

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ASUSTEK COMPUTER INC. and ASUS COMPUTER INTERNATIONAL,
Petitioner

v.

NOKIA TECHNOLOGIES OY,
Patent Owner

Case: IPR2025-01154
U.S. Patent No. 11,805,267

PATENT OWNER'S PRELIMINARY RESPONSE

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TABLE OF EXHIBITS

Exhibit	Description	Previously Submitted
2001	Declaration of R. Mitch Verboncoeur in Support of <i>Pro Hac Vice</i> Admission	X
2002	Declaration of R. Mitch Verboncoer in Support of Patent Owner’s Notice of Intent to Designate a Provisionally Recognized PTAB Attorney as Back-Up Counsel	X
2003	Order No. 10-First Amended Adopted Procedural Schedule in Investigation No. 337-TA-1448, dated June 25, 2025	X
2004	Complaint Initiation in Investigation No. 337-TA-1448, dated April 11, 2025	X
2005	Respondents’ Initial Invalidity Contentions in Investigation No. 337-TA-1448, dated July 1, 2025	X
2006	Respondents’ Exhibit E-6 Claim Chart –“Karczewicz II,” Regarding U. S. Patent 11,805,267, dated July 1, 2025	X
2007	Exhibit E-5 Invalidity Chart- “Karczewicz II,” Regarding U. S. Patent 11,805,267	X
2008	Exhibit E-6 Invalidity Chart- “Karczewicz I,” Regarding U. S. Patent 11,805,267	X
2009	Background Information Regarding Marta Karczewicz	X
2010	Declaration of Dr. Iain Richardson	
2011	CV of Dr. Iain Richardson	
2012	File History of App. Ser. No. 15/250,124 (“124 Application”)	
2013	File History of App. Ser. No. 15/490,469 (“469 Application”)	
2014	File History of App. Ser. No. 15/876,495 (“495 Application”)	
2015	File History of App. Ser. No. 16/729,974 (“974 Application”)	
2016	Pat. App. Pub. No. US 2009/0257503 to Yan Ye, Peisong Chen, and Marta Karczewicz (“Ye ’503”)	

Exhibit	Description	Previously Submitted
2017	Pat. App. Pub. No. US 2010/0086027 to Rahul Panchal and Marta Karczewicz (“Panchal”)	
2018	Pat. App. Pub. No. US 2013/0142262 to Yan Ye and Alexandros Tourapis (“Ye ’262”)	
2019	VCEG-AI33 by Yan Ye, Peisong Chen, and Marta Karczewicz	
2020	U.S. Pat. No. 9,161,057 to Marta Karczewicz, Peisong Chen, and Yan Ye (“Karczewicz ’057”)	
2021	Excerpts from “The H.264 Advanced Video Compression Standard”, Richardson, 2010 (Cover pages, book pages 28-38, 69, 106, 108, 223-229)	
2022	Reserved	
2023	Reserved	
2024	Reserved	
2025	Deposition Transcript of Immanuel Freedman, dated November 26, 2024	
2026	A True and Correct Copy of “Marta Karczewicz,” published by the European Patent Office, available at https://www.epo.org/en/news-events/european-inventor-award/meet-the-finalists/marta-karczewicz (last accessed 10/2/2025)	
2027	Richardson, The H.264 Advanced Video Compression Standard (page 283)	
2028	A True and Correct Copy of “Marta Karczewicz,” published by the European Patent Office, available at https://www.epo.org/en/news-events/european-inventor-award/meet-the-finalists/marta-karczewicz (last accessed 10/2/2025)	
2029	A True and Correct Copy of the USPTO’s Webpage Describing the European Patent Office (EPO), available at https://www.uspto.gov/learning-and-resources/pursuing-international-ip-protection/european-patent-office (Last accessed 10/6/2025).	
2030	Declaration of Dr. Iain Richardson from IPR 2024-00626	

Exhibit	Description	Previously Submitted
2031	Declaration of Dr. Iain Richardson from IPR 2024-00626	

I. INTRODUCTION

Petitioner advances only one ground in the petition, which was known to, considered by, and rightfully rejected by the Patent Office in issuing the '267 Patent and each of its five priority applications. The Board should therefore deny institution on the merits.

Petitioner's only ground modifies and combines two references, one of which was before the Patent Office during prosecution of the '267 Patent, and both of which are duplicative of numerous references considered by the Patent Examiner. In short, this ground proposes to take two known processes (sub-pixel interpolation using higher-precision intermediate values and bi-prediction using two low-precision prediction results) ***and materially change both processes*** so that intermediate values from the first process (selected by Petitioner) are retained, rather than discarded, and are used instead of predictions in subsequent steps rather than the final interpolated prediction values conventionally used. This is the essence of hindsight reconstruction of the Challenged Claims. Neither reference suggests such a combination would be possible, much less desirable, and numerous references teaching both parts of Petitioner's proposed modified combination were considered during prosecution.

Because the only ground is not new over art and arguments already considered by the Patent Office, and because the only ground does not establish a reasonable likelihood that the Challenged Claims are unpatentable, institution should be denied.

II. BACKGROUND

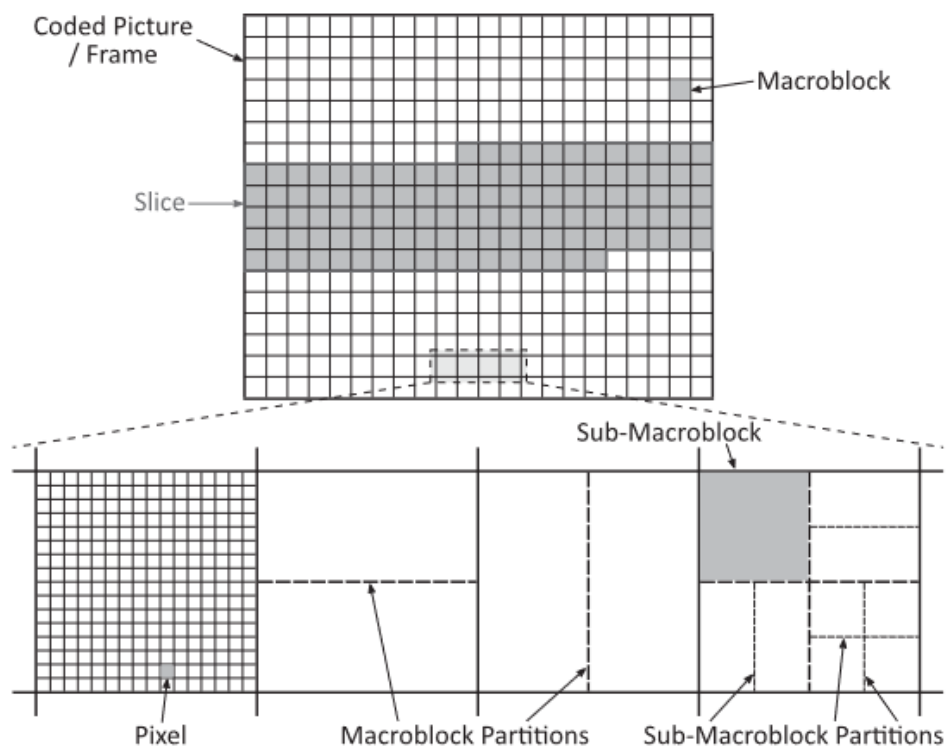
A. Technical Background

The '267 Patent relates to an improvement in the processing of bi-prediction in video coding. As explained in more detail below, motion compensated prediction in video coding is a computationally intensive aspect of video coding, requiring an encoder to generate and evaluate many possible predictions to obtain a prediction sufficient to encode video at an acceptable bit rate. Motion prediction using bi-prediction uses a combination of two predictions, and so may require twice as much computation to generate and evaluate the individual predictions, as well as additional processing to determine which combination of predictions works well enough to use. Ex-2010, ¶¶ 46, 50-53.

1. Components of Digital Video

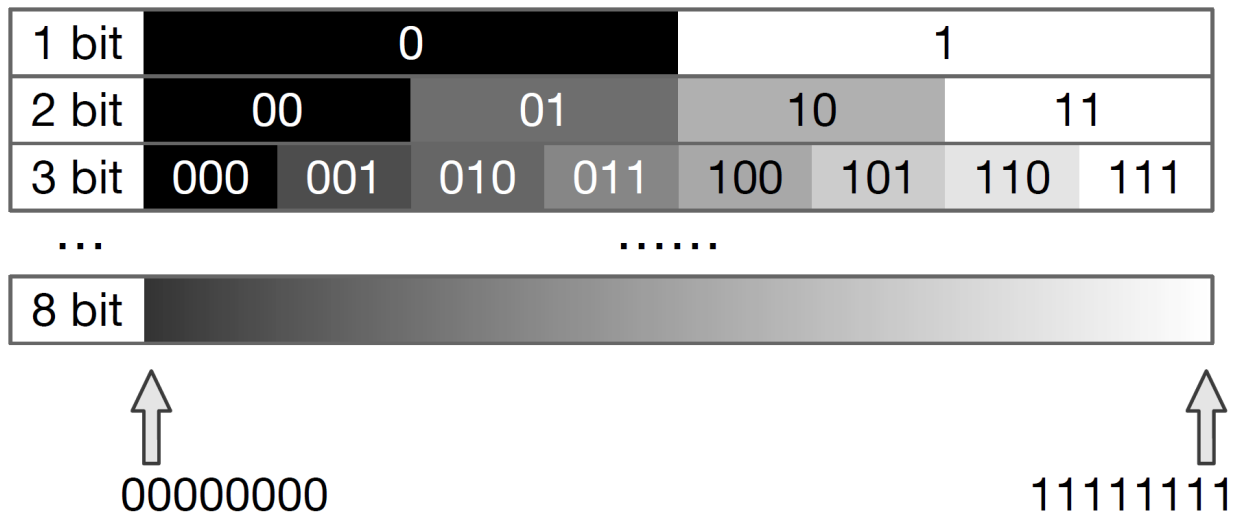
Video playback involves displaying a succession of individual frames or pictures to a viewer, creating the experience of viewing a moving picture. In digital video, each of these frames is included in a collection known as a sequence. A digital video can consist of multiple sequences.

The smallest addressable unit of a digital video frame is a pixel (picture element). Individual frames of digital video are typically partitioned into blocks, which consist of an $M \times N$ array of pixels. For example, one type of block called a “macroblock” is 16×16 pixels. Blocks, in turn, are commonly collected into groups known as “slices.”



Values for pixels in digital video can be represented in as binary numbers. For example, pixels with 8-bit precision can have components (brightness or color) with

256 possible values.¹ 10-bit is higher precision because it allows for a greater range of possible values: 1024 possible values. The figure below illustrates 1, 2, 3 and 8 bit precision representations.



The difference between the lower bit precision and higher precision representations involves the number of possible values (not the specific values themselves). In other words, there is a greater ability to express different

¹ An n-bit variable can take up to 2^n possible values. Ex-2010 at ¶ 44. The exact values represented by an 8-bit variable may vary depending on the convention used to interpret the bits. For example, an unsigned 8-bit variable could map to values from 0 to 255, while a signed 8-bit variable using two's complement could map to values from -128 to 127. In either case, eight bits can convey up to 256 possible values. *Id.* at ¶¶ 44, 72.

brightnesses and colors in a higher precision system even though lower precision and higher precision systems can express both the minimal brightness (black) and the maximum brightness (white) for a given pixel.

Digital videos today commonly display 30 frames per second, with each frame comprising resolutions such as 1920x1080 pixels (1080p video) or 3840x2160 (4K). Ex-2010 at ¶ 46. This results in a lot of pixel data. *See id.* at ¶ 48. For every second of a 4K and 30 FPS digital video played, 248,832,000 pixels are needed for the video to be displayed on a screen. For a video using eight bits for each component of each pixel, this equates to 746 megabytes of pixel data needed to display each second of video. This enormous amount of information presents a problem: Bandwidth is limited, and devices have limited storage capacities. Accordingly, video coding experts have made significant efforts to develop techniques that compress video information to reduce the number of bits that must be transmitted to display high-quality digital video.

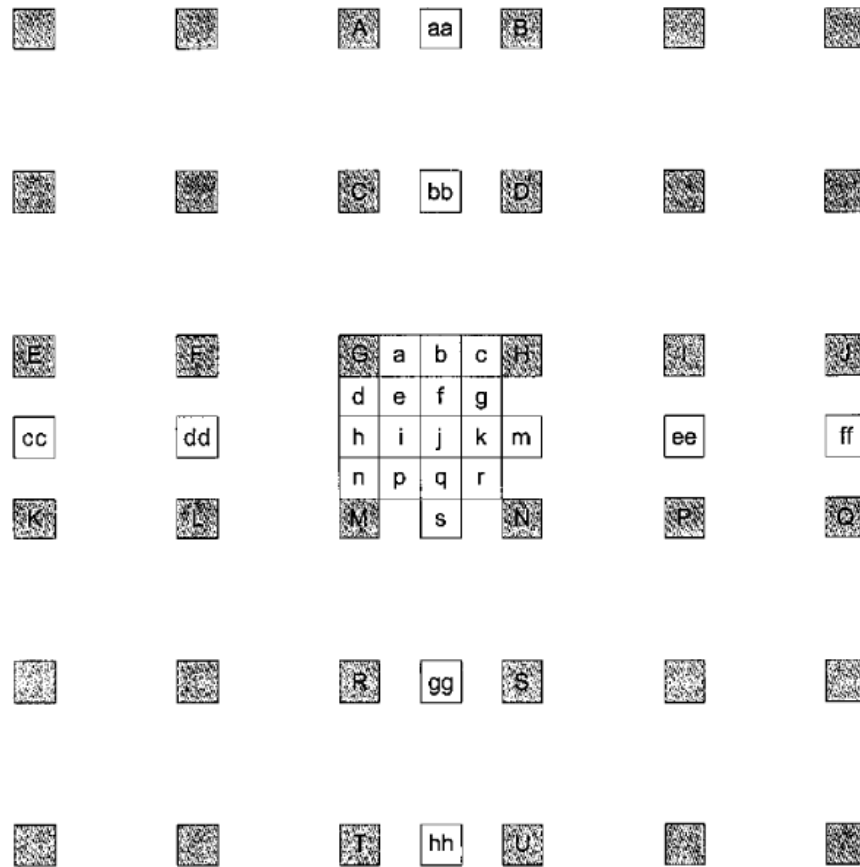
2. Motion-Compensated Prediction

One widely deployed technique for reducing the amount of information needed for digital video is motion-compensated prediction. With motion-compensated prediction, data for blocks of pixels in an image frame is not directly included in the bitstream, and instead the pixel values for the block of pixels are predicted using the data of one or more other frames in the video called “reference frames.” The best-

matching blocks of a reference frame are identified through motion vectors. These motion vectors can be encoded into a bitstream or predicted from other information in the bitstream. Once identified via a motion vector, the best-matching block is used to form a prediction of the pixel values of the current block. Then the difference between the prediction and the current block—called a residual error— can be encoded. A better prediction means less residual error, which in turn reduces the amount of data that must be encoded into the bitstream to represent the residual error.

3. Sub-Pixel Interpolation

Although digital video frames consist of discrete pixels, the motion between frames may not align exactly with the locations of these pixels. To account for this, video coding standards allow motion vectors to be represented at fractional pixel accuracy. For example, the H.264 Standard allows motion vectors to have up to quarter-pixel accuracy. ASUS-1001 at 3:6-11.



When a motion vector points to a fractional pixel location, the value of samples used to predict a block based on that motion vector must be calculated by interpolation. Interpolation is typically performed using P-tap filters, which take a weighted average of P sample values on either side of the subpixel being computed to predict the subpixel value. Ex-2010 at ¶¶ 53-54. Figure 12, reproduced above, illustrates the original integer pixels (in shaded blocks) and the half-pixel and quarter-pixel subpixels that can be computed from them. ASUS-1001 at 12:63-13:10, Fig. 12. For example, the prediction “P1” might be predicted using the following 6-tap filter:

$$P1 = (E_1 - 5F_1 + 20G_1 + 20H_1 - 5I_1 + J_1)$$

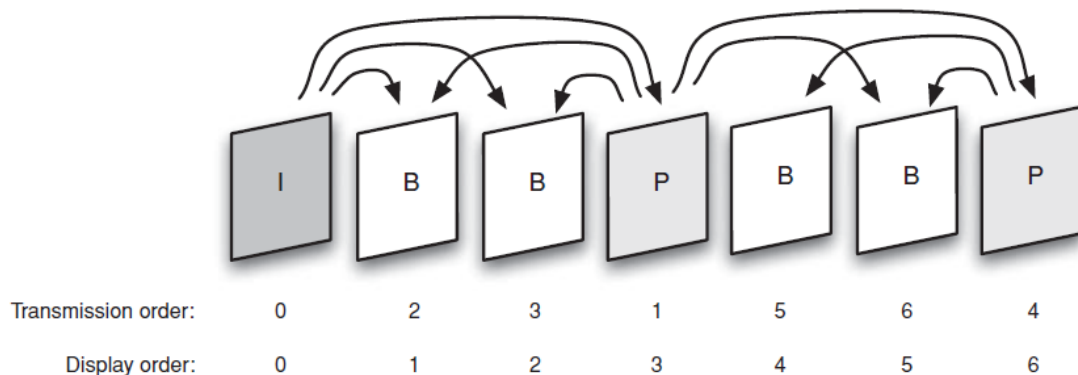
The capital letters $E_1, F_1, \dots, J_1$ represent the integer pixels shaded in Figure 12 above. By applying this 6-tap filter, the values of integer pixels are combined to form a high-precision prediction of the subpixel value. This higher precision results from the mathematics of the filter process. Each weighted integer pixel value has the same number of possible values before and after being multiplied by a weight. However, each pixel is independent of the other, which means that the filter output can take a greater number of possible values than the individual pixel values themselves.² A similar P-tap filtering process can be used to compute quarter-pixel values from half-pixel values. *See id.* at 3:6-10.

4. Bi-Prediction

Bi-prediction is a motion-compensated prediction technique in which two reference frames are used to predict a current picture instead of one. Two motion vectors are used to point to two different best-matching blocks from different reference frames. Two predictions are formed, each formed from one of the best-

² As a simplified example, consider that two numbers selected independently from the set of even numbers, $X=2$ and $Y=4$, have an average value of 3, which is not an even number.

matching blocks in the different reference frames, these two predictions are then combined to form a “combined prediction.” An advantage of bi-prediction is that this combined prediction may be more accurate than any single prediction, which further reduces the residual error to be encoded. Thus, bi-prediction increases the degree to which video can be compressed at the cost of the additional processing needed to form the two predictions and combine them. Typically, video sequences are made up of I frames (which do not depend on other frames), “P” frames, where blocks can be predicted from at most one reference frame, and “B” frames, where blocks can be bi-predicted. This is illustrated in the figure below. In most video streams, the great majority of frames are B frames.



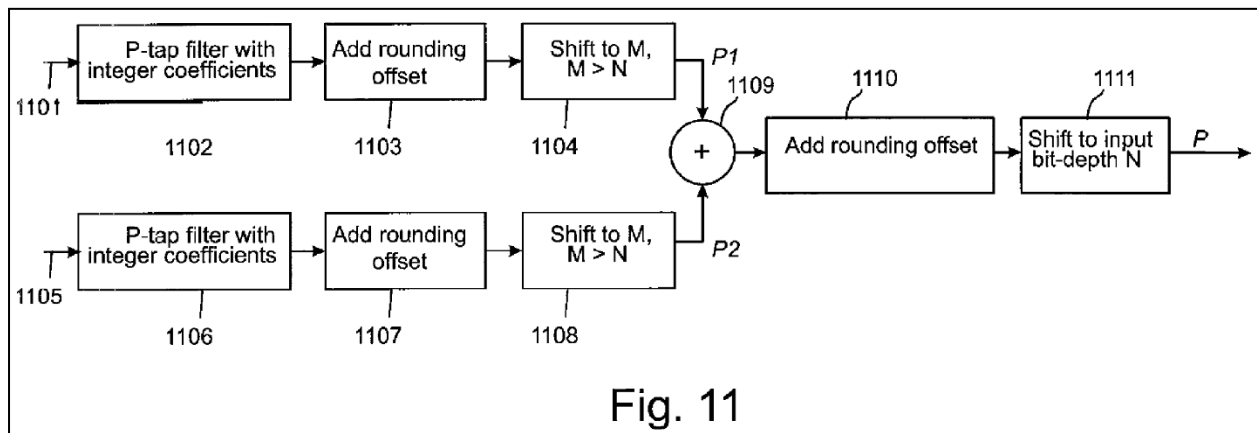
The H.264 Standard, which predates the '267 Patent, made use of two different methods for combining predictions from two reference frames: default bi-prediction and weighted bi-prediction. With default bi-prediction, the two predictions are averaged, each contributing half of the final prediction value. With weighted bi-prediction, the two predictions are multiplied by weighting factors representing their

relative contribution to the final prediction. Weighting factors can be signaled explicitly in the bitstream or can be computed based on the relative distance between the current frame and the corresponding reference frame.

B. The '267 Patent

The inventors of the '267 Patent recognized the accumulation of rounding errors in conventional bi-prediction was a longstanding problem in need of a more effective solution. ASUS-1001 at 3:56-4:26. Although other techniques such as alternating upward and downward rounding of predictions had been suggested, these methods were considered suboptimal as they increased the complexity of encoders and decoders. *Id.* As the '267 Patent explains, existing approaches increase complexity due to the need for “two separate code branches” for bi-directional averaging. *Id.* at 4:21-25. Moreover, the '267 Patent explains that “motion estimation routines in the encoder may need to be doubled for both cases of rounding and truncation.” *Id.*

The inventors of the '267 Patent also observed that the accuracy of predictions relates to coding efficiency. *Id.* at 3:12-24; 3:49-51. Because the residual error resulting from a more accurate prediction will be smaller, that residual contributes fewer bits when quantized, entropy coded and included in the bitstream. *Id.* at 3:25-30, 12:4-20; Ex-2010 at ¶¶ 50-51, 56, 67-68.



The inventors' solution to this issue was to reduce rounding errors by retaining more of the precision created by the application of P-tap filters when generating predictions, as shown in Figure 11 above. This approach allows reference frames to be stored at their original bit depth but uses higher bit depth (high precision) operations for sub-pixel interpolation and bi-prediction to avoid loss of precision before a combined prediction was calculated. *Id.* at 12:41-14:27. Rather than reducing interpolated values to the precision of input pixels, predictions are made at the same higher precision and reduced to the input precision by right shifting after the predictions are combined. *Id.* at 14:4-10.

C. The '267 Patent's Prosecution History

The '267 Patent claims priority, through five utility patent applications, to a provisional patent application filed in January 2011. The first utility application (App. No. 13/344,893, ASUS-1007) was subject to multiple Office Actions and responses before being allowed. The four subsequent intervening applications were

allowed on the first Office Action, or after an obviousness type double-patenting rejection. During the prosecution of each application, the same art previously considered was cited. The application that issued as the '267 Patent followed a similar pattern, but additional art was submitted to the Patent Office. The same Examiner and Supervisory Examiner allowed each patent in the family, and the reasons for allowance for each refer back to the original '893 Application (ASUS-1007). Accordingly, Patent Owner addresses both the file history of the '267 Patent as well as its related priority applications below.

1. Priority Applications

a) Application No. 13/344,893

The originally filed claims in the '893 Application had many elements in common with the Challenged Claims. *Compare* ASUS-1007 at 36 with ASUS-1001 claim 1. Both recite a block having a first precision, both recite obtaining a first and second prediction with a higher, second precision, using reference pixel locations, and both recite obtaining a combined prediction using the first and second predictions.

The original claims were rejected over a combination of Ye (US 2013/0142262, Ex-2018) (“Ye '262”) and Noda (US 2009/0087111). ASUS-1007 at 146. The Examiner wrote that Ye '262 satisfied the requirement that the first and second prediction of the claims have a higher, second precision because the

predictions $P_0(x,y)$ and $P_1(x,y)$ in Ye '262 could be the result of fractional motion vectors, which allow for more precise motion tracking and prediction compared with integer pixel precision. ASUS-1007 at 147-148. Patent Owner later amended the claims to recite that the first precision indicates the number of bits needed to present values of said pixels, and the second precision indicates the number of bits needed to represent values of said first prediction and said second prediction. ASUS-1007 at 236. Patent Owner then explained that Ye '262's disclosure did not teach or suggest that the number of bits needed to represent the predictions in Ye '262 was greater than the number of bits needed to represent the values of pixels in the current block. ASUS-1007 at 242-243. In other words, the first and second predictions in Ye ($P_0(x,y)$ and $P_1(x,y)$) had the same precision at the current block, and so did not have the second precision.

In the following Office Action, the Examiner acknowledged that Ye '262's teaching of weighted predictions ($w \cdot P_0(x,y)$ and $(W-w) \cdot P_1(x,y)$) did not teach a prediction having a second precision, which is higher than said first precision, wherein the second precision indicates the number of bits needed to represent values of said first prediction and values of said second prediction. ASUS-1007 at 251-252.

Ye does not disclose explicitly the following claim limitations (emphasis added):

using said first reference pixel location to obtain a first prediction, said first prediction having a second precision, which is higher than said first precision, wherein the second precision indicates the number of bits needed to represent values of said first prediction and values of said second prediction;

ASUS-1007 at 252.

The Examiner then relied on Noda, which used increased bit depth reference frames, to meet this limitation. ASUS-1007 at 252. In Noda, the bit depth of each pixel in a reference frame was increased from N to N+M bits, and then predictions were generated at N+M bits. ASUS-1007 at 252.

In response, Patent Owner amended the claims to require the reference blocks used to obtain the first and second prediction have the same precision (the first precision) as the current block. ASUS-1007 at 272. This excluded Noda, because in Noda the reference blocks used to generate predictions had the same N+M precision as the first prediction and second predictions.

In the remarks, the Patent Owner argued that Ye '262's application of weights to predictions $P_0(x,y)$ or $P_1(x,y)$ did not increase the precision of $P_0(x,y)$ or $P_1(x,y)$, but simply changed the range of values at the existing precision by mapping the original precision values to a new range of values. ASUS-1007 at 281.

The claims of the '893 Application were subsequently allowed. ASUS-1007 at 294-311. The Primary Examiner on the case was Peter Le, and his Supervisory Examiner was Sath Perungavoor. ASUS-1007 at 310-311.

b) Subsequent Intervening Priority Applications

Shortly before the '893 Application issued, Patent Owner filed a continuation application, No. 15/250,124. Ex-2012. The Examiner requested a terminal disclaimer over the parent case (the '893 Application), and following entry of a terminal disclaimer the '124 Application was allowed without rejection. Ex-2012 at 20-30. The '124 Application was allowed by the same Examiner who allowed the '893 Application.

Shortly before the '124 Application issued, Patent Owner filed a continuation application, No. 15/490,469. Ex-2013. The Examiner allowed the '469 Application on the first application following the filing of a terminal disclaimer over the '893 and '124 Applications. Ex-2013 at 14-24. The '469 Application was allowed by the same Examiner who allowed the '893 and '124 Applications.

Shortly before the '469 Application issued, Patent Owner filed a continuation application, No. 15/876,495. Ex-2014. The '495 Application was subsequently rejected for obviousness type double patenting over the claims issued from the '893 and '469 Applications. The Examiner subsequently allowed the '495 Application following the filing of a terminal disclaimer over the '893, '124, and '469

Applications. Ex-2014 at 6-13. The '495 Application was allowed by the same Examiner who allowed the '893, '124, and '469 Applications.

Shortly before the '495 Application issued, Patent Owner filed a continuation application, No. 16/729,974. Ex-2015. The Examiner allowed the '974 Application on the first application following the filing of a terminal disclaimer over the '495 Application. Ex-2015 at 7-14. The '974 Application was allowed by the same Examiner who allowed the '893, '124, '469, and '495 Applications.

2. Application No. 17/328,750

Shortly before the '974 Application issued, Patent Owner filed a continuation application, No. 17/328,750. ASUS-1002. The '750 Application ultimately issued as the '267 Patent. ASUS-1002 at 369. During prosecution, the '750 Application was initially rejected for obviousness type double patenting over the claims issued from the '974 and '495 Applications. ASUS-1002 at 123-130. The '750 Application was allowed following Patent Owner's submission of a terminal disclaimer. ASUS-1002 at 181-188. After allowance but before issuance, Patent Owner filed an RCE, requesting consideration of additional prior art references. ASUS-1002 at 205-316. The '750 Application was subsequently allowed again. ASUS-1002 at 323-330. Following payment of the issue fee, Patent Owner received an Office Action for a related European application and petitioned the Patent Office to consider that European action as well before allowing the '750 application to issue. ASUS-1002

at 352-355. The '750 Application was allowed over this additional information as well, and the '267 Patent issued on October 31, 2023. ASUS-1002 at 364-365, 369. The '750 Application was allowed by the same Examiner who allowed the '893, '124, '469, '495, and '974 Applications.

3. Prior Art Cited in Prosecution

The chart below summarizes the art of record during the prosecution of the '267 Patent as well as its priority applications that is relevant to the Petition. Additional art was also raised and considered, but the art below is either the same art raised by the Petition or is not meaningfully different from the art raised in the Petition.

Reference	Inventors / Authors	'893 FH	'124 FH	'469 FH	'495 FH	'974 FH	'750 FH
US 2009/0257503 "Ye '503" Ex-2016	Yan Ye, Peisong Chen, Marta Karczewicz	¥ ³	¥	¥	¥	¥	¥
US 2010/0086027 "Panchal" Ex-2017	Rahul Panchal, Marta Karczewicz	†	¥	¥	¥	¥	¥
US 2013/0142262 "Ye '262" Ex-2018	Yan Ye, Alexandros Tourapis	†‡	¥	¥	¥	¥	¥
VCEG-AI33 Ex-2019	Yan Ye, Peisong Chen, Marta Karczewicz	¥	¥	¥	¥	¥	¥

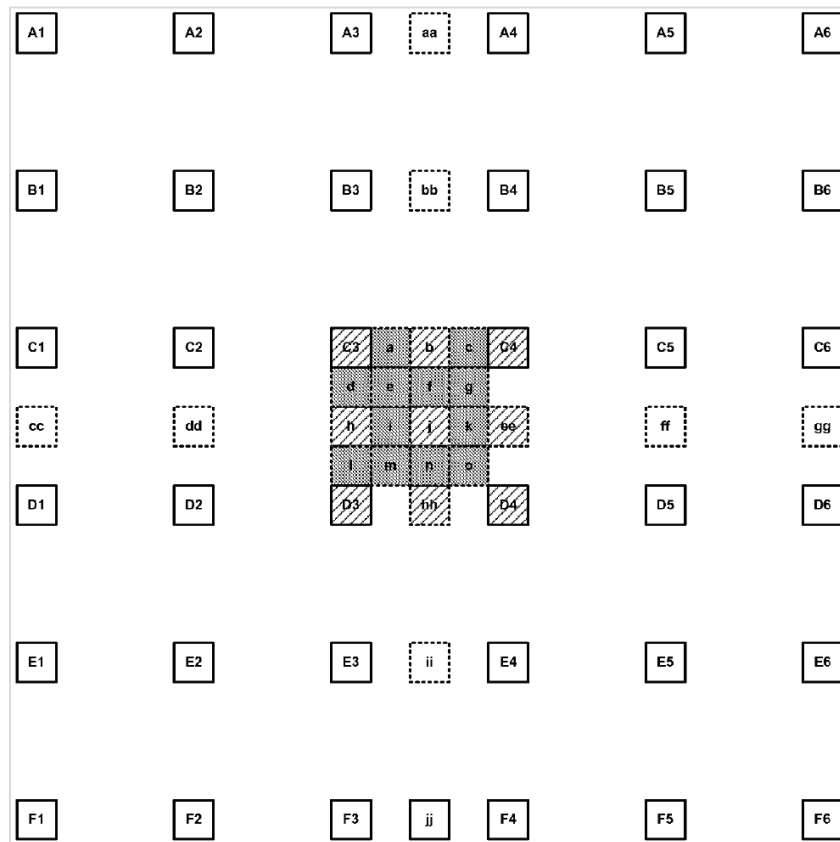
³ Key: † Cited by examiner; ‡ Discussed in office actions; ¥ Cited by applicant.

Reference	Inventors / Authors	'893 FH	'124 FH	'469 FH	'495 FH	'974 FH	'750 FH
U.S. Pat. 9,161,057 “Karczewicz '057” Ex-2020	Marta Karczewicz, Peisong Chen, Yan Ye						¥
US 2009/0257499 (Karczewicz-II from petition) ASUS-1006	Marta Karczewicz, Yan Ye, Peisong Chen						¥

a) Ye '503 (Ex-2016)

Ye '503 was cited by Patent Owner to the Examiner during the prosecution of the original application in the family. ASUS-1007 at 88. Ye '503 was also cited by the Patent Owner in each subsequent family member, including the '750 Application, and is cited on the face of the '267 Patent. ASUS-1002 at 74; ASUS-1001 at 2. Ye '503 teaches the use of an alternative interpolation scheme to that adopted for H.264 which “keep[s] the highest possible precision through intermediate steps” of interpolation by using intermediate values (b1, h1, and j1) to interpolate quarter-pixel subpixel values. Ex-2016 at ¶¶ 98-99. This disclosure is substantively identical to the disclosure Petitioner relies upon from Karczewicz-II, which will be addressed in greater detail below. Ye '503 also teaches the register mathematics used to accomplish this interpolation of intermediate values without exceeding the 16-bit register limit. Ex-2016 at ¶¶ 100-102. The figure below

illustrates both the quarter-pixel positions interpolated (dark grey) and the positions corresponding to the values or intermediate values used in their interpolation.



Ex-2016 at 8.

b) Panchal (Ex-2017)

Panchal was cited by the Examiner during the prosecution of the original application in the family and used, in combination with Ye '262 and Noda, as part of an obviousness rejection. ASUS-1007 at 152-156. Panchal was also cited by the Patent Owner in each subsequent family member, including the '750 Application, and is cited on the face of the '267 Patent. ASUS-1002 at 74; ASUS-1001 at 2.

Panchal teaches various forms of bi-prediction, as well as strategies for choosing between them, including whether to use default or explicit weights or to signal an offset as part of the bi-prediction. Ex-2017 at Figs. 4, 5. As part of its disclosure, Panchal teaches default weighted bi-prediction (Equation 1, ¶ 60), weighted bi-prediction with explicit weight and multiple rounding offsets (Equation 2, ¶ 61), and weighted bi-prediction with implicit weights and a fixed rounding offset (Equation 3, ¶ 62).

c) Ye '262 (Ex-2018)

As addressed in the summary of the prosecution history of the '893 Application above, Ye '262 was a central focus of the Examiner during the prosecution of the original application in the family, and was the central reference in numerous obviousness rejections. Ye '262 was also cited by the Patent Owner in each subsequent family member, including the '750 Application, and is cited on the face of the '267 Patent. ASUS-1002 at 74; ASUS-1001 at 2. Ye '262 teaches block-based motion prediction, including weighted bi-prediction, with predictions from two different reference frames based on motion vectors. Ex-2018 at ¶¶ 24-25. Ye '262 further teaches that these predictions can be made from motion vectors with fractional-pixel precision and can be interpolated from pixel values using a 6-tap filter. Ex-2018 at ¶ 28.

d) VCEG-AI33 (Ex-2019)

VCEG-AI33 was cited by Patent Owner to the Examiner during the prosecution of the original application in the family. ASUS-1007 at 327. VCEG-AI33 was also cited by the Patent Owner in each subsequent family member, including the '750 Application, and is cited on the face of the '267 Patent. ASUS-1002 at 78; ASUS-1001 at 3. VCEG-AI33 is a proposal to “increas[e] precision of interpolation and bi-directional prediction during motion compensated prediction” by using intermediate values for half-pixel positions to interpolate values for quarter-pixel positions. Ex-2019 at 1. The disclosed interpolation method from VCEG-AI33 uses the same equations found in Ye '503 and the Karczewicz-II reference relied upon by the petition. VCEG-AI33 also has the same authors as Ye '503 and Karczewicz-II.

e) Karczewicz '057 (Ex-2020)

Karczewicz '057 was cited to the Examiner during the prosecution of the '750 application, which ultimately issued as the '267 Patent. ASUS-1007 at 75. Karczewicz '057 is listed as considered by the Examiner on the face of the '267 Patent. ASUS-1001 at 2. Similar to Panchal, Karczewicz '057 teaches multiple forms of bi-prediction, including default weighted bi-prediction, explicit weighted bi-prediction, and implicit weighted bi-prediction, as well as strategies for selecting between them. Ex-2020 at 1 (abstract), 10 (Fig. 7), and 16-17 (12:11-14:65).

Karczewicz '057 also incorporates VCEG-AI33 by reference as a document related to the techniques described in Karczewicz '057. Ex-2020 at 14 (8:5-12).

f) Karczewicz-II (ASUS-1006)

Karczewicz-II was cited to the Examiner during the prosecution of the '750 application, which ultimately issued as the '267 Patent. ASUS-1007 at 74. Karczewicz-II is listed as considered by the Examiner on the face of the '267 Patent. ASUS-1001 at 2. The substance of Karczewicz-II will be addressed below in connection with the art raised in the Petition.

D. The Asserted Prior Art

1. Karczewicz-I (ASUS-1005)

Karczewicz-I (ASUS-1005) teaches bi-prediction both with and without weights, as well as several different techniques for determining weights. ASUS-1005 at ¶¶ 60-62. Karczewicz-I also teaches that rounding error, which can accumulate in bi-prediction, can be resolved by using rounding offsets, and presents several strategies for doing so. ASUS-1005 at ¶¶ 64-69.

2. Karczewicz-II (ASUS-1006)

Karczewicz-II (ASUS-1006) teaches equations for obtaining 8-bit interpolated values using higher precision intermediate values temporarily stored in 16-bit processor registers. (ASUS-1006) ¶¶ 99-106.

E. POSITA

Patent Owner has applied Petitioner's POSITA for the sake of this Response. Petition, 5-6. This Response does not depend on this skill level. Patent Owner reserves the right to argue in favor of different level of skill should trial be instituted.

F. Claim Construction

Petitioner takes a position on the meaning of "precision." *See* Petition, 6. This Response does not depend on this definition, so Patent Owner does not address it. Patent Owner reserves the right to address this position should trial be instituted.

G. Claim Listing

For the sake of this analysis, Patent Owner will use Petitioner's limitation labels provided in the petition's claim appendix (Petition, iv-xiii).

III. ARGUMENT

A. Petitioner's Expert Declaration is Improper and its Reliance on Other Expert Opinions Should Be Disregarded

The Federal Rules of Evidence apply to proceedings before the PTAB, such as this one. 37 CFR § 42.62(a). Federal Rules of Evidence 702 permits expert testimony upon a showing by the proponent of the testimony that (a) the expert's specialized knowledge will help the trier of fact to understand the evidence or determine a fact at issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert's opinion reflects a reliable application of the principles and methods to the facts of

the case. FRE 702. Federal Rule of Evidence 702 was amended in 2023 “to clarify that the proponent of expert testimony bears the burden of establishing its admissibility and to emphasize that an expert's opinion must stay within the bounds of a reliable application of the expert's basis and methodology.” *EcoFactor, Inc. v. Google LLC*, 137 F.4th 1333, 1339 (Fed. Cir. 2025). Opinion testimony that is not the result of the qualified expert’s application of specialized knowledge, training, and experience to the facts of a case “would not be helpful to the factfinder” and, in fact “serves only to cause mischief and confuse the factfinder.” *Kyocera Senco Indus. Tools Inc. v. Int’l Trade Comm’n*, 22 F.4th 1369, 1377 (Fed. Cir. 2022).

“Expert testimony based solely or primarily on the opinions of other experts is inherently unreliable.” *Hunt v. McNeil Consumer Healthcare*, 297 F.R.D. 268, 275 (E.D. La. 2014). Expert opinions generally cannot be based upon the opinions of others, whether they are in evidence or not. *American Key Corp. v. Cole Nat’l Corp.*, 762 F.2d 1569, 1580 (11th Cir. 1985). An expert cannot be used as a conduit to introduce the opinions of another expert and must instead undertake an independent investigation. *EEOC v. Mod. Grp., Ltd.*, 725 F.Supp.3d 644, 685 (E.D. Tex. 2024).

The petition relies on the declaration of Dr. Havlicek, which in turn is simply a conduit for introducing the declarations of Dr. Immanuel Freedman from other IPR proceedings. ASUS-1003 at pp. 62-463 (identified as appendices B and C). Dr.

Havlicek's declaration, outside of the appendices, is 43 paragraphs covering just over 28 pages. 10 pages of Dr. Havlicek's declaration consists of a listing of the claims of the '267 patent, which is the only time Dr. Havlicek mentions any challenged claim. The entirety of Dr. Havlicek's analysis of the 36 challenged claims consists of 21 words:

I have carefully reviewed Dr. Freedman's analysis in this regard, and I agree with and adopt his analysis as my own.

ASUS-1003 ¶34.

This is not proper expert testimony and should be excluded under Rule 702. Dr. Havlicek's report does not reflect an independent investigation or application of reliable methods to the facts of this case. Instead, Dr. Havlicek is being used as a conduit to introduce the opinions of Dr. Freedman into this case by "agreeing with" and "adopting" approximately 400 pages of analysis while conducting no meaningful analysis of the claims or the references himself.

The petition itself relies almost exclusively on the appendices of Dr. Havlicek's declaration (i.e., Dr. Freedman's declarations). These declarations should likewise be excluded, as they were provided for different proceedings that are now resolved, and neither Dr. Freedman nor Amazon are a party to this proceeding.

As shown above, Petitioner's expert declaration is improper and its reliance on other expert opinions should be disregarded. The Board should therefore deny institution, as the petition lacks evidentiary support without the improper expert testimony.

B. Dr. Marta Karczewicz

All grounds in this petition relate to a combination of two references authored by Dr. Marta Karczewicz and her team at Qualcomm. Dr. Karczewicz is a global pioneer in the field of video coding and has hundreds of patents on video compression technologies. Dr. Karczewicz is a named inventor on more than 800 granted U.S. patents and more than 250 granted European patents in the field. Ex-2017. In 2019, Dr. Karczewicz was one of three finalists for the European Inventor Award in the Lifetime Achievement category. Ex-2028. Dr. Karczewicz's inventions are credited by the European Patent Office for helping improve video compression by a factor of 1,000 over the course of 20 years. Ex-2028. In 2023, Dr. Karczewicz was recognized by the European Patent Office as one of the 50 leading voices in technology across all technology areas. Ex-2026. No one else working in the field of video coding even made the list. In short, Dr. Karczewicz is one of the most creative, prolific, accomplished, and recognized innovators in the field of video coding. The petition relies entirely on the idea that a person of ordinary skill, having ordinary creativity, would modify and combine two of Dr. Karczewicz's inventions

in a way that no evidence suggests was ever contemplated by either Dr. Karczewicz or her team.

C. Petitioner Has Not Established A Reasonable Likelihood That The Challenged Claims Are Unpatentable In Light Of Ground 1.

Petitioner raises only one ground: a § 103 combination that proposes modifying Karczewicz-I using Karczewicz-II. Petition, 2. Karczewicz-I discloses conventional bi-prediction techniques with one modification: allowing an encoder to signal to a decoder whether a prediction should be unrounded or rounded by a signaled offset. ASUS-1005 at ¶ 63-64. The purpose of this added signaling is to “provide better prediction accuracy” compared to conventional bi-prediction, in which “rounding error can accumulate.” *Id.* at ¶ 64.

Petitioner proposes that a POSITA would have been motivated to ignore Karczewicz-I’s key teaching and that the accumulation of rounding error should instead be addressed by retaining higher-precision subpixel samples from Karczewicz-II. Petition, 15-25, 33-35. Karczewicz-I already offers a solution to accumulation of rounding error. A POSITA would not be motivated to look to Karczewicz-II to implement an alternative solution as there is no teaching in either document which would cause a POSITA to seek an alternative to the solution the problem already taught by Karczewicz-I. Petitioners’ proposed modification is self-

defeating. Both references share the same inventors, including Marta Karczewicz, a renowned innovator in the field of video coding. See § III.B *supra*.

That the authors of the Karczewicz references themselves never proposed such a modification shows that a POSITA would not look to replace Karczewicz-I's disclosure with this alternative technique. Petitioners' ground is motivated by hindsight and is not rooted in the actual disclosure of Karczewicz-I or Karczewicz-II. Accordingly, it should be rejected.

A POSITA would not be motivated to modify Karczewicz-I and Karczewicz-II in the way alleged. Petitioners' Karczewicz-I and Karczewicz-II Ground 1 is not a straightforward combination but rather a modification of both references. Despite the "similar video-coding architecture" the Petitioners claim would motivate a POSITA to combine the two references, the proposed modifications would change the architecture taught by both references. These modifications would in turn lead to increased technical complexity and unwanted costs that would dissuade a POSITA from building such a system.

1. The Karczewicz inventors were people of extraordinary skill in the art and did not make the allegedly obvious combination.

The lack of any motivation to modify and combine the Karczewicz-I and Karczewicz-II references is confirmed by the fact that each reference was authored by the same inventors who—despite being people of *extraordinary* skill in the art—

never made the modifications Petitioners now allege would have been obvious to an ordinary artisan.

Both Karczewicz-I and Karczewicz-II were authored by the same three inventors: Marta Karczewicz, Peisong Chen, and Yan Ye. ASUS-1005 at (75), ASUS-1006 at (75). The expert from the prior petition, Dr. Freedman, whose opinions were adopted in whole by Petitioner's expert Dr. Havlicek without additional explanation, disclaimed any knowledge of who Marta Karczewicz and her colleagues were. Ex-2025 at 76:19-78:22. Indeed, as stated, Dr. Marta Karczewicz is a renowned expert in the field of video coding and participated heavily in the standardization process for multiple video coding standards. Ex-2010 at ¶ 135. *See* § III.B *supra*. Dr. Karczewicz was (and should be) well known to video coding experts, including at the time of the '267 Patent. *Id.* The European Patent Office recognized her as one of the 50 leading voices in technology, with hundreds of patents in video coding. *Id.*; Ex-2017. The inventors of Karczewicz-I and Karczewicz-II, in particular Dr. Karczewicz, are giants in the field of video coding. Petitioners' Ground 1 calls into question why, if an ordinary artisan would allegedly be motivated to modify Karczewicz-I by alleged commonalities between the two references, the exceptionally skilled inventors of those same references failed to do so.

Petitioners argue that a POSITA would find it obvious to apply the subpixel interpolation methodologies of Karczewicz-II to the bi-prediction technique of Karczewicz-I. Petition, 8-29. Yet by the time Karczewicz-I was filed, Karczewicz-II had already been on file for three months, and its provisional application had been disclosed another year prior. *Compare* ASUS-1005 at (22) *with* ASUS-1006 at (22), (60). Further still, interpolation disclosures akin to Karczewicz-II were included in the VCEG-AI33 submission, authored by the inventors of the Karczewicz references. *Compare* ASUS-1006 at ¶ 104, Table 7, 8; *with* Ex-2019 at pp. 1-4 (showing the same interpolation process and 16-bit registers); *see also* Ex-2010 at ¶ 106. VCEG-AI33, in turn, was incorporated by reference into Karczewicz-I. ASUS-1005 at ¶ 37. Put simply, Marta Karczewicz, Peisong Chen, and Yan Ye were certainly aware of the contents of Karczewicz-II at the time they drafted Karczewicz-I.

According to Petitioners, a POSITA would have a bachelor's degree and two to three years of practical experience with video encoding or decoding. Petition, 5-6. Yet the Karczewicz inventors, each possessing far more experience than Petitioners' POSITA, did not combine them in the way that Petitioners now assert would be obvious. Dr. Freedman (and by extension Petitioner's expert Dr. Havlicek) provided little explanation as to how this is possible, instead denying any familiarity with the '267 Patent's inventors and questioning whether they were POSITAs or

even aware of their own inventions. Ex-2025 at 76:19-78:22. Petitioners sticking their heads in the sand as to the capabilities of the Karczewicz inventors should not suffice to meet their burden. On the other hand, Nokia's expert, Dr. Richardson, offers a simpler explanation: The inventions claimed in the '267 Patent were not obvious. Ex-2010 at ¶ 107.

2. Karczewicz-I already includes the higher-precision interpolation equations of Karczewicz-II, so a POSITA would not be motivated to modify Karczewicz-I to incorporate the interpolation methods of Karczewicz-II as alleged in the Petition

The Petition seeks not just to combine Karczewicz-I and Karczewicz-II but to modify them both in the process. The Petition fails to show that a POSITA would be motivated to make this modified combination and fails to show that a POSITA would have had a reasonable expectation of success in making such a combination. Ex-2010, ¶ 81.

“An obviousness determination requires finding that a person of ordinary skill in the art would have been motivated to combine or modify the teachings in the prior art *and would have had a reasonable expectation of success in doing so.*” *Regents of University of California v. Broad Institute, Inc.*, 903 F.3d 1286, 1291 (Fed. Cir. 2018) (emphasis added). Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements,” but “must instead articulate specific reasoning, *based on evidence of record*, to support the legal conclusion of

obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016) (emphasis added). Further, “[t]he obviousness inquiry does not merely ask whether a skilled artisan could combine the references, but instead asks whether they would have been motivated to do so.” *Adidas AG v. Nike, Inc.*, 963 F.3d 1355, 1359 (Fed. Cir. 2020) (internal quotations omitted).

The Petition asserts that Karczewicz-II “teaches improved calculations for averaging two integer or interpolated pixel values, where rounding is delayed until later in the process, thereby maintaining higher precision for intermediate calculations” and that those “complimentary teachings” would “improve Karczewicz-I by reducing rounding inaccuracies.” Petition at 10. However, Karczewicz-I already includes the higher-precision interpolation equations the Petition relies upon from its incorporation by reference of VCEG-AI33. ASUS-1005 at ¶ 37; Ex-2010, ¶ 82. As noted above, VCEG-AI33 includes the same teachings relied upon in Karczewicz-II, including the same equations for interpolation of quarter-pixel values using intermediate values for half-pixel positions. Ex-2010, ¶ 82; § II.C.3.d, *supra*. A POSITA would therefore understand Karczewicz-I to already employ the improved interpolation techniques of Karczewicz-II and would not look to Karczewicz-II for any further combination or modification. *Id.*

Moreover, the Petition fails to show that a person of *ordinary* skill in the art would have any motivation to take one part of Karczewicz-II (regarding sub-pixel

interpolation) and be inspired to modify an entirely different part of Karczewicz-I (regarding bi-prediction) despite neither reference suggesting such a modification. Nor does the Petition show the *ordinary* artisan would have any reasonable expectation of success in doing such a modification. The law requires one to consider the person of ordinary skill in the art with “ordinary creativity.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007). As explained in Section III.C.6, the proposed combination and modifications of Karczewicz-I and Karczewicz-II are overly complicated and lead to significant downsides even if such combination and modifications were technically feasible. Thus, an ordinary artisan with ordinary creativity would lack motivation to combine and modify or any reasonable expectation of success.

3. A POSITA would be motivated to use the teachings of Karczewicz-I and Karczewicz-II as expressly set out in both references rather than engaging in the unnecessary modifications from the Petition

The express teachings of both Karczewicz-I and Karczewicz-II call for the output of Karczewicz-II and the input of Karczewicz-I to be at the same 8 bits as the current block of pixels. As a result, even if a POSITA were motivated to combine Karczewicz-I and Karczewicz-II, they would not combine Karczewicz-I and Karczewicz-II in the manner asserted in the Petition. Ex-2010, ¶ 83.

Karczewicz-I refers to the result of its bi-predictions as “prediction data.” ASUS-1005 at ¶¶ 64, 69. Karczewicz-I further teaches that, once suitable prediction data is found, it is subtracted from the original block being coded to create a residual block. ASUS-1005 at ¶ 73. And at the encoder, the received residual block is added to the prediction data to reproduce the original data. ASUS-1005 at ¶ 84. Because they are added and subtracted, the current block pixels and the prediction data must have the same bit depth. Ex-2010, ¶ 84. The unweighted bi-prediction equation relied upon by the Petition from Karczewicz-I takes in predictions $\text{pred0}(i,j)$ and $\text{pred1}(i,j)$, adds them, and right-shifts by 1, then outputs prediction data $\text{pred}(i,j)$. ASUS-1005 ¶ 60; Ex-2010, ¶ 84. This means that the predictions $\text{pred0}(i,j)$ and $\text{pred1}(i,j)$ and the combined prediction $\text{pred}(i,j)$ have the same bit depth. *Id.* Accordingly, the input predictions in Karczewicz-I ($\text{pred0}(i,j)$ and $\text{pred1}(i,j)$) need to have the same bit depth as the pixels of the current block. *Id.*

Similarly, each of the interpolated values for sub-pixel positions in Karczewicz-II have the same precision as the original input pixels. The petition focuses on intermediate values in the interpolation process of Karczewicz-II, but the key teaching of Karczewicz-II is the use of a limited number of higher-precision registers to handle higher-precision intermediate values generated by sub-pixel interpolation filters. ASUS-1006 at 23-24 (Table 5, showing the use of 2 registers, r1 and r2; Table 6, also showing 2 registers, Table 7, showing 4 registers, r1-r4, and

Table 8, showing 2 registers r1 and r2); Ex-2010, ¶¶ 100, 106. This means that, by design in Karczewicz-II, the higher-precision intermediate values from interpolation filters are ephemeral, and the output of Karczewicz-II's innovative interpolation filter is the same as its input: 8 bits. So Karczewicz-II teaches using 8-bit reference blocks to generate 8-bit predictions, using high-precision intermediate values. Ex-2010, ¶ 85.

Taken together, then, Karczewicz-II teaches generating 8-bit prediction values for fractional motion vectors by interpolation of 8-bit pixel values, and Karczewicz-I teaches combining those 8-bit values to generate an 8-bit combined prediction. Ex-2010, ¶ 86. A POSITA seeking to combine the teachings of Karczewicz-I and Karczewicz-II would be motivated to use the 8-bit outputs of Karczewicz-II for the 8-bit inputs to Karczewicz-I rather than modify both references as suggested by the Petition. The Petition does not even argue that Karczewicz-I or Karczewicz-II, used in accordance with the teachings actually present in either reference, would practice the challenged claims.

To overcome this shortcoming in its chosen art, Petitioner seeks to modify both references in an unconventional manner: store and use the intermediate values of Karczewicz-II as predictions (which neither Karczewicz-I or Karczewicz-II teach or suggest), and use those intermediate values as inputs for bi-prediction in Karczewicz-I (which neither Karczewicz-I nor Karczewicz-II teach or suggest).

Petition, 8-29, 36-45. To justify this modification, Petitioner points to paragraph 99 of Karczewicz-II as standing for the proposition that Karczewicz-II “teaches improved calculations for averaging two integer or interpolated pixel values, where rounding is delayed until later in the process, thereby maintaining higher precision for intermediate calculations.” Petition at 10. However, the process addressed by Paragraph 99 of Karczewicz-II is the process of interpolating final 8-bit values from a block of 8-bit pixel values to be used as predictions in motion compensated prediction. Ex-2010, ¶ 89. This teaching is already incorporated into Karczewicz-I, by its incorporation by reference of VCEG-AI33, and so would not require the modifications petitioner requires for its obviousness argument.

The obviousness inquiry is made from the perspective a person of ordinary skill in the art. *Regents*, 903 F.3d at 1291. A POSITA is “a person of ordinary creativity.” *KSR Int’l Co*, 550 U.S. at 421. As a result, the obviousness inquiry must take account of the “routine steps” and creativity of a person of ordinary creativity in the obviousness inquiry. *Ball Aerosol & Specialty Container, Inc. v. Ltd. Brands, Inc.*, 555 F.3d 984, 993 (Fed. Cir. 2009). Here, a POSITA reading Karczewicz-I, with its 8-bit inputs, and Karczewicz-II, with its 8-bit outputs, would exercise “ordinary creativity” in combining them by connecting the output of Karczewicz-II to the input of Karczewicz-I. Petitioner’s proposal to break both references use

intermediate values from Karczewicz-II as an input to a modified Karczewicz-I is well beyond the “ordinary creativity” of POSITA.

4. A POSITA would not have been motivated to incur the costs of the Petition’s modified combination, as there is no reasonable expectation that such costs would yield a better solution than those already taught by Karczewicz-I and Karczewicz-II

Petitioner never addresses much less provides a motivation to incur the significant cost of moving to higher precision predictions in its Karczewicz-I/Karczewicz-II combination. Ex-2010, ¶ 90. As an initial matter, the proposed modification of both references disregards the benefits taught by each references. The advance of Karczewicz-II was the use of a small number of 16-bit registers to calculate the 8-bit final values for each sub-pixel position using higher-precision intermediate values. ASUS-1006 ¶¶ 53, 59; Ex-2010, ¶ 90. Interrupting the methods of Karczewicz-II to retain intermediate values would require those higher precision values to be saved and stored, requiring a great many high-precision registers. A POSITA would not be motivated to abandon this advance to reduce rounding in bi-prediction, especially considering that Karczewicz-I already provides a solution in the form of rounding offsets. ASUS-1005 ¶¶ 64-69; Ex-2010, ¶ 90. In other words, a POSITA would see no need to modify Karczewicz-I to address the issue of rounding in bi-prediction, so a POSITA would not be motivated to make the change contemplated by the Petitioner. Ex-2010, ¶ 90.

A POSITA would also understand that the modifications proposed by Petitioner would have considerable costs and disadvantages and so would not be motivated to make them. Ex-2010, ¶ 91. For example, a POSITA would understand that the proposed modifications would require generating and storing intermediate values for the 16 sub-pixel positions at the encoder to generate a suitable search area in each reference frame, requiring a significant increase in the storage and memory bandwidth demands for motion compensated prediction. *Id.* To maintain the same search space allowed with 8-bit values, Petitioner's stored intermediate values would need twice the available memory. *Id.* Further, memory bandwidth would need to be doubled to accommodate the additional precision of the stored intermediate values, or searching a given number of potential predictions would take twice as long. *Id.* This would result either in slower encoding or encoding that searched fewer potential predictions, harming efficiency. *Id.* In the absence of additional storage space, values for sub-pixel positions would need to be recalculated every time they were needed, which would add significant time to each prediction candidate searched, either increasing encode time or decreasing search space, reducing the quality of predictions. *Id.* A POSITA would not be motivated to incur these costs nor reduce the quality of predictions to avoid rounding errors. *Id.*

Similarly, at the decoder a POSITA would understand obtaining and using higher precision predictions was costly, and the results would not match the results

of the encoding process unless the encoder also implemented higher precision predictions. Ex-2010, ¶ 50, 98. Accordingly, a POSITA would not be motivated to implement the modified combination of Karczewicz-I and Karczewicz-II at the decoder unless also motivated to do so at the encoder. As demonstrated above, there would be strong motivation against making such a modified combination.

Even though Karczewicz-I already includes the higher-precision interpolation equations of Karczewicz-II, and the authors of Karczewicz-I fully knew the benefits of high-precision intermediate values in the context of sub-pixel interpolation, and the authors of Karczewicz-I chose to use pixel-precision predictions as inputs in its bi-prediction, Petitioner claims Karczewicz-I motivates the modification of both Karczewicz-I and Karczewicz-II to achieve its proposed combination. This argument is implausible at best. Petitioner's entire combination is driven by hindsight, constructed using the '267 Patent as a roadmap. As Karczewicz-I already had a solution to the rounding problem (the use of rounding offsets), there was no need for the extra technical costs of Karczewicz-II, with no guarantee that Karczewicz-II method would improve upon the Karczewicz-I existing solution.

Petitioners argue a POSITA reading Karczewicz-I would look to Karczewicz-II to find "complementary teachings that improve Karczewicz-I by reducing rounding inaccuracies," (Petition, 10), but as explained, the inventors of Karczewicz-I knew about Karczewicz-II at the time of Karczewicz-I was written and

failed to make the modifications that allegedly would have been obvious to a POSITA.

5. The use of the same generic block diagram in Karczewicz-I and Karczewicz-II would not motivate a POSITA to modify and combine the references

Petitioners argue that a POSITA would be motivated to “implement teachings from Karczewicz-I and Karczewicz-II using their common architecture,” referring to the similar Figure 2 and similar Figures 3 and 4 included in both references (reproduced below) Petition, 9 (citing ASUS-1005, Fig. 2, Fig. 3; ASUS-1006, Fig. 2, Fig. 4).

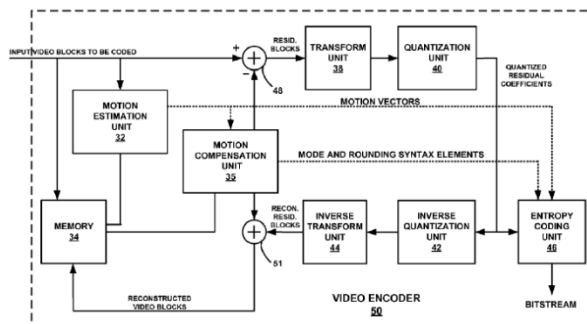


FIG. 2

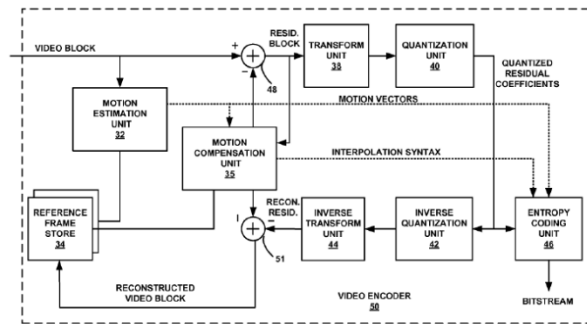


FIG. 2

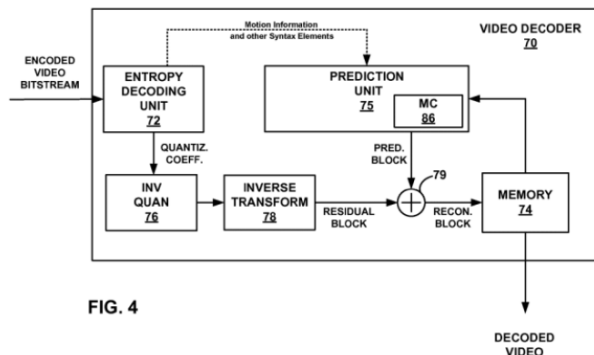


FIG. 4

DECODED VIDEO

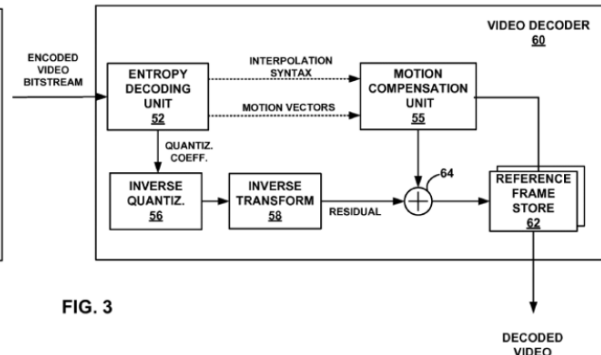


FIG. 3

DECODED VIDEO

As Dr. Richardson explains, this block diagram is a generic illustration of a video coding system that makes use of motion-compensated prediction and does not include any features unique to the Karczewicz references. Ex-2010 at ¶¶ 49, 103-104. Indeed, this “common architecture” is nothing more than a basic functional diagram that could be applied to most, if not all, video coding systems since the 1990s. *Id.* This opinion is shared by Petitioners’ expert, Dr. Havlicek, who describes the architecture as a “fundamental model . . . used by major video encoding standards since the 1990s.” ASUS-1003, Appx-B ¶ 3. Because the architecture illustrated in Figure 2 does not characterize any of the alleged innovations of either Karczewicz-I or Karczewicz-II and can be found in numerous video coding systems, a POSITA would be unlikely to view Figure 2 as a compelling reason or inspiration to modify one reference using the teachings of the other. Further, as the two block diagrams are the same, a POSITA would not have been motivated to modify either reference in attempting a combination, as they already share a common, albeit ubiquitous, architecture.

Further, Petitioners overstate the relationship between the references by arguing “Karczewicz-I and Karczewicz-II both encompass motion prediction calculations that average interpolated pixel values.” Petition, 11. As Dr. Richardson explains, Karczewicz-I relates to default and weighted bi-prediction. These techniques employ averaging of prediction values. Ex-2010 at ¶¶ 71-72.

Karczewicz-II relates to interpolation of pixel values to produce predictions. *Id.* at ¶ 75. At best, these references are associated with motion-compensated prediction schemes like those found in H.264. A POSITA would find the fact both references relate to motion-compensated prediction unremarkable. Motion-compensated prediction refers to a broad, widely known, and widely used category of techniques. *See id.* at ¶¶ 61, 63, 65. For example, H.264 includes a large number motion-compensated prediction techniques, many of which are not directly related to one another. *See id.*

Moreover, as addressed above, Karczewicz-I already incorporates by reference VCEG-AI33, which includes the same interpolation teachings petitioners rely upon in Karczewicz-II. To prevail, Petitioner must not only show that a POSITA would be motivated to combine these two references, but would be motivated to modify each in a manner contrary to their teachings. To the extent the Board credits Petitioner's argument that Karczewicz-I and Karczewicz-II have a "common architecture," the Board would also have to conclude that a person having ordinary creativity, faced with two references with a generic "common architecture," would be motivated to modify them both. Petitioner has not provided evidence sufficient to support such a finding.

6. Petitioners' alleged Karczewicz modifications are technically intractable, and a POSITA would not be motivated to make them.

Guided by hindsight, Petitioners argue that a POSITA would use Karczewicz-II to modify Karczewicz-I. In its disclosure of conventional bi-prediction, Karczewicz-I discloses the following equation for combining two predictions:

$$pred(i, j) = (pred0(i, j) + pred1(i, j) + 1) \gg 1$$

Petition, 14-15 (citing ASUS-1005 at ¶¶ 58-60). This equation takes a first prediction (pred0) and a second prediction (pred1), both at the input bit depth, and averages them by summing their values, adding a rounding offset (+1), and applying a right shift, which has the mathematical effect of dividing by two. ASUS-1005 at ¶¶ 57-60. Because these two predictions are at the input bit depth, which means that the predictions are, at most, at the “first precision” disclosed in the claims of the '267 Patent, Karczewicz-I does not disclose the challenged claims. Ex-2010 at ¶¶ 71-72, 83-88, 91.

Attempting to account for this failing, Petitioners argue that Karczewicz-II could be applied to three different calculation scenarios (a subset of the possible scenarios) depending on whether the motion vectors used for bi-prediction correspond to integer, half-pixel, and center-pixel motion-compensated predictions. *See* Petition, 15, 19, 23; Ex-2025 at 101:2-103:22 (agreeing that the three

enumerated scenarios in the Petition do not cover all possible motion vector calculation scenarios).

In their Scenario 1, which Petitioners argue applies when “averaging a half-pixel value with an integer pixel value,” Petitioners propose modifying the conventional bi-prediction equation of Karczewicz-I using equations disclosed in Karczewicz’s Table 3. Petition, 15-17 (citing ASUS-1006 at Table 3, shown below with Petitioners’ annotation).

TABLE 3

$a = (C3 \ll 5 + b1 + 32) \gg 6$
$c = (C4 \ll 5 + b1 + 32) \gg 6$
$d = (C3 \ll 5 + h1 + 32) \gg 6$
$l = (D3 \ll 5 + h1 + 32) \gg 6$
$f = (j1 \gg 5 + b1 + 32) \gg 6$
$i = (j1 \gg 5 + h1 + 32) \gg 6$
$k = (j1 \gg 5 + ee1 + 32) \gg 6$
$n = (j1 \gg 5 + hh1 + 32) \gg 6$

Petitioners argue that such a modification would yield a new equation, applicable to bi-prediction using half-pixel and integer motion vectors:

$$\text{pred}(i,j) = (\text{non-rounded}(\text{pred0}(i,j)) + \text{pred1}(i,j) \ll 5 + 32) \gg 6$$

Petition, 19.

In their Scenario 2, which Petitioners argue would apply to a “first motion vector pointing to a center-pixel position and the second motion vector pointing to a

half-pixel position,” Petitioners propose modifying the conventional bi-prediction equation using a different set of equations from Karczewicz-II’s Table 3. Petition, 19-21 (citing ASUS-1006 at Table 3, shown below with Petitioners’ annotations).

TABLE 3

$$\begin{aligned}
 a &= (C3 \ll 5 + b1 + 32) \gg 6 \\
 c &= (C4 \ll 5 + b1 + 32) \gg 6 \\
 d &= (C3 \ll 5 + h1 + 32) \gg 6 \\
 l &= (D3 \ll 5 + h1 + 32) \gg 6 \\
 f &= (j1 \gg 5 + b1 + 32) \gg 6 \\
 i &= (j1 \gg 5 + h1 + 32) \gg 6 \\
 k &= (j1 \gg 5 + ee1 + 32) \gg 6 \\
 n &= (j1 \gg 5 + hh1 + 32) \gg 6
 \end{aligned}$$

This time, a different modified bi-prediction equation results, which Petitioners assert should be used for bi-prediction using center-pixel and half-pixel motion vectors:

$$\text{pred}(i,j) = (\text{non-rounded}(\text{pred0}(i,j)) \gg 5 + \text{non-rounded}(\text{pred1}(i,j)) + 32) \gg 6$$

Petition, 22.

Finally, in Scenario 3, Petitioners propose that when “both motion vectors point to half-pixel positions,” equations from Karczewicz-II’s Table 4 should be used to modify Karczewicz-I. Petition, 23-24 (citing ASUS-1006 at Table 4, shown below).

TABLE 4

$e = (b1 + h1 + 32) \gg 6$ $g = (b1 + ee1 + 32) \gg 6$ $m = (h1 + hh1 + 32) \gg 6$ $o = (ee1 + hh1 + 32) \gg 6$

Petitioners argue that the modified bi-prediction equation of Karczewicz-I could then be constructed as:

$$\text{pred}(i,j) = (\text{non-rounded}(\text{pred0}(i,j)) + \text{non-rounded}(\text{pred1}(i,j)) + 32) \gg 6$$

Petition, 25.

As Dr. Richardson explains, the sum of these three scenarios (again, only a subset of possible scenarios) is a complex system that a POSITA would not think to construct. Ex-2010 at ¶¶ 111-112. The modifications Petitioners envision for these scenarios seems more like a hindsight attempt to emulate the language of the '267 Patent's claims than a plausible outcome from a POSITA reading the two Karczewicz references. Petitioner's three scenarios result in predictions being stored using at least three different precisions (indicated by yellow (13 bits), green (8 bits) and blue (18 bits) highlighting) during encoding:

Scenario 1	$\text{pred}(i,j) = (\text{non-rounded}(\text{pred0}(i,j)) + \text{pred1}(i,j) \ll 5 + 32) \gg 6$
Scenario 2	$\text{pred}(i,j) = (\text{non-rounded}(\text{pred0}(i,j)) \gg 5 + \text{non-rounded}(\text{pred1}(i,j)) + 32) \gg 6$

Scenario 3	$\text{pred}(i,j) = (\text{non-rounded}(\text{pred0}(i,j)) + \text{non-rounded}(\text{pred1}(i,j)) + 32) \gg 6$
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Because the equation to be used in a scenario can be determined only by considering both motion vectors used for bi-prediction, a system implementing Petitioners' proposal cannot determine whether it should make use of a rounded prediction value, a partially rounded prediction value, or a non-rounded prediction value until after the second motion vector has been determined. *Id.* at ¶¶ 94-95, 113-115. Such a configuration would be costly, especially for an encoder, which must repeatedly test possible pairs of motion vectors to determine which pair minimizes the residual error so that it can be coded into the resulting bitstream. *Id.* at ¶¶ 45-52, 95-97, 115. However, this implementation would incur similar costs if implemented in a decoder because a decoder that is configured to decode bi-predictions selected according to Petitioners' modified process would require encoders to perform the complicated and inefficient process proposed by Petitioners. *See id.* at ¶ 115. Dr. Richardson notes that these costs would be especially prominent when implementing a video encoder or decoder in hardware, where additional memory would be required to store the possible values of predictions produced in each scenario. *Id.* Expert Dr. Freedman (whose opinions were adopted without further explanation by Dr. Havlicek) provided no opposition on this point, noting in his deposition that he was

“not qualified to speak about the internals of any piece of hardware.” Ex-2025 at 104:3-16.

Even if implemented in software, Petitioners’ argument assumes that a POSITA would have written “separate code branches” for various scenarios of bi-directional averaging. However, the ’267 Patent explains that this is inefficient and undesirable. Ex-2010 at ¶ 116; ASUS-1001 at 4:21-25. Moreover, as Dr. Richardson explains, three or more “separate code branches” would be needed—at least one for each of the scenarios 1, 2, and 3—for Petitioners’ alleged modification for operations that “may be carried out millions of times per second in a typical video coding application.” Ex-2010 at ¶ 116. A POSITA would not be motivated to create such an inefficient system, and other than incorrectly characterizing such extensive modifications as a “tiny change,” neither Dr. Freedman, Dr. Havlicek, nor Petitioner advance any compelling reason to believe otherwise. Ex-2025 at 102:21-103:10.

Further, Petitioner argues that “even if code branches or logic costs were needed to handle these three scenarios for the combination, they are generic costs that were already needed for H.264 even without the combination” and “separate code branches were known and used in the prior art, despite their alleged inefficiency or cost.” Petition at 26. *See also* ASUS-1003, ¶ 37. This analysis misunderstands the costs introduced by Petitioner’s modifications to Karczewicz-I and Karczewicz-II. In both Karczewicz-I and Karczewicz-II, all interpolation results used for bi-

prediction can be stored using only 8 bits, so only 8 bits of storage and associated data pathways are required for each candidate. Ex-2010 at ¶ 93. Further, standard memory word sizes (e.g., 32 bits) can be used to store and retrieve an integer number of pre-calculated candidates when determining which combination of motion vectors from two reference frames, allowing 4 candidate prediction values to be checked for a single memory access. *Id.* Under Petitioner’s modified proposal, some predictions are stored at 8 bits, some at 13 bits, and some at 18 bits. Ex-2010 at ¶ 94. As a result, a standard 32-bit word would hold 4 8-bit predictions, 2 13-bit predictions, and only 1 of 18-bit prediction. Ex-2010 at ¶ 95. This would require a complete redesign of the architecture used for storing and retrieving interpolated values in the encoder and even then would be incredibly wasteful – wasting 6 of every 32 bits for 13 bit predictions and 14 of every 32 bits for 18 bit predictions. *Id.* Dr. Havlicek and the petition completely ignore this cost and complexity. Ex-2010, ¶¶ 92-95.

The question is not whether code branches are known or used in the art; it is whether a POSITA would be motivated to add significantly **more** computing and/or logic as Drs. Havlicek and Freedman propose. Far from being a ‘minor implementation detail’ as Dr Havlicek suggests (ASUS-1003 at ¶ 39), the considerable additional computing and/or logic costs of the proposed combination (Karczewicz-I with Karczewicz-II) significantly change the principle of operation

of both Karczewicz-I and Karczewicz-II with no evidence or guarantee of an accompanying performance benefit. Ex-2010, ¶ 116.

To prevail on obviousness, Petitioners must establish that a POSITA, with ordinary creativity, would have been motivated to make their modified combination with a reasonable expectation of success. However, nothing in the Petition or its supporting evidence even addresses the scale of costs required to implement their proposed modification of Karczewicz-I and Karczewicz-II, much less their expectation in successfully making the modified combination despite the costs.

Petitioner attempts to minimize the computational ramifications of the Karczewicz-I combination with Karczewicz-II by stating “[a] POSITA would have recognized that there were ways of minimizing the complexity and limiting the number of searches to a small number.” Petition, 27. But Petitioner provides no technical basis as to how this enables the feasibility of the three-scenario combination. Further, “limiting the number of searches to a small number” would not solve the complexity problem introduced by Petitioner’s proposed modified combination. Interpolation is performed and saved at the encoder in preparation for searches, and predictions would need to be stored and retrieved at the three different precisions contemplated by Petitioner’s modified combination of Karczewicz-I and Karczewicz-II regardless of how many searches are performed. Reducing the number of searches performed to compensate for the increased complexity of the

proposed modification would also reduce the quality of the best-matching block identified, resulting in a significant drop in coding efficiency. Ex-2010, ¶ 95. A POSITA would not be motivated to make such a trade-off. Ex-2010, ¶ 98.

Additionally, Petitioner states that “[f]or video codecs, performance is often improved at the expense of increased computational complexity.” Petition, 27. But this statement, again, misunderstands the problem with Petitioner’s combination. Video codec designers try to improve performance and reduce complexity. Ex-2010, ¶ 100. A more complex codec is more costly to use at the encoder and, potentially, the decoder, so reducing complexity is a primary goal. Trading off performance for complexity is only contemplated where the improvement in performance outweighs the complexity cost. Drastically increasing the complexity of Karczewicz-I to address a problem Karczewicz-I already purports to solve through the use of a simple rounding offset would not have been obvious to a POSITA and in fact was not obvious to one of the most celebrated innovators in video coding or her team.

Thus, a POSITA would not be motivated to make the modifications that Petitioner proposes. Thus, a POSITA would recognize that Petitioner’s proposal would incur considerable technical costs and disadvantages. Ex-2010, ¶ 115.

Petitioners’ combination of Karczewicz-I and Karczewicz-II is a collage constructed from bi-prediction and subpixel interpolation techniques that would incur technical costs that a POSITA would find untenable. Additionally, the fact that

both references originated from the same inventors and yet no such combination was made nor suggested demonstrates that an ordinary artisan (much less someone of exceptional skill in the art) would not find such a combination obvious. For these reasons, the Board should reject Petitioners' Ground 1 and find that the challenged claims are non-obvious and valid.

7. Independent Claims 1, 7, 13, 19, 25, and 31

Petitioners have failed to demonstrate that a POSITA would be motivated to combine Karczewicz-I and Karczewicz-II to yield the inventions of claims 1, 7, 13, 19, 25, and 31 for the reasons discussed above. Ex-2010, ¶¶ 118, 125.

8. Dependent Claims 2-6, 8-12, 14-18, 20-24, 26-30, and 32-36

Dependent claims 2-6, 8-12, 14-18, 20-24, 26-30, and 32-36 depend on claims 1, 7, 13, 19, 25, and 31. Accordingly, Petitioners have failed to demonstrate that a POSITA would be motivated to combine Karczewicz-I and Karczewicz-II to yield the inventions of claims 2-6, 8-12, 14-18, 20-24, 26-30, and 32-36 for the reasons discussed above. Ex-2010, ¶¶ 119-123, 126-130.

IV. CONCLUSION

For any or all the above-described reasons, Patent Owner respectfully requests that the Board deny institution.

Dated: October 7, 2025

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CERTIFICATION OF WORD COUNT

The undersigned hereby certifies that the portions of the above-captioned **PATENT OWNER'S PRELIMINARY RESPONSE** specified in 37 C.F.R. §42.24 have 10,139 words, in compliance with the 14,000 word limit set forth in 37 C.F.R. §42.24(b)(1). This word count was prepared using Microsoft Word 2010.

Dated: October 7, 2025

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CERTIFICATION OF SERVICE

The undersigned hereby certifies that a copy of this **PATENT OWNER'S PRELIMINARY RESPONSE PURSUANT TO 37 C.F.R. § 42.10(b)** has been served on Petitioner via email on the following counsel of record for Petitioner:

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