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Paper 69
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICROSOFT CORPORATION,
Petitioner,

v.

BRADIUM TECHNOLOGIES LLC,
Patent Owner.

Case IPR2016-00448
Patent 7,908,343 B2

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

McNAMARA, *Administrative Patent Judge*.

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

BACKGROUND

On July 25, 2016, we instituted an *inter partes* review of claims 1–20 (the "challenged claims") of U. S. Patent No. 7,908,343 B2 ("the '343 Patent"). Paper 9 ("Dec. to Inst."). Patent Owner filed a Confidential Corrected Patent Owner Response (Paper 20, "PO Resp.") and a public version (Paper 21) and a Motion to Seal (Paper 19), Petitioner filed a Petitioner Reply (Paper 34, "Pet. Reply"). Petitioner and Patent Owner both filed Motions to Exclude (Papers 45 and 47, respectively) and corresponding oppositions (Papers 49 and 47, respectively) and replies (Papers 55 and 58 (confidential) and 59 (public), respectively). Patent Owner also filed a Motion to Seal its Opposition to Petitioner's Motion to Exclude. Paper 52. Transcripts of a combined oral hearing in this proceeding and IPR2016-00449 held on April 18, 2017 (Paper 80, "Hrg. Tr." (public); Paper 81, "Confidential Hrg. Tr." (confidential)) have been entered into the record.

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. §318(a). We base our decision on the preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

Having reviewed the arguments of the parties and the supporting evidence, we conclude that Petitioner has demonstrated by a preponderance of the evidence that the challenged claims are unpatentable.

THE '343 PATENT (EXHIBIT 1001)

In the '343 Patent, large scale images are retrieved over network communication channels for display on client devices by selecting an update image parcel relative to an operator controlled image viewpoint to display on the client device. Ex. 1001, Abstract; col. 3, ll. 44–48. A request for an

update image parcel is associated with a request queue for subsequent issuance over a communication channel. *Id*. at col. 3, ll. 48–51. The update image parcel is received in one or more data packets on the communications channel and is displayed as a discrete portion of the predetermined image. *Id*. at col. 3, ll. 51–57. The update image parcel optimally has a fixed pixel array size and may be constrained to a resolution equal to or less than the display device resolution. *Id.*

The system described in the ’343 Patent has a network image server and a client system where a user can input navigational commands to adjust a 3D viewing frustum for the image displayed on the client system. *Id*. at col. 5, ll. 24–53. 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. *Id.* at col. 3, ll. 44–48. When the viewing frustum is changed by user navigation commands, a control block in 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. *Id.* at col. 7, ll. 8–25.

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. *Id*. at col. 6, ll. 1–6. Figure 2 of the ’343 patent is reproduced below.

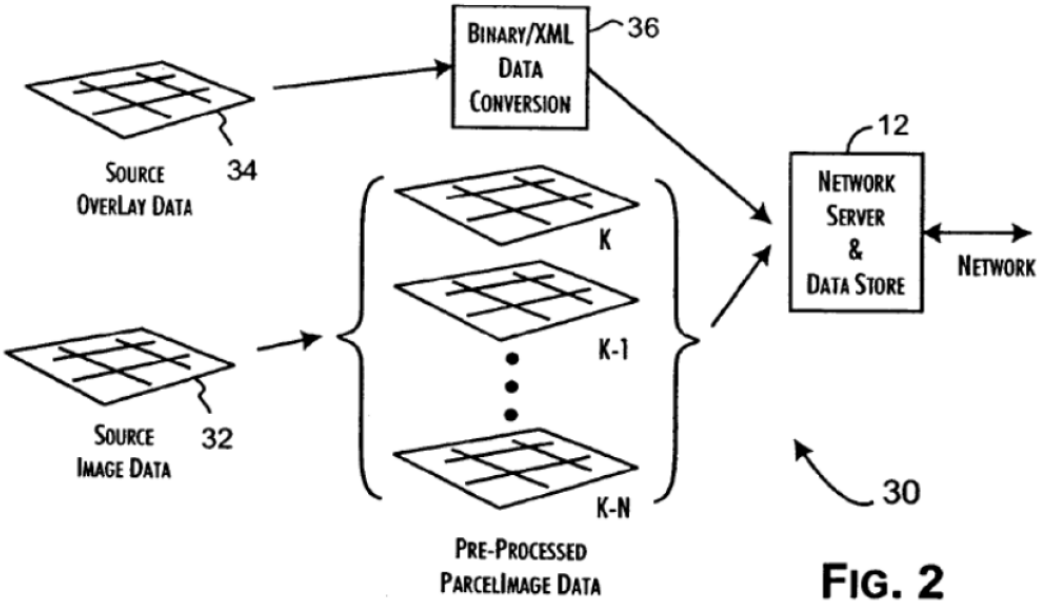

FIG. 2

Figure 2 depicts preparation of pre-processed image parcels at the network image server. *See id.* at col. 4, ll. 54–57; col. 5, ll. 60–62; 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. 4–6. 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. 6–11. 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. 11–16. 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. 17–22. The image parcels are stored in a file of defined configuration, such that any parcel can be located by specification of a K_D, X, Y value, representing the image set resolution index D and the corresponding image array coordinate. *Id*. at col. 6, ll. 23–26. The TCP/IP protocol is used to deliver image parcels, e.g., 2K-byte compressed image parcels, to the clients. *Id.* at col. 7, ll. 28–29, 35–37. For preferred embodiments, where network bandwidth is limited, entire image parcels preferably are delivered in corresponding data packets. *Id.* at col. 7, ll. 29–32. 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. *Id*. at col. 7, ll. 32–35.

ILLUSTRATIVE CLAIM

Claim 1, which is drawn to a method is illustrative:

> 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-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, wherein 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;

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.

GROUND OF INSTITUTION

In our Decision to Institute, we instituted trial on the following challenge to patentability:

Claims 1–20 as obvious under 35 U.S.C. § 103(a) over Reddy[1] in view of Hornbacker.[2] Dec. to Inst. 44–45.

[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").

CLAIM CONSTRUCTION

In our Decision to Institute, we applied the ordinary and customary meaning to the terms not construed. Dec. to Inst. 11–12. We determined that the term "mesh" in claims 13 and 20 required no further construction. *Id*. at 12. 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 also involved the '343 Patent, in our Decision to Institute in this proceeding, 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. to Inst. 11. Neither party proposed constructions for any other claim terms. *Id*. at 12.

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 to Institute) 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. Petitioner does not oppose this construction and Patent Owner's proposed construction is consistent with the usage of the term in the '343 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*. 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 '343 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 (citing Ex. 1001, col. 1, ll. 25–30). Patent Owner contends that wireless networks are a form of limited bandwidth communications channel as disclosed in the '343 Patent, which contemplates performance on wireless devices in describing its preferred embodiment of 4 concurrent threads. *Id.* at 10–11 (citing Ex. 1001, col. 3, ll. 6–9, col. 7, ll. 64–67).

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 '343 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. 1001, col. 3, ll. 6–9; 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 ("Levanon Test.") 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. 12 (citing Ex. 1001, col. 5, ll. 31–34, Ex. 2003, Declaration of Dr. Peggy Agouris ("Agouris Decl.") ¶¶ 37–43). Patent Owner contends that the '343 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 12–13.

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 '343 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 personal 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. 1001, col. 2, ll. 45–53; col. 2, l. 59–col. 3, l. 6. 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. 7–19. 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 itself has a limited communication bandwidth.

LEVEL OF ORDINARY SKILL IN THE ART

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).

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 '343 Patent, a person of ordinary skill in the art for the technology disclosed in the '343 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. 10 (citing Ex. 1005 ¶¶ 27–31).

Patent Owner cites the Declaration of Dr. Peggy Agouris (Ex. 2003, "Agouris Decl.") 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. 8 (citing Ex. 2003 ¶¶ 17–18). In addition, Patent Owner argues that the education levels of the listed inventors for the '343 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. *See* Ex. 2003, Agouris Decl., ¶ 18 (stating that Dr. Agouris's proffered opinions would not change even if Petitioner's definition of the level of ordinary skill in the art is applied). Based on the foregoing, we determine that a person of ordinary skill in the art at the time of the invention of the '343 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.

ANALYSIS OF PRIOR ART CHALLENGES

The sole ground on which we instituted *inter partes* review is Petitioner's challenge to clams 1–20 as obvious under 35 U.S.C. § 103 over the combination of Reddy and Hornbacker. A patent claim is unpatentable under 35 U.S.C. § 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 said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 406 (2007). The test for obviousness is

whether the combination of references, taken as a whole, would have suggested the patentees' invention to a person having ordinary skill in the art. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). 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 ordinary skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

Whether a patent claiming the combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *KSR*, 550 U.S. at 417. To reach this conclusion, however, requires more than a mere showing that the prior art includes separate references covering each separate limitation in a claim under examination. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). Obviousness requires the additional showing that a person of ordinary skill at the time of the invention would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention. *Id.* However, a precise teaching directed to the specific subject matter of a challenged claim is not necessary to establish obviousness. *KSR*, 550 U.S. at 418. As the Supreme Court recognized, in many cases a person of ordinary skill "will be able to fit the teachings of multiple patents together like pieces of a puzzle," recognizing that a person of ordinary skill "is also a person of ordinary creativity, not an automaton." *Id.* at 420–21. Against this general background, we consider the references, other evidence, and arguments of the parties.

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 browser plug-in. Pet. 18, 26. 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. Pet. 15 (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 (citing Ex. 1003, Abstract, p. 6, l. 20–p. 7, l. 1; p. 13, l. 28–p. 14, l. 11, p. 14, ll. 26–28). According to Petitioner, like Reddy, Hornbacker addresses similar technical issues as those addressed in the ’343 Patent, i.e., network and system performance problems in accessing large image files from a network file server. *Id.* at 18. The ’343 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. 1001, col. 1, ll. 48–51. 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. 14.

Patent Owner contends that Reddy fails to disclose several of the elements recited in the claims, including the “limited communications bandwidth computer device” recited in all the claims, 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. Patent Owner contends that Hornbacker does not disclose storing each data parcel on the remote computer in a file of defined configuration such that a data parcel can be located by specifying a K_D, X, Y value, as recited in all the claims. *Id.* at 17–18. Patent Owner further contends that neither Reddy nor Hornbacker discloses the prioritizations elements of claims 10 and 11. *Id.*

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 to 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, but 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. PO Resp. 18–19.

Patent Owner further contends that objective considerations demonstrate that the claimed subject matter is not obvious under 35 U.S.C. § 103. PO Resp. 52–60.

Our Decision to Institute 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, 13.A, 13.B). For consistency, we use the same claim element designations in this Decision. Independent

claim 1 and claims 2–12 that depend from claim 1 are drawn to a method. Independent claim 13 and claims 14–20 that depend from claim 13 are drawn to an apparatus.

Patent Owner disputes that Reddy and Hornbacker disclose certain claim elements reciting (i) a limited bandwidth communication channel and a limited communication bandwidth computer device in all claims (PO Resp. 21–26), (ii) selection of data parcels for progressive resolution enhancement in claims 13.F, 13.G, 13.H and dependent claim 14–20 (*id*. at 26–28), (iii) prioritization of requests for image parcels recited in dependent claim 15 and the use of a prioritization value recited in dependent claims 10 and 11 (*id.* at 28–35), and (iv) the "efficient data structure recited in claim 1.D, 1.J, 13. J, and 13.P and all dependent claims (*id.* at 35–43). Our Decision to Institute includes a detailed analysis of each claim element in the context of the Reddy and Hornbacker references. Dec. to Inst. 23–44. Mindful that at this stage of the proceeding the burden of proof is on the Petitioner by a preponderance of the evidence, below we address the specific arguments raised by Petitioner and Patent Owner as to whether the claims are unpatentable.

Reddy

Reddy "aim[s] to enable visualization of near photorealistic 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.* at ¶¶ 9, 10. Reddy also discloses a custom terrain visualization package (TerraVision II) that can browse standard VRML data structures. *Id.* at ¶ 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.* at ¶¶ 9, 48.

Recognizing that the time to download and render a terrain model would prohibit real time interaction, Reddy employs level of detain (LOD) techniques to change a model's complexity based on selection criteria, such as distance from the viewpoint or projected screen size. *Id.* at ¶¶ 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.* at ¶ 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.* at ¶ 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 the network" because "we need only fetch and display for the region that the user is viewing, and only at a sufficient resolution for the user's viewpoint." *Id.* at ¶ 17.

Reddy employs terrain 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.* at ¶¶ 18, 19, 22. To implement the multi-resolution hierarchy, a tree file initially loads a single geotile. *Id.* at ¶ 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.* at ¶¶ 19, 21. Except for extending the tree for higher resolution, the hierarchy of tree files need be generated only one time. *Id.*

A user browses terrain data using a standard VRML plug-in for Internet browsers, such as Internet Explorer. Ex. 1004, ¶ 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 position-changed eventOut of a ProxmitySensor placed around the entire scene to

project a 3D geocentric coordinate onto the map, allowing users to ascertain their location). *Id.* at ¶¶ 35–37.

TerraVision II is a custom VRML browser specifically designed to optimize navigation of Reddy's VRML databases. *Id.* at ¶ 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*. at ¶ 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*. at ¶ 42), (iii) techniques to address discontinuities resulting from adjacent tiles of different resolutions *id.* at ¶ 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*. at ¶ 44), (v) tile caching to reduce the need to read and parse data for recently visited regions (*id* at ¶ 45), and (vi) extrapolation to predict a user's future moves based on current flightpath and prefetch relevant tiles for immediate rendering (*id*. at ¶ 46). As noted above, however, TerraVision II is not required to view Reddy's VRML data sets. *Id.* at ¶ 47.

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. Ex. 1003, p. 13, ll. 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 p. 14, ll. 11–12.

Independent Claim 1

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 parcel." Petitioner cites Reddy as teaching geographic data divided into tiles, each of which is an element of the source image array. Pet. 24. Petitioner cites Hornbacker as likewise teaching an image divided into tiles. *Id.* Noting that Reddy discloses 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 to retrieve geotiles containing URL links to imagery files. *Id*. at 29. 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 30. According to Petitioner, 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*.

Patent Owner contends that Reddy does not disclose a limited communication bandwidth computer device, as recited in independent claim 1 and incorporated into dependent claims 2–12. PO Resp. 23–26. In a related argument, Patent Owner also contends that Reddy does not disclose a limited bandwidth communications channel, as recited in independent apparatus claim 13 and incorporated into dependent claims 14–20. *Id*. at 21–22. In its "limited bandwidth" arguments, Patent Owner contends that Reddy does not disclose the operation of TerraVision II with a narrowband or wireless connection or any other relatively low bandwidth network connection and that Petitioner's mention of a laptop as disclosing a limited bandwidth communications channel mischaracterizes Reddy. *Id.* at 22. 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 22 (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 fast 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. 25. 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.*

However, we find persuasive Petitioner's response that the subject matter Patent Owner cites from Digital Earth also discloses that some of TerraVisons's features 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." Pet. Reply 5 (citing Ex. 2066, 4). We also note that 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. As discussed above, our construction of "limited communications bandwidth computer device" is not limited to a small client, such as PDAs, smartphones, or automobile navigation systems, nor is our construction of a "limited bandwidth communications channel" limited to a wireless channel. 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 the features of claim element 1.A. *See* Ex. 1004 ¶ 48. In view of the above evidence and arguments, we find that Petitioner has shown that Reddy and Hornbacker disclose the features of claim element 1.A, i.e. "issuing from a limited communication bandwidth computer device to a remote computer a request for an update parcel."

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. 30. 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*. Petitioner presents persuasive 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 30–31 (citing Ex. 1004 ¶ 3; Ex. 1005, Michalson Decl. ¶ 146). Petitioner further cites Hornbacker as teaching that URLs containing the zoom level and location of a tile offering advantageous way to request tiles. *Id.* at 31. Patent Owner does not dispute explicitly Petitioner's contentions concerning element 1.B. Having considered all the evidence and arguments of record, we are persuaded that Petitioner has shown that that Reddy's pan and zoom system based on a viewpoint chosen by the user discloses the features of claim element 1.B

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. 31. 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.* Patent Owner does not dispute explicitly Petitioner's contentions concerning claim element 1.C. Reddy and Hornbacker both disclose that the displayed element is generated using

terrain tiles, including imagery that is downloaded, texture mapped and displayed to the user. Ex. 1004, ¶¶ 3, 24, Michalson Decl., Ex. 1005, ¶ 149. Having considered the above evidence and arguments of record, we are persuaded that Petitioner has demonstrated that the references disclose claim element 1.C. Further below in this Decision, we address Patent Owner's contention that a person of ordinary skill would not have been motivated to apply Hornbacker's teaching concerning document imaging to Reddy's mapping system.

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-N} of derivative images of progressively lower image resolution." *Id*. at 31. Patent Owner contends that neither Reddy nor Hornbacker discloses the "efficient data structure" recited in claim elements 1.D, 1.J, 13.J, and 13.P. PO Resp. 35–36. We address these limitations together, as discussed by Patent Owner. Claims elements 1.D and 13.J are substantially the same. Claim element 13.J recites "wherein delivering the defined data parcel further comprises processing source image data to obtain a series of K_{1-N} of derivative images."

As to elements 1.D and 13.J, 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. Pet. 31–32 (citing Ex. 1004 ¶¶ 14–17, 19–21, 24, 42, Fig. 1; Ex. 1550 ¶¶ 1512–53), 52–53. 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 pathname to generate the necessary VRML data. *Id*. at 32 (citing Ex. 1004, ¶ 52, Michalson Decl.

¶ 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, 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 Michalson Decl. ¶ 154).

Claim elements 1.J and 13.P are substantially the same. Claims 1.J and 13.P recite "storing each data parcel on the remote computer in a file of a defined configuration such that a data parcel can be located by the specification of a K_D, X, Y value that represents the data set resolution index D and corresponding image array coordinate." *Id*. at 38, 54. 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*. at 38 (citing Ex. 1004, ¶¶ 19–22, 24–26).

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 understand 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 '343 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 39 (citing Michalson Decl. ¶¶ 169–171).

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 '343 Patent." Michalson Decl. ¶ 170. 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.* 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 interpret 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.* at ¶ 171. According to Petitioner, identifying tiles using geocentric coordinates (e.g., latitude, longitude) corresponds to using x, y, z coordinates within a single image. Pet. 38.

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 '343 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. 37. However, as Petitioner points out, the words "conformal" or "cylindrical" do not appear in the '343 Patent. Pet. Reply 13. Petitioner also notes that Patent Owner has accused Petitioner's Bing Map Tile System of infringing the claims of '343 Patent. *Id.* at 13–14. 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 '343 Patent.[3]

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. 37–38. 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 '343 Patent. *Id.* at 38. 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.* at 37. 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 38 (citing 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, Declaration of Dr. Peggy Agouris ("Agouris Decl.") ¶ 147). Patent Owner states that VRML

[3] Patent Owner's citation of Petitioner's accused product as evidence of features of the claims of the '343 Patent could be perceived an improper attempt to obtain an advisory opinion from this panel on infringement, an issue that is outside our jurisdiction.

files map images to geometry using the "image texture" node, which specifies a texture map via URL. *Id.* at 38–39 (citing Agouris Decl., Ex. 2003 ¶ 147). 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 '343 Patent or Hornbacker's K_D, X, Y image width. *Id.* at 39.

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. 39–40. Patent Owner asserts that Dr. Michalson conflates VRML coordinates of an image with the array indices of an image. *Id.* at 40. According to Patent Owner, in the content 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*. at 40–41. 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 41.

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 12. 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*. Petitioner further notes that the

claims of the ’343 Patent do not exclude the use two-dimensional imagery with other data, such as a polygon mesh to depict elevation data or textures, such as satellite imagery and aerial photography, that are unique to particular coordinates. *Id.* at 13. 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 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 11 (citing PO Resp. 38–39). Although Patent Owner contends that “[a] VRML file does not generate URLs and stores them in the ‘Image Texture’ node,” Patent Owner agrees that “VRML files map images to geometry using the ‘Image Texture’ node, which specifies a texture map via URL.” PO Resp. 38–39.

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 14. 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.* (citing Ex. 1005, Michalson Dec. ¶ 169). Based on the scope of the 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.

Patent Owner contends that Hornbacker does not disclose the efficient data structure recited in claims 1 and 13 because Hornbacker does not disclose processing source image data to obtain a series of K1-N of derivative images. PO Resp. 41 (citing Ex. 2003, Agouris Decl. ¶ 120). Patent Owner argues that Hornbacker does not 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.* at 41–42 (citing Ex. 1003, 6:1–17, 10:24–28, Figs. 3B, 4A, 4B). 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. 42 (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 42 (citing Agouris Decl., Ex. 2003, ¶¶ 121–123; Ex. 1003 pp. 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 tile storagelocation or in the view tile name." *Id.* at 9:20–25.

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. 43. However, as Petitioner points out, Patent Owner acknowledges that 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. Pet. Reply 15, *see also* Ex. 1003, 5:16–24, 29–31, Figs. 3A and 3B. Having reviewed and considered all of the above evidence and arguments, we are persuaded that Petitioner has demonstrated that Reddy and Hornbacker disclose claim elements 1.D, 1.J, 13.J, and 13.P.

Petitioner identifies as claim element 1.E the limitation that recites, "wherein series image K0 being subdivided into a regular array," and as claim element 1.F the recitation that recites, "wherein each resulting image parcel of the array has a predetermined pixel resolution." Pet. 33. 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 1a 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.* Petitioner notes that this disclosure is similar to the teachings in the '343 Patent at column 6, lines 6–9. *Id.* Patent Owner does not dispute explicitly Petitioner's contentions that the references disclose claim element 1.E or 1F. In light of the evidence and the arguments discussed above, we are persuaded that Petitioner has demonstrated the references disclose claim elements 1.E and 1.F.

Petitioner identifies as claim element 1.G the recitation that the image data has a color or bit per pixel depth representing a data parcel size of a predetermined number of bytes. Pet. 33–34. 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*. at 34 (citing Ex. 1004, p.31 sidebar). Petitioner further contends that a person of ordinary skill would recognize the size of the data representing an uncompressed tile is similar to the product of the bit depth multiplied by the pixel dimensions and would understand from this teaching that the data parcel size for each tile is the same, in a manner similar to that disclosed in the '343 Patent at

column 6, lines 6–16. *Id.* at 34–35. 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 35 (citing Ex. 1003, p. 6, l. 20–p.7, l. 3; Michalson Decl. ¶ 162). In light of the evidence and arguments discussed above, we are persuaded that Petitioner has demonstrated that the references disclose element 1.G. Patent Owner does not dispute explicitly Petitioner's contentions that the references disclose element 1.G.

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. 35–36. Petitioner argues that Reddy discloses this aspect of the '343 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 36. Noting that 1/2 the width x 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 Fig. 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 cites the testimony of its expert, Dr. Michalson, for

the proposition that the resolution and array subdivision are varied in relation and a fixed size of 128 by 128 pixels is maintained. *Id.* (citing Michalson Decl. ¶ 164). 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.* at 36–37. 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 (citing Michalson Dec. ¶ 165). Patent Owner does not dispute explicitly Petitioner's contentions that the references disclose claim element 1.H. Having considered all of the above above arguments and evidence, we are persuaded Petitioner has demonstrated that the references disclose claim element 1.H

Petitioner identifies as claim element 1.I the recitation "wherein the processing further comprises compressing each data parcel." Pet. 37. Acknowledging that Reddy does not mention the use of compression explicitly, Petitioner argues that a person of ordinary skill would recognize that compression would be advantageous in the context of a network system involving repeated transfers of image data on a distributed network with limited bandwidth, for example to a laptop computer used in emergency response situation. *Id*. Petitioner notes that a person of ordinary skill would be familiar with image compression and 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, Michalson Dec. ¶ 166). 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.* Patent Owner does not dispute explicitly Petitioner's that the references disclose claim element 1.I. Having considered the above arguments and evidence, we are persuaded Petitioner has demonstrated that the references disclose claim element 1.I.

Petitioner identifies as claim element 1.K the limitation that recites "receiving said update parcel from the data parcel stored in the remote computer over a communications channel" and as claim element 1.L the limitation that recites "displaying on the limited communications bandwidth computer device the update data parcel that is a part of said predetermined image, an image wherein said update parcel uniquely forms a discrete portion of said predetermined image." Pet. 40–41. 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.K. In view of the above evidence and arguments of record, we are persuaded that Petitioner has demonstrated that Reddy and Hornbacker disclose claim element 1.K

With regard to claim element 1.L, 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.* at 41 (citing Ex. 1004 ¶¶ 3, 15–16, 18, 24, Fig. 1). As discussed above

with respect to claim element 1.D, we are persuaded that satellite imagery and aerial photography are unique to particular coordinates. Based on the foregoing, 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.

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.

Independent Claim 13

Independent claim 13 is an apparatus claim in which many of the structural elements correspond to steps of the method discussed above with respect to claim 1. Elements of claim 13 not included in claim 1 are: claim element 13.H ("render said defined data parcel over discrete portion of said mesh to provide for a progressive resolution enhancement of said defined image on said display"), claim element 13.O ("wherein the processing further comprises compressing each data parcel"), and claim element 13.P ("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 array coordinate"). We addressed claim element 13.P in our discussion of claim elements 1.D, 1.J, 13.J, and 13.P above. Patent Owner does not dispute explicitly that data compression (element 13.O) is disclosed by Reddy and Hornbacker. We discussed the disclosure of data compression above. We do not repeat the discussion of these elements here and note that in view of the evidence and arguments discussed above, we are persuaded that Petitioner

has demonstrated that claim elements 13.O and 13.P are disclosed by Reddy and Hornbacker.

We turn our attention to claim element 13.H. Patent Owner contends that neither Reddy nor Hornbacker discloses "progressive resolution enhancement," as that feature is recited in elements 13.F, 13.G., and 13.H. PO Resp. 26–28. Together the claim limitations identified by Petitioner as claim elements 13.F, 13.G, and 13.H recite that "said processor is operative to select said defined data parcel, retrieve said defined data parcel via said limited bandwidth communications channel interface 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. 51–52.

Petitioner contends that claim elements 13.F, 13.G. and 13.H are taught by Reddy and Hornbacker for the same reasons as those articulated for claim elements 1.B (Reddy teaches an algorithm executed by a processor to select identified tiles), 1.A (Reddy teaches a local cache on a display device is advantageous to enable rapid display of pre-fetched tiles that are cached after being received), and 1.C (Reddy teaches a quad-tree structure that facilitates use of a progressive coarse-to-fine algorithm to retrieve and display tiles). *Id.*

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. 27 (citing Ex. 2003, Agouris Decl. ¶¶84–86). 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. *Id.* However, Patent Owner acknowledges that when the user approaches a

region of terrain, more detail is progressively loaded in a coarse-to-fine fashion. *Id.* 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 28. 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*.; Ex. 2003, Agouris Dec. ¶ 85 ("TerraVison II system performs this fixed, simple algorithm in response to the user's proximity to any particular tile, operating in a fixed manner with no selection being done by the processor.").

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, Michalson Reply Decl., Ex. 1016 ¶ 58). Claim elements 13.F, 13.G, and 13.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. As Petitioner points out, Reddy satisfies these limitations by its disclosure of a given tile replacing a lower resolution tile. *Id*. (citing Ex. 1004 ¶ 44). Patent Owner's arguments that Reddy discloses selecting tiles only as a user approaches an area is not persuasive because these claim limitations of claim 13 do not exclude the processor selecting tiles based on user action.

Accordingly, having considered all of the above evidence and arguments, we are persuaded that Petitioner has demonstrated by a preponderance of evidence the combination of Reddy and Hornbacker teaches all the limitations of claim 13.

Dependent Claims 2–9

Claim 2 recites that the update data parcel further comprises one of an image parcel textured mapping, a map parcel, a navigation cue, a text overlay, and a topography. Patent Owner does not dispute explicitly that the features of dependent claim 2 are disclosed in the references. We agree with Petitioner that Reddy's disclosure of terrain tiles (update data parcels) that includes satellite or aerial imagery (map parcels) and elevation data (topography) disclose the features recited in dependent claim 2. Pet. 41 (citing Ex. 1004, ¶¶ 2–3, 12, 17–18, 20, 24, 25, 38; Ex. 1005, ¶ 180).

Claim 3 recites that the limited communications bandwidth computer device comprises one of a mobile computer system, a cellular computer system, and other devices. Petitioner contends that Reddy teaches that the client may be implemented using a browser on a laptop, which is a mobile computer system, as claimed. Pet. 42. Petitioner also cites Reddy's disclosure that of using such system in a distributed, time-critical environment, such as disaster response and Hornbacker's disclosure of a browser plug in for use on a palm top computer as synonymous with a handheld system of personal digital assistant. Patent Owner does not address explicitly Petitioner's contention relative to claim 3. Based on the above evidence and arguments, we are persuaded that Petitioner has demonstrate by a preponderance of the evidence that Reddy and Hornbacker

disclose the limitations of claim 3, consistent with the ordinary meaning of a limited communications bandwidth computer.

Claims 4 and 5 recite limitations concerning the predetermined pixel resolution for each data parcel being a power of 2 (claim 4) and one of 32 x 32, 64 x 64, 128 x 128, and 256 x 256 (claim 5). Petitioner cites its discussion of claim element 1.F and the Michalson Declaration in support of its contention that Reddy discloses these limitations. Pet. 42. Patent Owner does not dispute explicitly Petitioner's contentions concerning claims 4 and 5. Based on the evidence and arguments, we are persuaded that Petitioner has shown by a preponderance of the evidence that Reddy discloses the limitations in claims 4 and 5.

Claim 6, which depends from claim 1, recites that the communications channel is a packetized communications channel and that the update data parcel is received from the packetized communication channel in one or more data packets. *Id*. We agree with Petitioner that Reddy and Hornbacker disclose transmitting system tiles over the World Wide Web, which a person of ordinary skill would recognize to use the well-known TCP/IP protocol to transmit data packets. *Id.* at 42–43. Patent Owner does not dispute explicitly that these features are disclosed in Reddy and Hornbacker. Based on the evidence and arguments discussed above, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that the references disclose the limitations recited in claim 6.

Claim 7 depends from claim 6 and recites that the data packet contains an update image parcel as a compressed representation of the discrete portion of the predetermined image. *Id.* at 43. Noting that both Reddy and Hornbacker disclose the TCP/IP protocol, Petitioner contends that it would

be an obvious modification of Reddy to transmit compressed image tiles in data packets as taught by Hornbacker. *Id.* at 43–44. Patent Owner does not dispute explicitly Petitioner's contentions and we are persuaded by Petitioner's argument that compressing image tiles as taught by Hornbacker would be an obvious modification of Reddy.

Claim 8 depends from claim 7 and recites that the data packet contains an update image parcel as a fixed compression ratio representation of the discrete portion of the predetermined image. Petitioner persuasively cites to Hornbacker's teaching of a fixed 4:1 compression ratio that could be advantageously combined with the teaching of Reddy. *Id.* at 44. Patent Owner does not dispute explicitly Petitioner's contentions that the references disclose the limitations of claim 8. Based on the above evidence and arguments, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that the limitations in claim 8 are disclosed by the references.

Claim 9 depends from claim 7 and recites that the "update image parcel contains pixel data in a fixed size array independent of the pixel resolution of said predetermined range." Petitioner persuasively cites the disclosure in Reddy of using fixed sized imagery tiles, e.g., 128 x 128 pixels regardless of the pixel resolution of the original imagery (predetermined image) processed, even though the original source imagery can be massive. Pet. 44–45. Patent Owner does not dispute explicitly that the feature recited in claim 9 is disclosed in the references.

Dependent Claims 10, 11, 15, and 16

Claim 10 depends from claim 1. Petitioner identifies claim element 10.A as reciting, "wherein issuing the request for an update data parcel

further comprises preparing the request by associating a prioritization value to said request." Pet. 45. Petitioner argues Reddy teaches that the TerraVision II browser utilizes a progressive coarse-to-fine algorithm to load and display new data as a user approaches an area of terrain or to display the highest resolution data available if some high-resolution tiles have yet to arrive and employs an algorithm to predict a user's future movement by extrapolating a flightpath and pre-fetching tiles accordingly. *Id.*

Claim element 15.A recites "said processor is operative to prioritize the retrieval of said data parcel among a plurality of data parcels pending retrieval." Pet. 55. Claim element 15.B recites "wherein the relative priority of the data parcel is based on the difference in resolution of the image parcel and resolution of said plurality of selected data parcels." *Id.* As to claim element 15.A, Petitioner contends that "[p]ertinent teachings regarding the client device's assigning a priority value to multiple tiles (data parcels) pending retrieval are discussed above in regard to claim element 10.A." *Id.* As to claim element 15.B, Petitioner argues that Reddy prioritizes the retrieval of lower resolution tiles over higher resolution tiles as discussed in regard to claim element 10.A. *Id.*

Petitioner identifies as claim element 10.B the recitation "wherein said prioritization value is based on the resolution of said update data parcel relative to that of other data parcels previously received by the limited communication bandwidth computer device." *Id*. at 46. Petitioner argues that a person of ordinary skill would be motivated to employ the progressive retrieval of tiles in a coarse-to-fine manner and maintenance of a tile cache to eliminate the need to reload and parse data for terrain regions the user has recently browsed, as disclosed in Reddy. *Id.* Thus, according to Petitioner,

a person of ordinary skill would understand Reddy to teach that prioritization of requests for tiles is based on tiles previously received, thereby avoiding the use of additional bandwidth on lower-resolution tiles already in memory. *Id.*

Petitioner identifies as claim element 10.C the recitation "wherein issuing said request is responsive to said prioritization value for issuing said request in a predefined prioritization order." Pet. 47. Petitioner contends that the retrieval of certain tiles based on the coarse-to-fine progressive display of tiles would be accomplished according to rules mean that a predefined prioritization order exists before the browser request tiles on a particular occasion. *Id.* (citing Michalson Decl. ¶ 197).

As to claim 10, Patent Owner contends that neither Reddy nor Hornbacker discloses the use of a "prioritization value." PO Resp. 32–35. In addition, Patent Owner contends that neither Reddy nor Hornbacker discloses prioritization of requests for image parcels, including based on difference in resolution, as recited in claim 15. *Id.* at 28–32. Patent Owner acknowledges that in Reddy, higher resolution "child" tiles representing a location are loaded as the user moves closer to the location and crosses a proximity threshold. *Id.* at 27–28. According to Patent Owner, this fixed "coarse-to-fine" algorithm does not involve prioritization of tiles, but instead this distance-based LOD constitutes a basic form of streaming in which various areas of the screen are displayed at various resolutions. *Id.* at 29–30. Indeed, in the context of TerraVision's ability to use stored lower resolution tiles until higher resolution tiles arrive over the network, Reddy states that "TerraVison implements a basic form of streaming for both geometry and imagery." Ex. 1004 ¶ 44. However, we do not understand this "streaming"

to negate the implementation of priority in determining which tiles to request, as claimed. As discussed above, in the context of determining which tiles to request, Reddy employs an algorithm that requests higher resolution tiles when a user crosses a proximity threshold. That these higher resolution tiles are children of a lower resolution tile does not change the fact that the next request for tiles is prepared based on a proximity value, placing these higher resolution tiles as higher in priority than other tiles.

We agree with Petitioner that Patent Owner attempts to read into the priority features of the claims an algorithm that requires assigning a priority value to specific parcels. No such algorithm is recited in the claims, which require only that the update data parcel request be prepared by "associating a prioritization value to said request."

The priority is also influenced by Reddy's disclosure of pre-fetching. Patent Owner argues that Reddy's pre-fetching based on extrapolation of a user's flight path discloses nothing about the order of tile retrieval because there is "no way to decide what resolution level of what location to download in what order." PO Resp. 30. According to Patent Owner, Dr. Michalson's testimony that a person of ordinary skill would recognize that to prioritize a request Reddy would assign a higher value to a request for tiles that are needed sooner assumes information not disclosed in Reddy, which does not provide a particular way to prioritize tile requests. *Id.* at 31.

However, we agree with Petitioner that Patent Owner's argument is based on a narrow interpretation of priority that is not consistent with the understanding of one of ordinary skill. Reddy's disclosure of "prediction and pre-fetching" of tiles states that TerraVison attempts to predict users' future moves by simple extrapolation of current flight path. Ex. 1004 ¶ 46.

Pre-fetching tiles based on such prediction indicates that tiles along the path have a higher priority than other tiles in the image field. That Reddy does not disclose an exact algorithm for such prediction and pre-fetching does not render the claims 10, 11 and 15 any less obvious, as none of these claims recites a specific algorithm, other than to require that an update data parcel request be made by associating with the request a prioritization value based on the resolution of the update data parcel relative to other data parcels previously received. As discussed above, as the user approaches a particular area, a proximity threshold is crossed and tiles that have been pre-fetched based on extrapolation of the user's flight path are accessed. TerraVision as disclosed by Reddy implements two levels of priority (i) pre-fetching of tiles based on extrapolating the user's path and (ii) accessing of higher resolution tiles when the user crosses a proximity threshold (a prioritization value based on the resolution of the update parcel relative to parcels previously received). Thus, we are persuaded that Reddy discloses to one of ordinary skill the features of claim 10 and 15.

Claim 11 depends from claim 10 and recites, "wherein said prioritization values is based on the relative distance of said update data parcel from said operator controlled image viewpoint." Claim 16 depends from claim 13 and recites limitations similar to those of claim 11. Petitioner contends that this feature is taught by Reddy's distance based level of detail disclosure in which higher resolution tiles are loaded near the user viewpoint in a "coarse-to-fine" manner when the user approaches a region of terrain. Pet. 47–48. As discussed above, Petitioner further notes that Reddy discloses a pre-fetch based on the user's extrapolated flightpath. *Id.* Patent Owner contends that distance based LOD is simply a matter of downloading

higher resolution information for locations near the user. PO Resp. 30. We have addressed this issue above and are not persuaded by Patent Owner's arguments. In view of the above evidence and arguments, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that Reddy and Hornbacker disclose the limitations of claims 10, 11, 15, and 16.

Dependent Claim 12

Claim 12 depends from claim 1 and recites, "wherein displaying the image further comprises multi-threading on the limited communications bandwidth computer device using the update data parcels to displayed image." Petitioner cites paragraph 41 of Reddy, which discloses that TerraVison II is a multi-threaded application, whose sole purpose is rendering large geographic databases in real time. Pet. 48 (citing Ex. 1004 ¶ 41). Based on this evidence, we are persuaded that Petitioner has shown by a preponderance of the evidence that Reddy discloses the limitation recited in claim 12.

Dependent Claims 14, 17–20

Claim 14 depends from claim 13 and recites "wherein said processor is responsive to said defined screen resolution and wherein said processor is operative to limit selection of said defined data parcel to where the resolution of said defined data parcel is less than or equal to said defined screen resolution." Petitioner argues that the LOD techniques in Reddy to render a 3-D image use selection criteria such as projected screen size and therefore must operate on a display of defined screen resolution. Pet. 49 (citing Michalson Decl. ¶ 203). Dr. Michalson further testifies that it would be obvious to a person of ordinary skill that any digital display would have a finite resolution and that rendering of images on that display would be

limited by the resolution of the screen or the defined area of the screen. *Id*. (citing Michalson Decl. ¶ 204). Noting that Reddy teaches the LOD techniques used to retrieve data are designed so that any distant detail that projects to less than a single pixel on the screen generally will not be visible, Petitioner argues that a person of ordinary skill would understand that TerraVision II limits selection of the retrieved view tiles to those tiles whose resolution as displayed on the screen is no higher than the resolution of the screen. *Id*. at 54–55. Based on the foregoing, we are persuaded that Petitioner has shown by a preponderance of the evidence that Reddy teaches the limitations recited in claim 14.

Petitioner asserts that claims 17, 18, and 19 recite limitations that are substantively similar to those recited in claims 2, 4, and 5 respectively. Pet. 56–57. We reach the same conclusions relative to claims 17, 18, and 19 as those we reached with respect to claim 2, 4, and 5.

Claim 20 recites that "the processor performs multi-threading to render said defined data parcel over the discrete portion of said mesh to provide for the progressive resolution of said defined image on said display." Petitioner notes that TerraVision II is a multi-threaded application and references its discussion of claim element 13.H concerning TerraVision's disclosure of rendering retrieved tiles (data parcels) over a discrete portion of the terrain model (mesh) to provide progressive enhancement. Pet. 57. In view of our discussion of claim element 13.H above, we agree with Petitioner as to claim 20.

Motivation To Combine

Having determined that the combination of Reddy and Hornbacker discloses the elements recited in claims 1–20, 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. 21), 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 21–22. Petitioner cites Hornbacker as analogous art for its disclosure of GIF compression of image data for efficient transmission on the Web. *Id.* at 22. 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.

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. 27–30. Dr. Agouris testified that a person of ordinary skill would not have considered a document-processing reference, for systems geographic information systems (GIS) such as those described by Reddy. Ex. 2003, Agouris Decl. ¶¶ 126–134. 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; Ex. 2003, Agouris Decl. 135–137. 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"), 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; Ex. 2003, Agouris Decl. ¶ 137

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.* at 17. 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 claim 13 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 '343 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 '343 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 recognize 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, Michalson Reply Decl. ¶¶ 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. 49–51. 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. 49. 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.* at 50 (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 than a memory and 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 elements 1.D, 1.J, 13.J, and 13.P 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. 51–52. According to Patent Owner,

the data structure in the ’343 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 ’343 Patent’s K_D, X, Y system and more information dense than that of the ’343 Patent. *Id.* (citing PO Resp. § IV.C.6 (discussion of claim elements 1.D, 1.J, 13.J, 13.P). 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 1–20.

Objective Considerations

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. 2012). 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 ’343 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 in the title of the ’343 Patent was documented previously by Reddy. Pet. 18.

Patent Owner cites techniques disclosed in Knowlton[4] and White[5] 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. *Id.* at 52 (citing Ex. 2003, Agouris Decl. ¶¶ 151–153). Patent Owner cites Yap as documenting the transmission of map data over the internet to be hampered by bandwidth limitations. *Id.* at 54 (citing Ex. 2003, Agouris Decl. ¶ 154). 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, 1:54–56; 2:4–5. Thus, to the extent that Patent Owner relies on progressive resolution in the '343 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 2:14–17. As discussed above, Reddy accomplishes this goal with its level of detail approach based on the user viewpoint. Ex. 1004 ¶¶ 12–14. Thus, we are not persuaded that Patent Owner has demonstrated the '343 Patent addresses a long felt need that was not addressed previously by Reddy.

[4] U.S. Patent 4,222,076 "Progressive Image Transmission" to Knowlton, issued Sep. 9, 1980
[5] Richard L. White, Jeffery W. Percival, "Compression and Progressive Transmission of Astronomical Images"

Patent Owner cites industry praise for the "[t]he technology claimed in the '343 Patent" as another indication that the claimed invention is not obvious. PO Resp. 55–57. Patent Owner cites favorable press in the form of recognition of 3DVU[6] by Red Herring that in 2005 3DVU was one of the most promising European companies. PO. Resp. 56. We have excluded from evidence a press release concerning the Red Herring recognition. Paper 67, 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[7], Declaration of Isaac Levanon ("Levanon Decl.") ¶ 36. Mr. Levanon has testified that he is a member of an entity that owns 50% of Patent Owner, Bradium. Ex. 1019, Transcript of Deposition of Isaac Levanon ("Levanon 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 invention claimed in the '343 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

[6] Patent Owner describes 3DVU as a company formed by inventor Isaac Levanon to commercialize the technology in the '343 Patent. PO Resp. 55 n.4.
[7] We cite Ex. 2072, the public version of Mr. Levanon's Declaration. A confidential version was filed as Ex. 2004.

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. 56–57. 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 '343 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 "[ba]sed 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 '343 Patent. The 2007 Frost & Sullivan award was made long after the earliest filing date of the '343 Patent (at least as early as Dec. 24, 2001, and possibly as early as Dec. 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. 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 '343 Patent and 3DVU and that licensing the technology would accelerate Petitioner's own development efforts. PO Resp. 55. Patent Owner's specific citations to valuation and to Microsoft's purported praise of the technology primarily come from Ex. 2013, which was prepared by a third party for 3DVU, and cannot be attributed directly to Microsoft. *Id.* at 56 (citing Ex. 2013 at 3, 6, 7).

Petitioner argues that its discussions with 3DVU were not driven by the technology embodied in the '343 Patent, but by non-patented technology later developed for a process displaying 3D terrain elevations. Pet. Reply 26. Petitioner cites to the Declaration of Yonatin 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 68, 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") and information concerning the elevation file format on the preliminary due diligence document (Ex. 2034, 4). Pet. Reply 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 ’343 Patent.

Patent Owner also cites licensing activities involving Denso’s Kenwood navigation system and a demonstration project with Daewoo Precision Industries. PO Resp. 57–58. 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 ’343 Patent.[8] 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, 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

[8] 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 ’343 Patent.

navigation products and that these products, particularly Navi2Go, are also evidence of commercial success. PO Resp. 59–60. 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 '343 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 '343 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 '343 Patent with the alleged

industry praise, discussions between 3DVU and Petitioner, licensing activities and the products cited as evidence of commercial success.

SUMMARY

In consideration of the above, having weighed each of the *Graham* factors, we are persuaded that Petitioner has demonstrated by a preponderance of the evidence that claims 1–20 of the ’343 Patent are unpatentable as obvious under 35 U.S.C. § 103 over Reddy and Hornbacker.

ORDER

In consideration of the above, it is

ORDERED that claims 1–20 of the ’343 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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