that a person of ordinary skill would have recognized that the size of the data representing an uncompressed tile corresponds to the product of the bit depth multiplied by the pixel dimensions, as illustrated in the example described in paragraphs 15, 16, and 17 of Reddy, and would have understood from this teaching that the data parcel size for each tile is the same, in a manner similar to that disclosed in the '506 patent at column 6, lines 12–22. *Id.* at 35–36 (citing Ex. 1004 ¶¶ 15, 16, 17, Fig. 1; Ex. 1005 ¶¶ 157, 158, 159). Petitioner cites Hornbacker as teaching the use of GIF compression and argues that a person of ordinary skill would recognize this teaching also reflects a fixed data parcel size that is dependent on the number of bits per pixel (color depth). *Id.* at 36 (citing Ex. 1003, 6:20–7:3; Ex. 1005 ¶ 160). Thus, Petitioner has provided sufficient evidence to determine that the references disclose element 1.G. Patent Owner does not dispute explicitly Petitioner's contentions that the references disclose claim element 1.G.

Accordingly, based on the complete record, we are persuaded that Reddy and Hornbacker, individually or in combination, teach "image data has a color or bit per pixel depth representing a data parcel size of a predetermined number of bytes," as recited in claim 1.

(7) Element 1.H

Petitioner identifies as claim element 1.H the recitation "resolution of the series $K_{1\text{-}N}$ of derivative images being related to that of the source image

data or predecessor image in the series by a factor of two, and said array subdivision being related by a factor of two such that each image parcel being of a fixed byte size." Pet. 36. Petitioner argues that the recited claim limitation is supported by the disclosure in the Specification of the '506 patent that the array subdivision and pixel resolution in successive layers are each related to the predecessor image or array "by a factor of four" (i.e., a factor of two in each dimension). *Id.* at 36–37 (citing Ex. 1002, col. 6, ll. 7–22).

Petitioner asserts that Reddy discloses this aspect of the '506 patent because Reddy teaches varying the resolution and array subdivision of the series of images in relation, so as to maintain fixed size image tiles. *Id.* at 37. Noting that 1/2 the width multiplied by 1/2 the height equals 1/4 resolution, Petitioner observes that in Reddy a 1024 x 1024 original image is down-sampled to 512 x 512 pixels, then 256 x 256 pixels, and so on, and that, because all tiles have the same pixel dimensions, each progressively lower resolution layer image includes 1/4 the number of tiles from the previous layer. *Id*. (citing Ex. 1004 ¶¶ 14–15, Fig.1). Thus, the second level image in Figure 1(a) of Reddy includes 16 tiles (1/4 the 64 tiles in the bottom layer). *Id.* Petitioner notes that Reddy states this is a 512 x 512 pixel image (1/4 the resolution of the bottom layer image). *Id.* (citing Ex. 1004 ¶ 15). Petitioner argues that Reddy, therefore, discloses that the resolution and array subdivision are varied in relation, and a fixed size of 128 by 128 pixels for each tile is maintained. *Id.*

Petitioner further references its discussion of claim element 1.G, maintaining that a person of ordinary skill would understand Reddy to teach

a specified bit depth per pixel for the multiresolution pyramid. *Id.* Petitioner points out that with image tiles fixed as to pixel dimensions, the resulting byte size of the image tiles (data parcels) is also fixed at each level of the pyramid, and varies by powers of two as to both the number of tiles in the array and the resolution. *Id*. at 37–38 (citing Ex. 1005, Michalson Decl. ¶ 162). Patent Owner does not dispute explicitly Petitioner's contentions that Reddy discloses claim element 1.H.

We agree with Petitioner the claimed feature is described in column 6, lines 7–22 of the Specification, i.e., the array subdivision and pixel resolution in successive layers are each related to the predecessor image or array "by a factor of four," i.e., a factor of two in each dimension of a two-dimensional image. We are persuaded by Petitioner's explanation that Reddy discloses this claimed feature as described above because by deriving a 512 x 512 pixels image divided into 16 tiles of a 4-by-4 array from a 1024 x 1024 pixels image divided into 64 tiles of an 8-by-8 array, a fixed size of 128 x 128 pixels for each tile is maintained (i.e., 512 pixels divided by 4 and 1024 pixels divided by 8 both result in 128 pixels). In this example, the array subdivisions, i.e., 8-by-8 and 4-by-4, of the images are related by a factor of two. Accordingly, based on the foregoing and on the complete record, we are persuaded that Reddy discloses "resolution of the series $K_{1\text{-}N}$ of derivative images being related to that of the source image data or predecessor image in the series by a factor of two, and said array subdivision being related by a factor of two such that each image parcel being of a fixed byte size," as recited in claim 1.

(8) Elements 1.I and 1.J

Petitioner identifies as claim element 1.I the limitation that recites "receiving said update data parcel from the data parcel stored in the remote computer over a communications channel" and as claim element 1.J the limitation that recites "displaying on the limited communication bandwidth computer device using the update data parcel that is a part of said predetermined image, an image wherein said update data parcel uniquely forms a discrete portion of said predetermined image." Pet. 39.

As discussed above with respect to claim elements 1.A, 1.B, and 1.C, as well as in the Introduction section, Petitioner has shown that Reddy and Hornbacker disclose retrieving large-scale images over network communications channels for display on a limited communication bandwidth computer device. Patent Owner does not dispute explicitly Petitioner's contentions that the references disclose claim element 1.I.

With regard to claim element 1.J, Petitioner asserts that Reddy teaches that the data viewed by the user (i.e., displayed on the client device) includes satellite or aerial imagery which is specific to a particular location, and, therefore, forms a unique, discrete portion of a predetermined image. *Id.* (citing Ex. 1004 ¶¶ 3, 15–16, 18, 24, Fig. 1; Ex. 1005 ¶ 164). As discussed below with respect to dependent claim 7, we are persuaded by Petitioner's argument that a person of ordinary skill in the art would recognize satellite imagery and aerial photography as being unique to particular coordinates. *See also* Pet. Reply 12 (citing Ex. 1016, Michalson Reply Decl. ¶ 40 (opining that a person of ordinary skill in the art would recognize that satellite and aerial images are, by nature, specific to particular coordinates

since they depict a specific portion of the earth)). Patent Owner does not dispute explicitly Petitioner's contentions that the references disclose claim element 1.J.[4]

Based on the foregoing and based on the complete record, we are persuaded that Petitioner has demonstrated that Reddy discloses receiving and displaying an image with updated data parcels on a limited communications bandwidth computer device, where the update parcels uniquely form a discrete portion of a predetermined image.

(9) Conclusion

Accordingly, based on the complete record, we are persuaded that Petitioner has demonstrated by a preponderance of evidence the combination of Reddy and Hornbacker teaches all limitations of claim 1.

b. Independent Claims 8 and 15

Independent claims 8 and 15 are apparatus claims in which many of the structural elements correspond to steps of the method discussed above with respect to claim 1. Elements of claims 8 and 15 not included in claim 1 are as follows: (1) claim elements 8.C and 15.C, which recite "displayable

[4] Patent Owner's mention of element 1.J (as well as elements 13.J and 13.P) in its assertion with respect to dependent claims 7, 14, and 21 that "Hornbacker does not teach or suggest the efficient data structure as claimed in claims 1 and 13 (elements 1.D, *1.J, 13.J, 13.P*)" (PO Resp. 38 (emphasis added)) appears to be a result of a typographical error because Patent Owner does not discuss or identify any data structure in connection with element 1.J, and neither Petitioner nor Patent Owner identifies elements 13.J and 13.P in their papers.

over respective portions of a mesh corresponding to said defined image," (2) claim elements 8.D and 15.D, which recite "a communications channel interface supporting the retrieval of a defined data parcel over a limited bandwidth communications channel," (3) claim elements 8.G and 15.G, which recite "retrieve said defined data parcel via said limited bandwidth communications channel interface for storage in said memory," and (4) claim elements 8.H and 15.H, which recite "render said defined data parcel over a discrete portion of said mesh to provide for a progressive resolution enhancement of said defined image on said display."

Of these elements, we addressed the "limited bandwidth communications channel" limitation (elements 8.D, 15.D, and 8.G, 15.G) in our discussion of claim element 1.A above. We discuss below the rest of the elements not included in claim 1.

(1) Elements 8.C and 15.C

Petitioner identifies as claim elements 8.C and 15.C the claim limitation that recites [a plurality of image parcels] "displayable over respective portions of a mesh corresponding to said defined image." Pet. 48, 55. Petitioner asserts that Reddy discloses the use of a mesh to model the geometry of the terrain surface. *Id.* at 48. Noting that the caption of Figure 2 states that "closer terrain is represented in higher fidelity (more polygons) than distant terrain," Petitioner asserts that Figure 2 of Reddy depicts a mesh of polygons that models the varying elevation for a geographic area. *Id.* (citing Ex. 1004 ¶ 17, Fig. 2). Petitioner further argues Reddy teaches that image data may be displayed over respective portions of a polygon mesh

(e.g., a digital elevation model) and that both the terrain geometry (i.e., mesh) and the corresponding imagery that gets texture mapped onto that geometry are stored together in terrain tiles. *Id.* at 49 (citing Ex. 1004 ¶¶ 17, 18, 24; Ex. 1005 ¶ 192). According to Petitioner, Reddy's quad-tree structure links the terrain tiles to their respective GeoTiles so that the correct terrain and imagery for a geographic area and resolution can be identified. *Id.* (citing Ex. 1004 ¶¶ 19–24, Fig. 3). Citing the Declaration of Dr. Michalson, Petitioner argues that the image data parcels of the '506 patent are similarly stored in conventional quad-tree data structures and that Reddy, therefore, teaches a system based on well-known graphics principles which uses a polygonal mesh and maps the corresponding image data onto those polygons in order to create the desired "photorealistic" view of the terrain. *Id.* (citing Ex. 1002, col. 7, ll. 27–30; Ex. 1004 ¶¶ 2–3; Ex. 1005 ¶¶ 190–194). We are persuaded that Reddy's mesh of polygons and related data structure cited by Petitioner teaches displaying image parcels over portions of a mesh corresponding to the image to be displayed.

Patent Owner does not dispute explicitly Petitioner's contentions that Reddy discloses claim elements 8.C and 15.C. Based on the foregoing discussion and based on the complete record, we are persuaded that Petitioner has cited sufficient evidence to demonstrate that Reddy teaches [a plurality of image parcels] "displayable over respective portions of a mesh corresponding to said defined image," as recited in claims 8 and 15.

(2) Elements 8.H and 15.H

Patent Owner contends that neither Reddy nor Hornbacker discloses "progressive resolution enhancement" as that feature is claimed in claim elements 8.F, 8.G, and 8.H, as well as in claim elements 15.F, 15.G, and 15.H. PO Resp. 29–32. Together the claim limitations identified by Petitioner as claim elements 8.F, 8.G, and 8.H—which are identical to the claim limitations identified by Petitioner as claim elements 15.F, 15.G, and 15.H—recite that "said processor operative to select said defined data parcel, retrieve said defined data parcel via said limited bandwidth communications channel interface for storage in said memory, and render said defined data parcel over a discrete portion of said mesh to provide for a progressive resolution enhancement of said defined image on said display." Pet. 50–51. 55–56.

Petitioner contends that claim element 8.F[5] is taught by Reddy and Hornbacker for the same reasons as those articulated for claim elements 1.B, i.e., Reddy teaches an algorithm executed by a processor to select identified tiles. *Id.* at 50. With respect to claim element 8.G, Petitioner asserts that Reddy and Hornbacker teach retrieval of tiles over the limited bandwidth communications channel as discussed above with regard to claim element 1.A. *Id.* As for storing the data parcel in a memory, Petitioner argues that Reddy teaches a local cache on a display device to enable rapid display of

[5] Because claim elements 15.F, 15.G, and 15.H are identical to claim elements 8.F, 8.G, and 8.H, we only discuss claim elements 8.F, 8.G, and 8.H herein.

pre-fetched tiles that are cached after being received. *Id.* at 50–51 (citing Ex. 1004 ¶ 45; Ex. 1005 ¶¶ 198–199).

Addressing claim element 8.H, Petitioner asserts that Reddy teaches that the TerraVision II browser software utilizes a "progressive coarse-to-fine algorithm to load and display new data," and load new detail progressively as a user approaches an area of terrain or display the highest resolution data available if some high-resolution tiles have yet to arrive. *Id.* at 51 (citing Ex. 1004 ¶¶ 21, 44). Relying upon the testimony of Dr. Michalson, Petitioner argues that this "progressive, coarse-to-fine" algorithm provides "progressive resolution enhancement" as claimed by displaying coarse tiles first followed by higher-resolution tiles as they arrive. *Id.* (citing Ex. 1005 ¶ 200).

Patent Owner contends that neither Reddy nor Hornbacker discloses that the processor be operative to select a designated data parcel to provide resolution enhancement. PO Resp. 29–30. Patent Owner argues that Reddy does not disclose this feature because in Reddy no action is taken unless the user moves closer to an area, although Patent Owner acknowledges that when the user approaches a region of terrain, more detail is progressively loaded in a coarse-to-fine fashion. *Id.* at 30 (citing Ex. 1004 ¶ 21). Patent Owner argues that TerraVision does not disclose this claimed feature, because TerraVision falls back to currently available view tiles if a higher resolution tile has not yet arrived. *Id*. at 31. Patent Owner acknowledges that Hornbacker discloses progressive display using a file format that allows for initial display of a rough view while the remainder of the image is

downloaded, but contends that this is not selection of data parcels, but an application of an algorithm to stream data for an image. *Id*. at 32.

Claim elements 8.F, 8.G, and 8.H recite a processor that can select the defined data parcel, retrieve that data parcel, and render that data parcel to provide progressive resolution enhancement of the defined image. Petitioner points out that the claim language does not link selecting a data parcel with progressive resolution enhancement, but that, even if data selection and progressive resolution are linked, Reddy meets this limitation because it teaches the processor selects data parcels (tiles) as it loads appropriate tiles in a coarse-to-fine manner. Pet. Reply 6–7 (citing Ex. 1004 ¶ 44; Ex. 1016, Michalson Reply Decl. ¶ 58). We are persuaded by Petitioner's argument that Reddy satisfies these limitations by its disclosure of a given tile replacing a lower resolution tile. *Id*. at 7 (citing Ex. 1004 ¶ 44). As Petitioner also notes, Patent Owner's arguments concerning user actions is not persuasive because the claim limitations do not exclude the processor selecting tiles based on user actions. *Id*.

Accordingly, based on the foregoing and based on the complete record, we are persuaded that Reddy and Hornbacker teach "said processor operative to select said defined data parcel, retrieve said defined data parcel via said limited bandwidth communications channel interface for storage in said memory, and render said defined data parcel over a discrete portion of said mesh to provide for a progressive resolution enhancement of said defined image on said display," as recited in claims 8 and 15.

(3) Conclusion

Accordingly, in view of the evidence and arguments discussed above and on the complete record, we are persuaded that Petitioner has demonstrated by a preponderance of evidence the combination of Reddy and Hornbacker teaches all limitations of independent claims 8 and 15.

c. Dependent Claims 7, 14, and 21

Claims 7, 14, and 21 depend from claims 1, 8, and 15, respectively, and recite "the processing further comprises compressing each data parcel and storing each data parcel on the remote computer in a file of defined configuration such that a data parcel can be located by specification of a K_D, X, Y value that represents the data set resolution index D and corresponding image array coordinate."

Petitioner identifies as claim element 7.A the recitation "the processing further comprises compressing each data parcel." Pet. 44. Acknowledging that Reddy does not mention the use of compression explicitly, Petitioner argues that a person of ordinary skill would recognize that Reddy builds on the VRML97 specification which allows the use of compression. *Id.* (citing Ex. 1004 ¶¶ 1, 21, 24, 28, 34, 39, p. 31 (sidebar); Ex. 1005 ¶ 174). Petitioner cites Hornbacker's disclosure that GIF files used for image tiles may be compressed at a 4:1 ratio, and argues that Reddy's VRML-based system would be compatible with compression techniques. *Id.* at 44–45 (citing Ex. 1003, 6:20–7:3; Ex. 1005 ¶ 176). Noting that Reddy teaches the need to reduce bandwidth use to make the system capable of operating on a distributed network with limited bandwidth, e.g., a laptop

computer in an emergency response situation (*id.* at 44 (citing Ex. 1004 ¶ 48)), Petitioner asserts that a person of ordinary skill in the art would have recognized that compression as taught in Hornbacker would meet the goal of reduced bandwidth taught by Reddy (*id.* (citing Ex. 1005 ¶ 175)).

Patent Owner does not dispute explicitly Petitioner's contentions that the references disclose claim element 7.A. We are persuaded by Petitioner's argument that a person of ordinary skill in the art would have been motivated to combine Hornbacker's teaching of compressing image tiles with Reddy's teaching of using a laptop in an emergency response situation, and incorporate data compression in the Reddy's system to access terrain data over a limited bandwidth communication link. Based on the foregoing and on the complete record, we are persuaded that Petitioner has demonstrated sufficiently that the references teach claim element 7.A.

Petitioner identifies as claim element 7.B the recitation "storing each data parcel on the remote computer in a file of defined configuration such that a data parcel can be located by specification of a K_D, X, Y value that represents the data set resolution index D and corresponding image array coordinate." Pet. 45. Petitioner cites geotiles in Reddy as containing links to terrain tiles that include satellite, aerial, and mapping imagery, allowing a common navigation structure to link the imagery and features such as buildings, roads and annotations. *Id*. (citing Ex. 1004 ¶¶ 19–26, Fig. 3). Petitioner also notes that in Reddy tiles are related to a geographic area using a VRML geocentric coordinate system. *Id.* (citing Ex. 1004 ¶¶ 27–30). Petitioner contends that a person of ordinary skill would have understood that Reddy obtains imagery tiles utilizing a quad tree structure (a "defined

configuration" that facilitates retrieval of tiles for a particular area and at a particular resolution) that organizes tiles by location and resolution in a manner similar to the '506 patent, which discloses image data parcels stored in conventional quad tree data structures, where tree nodes of depth D correspond to the stored image parcel of the derivative image of resolution KD. *Id.* at 45–46 (citing Ex. 1002, col. 7, ll. 27–30; Ex. 1004 ¶¶ 22–24; Ex. 1005 ¶¶ 178, 179).

Dr. Michalson testifies that the structure of quad tree files disclosed in Reddy is "very similar to the structure taught by the specification of [the '506 patent]." Ex. 1005 ¶ 178. Dr. Michalson further testifies that tiles are selected based on the proximity to the user's viewpoint, using the quad tree structure to select tiles at the appropriate resolution based on their position in the LOD hierarchy. *Id.* ¶ 179 (citing Ex. 1004 ¶¶ 12–17, Fig. 1). Noting that the tiles are related to geographic area using a VRML geocentric coordinate system, Dr. Michalson observes that a person of ordinary skill would have interpreted the teachings of Reddy to mean that the TerraVision browser obtains the appropriate imagery tiles utilizing the quad tree structure by specifying the appropriate level of detail in the coordinates of the image. *Id.*

Citing the Microsoft Bing Map Tile System described in Exhibit 2059 as an example of a mapping system that uses K_D, X, Y values in accordance with the claims of the '506 patent, Patent Owner argues that a geocentric coordinate system is neither conformal (avoiding distortion) nor cylindrical (in which north-south is always straight up and down) and is not a grid of squares with x-y representing up and down and left and right. PO Resp. 33–

34. However, as Petitioner points out, the words "conformal" or "cylindrical" do not appear in the '506 patent. Pet. Reply 13. Petitioner also notes that Patent Owner has accused Petitioner's Bing Map Tile System of infringing the claims of '506 patent. *Id.* Patent Owner does not cite Exhibit 2059 as evidence of the state of the art at the time of the invention, and we do not consider whether the Microsoft Bing Map Tile System uses any features of the claims of the '506 patent.[6]

According to Patent Owner, terrain in Reddy's TerraVision II is defined via a customized set of arbitrary polygons in space, not as a grid. PO Resp. 34. Patent Owner argues that defining terrain via a customized set of arbitrary polygons in space, rather than a grid, is workable in VRML because VRML is a set of nodes or objects having characteristics linked to one another, such that in Reddy higher resolution child nodes can be loaded when a user enters a certain volume around a tile. *Id.* Patent Owner contends that a person of ordinary skill, however, would understand Reddy's coordinate system and data structure to be incompatible with the type of structure claimed in the '506 patent. *Id.* According to Patent Owner, Reddy does not disclose a file of defined configuration such that a data parcel can be located by specification of a K_D, X, Y value, as claimed. *Id.* Patent Owner argues that "Reddy describes its coordinate system as an X, Y, Z*3D* (not K_D, X, Y) coordinate offset from the earth's center." *Id.* at 35 (citing

[6] Patent Owner's citation of Petitioner's accused product as evidence of features of the claims of the '506 patent could be perceived an improper attempt to obtain an advisory opinion from this panel on infringement, an issue that is outside our jurisdiction.

Ex. 1004 ¶ 27). According to Patent Owner, Reddy does not disclose image files stored in an image array, but instead discloses data stored in VRML format, which is a format for describing objects contained in nodes that have various fields. *Id*. (citing Ex. 2003, Agouris Decl. ¶ 131). Patent Owner states that VRML files map images to geometry using the "image texture" node, which specifies a texture map via URL. *Id.* (citing Ex. 2003 ¶¶ 65, 90, 93, 131). Patent Owner argues that a VRML does not generate URLs but stores them in the Image Texture node and that Reddy does not teach any particular nomenclature for the Image Texture URL, including the K_D, X, Y structure claimed in the '506 patent. *Id.*

In a related argument, Patent Owner states that the K_D, X, Y, nomenclature would be incompatible with TerraVision II because Reddy uses VRML, which employs a 3D Cartesian coordinate system that would not benefit from a K_D, X, Y structure, due to the absence of a Z coordinate and insufficient precision for latitude and longitude coordinates of a geocentric system. PO Resp. 35–36. Patent Owner asserts that Dr. Michalson conflates VRML coordinates of an image with the array indices of an image. *Id.* at 37. According to Patent Owner, in the context of the complex VRML implementation of Reddy, the use of an X, Y, Z offset for the Earth's center does not equate to a file in which a data parcel can be located by specifying the X, Y, K_D value, where X, Y represents a corresponding image array coordinate. *Id*. Patent Owner also asserts that Reddy does not teach or suggest locating a data parcel via array coordinates because VRML is a list of linked nodes, not an array. *Id*. at 38.

As Petitioner notes, however, the claims do not specify how a data parcel must be located, other than by including x, y, coordinates and resolution. Pet. Reply 11. The open ended claims do not exclude the use of Z values and do not exclude utilizing quad tree nodes to locate a tile at a particular location and resolution. *Id*. at 11–12. Petitioner further notes that the claims of the '506 patent do not exclude the use of two-dimensional imagery with other data, such as a polygon mesh to depict elevation data or textures, such as satellite imagery and aerial photography, which a person of ordinary skill in the art would recognize as being unique to particular coordinates. *Id.* at 12 (citing Ex. 1004 ¶¶ 3, 15–17, 22, Fig. 1; Ex. 1016, Michalson Reply Decl. ¶¶ 40, 99–102). Petitioner cites Figure 3 of Reddy as illustrating how arrays of terrain tiles including texture data relate to geotile structures, so that geotiles can be used to locate terrain tiles. *Id.* at 11–12. As Petitioner notes, Patent Owner acknowledges that Reddy teaches image textures (including map images) are specified by URLs containing image coordinates that are specific for a given image, geographic area, or LOD. *Id.* at 10–11 (citing PO Resp. 35). Although Patent Owner contends that "[a] VRML file does not generate URLs and stores them in the 'Image Texture' node," Patent Owner acknowledges that "VRML files map images to geometry using the 'Image Texture' node, which specifies a texture map via URL." PO Resp. 35.

Petitioner disputes Patent Owner's assertion that Dr. Michalson interprets the claims to cover any configuration, and emphasizes Dr. Michalson's testimony that the tiles meet the claim elements if each tile is stored in a separate file having the required configuration. *Id*. at 13.

Petitioner also notes that Patent Owner does not address Dr. Michalson's testimony that storing a hierarchy of images in a single file would have been well-known to a person of ordinary skill. *Id.* at 14 (citing Ex. 1005 ¶¶ 181–185).

Based on the open ended claim language and Reddy's teachings that tiles are specific to a particular location and LOD, and located by URLs, Petitioner presents persuasive evidence that it would have been obvious to locate tiles using URLs specifying their location and LOD. We agree with Petitioner that the open ended claims do not exclude the use of Z values. We are persuaded by Petitioner's argument and evidence that Reddy's quad tree and multi-resolution image pyramid teaches locating tiles at a particular location and resolution, i.e., the claimed K_D, X, Y value.

Patent Owner further argues that Hornbacker's naming scheme forgoes the advantages of the claimed K_D, X, Y, approach because in Hornbacker SCALE is expressed in parts per 256 and TILE_NUMBER is formed from the tile X coordinate, the tile Y coordinate, and the image tile width. PO Resp. 39. However, as described in Hornbacker, Hornbacker's naming scheme includes X and Y coordinates and scale, such that following a hyperlink, the server delivers a different area of the drawing or changes the resolution of the image. Ex. 1003, 5:16–24, 29–30, Figs. 3A and 3B. Hence, we are persuaded by Petitioner's argument that Hornbacker teaches that tiles may be located and requested using a specially formatted URL specifying the "scale and region," corresponding to the claimed "data set resolution index" (scale) and region (coordinates). Pet. 46 (citing Ex. 1003, 3:17–21, 5:16–24, 8:16–23, 8:30–10:6, 10:24–28). We are also persuaded

by Petitioner's argument that because Reddy teaches that image tiles within the quad-tree organized terrain database can be obtained by URLs, a person of ordinary skill in the art would have recognized that the URL format of Hornbacker would provide an advantageous means to request tiles by location and resolution. *Id.* at 46–47 (citing Ex. 1004 ¶¶ 21, 26, 52; Ex. 1005 ¶ 180).

Accordingly, in view of the evidence and arguments discussed above and on the complete record, we are persuaded Petitioner has demonstrated by a preponderance of the evidence that Reddy and Hornbacker teach "the processing further comprises compressing each data parcel and storing each data parcel on the remote computer in a file of defined configuration such that a data parcel can be located by specification of a K_D, X, Y value that represents the data set resolution index D and corresponding image array coordinate," as recited in claims 7, 14, and 21.

d. Dependent Claims 6, 13, and 20

Claims 6, 13, and 20 depend from claims 1, 8, and 15, respectively, and further recite "wherein processing the source image data further comprises queuing the update data parcels on the remote computer based on an importance of the update data parcel as determined by the remote computer." Petitioner asserts that Reddy teaches the feature of predicting a user's future moves and pre-fetching tiles accordingly, including a "progressive, coarse-to-fine" algorithm based on the resolution of the tiles and the user's proximity to the tiles. Pet. 43 (citing Ex. 1004 ¶¶ 21, 44, 46). According to Petitioner, Hornbacker discloses a similar feature except that,

in Hornbacker, pre-computing view tiles takes place at a server. *Id.* (citing Ex. 1003, 7:26–8:6). Petitioner contends that, in order to make the best use of such a server pre-computing function as disclosed in Hornbacker, the server optimally would calculate the tiles in the same order that they would most likely be requested by the client. *Id.* (citing Ex. 1005 ¶ 171). Petitioner also cites the testimony of Dr. Michalson, who explains that queues are ubiquitous data structures in computer science and that a person of ordinary skill would expect an operation requiring a processor to prioritize between functions to use a queue as a way of sorting which functions are performed first. *Id.* (citing Ex. 1005 ¶¶ 172–173). Petitioner argues, therefore, it would have been obvious to a person of ordinary skill to combine the teachings of Reddy and Hornbacker, so as to queue the pre-computed tiles (update data parcels) on the server (remote computer) based on the importance of the tiles (likelihood to be requested by the client) as determined by the server. *Id.* at 43–44 (citing Ex. 1005 ¶ 171–173).

Patent Owner asserts that the "coarse-to-fine" algorithm of Reddy does not suggest queuing of tiles based on the tiles' importance. PO Resp. 42. Rather, according to Patent Owner, this proximity-based download constitutes a "basic form of streaming" for downloading higher-resolution tiles for locations near the user. *Id.* 43. Patent Owner acknowledges, however, in this "streaming" process, "higher-resolution tiles are . . . *loaded based on proximity* of the user to the location." *Id.* at 42–43 (emphasis added). Patent Owner does not explain why streaming based on the user's proximity to the tiles is inconsistent with queuing the tiles based on an "importance" of the tiles. We are persuaded by Petitioner's argument that

Reddy's prefetching of tiles based on proximity of the user to the tiles teaches "queuing . . . based on an importance of the update data parcel," as recited in the claim.

Patent Owner further asserts that Hornbacker does not disclose "prioritization of retrieval of tiles." PO Resp. 41. The claims, however, recite queuing based on an *importance*, not *prioritization*. As noted by Petitioner, Hornbacker teaches that a server "pre-compute[s] view tiles that may be *required by the next view request*." Pet. 43 (emphasis added) (citing Ex. 1003, 7:26–8:6); Pet. Reply 8. We are persuaded by Petitioner's argument that this likelihood to be requested by the client qualifies as an "importance" recited in the claims. *See* Pet. 43–44.

Patent Owner also argues that Hornbacker's pre-computation of view tiles "merely refers to the creation" of view tiles, and does not teach or suggest queuing of the tiles. PO Resp. 42. Petitioner argues, however, citing Dr. Michalson's testimony, a person of ordinary skill would have understood that computing more important tiles first teaches or suggests queuing tiles in the order of importance. Pet. Reply 8–9; Pet. 43–44 (citing Ex. 1005 ¶¶ 171–173).

Patent Owner further asserts that Reddy is incompatible with Hornbacker because the VRML data and images of Reddy are all pre-made and shared among all clients, and, therefore, there is no need in Reddy to compute tiles in response to a user request. PO Resp. 41. According to Dr. Michalson, Patent Owner ignores the fact that Reddy also teaches on-the-fly tile generation. Ex. 1016 ¶¶ 114–115 (citing Ex. 1004 ¶ 52). Paragraph 52 of Reddy, titled "Data on demand," describes that "it is possible to . . .

generate all VRML data on the fly from some underlying geographic database." Ex. 1004 ¶ 52. Paragraph 52 also describes running a script on the server to "generate[] the VRML representation *on demand*." *Id.* (emphasis added). Hence, we are persuaded by Petitioner's argument and Dr. Michalson's explanation that, in view of the suggestion in Reddy to utilize received URLs to generate the necessary geographic tiles, a person of ordinary skill in the art would look to the similar (but more extensive) teachings in Hornbacker regarding a tile generation pipeline responsive to requests containing URLs in order to implement processing of image data on demand. Pet. 40 (citing Ex. 1005 ¶¶ 165–167).

Based on the foregoing and on the complete record, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that the combination of Reddy and Hornbacker teaches or suggests "processing the source image data further comprises queuing the update data parcels on the remote computer based on an importance of the update data parcel as determined by the remote computer," as recited in claims 6, 13, and 20.

e. Dependent Claims 2–5, 9–12, and 16–19

Claims 2, 9, and 16 depend from claims 1, 8, and 15, respectively, and each further recite "processing the source image data further comprises one of pre-processing the source image data on the remote computer and processing the source image data in real-time on-demand based on the request for the updated image parcel." We agree with Petitioner that Reddy teaches both options (i.e., the "pre-processing" and "real-time on-demand" options for processing the source image data) because Reddy indicates that

the system may either "statically generate" the data offline (pre-processing) or generate the data on the fly using a server script that interprets the path name of the received URL and uses that URL to generate the required data from an underlying database. Pet. 40 (citing Ex. 1004 ¶ 52). As discussed in the previous subsection, we are also persuaded that the combination of Reddy and Hornbacker teaches or suggests implementing real-time processing of image data on demand. *Id.* (citing Ex. 1003, 3:22–27, 5:3–8, 5:16–6:19; Ex. 1004 ¶ 42; Ex. 1005 ¶¶ 165–167).

Patent Owner does not respond separately, with specificity, to Petitioner's challenge to claims 2, 9, and 16 beyond Patent Owner's arguments advanced with respect to claim 1 discussed above.

Accordingly, based on the complete record, we are persuaded that the combination of Reddy and Hornbacker teaches or suggests "processing the source image data further comprises one of pre-processing the source image data on the remote computer and processing the source image data in real-time on-demand based on the request for the updated image parcel," as recited in claims 2, 9, and 16.

Claims 3, 10, and 17 depend from claims 2, 9, and 16, respectively, and each further recite that the update data parcel is streamed over a communication channel. Petitioner argues Reddy teaches that the TerraVision II system uses a "progressive coarse-to-fine algorithm to load and display new data," allowing the user to "continue to interact with the terrain" while higher resolution tiles are arriving. Pet. 41 (citing Ex. 1004 ¶ 44). We agree with Petitioner that Reddy's characterization of this disclosure as a "form of streaming" teaches streaming data parcels over a

communication channel. *Id.* (citing Ex. 1004 ¶ 44; Ex. 1005 ¶ 168). As discussed above with respect to claim 6, Patent Owner acknowledges that the "coarse-to-fine" downloading of tiles in Reddy discloses a "basic form of streaming." PO Resp. 43. Accordingly, based on the complete record, we are persuaded that Reddy teaches "receiving the update data parcel over a communications channel further comprises streaming the update data parcel over a communications channel to the limited communication bandwidth computer device," as recited in claims 3, 10, and 17.

Claims 4, 11, and 18 depend from claims 1, 8, and 15, respectively, and each further recite "the limited communication bandwidth computer device further comprises one of a mobile computer system, a cellular computer system, an embedded computer system, a handheld computer system, a personal digital assistants and an internet-capable digital phone and a television." Petitioner asserts that Reddy teaches that its system may be implemented on a browser on a laptop machine, which is a mobile computer system. Pet. 41 (citing Ex. 1004 ¶ 48). As discussed above with respect to claim 1, Petitioner further argues that Reddy teaches the need for a flexible system capable of operating in connection with commonly used web browsers in a "distributed, time-critical environment" such as a disaster or emergency response scenario. *Id.* (citing Ex. 1004 ¶ 48). Petitioner also cites Hornbacker's teaching of a web browser plug-in capable of operating on a "palm-top computer," which Petitioner asserts a person of ordinary skill in the art would recognize as synonymous with a "handheld computer system," or "personal digital assistant." *Id.* (citing Ex. 1003, 14:26–28; Ex. 1005 ¶ 169).

Patent Owner does not respond separately to Petitioner's challenge to claims 4, 11, and 18 beyond Patent Owner's arguments advanced with respect to claim 1 discussed above. Based on the complete records, we are persuaded that the use of a laptop in emergency response scenarios in Reddy as well as the use of a palm-top computer in Hornbacker teaches "the limited communication bandwidth computer device further comprises one of a mobile computer system, a cellular computer system, an embedded computer system, a handheld computer system, a personal digital assistants and an internet-capable digital phone and a television," as recited in claims 4, 11, and 18.

Claims 5, 12, and 19 depend from claims 1, 8, and 15, respectively, and each further recite that "a size of the data parcel" on the remote computer is different from the update data parcel on the limited communication bandwidth computer device. Petitioner argues "a byte size" constitutes "a size," and, therefore, data parcels on the remote computer having different byte sizes from the data parcels on the client satisfy the limitation recited in claim 5. Pet. 42. Hence, Petitioner argues Hornbacker's disclosure of compressing tiles by a 4:1 ratio for transmission to the client teaches the limitation recited in claim 5 because the size of the compressed tile received by the client (update data parcel) is different from the size of the uncompressed tile (data parcel) on the server. *Id.* (citing Ex. 1003, 6:26–28; Ex. 1005 ¶ 170).

Petitioner also asserts that the combination of Reddy and Hornbacker renders claim 5 obvious. Petitioner argues Reddy teaches the need to reduce bandwidth use to make the system capable of operating on a distributed

network with limited bandwidth, e.g., a laptop computer in an emergency response situation. *Id.* (citing Ex. 1004 ¶ 48). Petitioner further contends that Reddy teaches a VRML-based system compatible with compression techniques. *Id.* Hence, citing the testimony of Dr. Michalson, Petitioner argues that one skilled in the art would have recognized that compression as taught in Hornbacker would meet the goal of reduced bandwidth taught by Reddy, and would have combined the GIF compression taught by Hornbacker in the three-dimensional geographic data browser of Reddy. *Id.* (citing Ex. 1005 ¶ 170).

Patent Owner does not respond separately, with specificity, to Petitioner's challenge to claims 5, 12, and 19 beyond Patent Owner's arguments advanced with respect to claim 1 discussed above.

Based on the foregoing and on the complete record, we are persuaded that transmission of compressed tiles in Hornbacker teaches or suggests update data parcels on the limited communication bandwidth computer device having a size different from the data parcels on the remote computer. We are also persuaded that a person of ordinary skill in the art would have been motivated to combine Hornbacker's teaching of use of compression with Reddy's teaching of using a laptop in an emergency response situation in order to access terrain data over a limited bandwidth communication link. Accordingly, we are persuaded that Hornbacker by itself or in combination with Reddy teaches or suggests "a size of the data parcel on the remote computer is different from the update data parcel on the limited communication bandwidth computer device," as recited in claims 5, 12, and 19.

4. Reasons for Combining Reddy and Hornbacker

Having determined that the combination of Reddy and Hornbacker discloses the elements recited in claims 1–21, we address the question of whether a person of ordinary skill would have been motivated to combine the teachings of these references. The motivation to combine need not be found in the references sought to be combined, but may be found in any number of sources, including common knowledge, the prior art as a whole, or the nature of the problem. *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F. 3d 1356, 1361 (Fed. Cir. 2006). There is no requirement that the prior art contain an express suggestion to combine known elements to achieve the claimed invention; the suggestion to combine may come from the prior art, as filtered through the knowledge of one skilled in the art. *Id*. (citing *Motorola, Inc. v. Interdigital Tech. Corp.*, 121 F.3d 1461, 1472 (Fed. Cir. 1997)).

Petitioner states that Reddy and Hornbacker seek to achieve similar objectives, i.e., transmission of large images (Pet. 23), and take a similar approach, i.e., using tiled images and accessing the database through the world wide web (*id*. at 22–23). Petitioner contends Reddy teaches an overall system that enables a standard computer, such a PC or laptop, to access large scale geographic information, but does not disclose the use of compression. *Id.* at 22–23. Petitioner cites Hornbacker as analogous art for its disclosure of GIF compression of image data for efficient transmission on the Web. *Id.* at 23. Petitioner argues that a person of ordinary skill would have been motivated to combine the teachings of Reddy and Hornbacker because Reddy teaches the need for a system that can operate on a conventional

computing device to access large amounts of geographic information, and Hornbacker, relying on similar network and Internet technologies, teaches operating on limited bandwidth connections (e.g., 28.8 Kbytes/sec) to allow a client to request specific image view data, e.g., in a manner closely related to Reddy's flyover capability. *Id.* at 24–25.

Patent Owner contends that a person of ordinary skill in the art would not have selected and combined Reddy and Hornbacker and that the asserted combination is driven by hindsight. PO Resp. 45. Patent Owner asserts that the prior art taught away from an image pyramid approach, such as TerraVision II, for real-time display over the World Wide Web because of a well-known difficulties in using smaller images at different resolutions to serve image and map data. *Id*. at 45–47. Citing U.S. Patent No. 6,182,114 B1 ("Yap") filed January 9, 1998 and issued on January 30, 2001 (entitled Apparatus and Method For Realtime Visualization Using User-Defined Dynamic, Multi-Foveated Images) as evidence of the state of the art, Patent Owner identifies such difficulties as including (i) the need to serve a "brand new image" for each pan/zoom results in visual discontinuities, (ii) bandwidth limitations and the use of discrete images are comparatively slow, (iii) a requirement for a fixed size viewing window when pre-computing multiple smaller images. *Id.* at 45–46 (citing Ex. 2009, 1:32–46). Patent Owner also argues that sending a lower resolution image followed by a new higher resolution image was understood to be redundant and inefficient and that progressive transmission techniques, such as disclosed in U.S. Patent No. 4,222,076 issued on September 9, 1980 ("Knowlton") (Ex. 2011), avoid such redundancy. *Id.* at 46 (citing Ex. 2011, 5:20–22, 8:28–31, Abstract).

Patent Owner further argues that Hornbacker recommends a progressive transmission algorithm be used to improve document viewing performance. *Id.* at 47.

As Petitioner points out, Patent Owner does not argue that Reddy itself teaches away from progressive resolution enhancement. Pet. Reply 17. Petitioner notes that Patent Owner argues that other references suggest inefficiencies with using multiple smaller images at different resolutions to serve map data. *Id.* However, as Petitioner points out, Reddy teaches a preferred embodiment that a person of ordinary skill would not ignore. *Id.* at 17–18. In our extensive discussion of claims 8 and 15 above, we determined that Reddy discloses progressive resolution enhancement. Patent Owner acknowledges that Hornbacker discloses progressive resolution display. PO Resp. 47. Patent Owner's arguments that other references suggest inefficiencies with the use of multiple, smaller images at different resolutions do not suggest that *Reddy* teaches away from the claimed subject matter or from the combination with Hornbacker.

Patent Owner next argues that Reddy teaches away from operation on a limited communications bandwidth computer device. Patent Owner states that Reddy explains the state-of-the-art in reference to a 3-D model of the Monterey Bay National Marine Sanctuary using multi-resolution techniques similar to Reddy and limiting the download of high resolution files based on their proximity to the viewer. PO Resp. 47–48 (citing Ex. 2005, "Monterey Bay Reference"). As evidence of slow performance, Patent Owner cites the disclosure in the Monterey Bay Reference that VRML makes 3-D graphics accessible to any desktop, and that rendering of the lowest level of detail

takes 73 seconds using a 28K modem and 40 seconds if the VRML data is saved locally. *Id.* at 48 (citing Ex. 2005, 27, 43). Patent Owner acknowledges that Reddy discloses view culling, but contends this would not improve the lowest level of detail where all tiles are viewed at once. *Id.* (citing Ex. 2003, Agouris Decl. ¶ 138). According to Patent Owner, Reddy's use of floating point values for elevation rather than integers, as in the Monterey Bay Reference, would likely result in even slower performance. *Id*. Patent Owner also contends that Petitioner uses the '506 patent as a roadmap to select discrete parts of TerraVision II (e.g., the image pyramid, view culling, and the coarse-to-fine algorithm) to be combined with the non-VRML system disclosed by Hornbacker to create an image-viewing client that operates on a limited communications bandwidth computer device. *Id.* at 49.

Petitioner responds that the Monterey Bay Reference concerns retrieving and rendering models of detailed bathymetric data, as opposed to simply retrieving and displaying imagery as claimed in the '506 patent and taught by Reddy. Pet. Reply 18 (citing Ex. 1016, Michalson Reply Decl. ¶¶ 130–132). According to Petitioner, a person of ordinary skill in the art would have recognized that downloading and rendering imagery for a particular perspective view (e.g., as shown in Figure 1(b) of Reddy), would take only a few seconds even over a dial up connection, particularly when utilizing compression. *Id.* Petitioner also notes that numerous small clients capable of floating point support were known before 1999. *Id*. (citing Ex. 1016 ¶¶ 102–103, 132).

Perhaps most persuasive, however, are statements in Reddy that using VRML offers cartographers and geographers the potential to disseminate 3-D maps and spatial data over the World Wide Web, that as one zooms into a region, higher resolution data such as elevation and imagery are progressively downloaded and displayed, that the functionality is implemented in a standard VRML browser for downloading data over the World Wide Web and that, but for its essential management of a level of detail using the view dependent techniques disclosed (including projected screen size to decide when to reduce terrain detail), the time required to download and render such a model would prohibit real-time interaction using the current generation of VRML browsers. Ex. 1004 ¶¶ 1, 3, 9, 12, 42, We note, in particular, Reddy's disclosure of view dependent level of detail techniques and are not persuaded that Reddy teaches away from operation on a limited bandwidth communications device.

In other words, the key feature disclosed in Reddy that enables real-time interactions (even over the World Wide Web link) is the view dependent level of detail techniques, not any technique that would operate only on high speed network connections. We do not perceive, nor does Patent Owner identify, anything in Reddy's view dependent level of detail techniques that implicates or specifies the speed or bandwidth of the communication connection over which the techniques are designed to operate. Therefore, we are not persuaded that Reddy teaches away from operation on a limited bandwidth communications device.

Patent Owner next contends that Reddy and Hornbacker are incompatible because they take different approaches that a person of

ordinary skill would not have combined. PO Resp. 50–51. Patent Owner argues that Reddy relies on customized client based software, while Hornbacker relies on a server-based system that creates custom tiles in response to simple HTTP requests from clients. PO Resp. 50. Thus, Hornbacker describes a server architecture that distributes image tiles to a Web browser at a URL through HTTP requests, but does not describe client side processing beyond noting that the workstation will connect with the server through a Web browser. *Id.* (citing Ex. 1003, 3, 5). For this reason Hornbacker can operate with devices such as notebook computers and palm top computers that have Web browsers installed. *Id.* (citing Ex. 1003, 14). Patent Owner argues that, in contrast, tiles in Reddy, which are pre-computed and shared by different system users, can be stored at the client's software memory for use by the client, and that Reddy does not teach implementing TerraVision II on a limited processing capability palm-top because TerraVision II is a stand-alone application that requires far more processing power and memory than a simple Web browser. *Id.* at 50–51.

Petitioner responds that Patent Owner provides no clear analysis of why pertinent features of Hornbacker, e.g., compression, the use of URLs to identify tiles based on coordinates and LOD, tiling pipeline, and use on portable devices, could not be applied by a person of ordinary skill to the teachings of Reddy. Pet. Reply 19. Although Patent Owner argues the teaching are incompatible, as Petitioner points out, Reddy discloses imagery tiles within image pyramids identified by links. Ex. 1004 ¶¶ 21–22. As discussed above, Patent Owner acknowledges that X, Y, position and LOD may be used to identify tiles with the image pyramid. We addressed Patent

Owner's incompatibly arguments in our discussion of claim element 1.D and dependent claims 6 and 7, and did not find them persuasive. Thus, we find Petitioner's arguments persuasive on this issue.

Patent Owner next contends that the reference combination is guided by impermissible hindsight. PO Resp. 52. According to Patent Owner, the data structure in the '506 patent would provide no advantage to a VRML system such as that disclosed by Reddy, and Hornbacker teaches a nomenclature lacking the advantages of the '506 patent's K_D, X, Y system and more information dense than that of the '506 patent. *Id.* (citing PO Resp. § IV.C.4 (discussion of dependent claims 7, 14, and 21). We have addressed these arguments previously in this Decision. It is unclear from Patent Owner's arguments why neither reference teaches or suggests it would be advantageous to use a file configuration that specifies an image parcel by K_D, X, Y, or how Patent Owner concludes Petitioner's motivation to combine is grounded in hindsight.

In consideration of the evidence and arguments above, we find that Petitioner has shown by a preponderance of the evidence that a person of ordinary skill would have been motivated to combine the teachings of Reddy and Hornbacker and that the proposed combination teaches all the elements of claims 1–21.

5. Objective Indicia of Non-Obviousness

A conclusion as to obviousness is not complete without a consideration of objective considerations, which constitute independent evidence of non-obviousness. *Mintz v. Dietz & Watson, Inc.*, 679 F.3d 1372, 1378 (Fed. Cir. 2013). Patent Owner asserts that it is entitled to a

presumption of nexus because its evidence is tied to specific products that embody the claims of the '506 patent. PO Resp. 53 (citing Declaration of Mr. Isaac Levanon ("Levanon Decl.")[7] ¶¶ 1–94; Exs. 2013, 2021, 2044, 2055). In support of its contention, Patent Owner cites to the *entirety* of the Declaration of Mr. Isaac Levanon, all 94 paragraphs of it, as well as four exhibits, without explaining what is discussed in the Levanon Declaration, what the cited exhibits are, what the significance of the exhibits is, and how the cited evidence show the claimed invention is embodied in which specific Patent Owner product. Without Patent Owner's explanation to guide us through the evidence, we are unable to determine whether Patent Owner's evidence is tied to specific products that embody the claimed invention. Therefore, Patent Owner does not demonstrate that it is entitled to a presumption of nexus. Accordingly, we consider the issue of nexus in the context of the specific objective considerations presented by Patent Owner in what follows.

Referencing Petitioner's statements that those in the industry recognized the challenges of disseminating a 3D map and spatial information over the Web, Patent Owner asserts that '506 patent addressed a long felt but unresolved need. PO Resp. 53 (citing Pet. 18). Patent Owner's citation to the Petition is unavailing, however, as Petitioner contends that the optimized delivery over limited bandwidth communication channels stated

[7] Patent Owner filed a public version (Ex. 2072) and a confidential version (Ex. 2004) of the Declaration of Mr. Isaac Levanon. We cite only to the public version, Exhibit 2072.

in the title of the '506 patent was documented previously by Reddy. Pet. 18. Patent Owner cites techniques disclosed in Knowlton (Ex. 2011)[8] and White (Ex. 2010)[9] published in 1994 as evidence of the perceived benefits of progressive transmission to solve the well-known problem of quick and efficient transmission of image data over a network by optimizing priority and bandwidth usage and by allowing the user to receive a crude version of the image from a remote database. PO Resp. 54 (citing Ex. 2003, Agouris Decl. ¶ 137). Patent Owner cites Yap as documenting the transmission of map data over the internet to be hampered by bandwidth limitations. *Id.* at 55 (citing Ex. 2003, Agouris Decl. ¶ 139). However, Yap states that progressive transmission, which "involves sending a relatively low resolution version of an image and then successively transmitting better resolution versions," barely begins to address the problem. Ex. 2009, col. 1, ll. 54–56; col. 2, ll. 4–5. Thus, to the extent that Patent Owner relies on progressive resolution in the '506 patent as addressing long felt need, Patent Owner's reliance is misplaced. Yap suggests that the problem could be solved if, in addition to variable resolution over time (progressive transmission) resolution is also varied over the physical extent of the image. *Id*. at col. 3, ll. 14–17. As discussed above, Reddy accomplishes this goal with its level of detail approach based on the user viewpoint. Ex. 1004

[8] Ex. 2011, U.S. Patent 4,222,076 "Progressive Image Transmission" to Knowlton, issued Sept. 9, 1980.
[9] Ex. 2010, Richard L. White, Jeffery W. Percival, "Compression and Progressive Transmission of Astronomical Images," SPIE Technical Conference, 2199 (1994).

¶¶ 12–14. Thus, we are not persuaded that Patent Owner has demonstrated the '506 patent addresses a long felt need that was not addressed previously by Reddy.

Patent Owner cites industry praise for the "[t]he technology claimed in the '506 patent" as another indication that the claimed invention is not obvious. PO Resp. 55–58. Patent Owner cites favorable press in the form of recognition of 3DVU[10] by Red Herring that in 2005 3DVU was one of the most promising European companies. PO Resp. 57. We have excluded from evidence a press release concerning the Red Herring recognition. Paper 65, Decision on Petitioner's Motion to Exclude ("Dec. on Pet. Mot. to Exclude") 6. However, as to Red Herring, Mr. Levanon testifies that "[s]ince our only product was based on, used and featured the patented technology, recognition for the company also reflected recognition of our patented technology." Ex. 2072, Declaration of Isaac Levanon ("Levanon Decl.") ¶ 36. Mr. Levanon has testified that he is a member of an entity trust that owns 50% of Patent Owner, Bradium. Ex. 1019, Levanon Dep. Tr. 10:6–15:13. We assign Mr. Levanon's testimony little weight because it is not corroborated, and Mr. Levanon, as an owner of Patent Owner, has a financial interest in the outcome of this proceeding. We further note that Mr. Levanon does not identify any particular product and Patent Owner cites no evidence demonstrating that the unidentified product incorporated the

[10] Patent Owner describes 3DVU as a company formed by inventor Isaac Levanon to commercialize the technology in the '506 patent. PO Resp. 56 n.9.

invention claimed in the ’506 patent. In addition, Mr. Levanon provides no evidence concerning what Red Herring considered in identifying 3DVU as a promising company, for example, whether Red Herring considered the particular market segment or its size, or the management, marketing and technical personnel working at 3DVU in its determination that 3DVU was a promising company.

Patent Owner also cites an award from Frost & Sullivan. PO Resp. 57–58. We have excluded Patent Owner’s press release concerning the Frost & Sullivan award from evidence in this proceeding. Dec. on Pet. Mot. to Exclude 2–3. However, Isaac Levanon, an inventor of the ’506 patent, former CEO of 3DVU, and, as discussed above is a member of an entity that currently is an owner of Patent Owner, testified that Frost & Sullivan award was given in 2007 and “[b]ased on my conversations with Frost & Sullivan and my understanding of their practices and the award, I understand that after researching numerous navigation solutions offered by other companies, Frost and Sullivan concluded that our solution was the one worthy of their award.” Ex. 2072 ¶ 37. There is nothing in the evidence that ties “our solution” to the invention claimed in the ’506 patent. The 2007 Frost & Sullivan award was made long after the earliest filing date of the ’506 patent (at least as early as December 24, 2001, and possibly as early as December 27, 2000), and there is no indication in the evidence that the Frost & Sullivan award was based on any product that incorporated the claimed invention. In addition, for the reasons discussed above, we assign little weight to Mr. Levanon’s uncorroborated testimony.

As part of its industry praise arguments, Patent Owner cites discussions between 3DVU and Petitioner Microsoft Corporation concerning possible acquisition of 3DVU's technology. PO Resp. 55–56. The existence of these discussions is not confidential, as Petitioner addresses them in its non-confidential Petitioner Reply. Pet. Reply 26. Patent Owner cites confidential Exhibit 2012 (an internal Microsoft form), confidential Exhibit 2013 (material prepared by a third party for inventor Levanon's company, 3DVU), confidential Exhibit 2015 (an e-mail chain concerning 3DVU's technology and further steps) and confidential Exhibit 2034 (a preliminary due diligence document) as evidence that Petitioner highly valued the '506 patent and 3DVU and that licensing the technology would accelerate Petitioner's own development efforts. PO Resp. 55–56. Patent Owner's specific citations to valuation and to Microsoft's purported praise of the technology primarily come from Exhibit 2013, which was prepared by a third party for 3DVU, and cannot be attributed directly to Microsoft. *Id.* (citing Ex. 2013 at 3, 6, 7).

Petitioner argues that its discussions with 3DVU were not driven by the technology embodied in the '506 patent, but by non-patented technology later developed for a process displaying 3D terrain elevations. Pet. Reply 25–26. Petitioner cites to the Declaration of Yonatan Lavi. Ex. 1017 ("Lavi Declaration"). However, the Lavi Declaration, and testimony of Dr. Michalson referencing the Lavi Declaration have been excluded because Petitioner could not produce Mr. Lavi for cross examination. Paper 66, Decision on Patent Owner's Motion to Exclude, 2–4. In support of its position, Petitioner also cites U.S. Patent No. 7,561,156 B2 titled Adaptive

Quadtree-Based Scalable Surface Rendering, issued to Mr. Levanon and Mr. Lavi in 2009 from an application filed on February 8, 2006 (Ex. 1025, "the '156 patent"), as well as information concerning the elevation file format on the preliminary due diligence document (Ex. 2034, 4). Pet. Reply 25–26. The preliminary due diligence document is dated September 13, 2005. Ex. 2034, 1. Thus, Petitioner's assertion that it was interested in non-patented technology is consistent with the February 8, 2006 filing of the application that led to the issuance of the '156 patent. For the reasons discussed above, Patent Owner does not establish a nexus between the Microsoft discussions and the technology embodied in the '506 patent.

Patent Owner also cites licensing activities involving Denso's Kenwood navigation system and a demonstration project with Daewoo Precision Industries. PO Resp. 58–60. Patent Owner cites the uncorroborated testimony of Mr. Levanon, but provides no analysis or other evidence that these activities involved products that incorporate the invention claimed in the '506 patent.[11] In addition, Patent Owner provides no information concerning whether its licensing fees were substantial in light of the development activities, the scope and size of the market, or other information that could demonstrate actual commercial success. Moreover,

[11] We have excluded from evidence several of Patent Owners exhibits concerning these activities as hearsay. *See* Dec. on Pet. Mot. Exclude. Untranslated Japanese language exhibits have also been excluded. However, even the excluded exhibits, including the Japanese language exhibits that reference a trademark and product name, do not demonstrate a relationship between the products and the invention claimed in the '506 patent.

Mr. Levanon's testimony contradicts its assertion that these activities indicate commercial success—Mr. Levanon testified that "[t]hrough our experience with Denso, Daewoo, and other manufacturers of car and car navigation systems, we concluded that it would take us a very long time to get into the market of embedded car navigation systems. Therefore, we decided to embark on a new field using our core technology–mobile navigation." Ex. 2072, Levanon Decl. ¶ 82.

Patent Owner further argues that, in view of its limitations in the car navigation system market, it embarked on the development of mobile navigation products and that these products, particularly Navi2Go, are also evidence of commercial success. PO Resp. 60–61. Although Mr. Levanon's uncorroborated testimony characterizes Navi2Go as a client-server system in which 3DVU maintained a server containing image, terrain, and map data and that an end user client could use the app to stream such data in real time (Ex. 2072, Levanon Decl. ¶ 85), Patent Owner provides no evidence that the system employed any of the features of the invention claimed in the '506 patent. Although Mr. Levanon testifies that thousands of people were willing to pay $9.99/month to access Navi2Go" (Ex. 2072, Levanon Decl. ¶ 90) and that "[t]he monthly user base grew at 30% rate at the time." (*id.*), Patent Owner provides no evidence of the market size, 3DVU's share of that market or specific information from which we can assess whether the product was commercially successful. Patent Owner further acknowledges that "the costs of maintaining Navi2Go, in particular maintaining sufficient server capacity, taxed the resources of the company, and it was difficult to achieve profitability. An increase in users resulted in a rapid increase in

server costs." *Id*. at ¶ 93. Based on this information, Patent Owner has not established commercial success of Navi2Go or tied that commercial success to the invention claimed in the '506 patent.

There is a presumption of nexus for objective considerations when the patentee shows that the asserted objective evidence is tied to a specific product and that product is the invention disclosed and claimed in the patent. *See WBIP v. Kohler*, 829 F. 3d 1317 (Fed. Cir. 2016). As discussed above, Patent Owner speaks in generalities, but does not provide any specific analysis tying the invention claimed in the '506 patent with the alleged industry praise, discussions between 3DVU and Petitioner, licensing activities and the products cited as evidence of commercial success. Patent Owner, therefore, does not demonstrate a nexus. In the absence of an established nexus with the claimed invention, secondary consideration factors are not entitled to much, if any, weight and generally have no bearing on the legal issue of obviousness. *See In re Vamco Mach. & Tool, Inc.*, 752 F.2d 1564, 1577 (Fed. Cir. 1985).

6. Conclusion

In consideration of the foregoing and based on the complete record, having weighed each of the *Graham* factors, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that claims 1–21 of the '506 patent are unpatentable as obvious under 35 U.S.C. § 103(a) over the combination of Reddy and Hornbacker.

V. MOTION FOR OBSERVATIONS

Patent Owner's observations are directed to the cross-examination testimony of Dr. Michalson (Ex. 2078), who was cross-examined after Petitioner filed its Petitioner Reply. We have considered Patent Owner's observations and Petitioner's responses in rendering our decision, and have accorded the testimony the appropriate weight as explained above. *See* Obs. 1–15; Obs. Resp. 1–14.

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1–21 of the '506 patent are *unpatentable*; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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