UNITED STATES INTERNATIONAL TRADE COMMISSION

Washington, D.C.

In the Matter of

CERTAIN VISION-BASED DRIVER ASSISTANCE SYSTEM CAMERAS AND COMPONENTS THEREOF

Inv. No. 337-TA-899

ORDER 13: CONSTRUING THE TERMS OF THE ASSERTED CLAIMS OF THE PATENT AT ISSUE

(October 9, 2014)

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I. INTRODUCTION

This Investigation was instituted by the Commission on November 14, 2013 to determine whether certain vision-based driver assistance system cameras and components thereof infringe U.S. Patent No. 6,807,287 (the "'287 patent").[1] *See* 78 Fed. Reg. 68,475-476 (Nov. 14, 2013). The named respondent is Magna Electronics, Inc. ("Magna").

Pursuant to Ground Rule 5A, a *Markman* hearing was held February 19, 2014 regarding the interpretation of certain terms of claims 1–3 and 8 of the '287 patent.

Prior to the hearing, Complainant TRW Automotive U.S. LLC ("TRW"), Magna, and the Commission Investigative Staff ("Staff") met and conferred in an effort to reduce the number of disputed claim terms to a minimum. The parties also filed initial and reply claim construction briefs, wherein each party offered its construction for the claim terms in dispute, along with support for its proposed interpretation. After the hearing and pursuant to Order No. 4, the parties submitted an updated Joint Claim Construction Chart.[2]

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[1] Complainant TRW Automotive U.S. LLC is the owner, by assignment, of the patent-in-suit. (Compl. at ¶ 44.)

[2] The claim terms discussed in detail in this Order were identified in the Updated Joint Proposed Claim Construction Chart as being agreed upon or remaining in dispute. For convenience, the briefs and chart submitted by the parties are referred to hereafter as:

CMIB	TRW's Initial *Markman* Brief
CMRB	TRW's Reply *Markman* Brief
RMIB	Magna's Initial *Markman* Brief
RMRB	Magna's Reply *Markman* Brief
SMIB	Staff's Initial *Markman* Brief
SMRB	Staff's Reply *Markman* Brief
JC	Updated Joint Proposed Claim Construction Chart

II. IN GENERAL

The claim terms construed in this Order are done so for the purposes of this section 337 Investigation. Those terms not in dispute need not be construed. *See Vanderlande Indus. Nederland BV v. Int'l Trade Comm'n*, 366 F.3d 1311, 1323 (Fed. Cir. 2004) (noting that the administrative law judge need only construe disputed claim terms).

Hereafter, discovery and briefing in this Investigation shall be governed by this construction of the claim terms. **All** other claim terms shall be deemed undisputed and shall be interpreted by the undersigned in accordance with "their ordinary meaning as viewed by one of ordinary skill in the art." *Apex Inc. v. Raritan Computer, Inc.*, 325 F.3d 1364, 1371 (Fed. Cir. 2003), *cert. denied*, 540 U.S. 1073 (2003).

III. RELEVANT LAW

"An infringement analysis entails two steps. The first step is determining the meaning and scope of the patent claims asserted to be infringed. The second step is comparing the properly construed claims to the device accused of infringing." *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995) (*en banc*) (internal citations omitted), *aff'd*, 517 U.S. 370 (1996). Claim construction is a "matter of law exclusively for the court." *Id.* at 970-71. "The construction of claims is simply a way of elaborating the normally terse claim language in order to understand and explain, but not to change, the scope of the claims." *Embrex, Inc. v. Serv. Eng'g Corp.*, 216 F.3d 1343, 1347 (Fed. Cir. 2000).

Claim construction focuses on the intrinsic evidence, which consists of the claims themselves, the specification, and the prosecution history. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005) (*en banc*); *see also Markman*, 52 F.3d at 979. As the Federal Circuit in *Phillips* explained, courts must analyze each of these components to determine the "ordinary

and customary meaning of a claim term" as understood by a person of ordinary skill in the art at the time of the invention. 415 F.3d at 1313. "Such intrinsic evidence is the most significant source of the legally operative meaning of disputed claim language." *Bell Atl. Network Servs., Inc. v. Covad Commc'ns Grp., Inc.*, 262 F.3d 1258, 1267 (Fed. Cir. 2001).

"It is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'" *Phillips*, 415 F.3d at 1312 (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1115 (Fed. Cir. 2004)). "Quite apart from the written description and the prosecution history, the claims themselves provide substantial guidance as to the meaning of particular claims terms." *Id.* at 1314; *see also Interactive Gift Express, Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1331 (Fed. Cir. 2001) ("In construing claims, the analytical focus must begin and remain centered on the language of the claims themselves, for it is that language that the patentee chose to use to 'particularly point[ ] out and distinctly claim[ ] the subject matter which the patentee regards as his invention.'"). The context in which a term is used in an asserted claim can be "highly instructive." *Phillips*, 415 F.3d at 1314. Additionally, other claims in the same patent, asserted or unasserted, may also provide guidance as to the meaning of a claim term. *Id.*

The specification "is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." *Id.* at 1315 (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)). "[T]he specification may reveal a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess. In such cases, the inventor's lexicography governs." *Id.* at 1316. "In other cases, the specification may reveal an intentional disclaimer, or disavowal, of claim scope by the inventor." *Id.* As a general rule, however, the particular

examples or embodiments discussed in the specification are not to be read into the claims as limitations. *Id.* at 1323. In the end, "[t]he construction that stays true to the claim language and most naturally aligns with the patent's description of the invention will be . . . the correct construction." *Id.* at 1316 (quoting *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998)).

In addition to the claims and the specification, the prosecution history should be examined, if in evidence. *Id.* at 1317; *see also Liebel-Flarsheim Co. v. Medrad, Inc.,* 358 F.3d 898, 913 (Fed. Cir. 2004). The prosecution history can "often inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it would otherwise be." *Phillips*, 415 F.3d at 1317; *see also Chimie v. PPG Indus. Inc.*, 402 F.3d 1371, 1384 (Fed. Cir. 2005) ("The purpose of consulting the prosecution history in construing a claim is to 'exclude any interpretation that was disclaimed during prosecution.'").

When the intrinsic evidence does not establish the meaning of a claim, then extrinsic evidence (*i.e.*, all evidence external to the patent and the prosecution history, including dictionaries, inventor testimony, expert testimony, and learned treatises) may be considered. *Phillips*, 415 F.3d at 1317. Extrinsic evidence is generally viewed as less reliable than the patent itself and its prosecution history in determining how to define claim terms. *Id.* at 1317. "The court may receive extrinsic evidence to educate itself about the invention and the relevant technology, but the court may not use extrinsic evidence to arrive at a claim construction that is clearly at odds with the construction mandated by the intrinsic evidence." *Elkay Mfg. Co. v. Ebco Mfg. Co.*, 192 F.3d 973, 977 (Fed. Cir. 1999).

IV. LEVEL OF ORDINARY SKILL IN THE ART

TRW submits that "a person of ordinary skill in the art of the '287 patent at the time of the invention would have had at least the qualifications of or equivalent to either a master's degree in electrical engineering or computer science with course work or research in vision systems or an undergraduate degree in electrical engineering or computer science with at least two years of work making optical vision systems." (CMIB at 3 n.1; *see also* TRW Ex. D at ¶ 27.)

Magna proposes that a person of ordinary skill would have a bachelor's degree in electrical engineering, computer science, mechanical engineering, physics, mathematics, or the equivalent thereof, at least two years of experience in the field of image processing, computer vision systems, automobile imaging systems, automotive vision systems or the like, and would be familiar with digital image processing, computer vision, and estimation theory. (RMIB at 9-10.)

Staff believes that in the absence of any other expert opinion or explanation from the private parties, TRW's proposed level of ordinary skill in the art appears to be consistent with the disclosure of the '287 patent. (SMIB at 4-5.)

Accordingly, as to "one of ordinary skill in the art," the undersigned finds that one of ordinary skill in the art would possess either a bachelor's degree in electrical engineering, computer science, or an equivalent field and two years of work experience making or designing optical vision systems, or a master's degree in electrical engineering, computer science, or an equivalent field with course work or research in vision systems. In addition, one of ordinary skill in the art shall be commensurate with the time of the respective invention, *i.e.*, the effective filing date for the patent-in-suit.

V. THE '287 PATENT

A. Overview

The '287 patent is entitled "Road Profile Prediction." The '287 patent issued on October 19, 2004 to named inventor Filip Jozef Johan Hermans, and is assigned on its face to Lucas Industries Limited.[3] The '287 patent relates to "a method and apparatus for road profile prediction suitable for use in an autonomous cruise control system for a road vehicle." ('287 patent at 1:6-8.) The '287 patent has eight claims. Claims 1–3 and 8 are asserted against Magna. The asserted claims read as follows (with the first instance of the disputed terms highlighted in **bold**):

1. Apparatus for road profile prediction ahead of a vehicle comprising:
a digitizer operable to digitize successive frames of video image data each containing *feature points*, including a **screen** image horizon, relating to the road profile ahead of the vehicle; an **inverse perspective transform** operable to process a frame of digitized video image data with reference to a *horizon position* on the screen to generate representations of said feature points in real coordinates; a **mathematical lane marking model** characterizing real geometrical constraints of the road by relating said real coordinates to a horizon error and road profile parameters including left and right lane offset values, lane heading, and lane curvature in terms of radius of curvature, said horizon error representing the difference between a position of the horizon on the screen obtained during calibration and the horizon position on the screen when processing said digitized video image data; and an **estimator**, taking into account current and previous video frames, operable for **estimating** the best fit of said real coordinates to said mathematical lane marking model to derive said horizon error, and correct estimates for lane parameters including left and right lane offset values, heading angle, and lane curvature in terms of radius of curvature.

2. An autonomous cruise control system comprising an apparatus as claimed in claim 1.

3. A method for road profile prediction ahead of a vehicle comprising: digitizing successive frames of video image data each containing feature points each including a screen image horizon, said frames relating to the road profile ahead of the vehicle in screen coordinates; processing by way of an inverse perspective transform a frame of digitized

[3] Lucas Industries was acquired by TRW Inc., a predecessor to TRW, in 1999. (Compl. at ¶ 17.)

video image data with reference to said screen image horizon position to generate a representation of said feature points in real coordinates; storing a mathematical lane marking model representing the real geometrical constraints of the road, which model relates said real coordinates to a horizon error and to road profile parameters including left and right lane offset values, lane heading, and lane curvature in terms of radius of curvature, which horizon error represents the difference between a position of the horizon on the screen obtained during calibration and the horizon position on the screen when processing said digitized video image data; finding the best fit of said second frame real coordinates to said mathematical lane marking model taking into account said horizon error; and

estimating, taking into account current and previous video frames, from said best fit correct estimates for said left and right lane offset values, heading angle, and lane curvature in terms of radius of curvature thereby to derive said road profile prediction ahead of said vehicle.

8. An autonomous cruise control system using a method as claimed in claim 3.

B. Agreed-Upon and Disputed Claim Terms

1. Construction of Agreed-Upon Claim Terms

a) "feature points"

The parties agree that the term "feature points," which appears in claims 1 and 3 of the '287 patent, should be construed as "the coordinates of lane marking candidates identified in a frame of video image data." (JC at 3.)

Accordingly, the undersigned hereby adopts the parties' proposed construction and shall construe "feature points" as "***the coordinates of lane marking candidates identified in a frame of video image data***."

b) "horizon position"

The parties agree that the term "horizon position," which appears in claims 1 and 3 of the '287 patent, should be construed as "representation of a point on which the images of parallel lines on the road will meet."[4] (*Id.*)

Accordingly, the undersigned hereby adopts the parties' proposed construction and shall construe "horizon position" as "***representation of a point on which the images of parallel lines on the road will meet.***"

2. Construction of Disputed Claim Terms

a) "estimator" / "estimating"

The term "estimator" appears in claim 1 of the '287 patent and the term "estimating" appears in claim 3 of the '287 patent. The parties disagree on the claim construction of said terms and have proposed the following constructions:

TRW	MAGNA	STAFF
Processor or controller or component thereof to estimate or for estimating, i.e., for calculating or determining an approximation	"estimator" – a recursive least squares algorithm "estimating" – using a recursive least squares algorithm	"estimator" – a recursive least squares algorithm "estimating" – no construction necessary

TRW argues that the '287 patent teaches a controller in the form of a processor, which includes an estimator means operable to make estimations. (*See* Sternstein, Tr. at 80:21-24; *see also* CMIB at 16 (arguing that the written description in the '287 patent supports and provides structural context by stating that the system of the invention is shown to "include[] a controller 10 in the form of a digital processor.").) TRW asserts that the claimed "estimator" must be the processor because the patent states that "[t]he present invention is specifically concerned with

[4] The parties have agreed that the agreed-upon definition of "horizon position" will not alleged as relevant to or used for interpretation of the term "screen." (JC at 3.)

the analysis of video image data . . . to provide information to the processor concerning the offset of left and right lane markings with respect to the monitoring point of the camera, the lane heading angle relative to the longitudinal axis of the vehicle and the curvature of the road ahead." (CMIB at 15 (citing '287 patent at 2:46-52).)

According to TRW, Magna's and Staff's proposed construction is incorrect because the specification distinguishes between an "estimator" and an "estimator algorithm." (*Id.* at 17 (citing '287 patent at Fig. 5, 5:28); CMRB at 18.) TRW claims that the equations that Magna seeks to limit the estimator to are an embodiment of the process used by the estimator and thus, should not be read into the claim as an additional limitation. (CMRB at 18.) TRW further argues that Magna's and Staff's proposed construction is incorrect because it incorporates the limitations added by dependent claims 6 and 7. (CMIB at 17.)

Magna contends that "estimator" is defined in the specification as an algorithm that may be run on a processor. (RMIB at 38; RMRB at 22.) Magna asserts that TRW's proposed construction is incorrect because the claim does not recite a processor or controller and "the specification is unequivocal that the 'estimator' is a specific set of mathematical formulas used to estimate." (RMIB at 41.) Moreover, Magna argues that the estimator is not part of the processor, but is a set of equations that could be used by a processor. (*Id.*) According to Magna, TRW fails to cite a single statement in the specification that defines, or even suggests, that the estimator is a processor. (RMRB at 22.)

Staff claims that the term "estimator" is not a term in common usage and does not have a readily recognized plain and ordinary meaning. (SMIB at 18.) Moreover, Staff argues that "one of ordinary skill in the art would not understand the term 'estimator' to represent a certain structure." (*Id.*) According to Staff, its proposed construction is correct because the specification

identifies "estimator" as "a recursive least squares algorithm." (*Id.* (citing '287 patent at 3:62-65, 5:23-26, 5:27-30, 6:18-19).) While Staff contends that the term "estimating" needs no construction, Staff would recommend construing "estimator" and "estimating" to encompass the same concept if necessary. (Taylor, Tr. at 87:3-7.)

Staff submits that TRW's proposed construction is inconsistent with the specification because TRW's argument that the estimator is the processor shown in Figure 1 is an inference, at best. (SMRB at 13.) In addition, Staff argues that TRW's assertion that "estimator" and "processor" are used interchangeably in the specification is not supported by the intrinsic record. (*Id.*)

The undersigned finds Staff's and Magna's arguments persuasive. The specification "is always highly relevant to the claim construction analysis. Usually it is dispositive; it is the single best guide to the meaning of a disputed term." *Phillips*, 415 F.3d at 1315 (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)). In this case, the specification clearly states that "[t]he estimator used to estimate the best fit of a lane marking model to the image uses a recursive least squares procedure of well known type." ('287 patent at 3:62-64, 4:2-15 (detailing that "[t]he structure of the estimator" is a sequence of equations).) Given the disclosure in the specification, the undersigned is not convinced by TRW's arguments based on claim differentiation. As the Federal Circuit has noted, "claim differentiation is a rule of thumb that does not trump the clear import of the specification." *Eon-Net LP v. Flagstar Bancorp*, 653 F.3d 1314, 1323 (Fed. Cir. 2011); *see also N. Am. Vaccine, Inc. v. Am. Cyanamid Co.*, 7 F.3d 1571, 1577 (Fed. Cir. 1993) ("While it is true that dependent claims can aid in interpreting the scope of claims from which they depend, they are only an aid to interpretation and are not

conclusive."). Moreover, the undersigned finds that TRW fails to provide sufficient evidentiary support for construing "estimator" as a processor or controller.

Accordingly, the undersigned hereby construes the term "estimator" as "***a recursive least squares algorithm***" and construes the term "estimating" as "***using a recursive least squares algorithm***."

b) "inverse perspective transform"

The term "inverse perspective transform" appears in claims 1, 3, and 4. The parties disagree on the claim construction of the term and have proposed the following constructions:

TRW	MAGNA	STAFF
operation of a processor or controller or component thereof operating as claimed	equation (1) as it appears in the '287 patent at column 3, with the variables as described at 3:17-28	algorithm (claim 1) / processing step (claim 3) that transforms the features from the digitzer [*sic*] (claim 1)/ digitizing step (claim 3), which are in screen coordinates, to real coordinates using equation (1) of the '287 patent described at col. 3, ll. 6–28

TRW claims that the "inverse perspective transform" is an "operation of a processor or controller or component thereof operating as claimed." (CMIB at 10; CMRB at 7.) In support, TRW argues that the specification requires a processor because it uses the terms "processor" and "inverse perspective transform" interchangeably. (CMRB at 10-11 (comparing '287 patent at 1:38-1:41 with '287 patent at 6:24-6:51).) TRW also argues that only a processor can perform the, "*operable to process*" (Claim 1) and "*processing by way of*" (Claim 3), claim limitations. (*Id.* at 10.) Moreover, TRW asserts that the "process" requirement of the claims requires a physical device because other courts have construed similar language to connote a physical device. (*Id.* at 11 (citing *Joao Bock Transaction Sys., LLC v. First Nat. Bank,* 11 C 64 72, 2013

WL 3199981, at *11 (N.D. Ill. June 24, 2013) (defining processing as "manipulating data *within the computer*;" process as "to manipulate data *in the computer*;" and processor as a "principal operating part *of a computer*")).)

TRW objects to Staff's and Magna's claim that the patentee acted as his own lexicographer in defining the term "inverse perspective transform" as Equation (1). (CMRB at 7-8.) According to TRW, the term "inverse perspective transform" relates to the transformation from screen coordinates into real coordinates. (*Id.* at 7-9.) As such, TRW argues that Equation (1) is just one embodiment of a transformation from screen to real coordinates. (*Id.* at 9.) TRW asserts that this is supported by the specifications repeated use of the term in reference to the transformation from screen to real coordinates. (*Id.* at 8 (citing '287 patent at 2:21-24, 2:63-3:2, and 3:6-3:8).) In addition, TRW claims that textbooks and the knowledge of one of ordinary skill illustrate that similar language is used when referring to the term outside of the patent. (CMIB at 8 (stating textbooks have defined "inverse perspective transform" as the transformation of points from a single plane (the screen) into three-dimensional space (the real world)).)

Magna argues that the patentee expressly indicated that he was acting as his own lexicographer by stating: "the inverse perspective transformation **is as follows**." (RMRB at 16 (quoting '287 patent at 3:17-26) (emphasis added).) In fact, Magna asserts that the patentee failed to provide other embodiments or use language that would indicate to one of ordinary skill in the art that alternative embodiments exist. (RMIB at 24-25.) Therefore, Magna claims that the patentee defined the term "inverse perspective transform" as Equation (1) and explained that it performs a transformation from screen coordinates into real coordinates. (*Id.*; Adkins, Tr. at 66:7-66:15.)

Magna argues that TRW's proposed construction is incorrect for three reasons. First, there is no indication in the claims, specification, or prosecution history that the "inverse perspective transform" is an operation of a piece of hardware. (RMIB at 25.) In fact, Magna asserts that the patentee eliminated the physical hardware requirement by removing the "processing means" from the claims during the prosecution of the patent. (Adkins, Tr. at 66:16-67:3.) Second, Magna argues that TRW's construction renders the term meaningless by reading the phrase "inverse perspective" out of the term. (RMIB at 25.) Finally, Magna argues that the cases cited by TRW fail to support its proposition that the verb "to process" requires a physical processor. (RMRB at 15.)

While Staff has proposed a slightly different construction then Magna, Staff principally agrees that "inverse perspective transform" should be construed to mean Equation (1). (SMIB at 11-13; SMRB at 9.) Staff argues that express statements defining the term "inverse perspective transform" as Equation (1) appear in both the specification and prosecution history. (Taylor, Tr. at 67:23-68:07; '287 patent at 3:17-3:28.) In addition, Staff asserts it is proper to limit "inverse perspective transform" to a preferred embodiment because the patentee presents Equation (1) as the entire invention. (SMRB at 10-11 (citing *Vulcan Eng'g Co., Inc. v. FATA Aluminum, Inc.*, 278 F.3d 1366, 1376 (Fed. Cir. 2002) ("claims are construed in light of the specification, and are not limited to a designated 'preferred embodiment' unless the embodiment is in fact the entire invention presented by the patentee.")).)

The undersigned finds both Staff's and Magna's arguments persuasive.[5] The specification inserts Equation (1) below the phrase "[t]he inverse perspective transformation **is as follows**."

[5] The undersigned finds TRW's construction not persuasive, as there is no indication in the claims, specification, or prosecution history that the "inverse perspective transform" is an operation of a piece of hardware. ('287 patent at 6:24-8:3.) In fact, the patentee eliminated the physical hardware requirement by removing the "processing means" from the claims during the prosecution of the patent. ('287 patent am. (Aug. 25, 2000).)

('287 patent at 3:17-26) (emphasis added). This expressly indicates that the patentee acted as his own lexicographer. *Sinorgchem Co., Shandong v. Int'l Trade Comm'n*, 511 F.3d 1132, 1136 (Fed. Cir. 2007) (stating "the word 'is' . . . may signify that a patentee is serving as its own lexicographer"). In addition, the patentee failed to provide other embodiments or use language that would indicate to one of ordinary skill in the art that alternative embodiments exist. ('287 patent at 3:17-3:28; *see Toro Co. v. White Consol. Indus., Inc.*, 199 F.3d 1295, 1301 (Fed. Cir. 1999) (stating a claim term may be limited to an embodiment when "[n]o other, broader concept was described as embodying the applicant's invention, or shown in any of the drawings, or presented for examination.").) Therefore, the undersigned finds that the patentee's lexicography governs in defining the term "inverse perspective transform." *Phillips v. AWH Corp.,* 415 F.3d 1303, 1316 (Fed. Cir. 2005) (the patentee's lexicography governs when a specification reveals a special definition given to a claim term). Additionally, the undersigned notes that while Staff's and Magna's purposed constructions are very similar, the undersigned finds Magna's construction preferable due to the unclear language included in Staff's proposed construction.

Accordingly, the undersigned hereby construes "inverse perspective transform" as ***equation (1) as it appears in the '287 patent at column 3, with the variables as described at 3:17-28.***

c) "mathematical lane marking model"

The term "mathematical lane marking model" appears in claims 1 and 3 of the '287 patent. The parties disagree on the claim construction of this term and have proposed the following constructions:

TRW	MAGNA	STAFF
description or relationship between parameters used by a processor or controller or component thereof characterized as claimed	equation (3) of the '287 patent described at col. 3, ll. 38–61	equation (3) of the '287 patent described at col. 3, ll. 38–61

TRW submits that the mathematical lane marking model is not a "bare algorithm," but is "something used on or by a processor performing the invention as claimed." (CMIB at 12-13; CMRB at 13.) Specifically, TRW asserts that the mathematical lane marking model is the description or relationship between parameters used by a processor or controller.[6] (CMRB at 13 ("it's the data to be used by a processor or controller.") TRW cites to the specification in support, arguing that it "clearly shows" that the mathematical lane marking model is handled by the processor/controller shown in Figure 1. (CMIB at 13 ("It is the 'controller 10 in the form of a digital processor which received data from a number of sources . . . [and] processes data received from these sources . . .'").) TRW contends that the claims also "support this construction" as they provide sufficient context to define the mathematical lane marking model. (Sternstein, Tr. at 68:25-69:4 ("we're talking about this is the description of the relationship between the parameters that's used by the processor controller, and then it's characterized in the claim how that relationship actually exists."); CMRB at 12 ("it is the description or relationship between at least these parameters that defines the model and these parameters are explicit in the claim language.").) TRW further asserts that its construction is supported by the prosecution history as

[6] According to TRW, it does not contend that the mathematical lane marking model is a hardware element (*i.e.*, processor/controller). (CMRB at 13.)

"the applicant consistently noted that the mathematical lane marking model is as claimed by including at least the five road profile parameters." (CMRB at 12.)

TRW objects to Magna's and Staff's construction, arguing that their construction "ignores the explicit teachings of the specification and unduly limits the claim's scope to a particular embodiment." (CMRB at 13; *see also* CMIB at 13.) TRW insists that the specification discloses more than one embodiment. (Sternstein, Tr. at 70:10-11 ("Equation three is only one embodiment to the generalized description in the claim definition.").) TRW therefore submits that equation 3 is not the only embodiment of the mathematical lane marking model. (CMRB at 13.)

Magna asserts that the patentee provided one specific mathematical lane marking model in the specification with no alternative embodiments and in doing so, acted as his own lexicographer. (RMIB at 27.) Magna therefore submits that the proper construction of mathematical lane marking model is the patentee's definition: '287 patent at equation (3) as appears at column 3, with the variables as described at 3:50-58. (*Id.* at 27-28, 30; *see also* RMRB at 18.) While Magna acknowledges that the written description does not explicitly recite the words "mathematical lane marking model," Magna contends that the claims provide the necessary guidance so that a person of ordinary skill in the art would understand that equation (3) of the '287 patent is that mathematical lane marking model. (*Id.* at 27.) Specifically, Magna argues:

> Claim 1 describes the [mathematical lane marking model] as follows: "a mathematical lane marking model characterizing real geometrical constraints of the road by relating said real coordinates to a horizon error and road profile parameters including left and right lane offset values, lane heading, and lane curvature in terms of radius of curvature… ." Thus, the claimed [mathematical lane marking model] relates the real x,z coordinates to the horizon error (ΔH), lane offset value s (*c1*), lane heading (*c2*), and lane curvature

> (*c3*) in order to characterize the geometrical, or spatial, constraints of the road. While those spatial constraints are originally expressed in equation (2), equation (3) is the only equation disclosed that takes into account horizon error, as required by the claim, by applying the inverse perspective transform to equation (2), yielding equation (3):
>
> $$x_0 = c_1 + \left(c_2 + \frac{2c_1\Delta H}{hf} - \frac{x_0\Delta H}{hf}\right)z_0 + \left(c_3 + \frac{c_2\Delta H}{hf} + \frac{c_1\Delta H^2}{(hf)^2}\right)z_0^2$$
>
> where $x0$ and $z0$ are the real co-ordinates using the fixed horizon and ΔH is the horizon error. Thus, this equation (3) characterizes the real geometrical constraints of the road as claimed.

(*Id.* at 27-28 (internal citations omitted).) Magna contends that there is no other equation disclosed that provides such a mathematical model according to the claim. (*Id.* at 28.)

As for TRW's construction, Magna asserts that nothing in the claims or the specification indicates that the mathematical lane marking model is a "description or relationship between parameters used by" a piece of hardware. (*Id.* at 28-29 ("The MLMM itself is plainly a mathematical operation not tied to any hardware."); *see also* RMRB at 18.) Magna further argues that TRW's construction would read out the requirement of any sort of mathematical model whatsoever, thereby rendering that term meaningless and converting the claim element "mathematical lane marking model" into simply the word "model." (*Id.* at 29.)

Staff agrees with Magna on the construction of mathematical lane marking model and proffers similar reasoning as to why equation (3) is the proper construction. (*See generally* SMIB at 13-16; SMRB at 11-12.)

Like the dispute the term "inverse perspective transform," the dispute between the parties regarding "mathematical lane marking model" centers on whether the claimed mathematical lane marking model is a type of mathematical operation (*i.e.,* equation 3), as Magna and the Staff contend, or whether it is something used on or by a processor performing the claimed invention, as TRW contends. (Sternstein, Tr. at 68:22-69:5 ("Your Honor, with regard to the mathematical

lane marking model, it's going to be very similar to the prior discussion that we just had, in that, again, we're talking about this is the description of the relationship between the parameters that's used by the processor controller, and then it's characterized in the claim how that relationship actually exists. Both the staff and Magna take it to be limited to equation three . . . ."); CMIB at 13; RMIB at 26-27; SMIB at 14; RMRB at 18; SMRB at 11.) Thus, for the same reasons TRW's arguments regarding the term "inverse perspective transform" failed, so do its arguments for this term. (*See* Section V.B.2.b., *supra*.) The undersigned agrees with Magna and Staff that the patentee defined this term in the specification of the '287 patent. ('287 patent at 3:38-61.) In addition, the patentee failed to provide other embodiments or use language that would indicate to one of ordinary skill in the art that alternative embodiments exist. *See Toro Co.*, 199 F.3d at 1301.

Accordingly, the undersigned hereby construes "mathematical lane marking model" as ***equation (3) of the '287 patent at 3:38-61.***

d) "screen"/ "on the screen"/ "screen image"

The terms "screen," "on the screen," and "screen image" appear in independent claims 1 and 3. The parties have agreed that these terms present a single issue for claim construction.[7] (*See* JC at 1.) The parties disagree on the claim construction of the terms and have proposed the following constructions:

Term	TRW	Magna	Staff
"screen"	2-D representation of data	A physical video display	Screen image from the video camera
"on the screen"	No additional construction necessary	On a physical video display	On (or in) the screen image from the video camera
"screen image"	No additional construction necessary	This is not a claim term and seems to be an improper attempt to dissect the claim term "screen image horizon." To the extent that "screen image" may ultimately be determined to be a claim term, it is "an image in the video image data that appears on the screen."	No construction necessary

According to TRW, the specification makes it clear that the term "screen" does not correspond to a physical device, but instead refers to a two-dimensional representation of data. (CMIB at 7; CMRB at 2.) TRW asserts that the patentee surrounded the term with quotation marks to indicate it was being used in an alternative way. (CMRB at 4-5 (citing *Sinorgchem Co., Shandong v. Int'l Trade Comm'n*, 511 F.3d 1132, 1136 (Fed. Cir. 2007)).) In addition, TRW claims that the term is used in reference to the processing of image data, as opposed to displaying image data on a physical display. (*Id.* at 3.)

[7] The undersigned rejects Magna's claim that "screen" should have a different meaning in the term "screen image" because the term screen was added to the claims in a similar context during prosecution of the patent. (*See* '287 patent am. (April 23, 2004)).

TRW argues that Magna's proposed construction is incorrect for the following three reasons. (CMIB at 7-10; CMRB at 2-6.) First, TRW contends the term "display" is separate and distinct from the term "screen." (CMRB at 5.) Second, TRW argues there is no indication that FIG. 2 is the output of an actual physical display, as the specification describes it as an illustration of video image data. (*Id.* at 3 (citing '287 patent 2:45-46).) Finally, TRW contends that a physical display would be "redundant to the driver, who can already see the scene ahead of the vehicle." (CMIB at 10.)

TRW asserts that Staff's proposed construction is accurate to the extent that no physical display is required. (CMRB at 2.) However, TRW claims that Staff's proposed construction does not clarify the meaning of the term in context and could be read as being unduly limiting. (*Id.* at 6.) In addition, TRW argues the "screen image" is not just the original image from the video camera because the claims require the data to be subsequently transformed and processed. (*Id.*)

Magna contends that the claims, specification, and the position taken by the patentee during prosecution lead to the necessary conclusion that the term "on the screen" means "on a physical video display." (RMIB at 16-20; RMRB at 5-10.) Specifically, Magna asserts there is a difference between "on the screen" and "in the screen" because both were used in the specification, but a conscious choice was made in only using "on the screen" in the claims. (RMRB at 5.) In addition, Magna argues that a physical display must be present because the preposition "on" indicates physical contact with the noun "the screen." (*Id.* at 16-17.) Furthermore, Magna claims that FIG. 2 would not exist without the presence of a physical display. (*Id.* at 18.)

Magna objects to the constructions proposed by TRW and Staff, arguing that they attempt to redefine plain and unambiguous terms by improperly deleting "on the" from "on the screen." (RMRB at 10-12.) In addition, Magna argues that TRW's and Staff's proposed constructions improperly alter the meaning of "screen image," which is a separate and distinct claim term. (*Id.* at 13-14.) Moreover, Magna asserts that adoption of TRW's or Staff's proposed construction would negate the public notice function of the patent claims. (*Id.* at 9-10 (citing *Halliburton Energy Serv., Inc. v. M-I LLC,* 514 F.3d 1244, 1249 (Fed. Cir. 2008)).)

According to Staff, the term "screen" does not require a physical display as it repeatedly appears in claims 1 and 3 in the context of analyzing and not displaying video image data. (SMIB at 10-11 (citing '287 patent at 2:45-51, 6:54-7:15).) Staff also asserts that the camera view shown in FIG. 3c illustrates the position of the horizon on the screen or a screen image of the video camera 11. (*Id.*) Staff therefore asserts that one of ordinary skill in the art would understand the term "screen" in claims 1 and 3 to refer to the screen image of video camera 11. (*Id.* at 10.)

Staff agrees with TRW to the extent that the "screen" does not correspond to a physical display and it refers to image data from the video camera. (SMRB at 4.) However, Staff asserts that neither the claims nor the specification provide a proper basis for limiting "screen" to a two-dimensional coordinate system. (*Id.* at 4-5.) In addition, Staff asserts that Magna's proposed construction should be rejected because "there is simply no support in the specification or prosecution history to require a 'physical video display.'" (*Id.*) Specifically, Staff asserts that "claims 1 and 3 are directed toward an apparatus/method for road profile prediction and do not expressly recite a 'display'/ 'displaying.'" (*Id.* at 6 (citing 6:24–25, 6:54–55).)

The claims repeatedly use the term "screen" in the context of analyzing, not displaying, video image data.[8] (*See* '287 patent at 6:24-7:15; *see also* CMIB at 9; CMRB at 3; SMIB at 10.) For example, claim 3 refers to "digitizing," "processing," "storing," "finding," and "estimating." ('287 patent at 6:55-7:15; SMIB at 10.) In addition, limiting the term "screen" to a physical display would be an improper importation of a limitation from figure 1. *Liebel-Flarsheim Co. v. Medrad, Inc.,* 358 F.3d 898, 913 (Fed. Cir. 2004) (stating "it is improper to read limitations from a preferred embodiment described in the specification—even if it is the only embodiment—into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited"). In fact, the parties stated that there is no indication in the intrinsic record that the term "screen" is a physical display. (*See* CMIB at 8; SMRB at 5; Adkins, Tr. at 37:11-15.) Moreover, the '287 patent describes that the "**present invention** specifically concerns the analysis of video image data . . . ." ('287 patent at 2:45-46); *See Honeywell Int'l, Inc. v. ITT Indus., Inc.,* 452 F.3d 1312, 1318 (Fed. Cir. 2006) (limiting the claims to the description of the **present invention**) (emphasis added). The undersigned therefore finds that the term "screen" does not require a physical display and should be construed in the context of analyzing video image data.

In the '287 patent, the term "screen" is used only with reference to a horizon position. ('287 patent at 6:30-34, 6:40-44, 7:2-6; RMIB at 16.) Specifically, the phrase "position of the horizon on the screen" only appears in the specification in relation to figures 3a-3c. ('287 patent at 3:23-25.) Looking at figure 3c, the horizon is illustrated as a horizontal line labeled "H," which runs across a representation of a VIDEO SENSOR 11 ("Video Sensor"). (*Id.* at 2:21-24

[8] The undersigned notes that the term "screen" is used throughout the specification and claims and is presumed to have a different meaning then the term "display," which only appears once in FIG. 1. *Chicago Bd. Options Exch., Inc. v. Int'l Sec. Exch., LLC*, 677 F.3d 1361, 1369 (Fed. Cir. 2012) (stating there is a "general presumption that different terms have different meanings").

(stating FIG. 3c illustrates a camera view); *compare* FIG. 1, *with Id.* at 2:37 (showing "video camera" and "video sensor" are used interchangeably); *see* CMIB at Ex. D at 1010-067 (stating charge couple device (CCD) are commonly utilized in video cameras).) In fact, figure 3c illustrates that X and Y coordinates are assigned to particular positions on the Video Sensor, with reference to center of the bottom of the Video Sensor. (*See* '287 patent at FIG. 3c (illustrating X=0 as a line running vertically in the center of the Video Sensor and Y=0 as a line running horizontal at the bottom of the Video Sensor.).) This Video Sensor is used to capture data from the environment in relation to coordinates of the Video Sensor (i.e., screen coordinates). In addition, the claims make reference to the "screen image horizon" as being a feature point relating to the road profile ahead of the vehicle. (*Id.* at 6:26-29.) Accordingly, the undersigned construes the disputed terms as follows:

Term	Construction
"screen"	Digital representation of the road profile ahead of the vehicle from the video camera
"on the screen"	On the digital representation of the road profile ahead of the vehicle from the video camera
"screen image"	Digital representation of the road profile ahead of the vehicle from the video camera

SO ORDERED.

Charles E. Bullock
Chief Administrative Law Judge

CERTAIN VISION-BASED DRIVER ASSISTANCE SYSTEM CAMERAS AND COMPONENTS THEREOF **Inv. No. 337-TA-899**

PUBLIC CERTIFICATE OF SERVICE

I, Lisa R. Barton, hereby certify that the attached **ORDER NO. 13** has been served by hand upon the Commission Investigative Attorney, Todd Taylor, Esq., and the following parties as indicated, on .

OCT 0 9 2014

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