In the United States Court of Federal Claims

No. 16-346C
Filed March 7, 2019
NOT FOR PUBLICATION

GEOSPATIAL TECHNOLOGY ASSOCIATES, LLC, Plaintiff, v. THE UNITED STATES, Defendant.	)	Patent Infringement; Claims Construction; United States Patent No. 8,897,489.

Richard T. Matthews, Counsel of Record, Williams Mullen, P.C., Raleigh, NC, for plaintiff.

Jenna Munnelly, Trial Attorney, Gary L. Hausken, Director, Intellectual Property Staff, Chad Readler, Acting Assistant Attorney General, Commercial Litigation Branch, Civil Division, United States Department of Justice, Washington, DC, for defendant.

CLAIM CONSTRUCTION MEMORANDUM OPINION AND ORDER

GRIGGSBY, Judge

I. INTRODUCTION

In this patent infringement action, plaintiff, Geospatial Technology Associates, LLC ("GTA"), alleges that the United States infringed upon one or more of the claims of United States Patent No. 8,897,489, issued on November 25, 2014 (the '"489 Patent"). The parties have filed briefs on the proper construction of several terms or phrases contained in the claims for the '489 Patent, and on the proper definition of a person of ordinary skill in the art ("POSITA") at the time of the invention of the '489 Patent. This Memorandum Opinion and Order addresses claim construction for the terms or phrases pertinent to the alleged infringement.

II. FACTUAL AND PROCEDURAL BACKGROUND[1]

A. Factual Background

In this patent infringement action, GTA alleges that various agencies of the United States government have infringed upon one or more claims of the '489 Patent. See generally Am. Compl.

1. The '489 Patent

As background, the '489 Patent was filed on January 28, 2011, and it relates back to provisional application No. 61/337,065, which was filed on January 29, 2010. '489 Patent at 1. Dr. William Basener is the sole listed inventor of the '489 Patent. Id.

On November 25, 2014, the United States Patent and Trademark Office ("USPTO") issued the '489 Patent to the Rochester Institute of Technology ("RIT"). Id. On November 12, 2015, RIT and GTA entered into an exclusive license agreement, in which RIT transferred all substantial rights in the '489 Patent to GTA. See Mem. Op. and Order at 16, Geospatial Tech. Assocs., LLC v. United States, No. 16-346C (Fed. Cl. Aug. 15, 2017), at Entry No. 25.

The '489 Patent patents technology involving automated image processing and target detection, which can be used for, among other things, military, drug enforcement, and geological purposes. Pl. Claim Constr. Br. at 6. The invention, as described in the '489 Patent abstract, is as follows:

> A method, non-transitory computer readable medium and apparatus that provides object-based identification, sorting and ranking of target detections including determining a target detection score for each pixel in each of one or more images for each of one or more targets. A region around one or more of the pixels with the determined detection score which are higher than the determined detection scores for the remaining pixels in each of the one or more identified regions with the determined object based score for each region is provided.

'489 Patent at 1.

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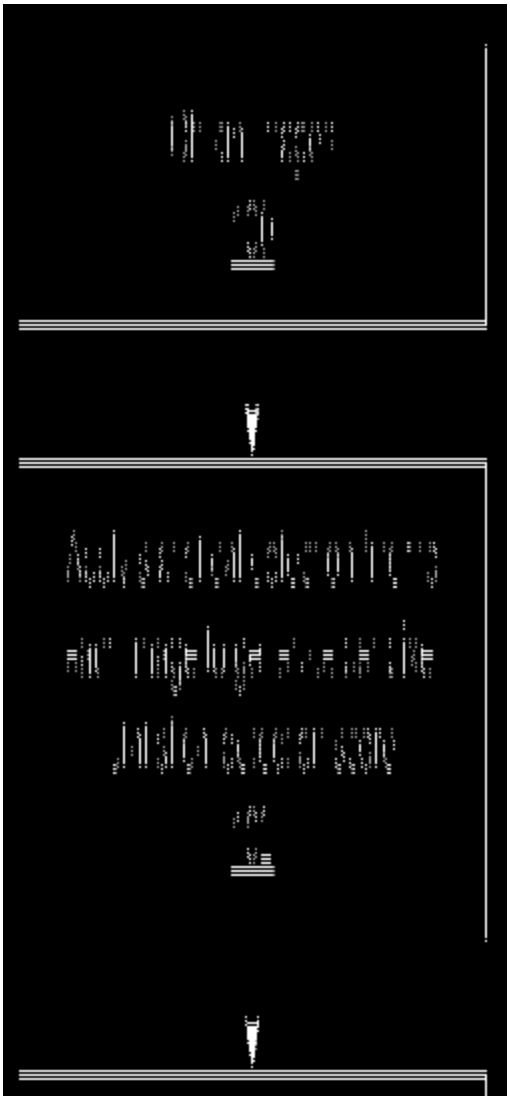
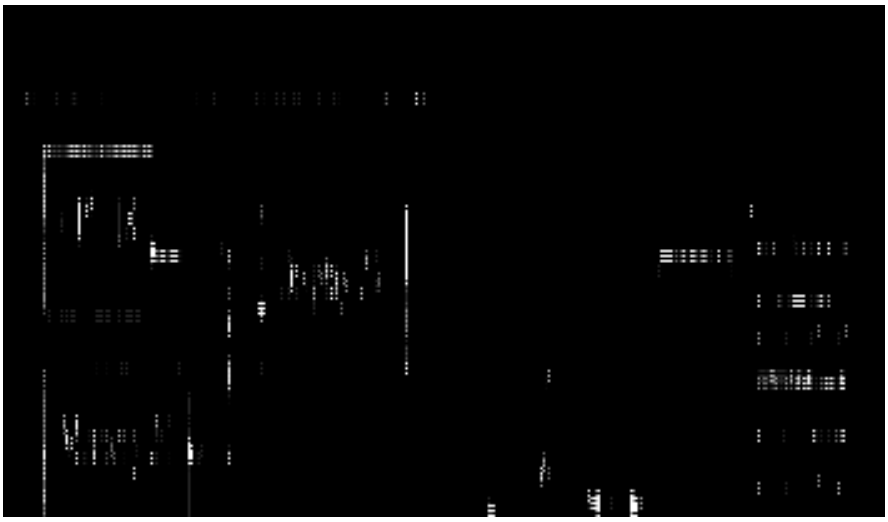
[1] The facts recited in this Memorandum Opinion and Order are taken from GTA's amended complaint ("Am. Compl."); the '489 Patent; and the parties' respective briefs on claim construction ("Pl. Claim Constr. Br.") and ("Def. Claim Constr. Br.").

Figure 2 of the ‘489 Patent provides an exemplary example of the method for target detection and is set forth below:



Id. at 3. The ‘489 Patent also provides that the method for target detection involves five steps. See id. at 4:45-6:27. First, obtaining the images. Id. at 4:45-4:50. Second, applying a target detection algorithm to determine a target detection score for each pixel. Id. at 4:51-4:60. Third, determining an object-based score for identified regions from the determined target detection scores, although other types of scores for other identification aspects could be determined. Id. at 5:3-5:10. Fourth, obtaining geographic location information associated with each of the images at capture. Id. at 6:5-6:11. Lastly, the fifth step involves providing one or more identified regions with the determined object-based score for each region. Id. at 6:16-6:27.

In addition, the '489 Patent provides that steps three and four are repeated iteratively, until all pixels with a detection score in any detection plane above a given threshold are included in one of the regions. Id. at 6:12-6:15. The '489 Patent also provides that each step of the process described above is performed using the exemplary example of the target detection processing apparatus contained in the '489 Patent and set forth below:



Id. at 2.[2]

2. Claims Of The '489 Patent

The '489 Patent consists of 33 claims, 27 of which are the subject of this action. See generally Pl. Claim Constr. Br. In this regard, the '489 Patent consists of 12 independent claims and 21 dependent claims. Id. at 7. Claims 2, 6-9, 28, and 29 depend upon Claim 1; Claims 11, 15, 17, 18, 30, 31 depend upon Claim 10; Claims 20, 24-27, 32 and 33 depend upon Claim 19. See '489 Patent at 6:58-13:9.

Claim 1 is the first independent claim, and this claim provides that:

> A method for identification, sorting and ranking detections of one or more targets, the method comprising:

[2] The numbers 12, 14 and 16 shown in Figure 1 above refer to the target detection processing apparatus; target signature library server; and a communications network, respectively. See '489 Patent at 2:60-65.

determining with a target detection processing apparatus a target detection score for each pixel of a spectral image for one or more targets by obtaining with the target detection processing apparatus a signature for one or more of the targets for the image, and applying with the target detection processing apparatus the statistical target detection filter using the one or more obtained signatures to rank each of the pixels by its statistical score;

identifying with the target detection processing apparatus a region around one or more of the pixels with the determined detection scores which are higher than a first score in said image;

determining with the target detection processing apparatus an object-based spectral identification score for each of the identified regions in said image; and

providing with the target detection processing apparatus the one or more identified regions with the determined object-based score for each region.

'489 Patent at 6:57-7:10.

Claim 3 is the second independent claim, and this claim provides that:

A method for identification, sorting and ranking detections of one or more targets, the method comprising:

determining with a target detection processing apparatus a target detection score for each pixel in each of one or more images for each of one or more targets;

identifying with the target detection processing apparatus a region around one or more of the pixels with the determined detection scores which are higher than a first score in each of the one or more of images;

determining with the target detection processing apparatus an object-based score for each of the identified regions in each of the one or more images; and

providing with the target detection processing apparatus the one or more identified regions with the determined object-based score for each region, wherein the determining a target detection score further comprises:

obtaining with the target detection processing apparatus a signature for one or more of the targets for each of the one or more images; and

applying with the target detection processing apparatus the statistical target detection filter using the one or more obtained signatures to rank each of the pixels by a number of standard deviations from a mean for each of the one or more images to determine the statistical deviation score.

Id. at 7:19-7:43.

Claim 4 is the third independent claim, and this claim provides that:

> A method for identification, sorting and ranking detections of one or more targets, the method comprising:
> determining with a target detection processing apparatus a target detection score for each pixel in each of one or more images for each of one or more targets;
> identifying with the target detection processing apparatus a region around one or more of the pixels with the determined detection scores which are higher than a first score in each of the one or more of images;
> determining with the target detection processing apparatus an object-based score for each of the identified regions in each of the one or more images; and
> providing with the target detection processing apparatus the one or more identified regions with the determined object-based score for each region, wherein the identifying further comprises:
> masking out from each of the regions with the target detection processing apparatus the one or more of the pixels in each of the one or more images which have the highest determined statistical detection scores in each of the one or more images;
> selecting with the target detection processing apparatus one or of the pixels which are end members for each of the regions; and
> identifying with the target detection processing apparatus a convex hull of the selected end members as a boundary for the one or more regions for each of the one more of images.

Id. at 7:44-8:4.

Claim 5 is the fourth independent claim, and this claim provides that:

> A method for identification, sorting and ranking detections of one or more targets, the method comprising:
> determining with a target detection processing apparatus a target detection score for each pixel in each of one or more images for each of one or more targets;
> identifying with the target detection processing apparatus a region around one or more of the pixels with the determined detection scores which are higher than a first score in each of the one or more of images;
> determining with the target detection processing apparatus an object-based score for each of the identified regions in each of the one or more images; and
> providing with the target detection processing apparatus the one or more identified regions with the determined object-based score for each region, wherein the determining the object based score further comprises:
> unmixing with the target detection processing apparatus the pixel with highest determined statistical detection score in each of the identified regions by finding one or more abundances to determine pixel spectra; and

comparing with the target detection processing apparatus target spectra for each of the one or more targets with the determined pixel spectra to determine the object based score for each of the identified regions.

Id. at 8:5-8:29.

Claim 10 is the fifth independent claim, and this claim provides that:

A non-transitory computer readable medium having stored thereon instructions for identification, sorting and ranking detections of one or more targets comprising machine executable code which when executed by at least one processor, causes the processor to perform steps comprising:
determining a target detection score for each pixel in a spectral image for each of one or more targets by obtaining a signature for one or more of the targets for the image, and applying the statistical target detection filter using the one or more obtained signatures to rank each of the pixels by its statistical score;
identifying a region around one or more of the pixels with the determined detection scores which are higher than a first score in said image;
determining an object-based spectral identification score for each of the identified regions in said image; and
providing the one or more identified regions with the determined object-based spectral identification score for each region.

Id. at 8:46-8:64.

Claim 12 is the sixth independent claim, and this claim provides that:

A non-transitory computer readable medium having stored thereon instructions for identification, sorting and ranking detections of one or more targets comprising machine executable code which when executed by at least one processor, causes the processor to perform steps comprising:
determining a target detection score for each pixel in each of one or more images for each of one or more targets;
identifying a region around one or more of the pixels with the determined detection scores which are higher than a first score in each of the one or more of images;
determining an object-based score for each of the identified regions in each of the one or more images; and
providing the one or more identified regions with the determined object-based score for each region, wherein the determining a target detection score further comprises:

obtaining a signature for one or more of the targets for each of the one or more images; and

applying the statistical target detection filter using the one or more obtained signatures to rank each of the pixels by a number of standard deviations from a mean for each of the one or more images to determine the statistical deviation score.

Id. at 9:3-9:24.

Claim 13 is the seventh independent claim, and this claim provides that:

A non-transitory computer readable medium having stored thereon instructions for identification, sorting and ranking detections of one or more targets comprising machine executable code which when executed by at least one processor, causes the processor to perform steps comprising:

determining a target detection score for each pixel in each of one or more images for each of one or more targets;

identifying a region around one or more of the pixels with the determined detection scores which are higher than a first score in each of the one or more of images;

determining an object-based score for each of the identified regions in each of the one or more images; and

providing the one or more identified regions with the determined object-based score for each region, wherein the identifying further comprises:

masking out from each of the regions the one or more of the pixels in each of the one or more images which have the highest determined statistical detection scores in each of the one or more images;

selecting one or of the pixels which are end members for each of the regions; and

identifying a convex hull of the selected end members as a boundary for the one or more regions for each of the one or more of images.

Id. at 9:25-9:48.

Claim 14 is the eighth independent claim, and this claim provides that:

A non-transitory computer readable medium having stored thereon instructions for identification, sorting and ranking detections of one or more targets comprising machine executable code which when executed by at least one processor, causes the processor to perform steps comprising:

determining a target detection score for each pixel in each of one or more images for each of one or more targets;

identifying a region around one or more of the pixels with the determined detection scores which are higher than a first score in each of the one or more of images;

determining an object-based score for each of the identified regions in each of the one or more images; and

providing the one or more identified regions with the determined object-based score for each region, wherein the determining the object based score further comprises:

unmixing the pixel with highest determined statistical detection score in each of the identified regions by finding one or more abundances to determine pixel spectra; and

comparing target spectra for each of the one or more targets with the determined pixel spectra to determine the object based score for each of the identified regions.

Id. at 9:49-10:3.

Claim 19 is the ninth independent claim, and this claim provides that:

A target detection processing apparatus comprising:

one or more processors;

a memory coupled to the one or more processors which are configured to execute programmed instructions stored in the memory comprising:

determining a target detection score for each pixel in a spectral image for each of one or more targets by obtaining a signature for one or more of the targets for the image, and applying the statistical target detection filter using the one or more obtained signatures to rank each of the pixels by its statistical score;

identifying a region around one or more of the pixels with the determined detection scores which are higher than a first score in said image;

determining an object-based spectral identification score for each of the identified regions in said image; and

providing the one or more identified regions with the determined object-based spectral identification score for each region.

Id. 10:18-10:37.

Claim 21 is the tenth independent claim, and this claim provides that:

A target detection processing apparatus comprising:

one or more processors;

a memory coupled to the one or more processors which are configured to execute programmed instructions stored in the memory comprising:

determining a target detection score for each pixel in each of one or more images for each of one or more targets;

identifying a region around one or more of the pixels with the determined detection scores which are higher than a first score in each of the one or more of images;

determining an object-based score for each of the identified regions in each of the one or more images; and

providing the one or more identified regions with the determined object-based score for each region, wherein the one or more processors is further configured to execute programmed instructions stored in the memory for the determining a target detection score further comprising:

obtaining a signature for one or more of the targets for each of the one or more images; and

applying the statistical target detection filter using the one or more obtained signatures to rank each of the pixels by a number of standard deviations from a mean for each of the one or more images to determine the statistical deviation score.

Id. at 10:45-11:3.

Claim 22 is the eleventh independent claim, and this claim provides that:

A target detection processing apparatus comprising:

one or more processors;

a memory coupled to the one or more processors which are configured to execute programmed instructions stored in the memory comprising:

determining a target detection score for each pixel in each of one or more images for each of one or more targets;

identifying a region around one or more of the pixels with the determined detection scores which are higher than a first score in each of the one or more of images;

determining an object-based score for each of the identified regions in each of the one or more images; and

providing the one or more identified regions with the determined object-based score for each region, wherein the one or more processors is further configured to execute programmed instructions stored in the memory for the identifying further comprising:

masking out from each of the regions the one or more of the pixels in each of the one or more images which have the highest determined statistical detection scores in each of the one or more images;

selecting one or of the pixels which are end members for each of the regions; and

identifying a convex hull of the selected end members as a boundary for the one or more regions for each of the one or more of images.

Id. at 11:4-11:31.

Lastly, Claim 23 is the twelfth independent claim, and this claim provides that:

A target detection processing apparatus comprising:
one or more processors;
a memory coupled to the one or more processors which are configured to execute programmed instructions stored in the memory comprising;
determining a target detection score for each pixel in each of one or more images for each of one or more targets;
identifying a region around one or more of the pixels with the determined detection scores which are higher than a first score in each of the one or more of images;
determining an object-based score for each of the identified regions in each of the one or more images; and
providing the one or more identified regions with the determined object-based score for each region, wherein the one or more processors is further configured to execute programmed instructions stored in the memory for the determining the object based score further comprising:
unmixing the pixel with highest determined statistical detection score in each of the identified regions by finding one or more abundances to determine pixel spectra; and
comparing target spectra for each of the one or more targets with the determined pixel spectra to determine the object based score for each of the identified regions.

Id. at 11:32-11:57.

3. The Claim Terms Or Phrases Requiring Construction

The parties identify the following disputed claim terms or phrases for construction by the Court:

a. Claim Term Or Phrase: "Target Detection Processing Apparatus" Claims 1-9, 15, 19, 21-24, 28 And 29

GTA's Construction	Government's Construction
No construction necessary.	Proposed construction: *"A computing system* which includes a processor, a memory storage device, a user input device, a display, and an interface system; which are coupled together by bus or other link.*"*

Joint Claim Constr. Statement at A1.

b. Claim Term Or Phrase: "Target Detection Score" Claims 1-5, 10-14 And 19-23

GTA's Construction	Government's Construction
No construction necessary. Alternatively: *"*A value or score assigned to a pixel based on the likelihood that the specified pixel contains evidence of a target*."*	Proposed construction: *"A numerical value that is* assigned to a pixel based on the likelihood that the specified pixel contains evidence of a desired target, i.e., the higher the number the more likely a target is located *in that area."*

Id. at A1-A2.

c. Claim Term Or Phrase: "First Score" Claims 1-5, 10, 12-14, 19 And 21-23

GTA's Construction	Government's Construction
Proposed construction: *"a first specified target* detection score or other threshold*."*	Proposed construction: *"The target* detection score*."*

Id. at A2.

d. Claim Term Or Phrase: "Higher Than A First Score" Claims 1, 3-5, 10, 12-14, 19 And 21-23

GTA's Construction	Government's Construction
No construction necessary. Alternatively: *"Of greater value than a specified target detection score or other threshold."*	Proposed construction: *"Numerically greater* than the target detection score."

Id. at A2-A3.

e. Claim Term Or Phrase: "Object-Based Spectral Identification Score" Claims 1, 10, And 19; "Object-Based Score" Claims 3-5, 12-14 And 21-23

GTA's Construction	Government's Construction
No construction necessary. Alternatively: *"Any metric that is computed from* the pixels in an identified region using a process that provides better understanding of the material *or object in the region."*	Proposed construction: *"A* numerical value that is assigned to an identified region based on the target detection scores assigned to the pixels in *that region."*

Id. at A3.

f. Claim Term Or Phrase: "Unmixing" Claims 5, 14, 23, 29, 31 And 33

GTA's Construction	Government's Construction
No construction necessary.	Proposed construction: *"A* method of separating *an 'object' having higher scores of a* characteristic or characteristics from the surroundings by determining the value for the object in excess of a calculated background value.*"*

Id. at A3-A4.

g. Claim Term Or Phrase: "Statistical Score" Claims 1, 10 And 19; "Statistical Detection Score(s)" Claims 4-5, 13-14, 22-23 And 28-33

GTA's Construction	Government's Construction
Proposed construction: *"A ranked or statistically* compared or determined target detection score."	Proposed construction: *"A numerical value,* assigned to a pixel, which is generated by applying a standard deviation algorithm which is determined based on the target detection scores *assigned to each pixels of an image."*

Id. at A4.

B. Procedural Background

GTA commenced this patent infringement action on March 16, 2016. See generally Compl. On June 30, 2016, the government answered the complaint. See generally Answer. On April 13, 2017, GTA filed an amended complaint. See generally Am. Compl. On May 15, 2017, the government answered the amended complaint. See generally Answer to Am. Compl.

After the government moved for summary judgment upon the ground that GTA lacks standing to bring this action, the Court issued a Memorandum Opinion and Order denying the government's motion on August 15, 2017. See generally Mem. Op. and Order at 16, Geospatial Tech. Assocs., LLC v. United States, No. 16-346C (Fed. Cl. Aug. 15, 2017), at Entry No. 25. Thereafter, GTA filed its initial identification of accused products and which claims of the patent the products infringed, on February 16, 2018, and GTA supplemented this submission on May 16, 2018. See generally Pl. Initial Identification; Pl. Supp. Identification. On April 16, 2018, the

government filed its initial identification of prior art and the government supplemented this submission on November 27, 2018. See generally Def. Initial Identification; Def. Supp. Identification.

On May 16, 2018, the parties filed their respective proposed claim terms to be constructed and proposed construction. See generally Pl. Claim Constr. Statement; Def. Claim Constr. Statement. On June 15, 2018, the parties filed their respective responses to the proposed claim construction statements. See generally Pl. Resp. to Claim Constr. Statement; Def. Resp. to Claim Const. Statement. On July 16, 2018, the parties filed a joint claim construction statement. See generally Joint Claim Constr. Statement.

On August 31, 2018, the parties filed their respective opening briefs on claim construction. See generally Pl. Claim Constr. Br.; Def. Claim Constr. Br. The parties filed their respective responsive briefs on claim construction on October 5, 2018. See Pl. Resp.; Def. Resp. On October 12, 2018, the parties filed a joint claim construction appendix and a pre-hearing statement. See generally Joint Claim Constr. App'x and Pre-Hearing Statement.

On November 29, 2018, the Court held a technological primer with the parties. See generally Tech. Primer Tr. On December 12, 2018, the Court held a claim construction hearing. See generally Claim Constr. Tr.

The matters related to claim construction having been fully briefed, and the Court constructs the disputed claims.

III. LEGAL STANDARDS

A. Patent Infringement Claims And Jurisdiction

This Court possesses subject-matter jurisdiction to consider patent infringement claims brought against the United States pursuant to 28 U.S.C. § 1498(a). Section 1498(a) provides, in relevant part, that:

> Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the United States Court of Federal Claims for the recovery of his reasonable and entire compensation for such use and manufacture.

28 U.S.C. § 1498(a).

B. Standards For Claim Construction

The United States Court of Appeals for the Federal Circuit has held that "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 v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (quoting Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc., 381 F.3d 1111, 1115 (Fed. Cir. 2004)). The Federal Circuit has also held that "[c]laim construction is a legal statement of the scope of the patent right." EPOS Techs. Ltd. V. Pegasus Techs. Ltd., 766 F.3d 1338, 1341 (Fed. Cir. 2014) (citing Lighting Ballast Control LLC v. Philips Elecs. N. Am. Corp., 744 F.3d 1272, 1276-77 (Fed. Cir. 2014) (en banc)). And so, the construction and meaning of the claims in a patent are questions of law for the Court to address. Markman v. Westview Instruments, Inc., 517 U.S. 370, 388-90 (1996) (holding that "there is sufficient reason to treat construction of terms of art like many other responsibilities that we cede to a judge . . . .")

While this Court is not required to construe every term in a patent, the Court must construe any term for which claim scope is disputed. *O2 Micro Int'l Ltd. v. Beyond Innovation* Tech. Co., 521 F.3d 1351, 1360-62 (Fed. Cir. 2008) (holding that "[w]hen the parties present a fundamental dispute regarding the scope of a claim term, it is the court's duty to resolve it.") In doing so, the Court first examines the intrinsic evidence of record, because "intrinsic evidence is the most significant source of the legally operative meaning of disputed claim language." Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996). Such intrinsic evidence encompasses the "patent itself, including the claims, the specification[,] and . . . the prosecution history." Id.

The Federal Circuit has also held that the Court should look to the ordinary and customary meanings attributed to terms within the claims by a POSITA at the date of the invention when construing claim terms. Phillips, 415 F.3d at 1313; see also Thorner v. Sony *Computer Entm't Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012) (stating that "[t]he words of a claim are generally given their ordinary and customary meaning as understood by a person of ordinary skill in the art when read in the context of the specification and prosecution history."). "That starting point is based on the well-settled understanding that inventors are typically

persons skilled in the field of the invention and that patents are addressed to and intended to be read by others of skill in the pertinent art." Phillips, 415 F.3d at 1313.

There are two exceptions to this general rule, namely: "(1) when a patentee sets out a definition and acts as his own lexicographer or (2) when the patentee disavows the full scope of the claim term either in the specification or during prosecution." Hill-Rom Servs., Inc. v. Stryker Corp., 755 F.3d 1367, 1371 (Fed. Cir. 2014) (quoting Thorner, 669 F.3d at 1365). And so, when a patentee acts as a lexicographer and uses terms in a manner other than their ordinary meaning, "the special definition of the term [must be] clearly stated in the patent specification or file history." Vitronics, 90 F.3d at 1582 (citing Hoechst Celanese Corp. v. BP Chems. Ltd., 78 F.3d 1575, 1578 (Fed. Cir. 1996)); see also Hormone Research Found., Inc. v. Genentech, Inc., 904 F.2d 1558, 1562 (Fed. Cir. 1990).

The Court must also review the patent's specification "to determine whether [an] inventor has used any terms in a manner inconsistent with their ordinary meaning." Vitronics, 90 F.3d at 1582. But, the Court must avoid "importing limitations from the specification into the claims." Phillips, 415 F.3d at 1323. The prosecution history may also be examined, principally to exclude interpretations disclaimed during prosecution. See Chimie v. PPG Indus., Inc., 402 F.3d 1371, 1384 (Fed. Cir. 2005) ("where the patentee has unequivocally disavowed a certain meaning to obtain his patent, the doctrine of prosecution disclaimer attaches and narrows the ordinary meaning of the claim congruent with the scope of the surrender") (internal citations omitted); see also Vitronics, 90 F.3d at 1582-83.

Lastly, extrinsic evidence, encompassing "all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises," can also be used to determine a term's meaning. Markman, 52 F.3d at 980. But, extrinsic evidence is "less significant than the intrinsic record" in the construction process. Phillips, 415 F.3d at 1317 (quoting C.R. Bard, Inc. v. United States Surgical Corp., 388 F.3d 858, 862 (Fed. Cir. 2004)). And so, the Court should consider extrinsic evidence only when intrinsic evidence cannot be used to resolve ambiguities in the claim language. Id. at 1317-18.

C. Patent Invalidity And Indefiniteness

The definiteness requirement for patents is codified in 35 U.S.C. § 112, which provides that "[t]he specification shall conclude with one or more claims particularly pointing out and

distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention." 35 U.S.C. § 112(b). In Nautilus, Inc. v. Biosig Instruments, Inc., the Supreme Court established the standard for determining indefiniteness by holding that "a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." 572 U.S. 898, 901 (2014); see also Interval Licensing LLC v. AOL, Inc., 766 F.3d 1364, 1371 (Fed. Cir. 2014) ("The claims, when read in light of the specification and the prosecution history, must provide objective boundaries for those of skill in the art.").

The Federal Circuit has also recognized that "an inventor need not explain every detail because a patent is read by those of skill in the art." Wellman, Inc. v. Eastman Chem. Co., 642 F.3d 1355, 1367 (Fed. Cir. 2011). The Federal Circuit has also held that failure to meet the definiteness requirement renders the subject claim invalid. See *Allen Eng'*g Corp. v. Bartell Indus., Inc., 299 F.3d 1336, 1349 (Fed. Cir. 2002).

D. Level Of Skill In The Art And POSITA

This Court has held that it should "examine patent claim terms and phrases from the perspective of a person of ordinary skill in the art" when construing patents. Beacon Adhesives, Inc. v. United States, 134 Fed. Cl. 26, 33 (2017). The Federal Circuit has also recognized that the "[f]actors that may be considered in determining the ordinary level of skill in the art include: (1) the types of problems encountered in the art; (2) the prior art solutions to those problems; (3) the rapidity with which innovations are made; (4) the sophistication of the technology; and (5) the educational level of active workers in the field." Ruiz v. A.B. Chance Co., 234 F.3d 654, 666-67 (Fed. Cir. 2000). And so, defining a POSITA is a basic factual inquiry for the Court. Graham v. John Deere Co., 383 U.S. 1, 17 (1966).

In this case, GTA proposes that a POSITA, at the time of the invention of the '489 Patent, is a person who "would have had at least a bachelor of science degree in mathematics, electrical engineering, image science, or similar scientific field, and either a graduate degree or five years of relevant experience in a similar field, in addition to experience as a hyperspectral image software algorithm developer." Pl. Claim Constr. Br. at 11. The government argues that a POSITA with respect to the '489 Patent is a person "who has a Bachelor of Science degree in engineering, computer science, image science, or similar field, and either a graduate degree, in

the above fields, or similar, or five years of relevant experience in the hyperspectral imaging field." Joint Claim Constr. App'x and Prehearing Statement at 1-2.

The Court finds that the parties' proposed definitions of a POSITA are substantially similar. And so, for the purposes of claim construction only, the Court defines a POSITA for the '489 Patent as follows:

> A person of ordinary skill in the art is a person who would have had a Bachelor of Science degree in engineering, computer science, image science, or similar field, and either a graduate degree, in the above fields, or similar, or five years of relevant experience in the hyperspectral imaging field.

IV. LEGAL ANALYSIS

A. Claim Construction

The Court constructs the disputed terms or phrases of the '489 Patent as follows:

1. Claim Term Or Phrase: "Target Detection Processing Apparatus" Claims 1-9, 15, 19, 21-24, 28 And 29

The parties disagree about whether the term "target detection processing apparatus," found in Claims 1-9, 15, 19, 21-24, 28 and 29 of the '489 Patent, requires construction to define the scope of the '489 Patent and whether, without construction, this term is precise enough to afford clear notice of what is claimed. See Joint Claim Constr. Statement at A1. In this regard, GTA argues that no construction of this term is necessary, because "target detection processing apparatus" can be given its plain and ordinary meaning by a POSITA. Pl. Claim Constr. Br. at 12. In addition, GTA argues that the government's proposed construction of this term would impermissibly import limitations from an exemplary embodiment in the '489 Patent into the relevant claims. Id. at 13. The government counters that, without construction, the claim term is not precise enough to afford clear notice of what is claimed, because the term would include any configuration that a person skilled in the art could contemplate. Def. Claim Constr. Br. at 11. And so, the parties propose the following construction of the term "target detection processing apparatus:"

GTA's Construction	Government's Construction
No construction necessary.	Proposed construction: *"A computing system* which includes a processor, a memory storage device, a user input device, a display, and an interface system; which are coupled together by bus or other link.*"*

Joint Claim Constr. Statement at A1.

The parties both rely upon intrinsic and extrinsic evidence to support their respective positions on the construction of the term "target detection processing apparatus."

a. Intrinsic Evidence

With regard to the intrinsic evidence, GTA points to the specification for the '489 Patent and argues that the term "target detection processing apparatus" does not require construction, because this term can be given its plain and ordinary meaning by a POSITA. Pl. Claim Constr. Br. at 12. Specifically, GTA argues that the '489 Patent provides that "[t]he target detection processing apparatus 12 includes a processor 18, memory storage device 20, a user input device 22, a display 24, and an interface system 26 which are coupled together by bus or other link, although the device may comprise other types and numbers of elements in other configurations." Id. (emphasis added); see also '489 Patent at 3:3-3:9. Given this, GTA contends that the specification makes clear that the target detection processing apparatus should not be limited to the specific device described in the specification and pictured in Figure 1 of the '489 Patent. Pl. Claim Constr. Br. at 12-13.[3]

GTA also relies upon the claim language to argue that a POSITA would understand the target detection processing apparatus to be a computing system with at least a processor and a memory sufficient to process the steps described in the claims, because Claim 19 of the '489 Patent describes the target detection processing apparatus as "comprising: one or more processors; a memory coupled to one or more processors which are configured to execute

[3] The specification for the '489 Patent provides that "an environment 10 with an exemplary target detection processing apparatus 12 is illustrated in FIG. 1." '489 Patent at 2:60-2:61.

programed instructions . . . ." '489 Patent at 10:20-10:22; see also Claim Constr. Tr. at 42:19-42:23. And so, GTA also contends that a POSITA would understand Figure 1 in the '489 Patent to represent an example of a target detection processing apparatus and not to be the only configuration for such a device. Pl. Resp. at 7-8.

The government relies upon the same portion of the specification for the '489 Patent to argue that the term target detection processing apparatus should be limited to the device described in Figure 1 of the '489 Patent, because a broader construction of the term would "include virtually any configuration that a person skilled in the art could contemplate." Def. Claim Constr. Br. at 11. And so, the government argues that a POSITA would not know what is meant by a "target detection processing apparatus" unless the term is limited to the specific device described in the specification. Def. Resp. at 3.

b. Extrinsic Evidence

Both parties presented expert testimony on the proper construction of the term "target detection processing apparatus" during the claim construction hearing. GTA's expert witness, William F. Basener, PhD ("Dr. Basener"), testified that a POSITA would understand a target detection processing apparatus to be "just a computer that is capable of executing the commands in the claims." Claim Constr. Tr. at 40:3-40:7. Dr. Basener also testified that a POSITA would believe that the only thing that a target detection process apparatus requires "is a processor and memory." Id. at 40:8-40:10.

In addition, Dr. Basener testified that the government's construction of this term was too limiting, because there are examples of a target detection processing apparatus at the time of the invention of the '489 Patent that do not include a display or user device. Id. at 40:11-40:16. And so, Dr. Basener opined that the "limitations [proposed by the government,] requiring a computer display or a user input device [be included in the target detection processing apparatus,] are not things a person of ordinary skill in the art in the field would expect." Id. at 42:9-42:12.

GTA's second expert witness, Nasser M. Nasrabadi, PhD ("Dr. Nasrabadi"), also testified that Figure 1 of the '489 Patent is "just an example of what could a [target detection processing apparatus] system be." Id. at 117:10-117:11. And so, Dr. Nasrabadi opined that a "target

detection apparatus" does not require all the components specified in Figure 1, but instead the components utilized "depends on the application." Id. at 116:25- 117:3.

Lastly, the government's expert witness, Joseph Meola, PhD ("Dr. Meola"), testified that the government's proposed construction of the term target detection processing apparatus "encompasses what a person of ordinary skill would interpret to mean a target detection processing apparatus, and the architectures that are generally used for target detection processing." Id. at 138:20-138:25. Dr. Meola also testified that "if other devices may comprise a target detection processing apparatus [outside of the scope of Figure 1 in the '489 Patent], I think it starts to make the claims and the scope ambiguous." Id. at 138:25-139:3. And so, Dr. Meola opined that "Figure 1 [of the '489 Patent] describes the architectures that are understood by a person in the field." Id. at 141:8-141:10.

c. Claim Construction

The Court finds that, based upon ample intrinsic evidence corroborated with the testimony of Dr. Basener and Dr. Nasrabadi, a POSITA would, with reasonable certainty, read the term "target detection processing apparatus" to mean an apparatus that may be the device described in Figure 1 of the '489 Patent, but could also be a computer system that has elements that may vary from the elements depicted in Figure 1 of the '489 Patent. In addition, the Court finds that construing this term as the government suggests would require an improper reading of particular embodiments and examples appearing in the specification into the claim language. See Constant v. Advanced Micro-Devices, Inc., 848 F.2d 1560, 1571 (Fed. Cir. 1988). And so, the Court concludes that no further construction of this term is necessary.

2. Claim Term Or Phrase: "Target Detection Score" Claims 1-5, 10-14 And 19-23

The parties disagree about whether the term "target detection score," found in Claims 1-5, 10-14 and 19-23, requires construction to define the scope of the '489 Patent and whether, without construction, the claim term is precise enough to afford clear notice of what is claimed. See Joint Claim Constr. Statement at A1-A2. GTA argues that no construction is required, because this term can be given its plain and ordinary meaning by a POSITA based upon the intrinsic evidence in the specification. Pl. Claim Constr. Br. at 13-14. Alternatively, GTA proposes a construction of this term that avoids imposing a numeric limitation. Id. The

government counters that the target detection score must be a numerical value, because a POSITA would not be reasonably certain of the scope of the claims if any possible value or score could be used. Def. Claim Constr. Br. at 12. And so, the parties propose the following construction of "target detection score:"

GTA's Construction	Government's Construction
No construction necessary. Alternatively: *"*A value or score assigned to a pixel based on the likelihood that the specified pixel contains evidence of a *target."*	Proposed construction: *"A numerical value* that is assigned to a pixel based on the likelihood that the specified pixel contains evidence of a desired target, i.e., the higher the number the more likely a target is located *in that area."*

Joint Claim Constr. Statement at A1-A2.

The parties both rely upon intrinsic and extrinsic evidence to support their respective positions on the construction of "target detection score."

a. Intrinsic Evidence

With regard to the intrinsic evidence, GTA argues that there should not be a numeric limitation imposed upon the term target detection score because the specification of the '489 Patent states that there can be target detection scores for each pixel, as well as for other numbers and types of image elements. Pl. Claim Constr. Br. at 14; see also '489 Patent at 4:51-4:58 ("In step 102, the target detection processing apparatus 12 applies a target detection algorithm, such as a statistical matched filter to the imagery using one or more signatures of desired targets obtained from the image and target signature library server 14 to determine a target detection score for each pixel, although the other types of target detection scores for other numbers and type of image elements can be determined and used."). And so, GTA argues that a POSITA would read the specification to provide an example and not to limit the target detection score to a numerical value. Pl. Resp. at 9.

GTA also argues that the prosecution history for the '489 Patent demonstrates that the target detection score need not be numeric. Id. at 10-11. In this regard, GTA argues that the USPTO Examiner's statement of reason for allowance for the '489 Patent supports this view,

because the statement recognizes that the "signature" for a target for an image contemplates the use of numerical and non-numerical values. Id.[4]

The government counters that the term "target detection score" must be limited to a "numerical value" based upon the claim language and the specification. Def. Claim Constr. Br. at 12. To support this view, the government argues that the specification supports Claim 1 of the '489 Patent by providing that "[t]he target detection processing apparatus 12 ranks each pixel, for example by a number of standard deviations from a mean for the detection plane . . . ." Id.; '489 Patent at 4:62-4:65. And so, the government contends that the reference in the specification to ranking each pixel "by a number of standard deviations" requires that the "target detection score" be a numerical value. Def. Resp. at 4; see also '489 Patent at 4:62-4:65.

b. Extrinsic Evidence

Both parties presented expert testimony on the proper construction of the term "target detection score" during the claim construction hearing. Dr. Basener testified that "a person of ordinary skill in the art would understand target detection and they would understand [that] a target detection score is the output from target detection." Claim Constr. Tr. at 49:8-49:11. Dr. Basener also acknowledged that "most often" a target detection score is a number. Id. at 49:11. But, he testified that a target detection score could also be a label, or a color. Id. at 49:8-49:13; 50:11-50:17.[5] And so, Dr. Basener opined that a POSITA would understand the term "target

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[4] The Examiner's statement provides, in relevant part, that:

> [O]btaining with the target detection processing apparatus a signature for one or more of the targets for the image, and applying with the target detection processing apparatus the statistical target detection filter using the one or more obtained signatures to rank each of the pixels by its statistical score . . . .

Pl. Resp. at Ex. B (USPTO Notice of Allowability at 4) (emphasis added); see also id. at 10.

[5] Dr. Basener discussed a specific non-numeric example, utilizing the Environment for Visualizing Images ("ENVI") program with Spectral Angle Mapper ("SAM"). Claim Constr. Tr. at 49:14-50:17. In this regard, Dr. Basener testified that, the ENVI program with SAM can:

> output in colors, and that's a standard output that comes from target detection processing software. But it often becomes a number along the way and then becomes a color, but it doesn't have to do that. You could

detection score" to be a number or something that is non-numeric, "[as] long as it has some way to rank and compare to a threshold, [and so,] it could be anything that allows you to compare to a threshold." Id. at 51:21-51:24.

Dr. Nasrabadi also testified that the target detection score need not be numerical stating that "[i]t could be a score, a value, a likelihood, a label, yes target/no target, multiple color . . . like [Environment for Visualizing Images], which is a classical technique in hyperspectral detection . . . It highlights different color." Id. at 119:2-119:7. And so, Dr. Nasrabadi opined that the term target detection score should not be limited to numerical values as the government seeks. Id. at 118:9-118:14.[6]

To support the view that the target detection score must be numerical, Dr. Meola testified that the target detection score "would be a numerical value that comes out of a target detection filter, a statistical detection filter, and that [a] numerical value is representing a likelihood of the presence of a target." Id. at 141:17-141:21. Dr. Meola also testified that "the numerical values can then be used to generate a decision, whether it's target or no target, or to develop a label, such as high confidence, medium confidence, low confidence, or a color that might be easier for an analyst to interpret, rather than having to work with the numerical values themselves." Id. at 141:22-142:3. And so, Dr. Meola opined that "at the heart of a target detection score is a numerical value, and I believe that a person of ordinary skill would understand it to be a detection score being a numerical value." Id. at 142:4-142:7.

> make target detection algorithms that never see a number and they just output a label, high/medium/low.

Id. at 50:11-50:17.

[6] GTA also relies upon Webster's New Collegiate Dictionary and a scholarly article, entitled Strategies for Hyperspectral Target Detection in Complex Background Environments, dated Dec. 21, 2005, to support its position on construction of target detection score. See Pl. Claim Constr. Br. at 14; Pl. Resp. at Ex. A (Michael T. Eismann, Strategies for Hyperspectral Target Detection in Complex Background Environments, IEEE Aerospace Conference, Version 3, 20, 21 (Dec. 21, 2005)).

c. Claim Construction

The Court concurs with GTA that the intrinsic and extrinsic evidence in this matter shows that a target detection score could be a value that is not numerical. The Court finds, however, that GTA's alternative construction of this term is more appropriate. See O2 Micro *Int'l Ltd. v.* Beyond Innovation Tech. Co., 521 F.3d 1351, 1361 (Fed. Cir. 2008) ("A determination that a claim term 'needs no construction' or has the 'plain and ordinary meaning' may be inadequate when a term has more than one 'ordinary' meaning or when reliance on a term's 'ordinary' meaning does not resolve the parties' dispute."); see also Eon Corp. IP Holdings v. Silver Spring Networks, 815 F.3d 1314, 1319 (Fed. Cir. 2016) ("[A trial] court's duty at the claim construction stage is, simply . . . to resolve a dispute about claim scope that has been raised by the parties."). And so, the Court construes the term "target detection score" as it appears in Claims 1-5, 10-14 and 19-23 to mean "a value or score assigned to a pixel based on the likelihood that the specified pixel contains evidence of a target."

3. Claim Term Or Phrase: "First Score" Claims 1-5, 10, 12-14, 19 And 21-23

The parties disagree about whether the term "first score," found in Claims 1-5, 10, 12-14, 19 and 21-23, should be limited to the "target detection score," or may include other thresholds. See Joint Claim Constr. Statement at A2. GTA argues that "first score" does not have the same meaning as the "target detection score," because this term is used in addition to the term "target detection score" in the '489 Patent. Pl. Claim Constr. Br. at 15. And so, GTA contends that a "first score" can be the "target detection score," or "a given threshold" that may be used in identifying a region with determined detection scores at a certain level. Id. The government counters that the only "score" referred to in the '489 Patent is the "target detection score" and so, the "first score" must be the "target detection score." Def. Claim Constr. Br. at 13. And so, the parties propose the following construction of the term "first score:"

GTA's Construction	Government's Construction
Proposed construction: *"a first specified target* detection score or other threshold.*"*	Proposed construction: *"The target detection* score.*"*

Joint Claim Constr. Statement at A2.

The parties both rely upon intrinsic and extrinsic evidence to support their respective positions on the construction of "first score."

a. Intrinsic Evidence

With regard to the intrinsic evidence, GTA relies upon the claim language and the tenants of claim construction to argue that the term "first score" is not identical to target detection score because this term is first introduced in Claim 1 as "a first score," indicating that this is the first time that this term will be used within the claim. Pl. Claim Constr. Br. at 15; see also '489 Patent at 6:60-7:4. GTA also argues that the term target detection score is similarly referred to as "a target detection score" when first introduced in the claim language. Pl. Claim Constr. Br. at 15. And so, GTA contends that the term "first score" need not appear in the '489 Patent if this term "were merely identical" to the target detection score. Pl. Resp. at 11; see also Bancorp. Servs., LLC v. Hartford Life Ins. Co., 359 F.3d 1367, 1373 (Fed. Cir. 2004) (holding that an inventor's use of different terms to identify similar claim limitations should be construed to mean that the two claim terms have different meanings); CAE Screenplates Inc. v. Heinrich Fiedler GmbH & Co. KG, 224 F.3d 1308, 1317 (Fed. Cir. 2000) ("In the absence of any evidence to the contrary, we must presume that the use of these different terms in the claims connotes different meanings.").

The government counters that the claim language uses the term "first score" to mean only "the target detection score," because when the term "first score" appears in the claim language, the only score determined prior to determining a "first score" is the "target detection score." Def. Claim Constr. Br. at 13; see also '489 Patent at 6:60-6:61, 7:2-7:3. And so, the government contends that the claim language shows that the "first score" can only be the "target detection score." Def. Claim Constr. Br. at 13. [7]

[7] GTA also relies upon language in the specification for the '489 Patent that states that: "steps 104-106 are repeated iteratively, removing the pixels in each region from consideration in subsequent iterations, until all pixels with a detection score in any detection plane above a given threshold are included in one of the regions," to support its argument that the term first score could involve other thresholds. Pl. Claim Constr. Br. at 15 (citing '489 Patent at 6:12-6:15). But, the government correctly argues that the phrase "a given threshold" does not appear in the claim language. Def. Resp. at 4-5.

b. Extrinsic Evidence

Both parties presented expert testimony to support their proposed construction of the term "first score" during the claim construction hearing. The parties' expert witnesses generally agree that the term "first score" is not the same as a "target detection score" and that a POSITA would understand the term "first score" to be a threshold. Claim Constr. Tr. at 58:9-58:14; 146:5-146:10.

Dr. Basener testified that "a first score is what we call a threshold and that's clear in the patent because we define the first score and then we compare our pixel values to the first score." Id. at 54:24-55:2. And so, Dr. Basener opined that "the first score is a threshold [and so, the] first score should be synonymous with threshold." Id. at 58:25-59:2.

Dr. Nasrabadi also testified that a first score "is a criteria to make a decision where the targets are . . . . It could be a value and so on." Id. at 121:10-121:13. In this regard, Dr. Nasrabadi testified that for a first score, you could create a threshold that "is not numerical; you have to choose some method of comparison, such as 1 percent of all the red points, red that means it's target." Id. at 121:4-121:8. And so, Dr. Nasrabadi opined that the first score has to be "some threshold" and does not have to be numerical. Id. at 121:4-121:5.

Dr. Meola testified that he agreed with Dr. Basener that "a POSITA, with their knowledge and experience, would be able to interpret from the context of a patent that [the term first score] does imply a threshold . . . ." Id. at 146:5-146:7. But, Dr. Meola further testified that "the first score would also be a numerical threshold that would be applied," because the target detection score is a numerical value. Id. at 146:9-146:10.

c. Claim Construction

The Court concurs with GTA that, based upon the intrinsic and extrinsic evidence presented, the term "first score" is not identical to, or interchangeable with, "the target detection score." The Court also concurs with GTA that the term "first score" need not be numeric. And so, the Court construes the term "first score" as it appears in Claims 1-5, 10, 12-14, 19 and 21-23 to mean "a first specified target detection score or other threshold."

4. Claim Term Or Phrase: "Higher Than A First Score" Claims 1, 3- 5, 10, 12-14, 19 And 21-23

The parties disagree about whether the term "higher than a first score," found in Claims 1, 3-5, 10, 12-14, 19 and 21-23, requires construction to define the scope of the '489 Patent and whether, without construction, the claim term is precise enough to afford clear notice of what is claimed. See Joint Claim Constr. Statement at A2-A3. GTA argues that this term requires no construction based upon the plain and ordinary meaning of the term as understood by a POSITA. Pl. Claim Constr. Br. at 16. Alternatively, GTA argues that the term "higher than a first score" should not be construed to limit the term to "the target detection score," or to numeric values. Id. at 16-17. The government counters that, based upon the language of the claims, there should be a numerical limitation placed on this term, so that a POSITA would understand the scope of the claims. Def. Claim Constr. Br. at 14. And so, the parties propose the following construction of the term "higher than a first score:"

GTA's Construction	Government's Construction
No construction necessary. *Alternatively: "Of greater value than a specified target detection score or other threshold."*	Proposed construction: *"Numerically greater than the target detection score."*

Joint Claim Constr. Statement at A2-A3.

The parties rely upon intrinsic and extrinsic evidence to support their respective positions on the construction of the term "higher than a first score."

a. Intrinsic Evidence

With regard to the intrinsic evidence, GTA argues that the term "higher than a first score" can be specified thresholds other than the "target detection score" and that this term also need not be a numerical value. Pl. Claim Constr. Br. at 15-16 ("steps 104-106 are repeated iteratively, removing the pixels in each region from consideration in subsequent iterations, until all pixels with a detection score in any detection plane above a given threshold are included in one of the regions."); Pl. Resp. at 12.

The government counters that the term "higher than a first score" must be construed to mean a numerical score based upon the ordinary meaning of the word higher and the intrinsic

evidence. Def. Claim Constr. Br. at 14. In this regard, the government observes that the word higher in the claim language is connected to the ranking of scores. Id.; see also '489 Patent at 6:67-7:4. The government also argues that the specification for the '489 Patent provides no guidance on how a non-numeric score would be ranked when utilizing a mathematical algorithm. Def. Resp. at 5-6; see also '489 Patent at 5:30-5:65, 6:29-6:31. And so, the government contends that, if a score is not a numerical value, it is unclear how the scores could be ranked. Def. Claim Constr. Br. at 14.

b. Extrinsic Evidence

Both parties presented expert testimony to support their proposed construction of the term "higher than a first score" during the claim construction hearing. Dr. Basener testified that "the only requirement on higher than a first score in the patent is that . . . we can compare the target detection scores to this first score, just that we have [to] be able to do that comparison." Claim Constr. Tr. at 62:4-62:7. Dr. Basener further testified that "[y]ou don't have to have numbers to do that comparison. The high/medium/low would allow you to do that comparison." Id. at 62:7-62:9. And so, Dr. Basener opined that determining what is higher than a first score "is just saying we're comparing that first score to the pixel scores . . . . This is just a comparison to a threshold." Id. at 61:3-61:6.

Dr. Nasrabadi also testified that a POSITA must "make a decision on these scores at every pixel" to determine what is higher than a first score. Id. at 121:21-121:22. Dr. Nasrabadi further testifies that "if [higher than a first score] is numerical, you basically say above .5. If [higher than a first score] is not numerical, you have to give [] a criteria, and that criteria means 1 percent of the red points, things like that." Id. at 122:3-122:6. And so, Dr. Nasrabadi opined that higher than a first score is not based upon a target detection score, nor is it required to be numerical. See id. at 121-22.

Dr. Meola testified that, "[b]ased upon the understanding that a target detection score is a numerical value and a first score is a numerical value, higher than a first score would be numerically greater than a first score." Id. at 147:6-147:10. And so, Dr. Meola opined that the output of the detection filter is a numerical value and "you're comparing it with a numerical value to declare whether a target is present or not." Id. at 147:15-147:18.

c. Claim Construction

Based upon the intrinsic and extrinsic evidence, the Court concurs with GTA that the term "higher than a first score" is not limited to numerical values, nor is this term limited to the "target detection score." And so, the Court construes the term "higher than a first score," as it appears in Claims 1, 3-5, 10, 12-14, 19, and 21-23, to mean "of greater value than a specified target detection score or other threshold."

5. Claim Term Or Phrase: "Object-Based Spectral Identification Score" Claims 1, 10 And 19; "Object-Based Score" Claims 3-5, 12-14 And 21-23

The parties agree that the terms "object-based spectral identification score" and "object-based score" should be given the same construction. See Joint Claim Constr. Statement at A3. But, the parties disagree about whether these terms require construction to define the scope of the '489 Patent and whether, without construction, the claim terms are precise enough to afford clear notice of what is claimed. Id.

In this regard, GTA argues that these two terms do not require construction, because the terms should be given their plain and ordinary meaning to a POSITA. Pl. Claim Constr. Br. at 17. Alternatively, GTA proposes a construction of the terms that would not impose a numerical limitation and is not based solely upon the target detection scores. Id. The government counters that a numerical limitation should be imposed upon these terms because, otherwise, a POSITA would not know the scope of the patent and could not be reasonably certain of what is claimed. Def. Claim Constr. Br. at 15-16. And so, the parties propose the following construction of the terms "object-based spectral identification score" and "object-based score:"

GTA's Construction	Government's Construction
No construction necessary. Alternatively: *"*Any metric that is computed from the pixels in an identified region using a process that provides better understanding of the material *or object in the region."*	Proposed construction: *"A* numerical value that is assigned to an identified region based on the target detection scores assigned to the pixels in *that region."*

Joint Claim Constr. Statement at A3.

The parties rely upon intrinsic and extrinsic evidence to support their respective positions on the construction of the terms "object-based spectral identification score" and "object-based score."

a. Intrinsic Evidence

With regard to the intrinsic evidence, GTA argues that the terms "object-based spectral identification score" and "object-based score" should be given their plain and ordinary meaning, because the specification for the '489 Patent explicitly states that an object-based score can be "any metric that is computed from the pixels in an identified region using a process that provides better understanding of the material or object in the region." Pl. Claim Constr. Br. at 18; see also '489 Patent at 5:8-5:10. And so, GTA further argues that the use of the phrase "any metric" in the '489 Patent means that "object-based spectral identification score" and "object-based score" include numeric and non-numeric values. Pl. Claim Constr. Br. at 17-18.

The government counters that the terms "object-based spectral identification score" and "object-based score" must have a numerical value, because these scores are based upon the target detection score, which also must have a numerical value. Def. Claim Constr. Br. at 15. To support this construction, the government notes that Claim 1 provides that, when a pixel is processed, a target detection score is determined and that, when an identified region of pixels is processed, an object-based spectral identification score is determined. Id.; see also '489 Patent at 6:61, 7:9-7:10. And so, the government reads this claim language to require that an object-based score—or object-based spectral identification score—must have a numerical value. Def. Claim Constr. Br. at 15.

b. Extrinsic Evidence

Both parties presented expert testimony to support their proposed construction of the terms "object-based spectral identification score" and "object-based score" during the claim construction hearing. Dr. Basener, testified that "the ['489 Patent] is very specific about what an object-based score is because a person of ordinary skill might not know what it is or actually wouldn't before reading the patent." Claim Constr. Tr. at 64:19-64:22. Dr. Basener also testified that "[t]here's nothing in the patent that says the object-based spectral identification score should be a numerical value." Id. at 68:4-68:6. In addition, Dr. Basener observed that the term object-based spectral identification score is provided with a description in the '489 Patent, at column 5, rows 7 through 10. Id. at 64:3-64:8.

Dr. Nasrabadi testified that the object-based score "has nothing to do with [. . . the] target detection scores." Id. at 123:4-123:5. And so, Dr. Nasrabadi opined that, the object based score does not utilize target detection scores. See id.

Dr. Meola testified that an object based score "would be a numerical value that is computed from the detection scores in the region or from the pixel spectra within the region as well." Id. at 148:8-148:11. Dr. Meola also testified that "it's a numerical value, but specifically how that score is computed is relatively vague and may offer confusion or uncertainty for a POSITA going through this." Id. at 148:11-148:14. And so, Dr. Meola opined that "a POSITA would understand that this [object based score] is a numerical value." Id. at 148:4-148:5.

c. Claim Construction

The Court concurs with GTA's view that the intrinsic and extrinsic evidence show that an "object-based spectral identification score" and "object based score" could be a metric that does not have a numerical value. The Court also finds that a construction of these terms is necessary. See O2 Micro *Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1361 (Fed. Cir. 2008) ("A determination that a claim term 'needs no construction' or has the 'plain and ordinary meaning' may be inadequate when a term has more than one 'ordinary' meaning or when reliance on a term's 'ordinary' meaning does not resolve the parties' dispute.") And so, the Court construes the terms "object-based spectral identification score" and "object-based score" as they appear in Claims 1, 3-5, 10, 12-14, 19 and 21-23 to mean "any metric that is computed from the pixels in an identified region using a process that provides better understanding of the material or object in the region."

6. Claim Term Or Phrase: "Unmixing" Claims 5, 14, 23, 29, 31 And 33

The parties disagree about whether the term "unmixing," found in Claims 5, 14, 23, 29, 31 and 33, requires construction in order for a POSITA to understand the scope of the claim. See Joint Claim Constr. Statement at A3-A4. GTA argues that no construction of this term is necessary, because the specification for the '489 Patent outlines the methods for unmixing and a POSITA would understand the term "unmixing" by its plain and ordinary meaning. Pl. Claim Constr. Br. at 18; see also Pl. Resp. at 14. The government counters that the term unmixing requires construction, because the claim language fails to adequately define this term and the

specification for the '489 Patent does not describe how the process of unmixing is performed. Def. Claim Constr. Br. at 16-17. And so, the parties propose the following construction of "unmixing:"

GTA's Construction	Government's Construction
No construction necessary.	Proposed construction: *"A* method of separating *an 'object' having higher scores of a* characteristic or characteristics from the surroundings by determining the value for the object in excess of a calculated background value.*"*

Joint Claim Constr. Statement at A3-A4.

The parties rely upon intrinsic and extrinsic evidence to support their respective positions on the construction of the term "unmixing."

a. Intrinsic Evidence

With regard to the intrinsic evidence, GTA argues that the embodiments of "unmixing" are explicitly discussed in the specification for the '489 Patent, thereby allowing a POSITA to understand the plain meaning of this term. Pl. Resp. at 14-15. In this regard, GTA argues that the specification for the '489 Patent expressly provides that "[t]he pixel is then 'unmixed' by target detection processing apparatus 12 by finding abundances a_1, a_2, …, a_i, a_t that give the best approximation of the pixel spectra as a linear combination of the background end members and the target." '489 Patent at 5:39-5:43.

In addition, GTA argues that each claim in the '489 Patent that includes the term "unmixing" specifies the method for conducting the step of "unmixing." Pl. Claim Constr. Br. at 18. For example, GTA correctly observes that Claim 5 provides that the unmixing step involves "unmixing with the target detection processing apparatus the pixel with the highest determined statistical detection score in each of the identified regions by finding one or more abundances to determine pixel spectra." '489 Patent at 8:22-8:25.

The government argues that the term "unmixing" requires construction, because the specification and the claim language of the '489 Patent make clear that the object-based scoring process requires: (1) identifying the highest scoring pixel for a given characteristic; (2)

establishing a region around the target; (3) selecting end members for that region; and then (4) "unmixing." Def. Resp. at 7; see also '489 Patent at 5:30-5:65, 6:1-6:4, 8:22-8:29. In addition, the government argues that "the purpose of the 'unmixing' is to separate the 'abundance' of a pixel or pixels that represent an 'object' from the value of its surroundings (the background)." Def. Resp. at 8; see also '489 Patent at 5:30-5:65. Lastly, the government observes that the process of "unmixing" is described in the mathematical calculations found in the specification for the '489 Patent. Def. Resp. at 8; see also '489 Patent at 5:43-5:65. And so, the government argues that the Court should construct the term "unmixing" to be consistent with this defined embodiment. Def. Resp. at 8.

b. Extrinsic Evidence

Both parties presented expert testimony to support their proposed construction of the term "unmixing" during the claim construction hearing and the parties' experts generally agree that a POSITA would understand what is meant by the term "unmixing." Claim Constr. Tr. at 149:13-149:15.

Dr. Basener testified that:

> [U]nmixing is a very basic standard process in the field. Every student who learns remotes sensing has to know what unmixing is. So a person of ordinary skill in the art would certainly know what unmixing is.

Id. at 71:11-71:14. Dr. Basener also testified that "if you look at the claim language [Claim 5], the unmixing here is used to . . . determine abundances." Id. at 71:14-71:16. Dr. Basener also observed that the term "unmixing" was well known at the time of the invention of the '489 Patent to a POSITA. See id. at 72:15-72:21. And so, Dr. Basener opined that a person of ordinary skill in the art in 2009 would understand the term "unmixing" to be the standard in the field at that time – a method for getting abundances.

Dr. Nasrabadi testified that "unmixing is [a] well understood process . . . . You have to know the abundances, the E[']s, and the A[']s, the proportionality. That's what unmixing is." Id. at 128:16-128:20. And so, Dr. Nasrabadi opined that "an expert in hyperspectral imaging,

whether their background is remote sensing or automatic target recognition, [would] know what unmixing means." Id. at 128:23-128:25.[8]

Dr. Meola testified that "I think in general that a POSITA would understand what is meant by unmixing and we generally agree with that." Id. at 149:13-149:15. But, Dr. Meola also testified that "unmixing is a very large field of research in itself, and the patent claims really don't define how the abundances are estimated," and, given this, "[a POSITA] wouldn't understand the scope of it." Id. at 149:16-149:19, 150:7. And so, Dr. Meola opined that "it's kind of unclear with regard to the scope if all unmixing approaches should be included within that." Id. at 150:10-150:12.

c. Claim Construction

Based upon the intrinsic evidence and the testimony of the parties' expert witnesses, the Court finds that a POSITA would, with reasonable certainty, understand the term "unmixing" by its plain and ordinary meaning as a standard term in the industry. And so, no further construction of this term is necessary.

7. Claim Term Or Phrase: "Statistical Score" Claims 1, 10 And 19; "Statistical Detection Score(s)" Claims 4-5, 13-14, 22-23 And 28-33

The parties agree that the terms "statistical score" and "statistical detection score(s)" should be given the same construction. See Joint Claim Constr. Statement at A4. But, the parties disagree about whether these terms should be limited to numerical values and to specific algorithms. Def. Resp. at 8-9.

As discussed above, GTA contends that the term "score" may encompass both numerical and non-numerical values within the context of the '489 Patent. Pl. Resp. at 15. GTA also contends that there should be no limit to specific algorithms imposed upon the terms "statistical

[8] GTA also relies upon a scholarly article entitled Spectral Unmixing, by N. Keshava and J.F. Mustard's, published January 2002, to show that a POSITA would understand "unmixing" by its plain and ordinary meaning, because the term is a standard term in the industry. See Pl. Resp. at 14; see also Pl. Resp. at Ex. C (N. Keshava & J.F. Mustard, Spectral Unmixing, 1:19 IEEE SIGNAL PROCESSING MAGAZINE 44, 44 (Jan. 2002) ("Spectral unmixing is the procedure by which the measured spectrum of a mixed pixel is decomposed into a collection of constituent spectra, or endmembers, and a set of corresponding fractions, or abundances, that indicate the proportion of each endmember present in the pixel."))

score" and "statistical detection score(s)," because the specification for the '489 Patent makes clear that the application of a standard deviation algorithm is an exemplary method. Id. at 15-16. The government counters that imposing a numerical limitation upon the construction of the terms "statistical score" and "statistical detection score(s)" is necessary to define the scope of the claim, and that limiting these terms to the standard deviation applied in the specification is necessary for a POSITA to be able to reasonably ascertain the scope of the claims. Def. Resp. at 9. And so, the parties propose the following construction of "statistical score" and "statistical detection score(s):"

GTA's Construction	Government's Construction
Proposed construction: "A ranked or statistically compared or determined target detection score."	Proposed construction: *"A numerical value,* assigned to a pixel, which is generated by applying a standard deviation algorithm which is determined based on the target detection scores *assigned to each pixels of an image."*

Joint Claim Constr. Statement at A4.

The parties rely upon intrinsic and extrinsic evidence to support their respective positions on the construction of the terms "statistical score" and "statistical detection score(s)."

a. Intrinsic Evidence

With regard to the intrinsic evidence, GTA argues that the plain meaning of the term "score" and the intrinsic evidence support construing the terms "statistical score" and "statistical detection score" to encompass numerical and non-numerical values, because the specification for the '489 Patent provides that there can be target detection scores for each pixel, as well as for other numbers and types of image elements. Pl. Claim Constr. Br. at 19-20; see e.g., '489 Patent at 4:51-5:2. GTA also argues that these terms should not be limited to an algorithm, as the government suggests, because the specification for the '489 Patent states that "the target detection processing apparatus 12 ranks each pixel, for example, by a number of standard deviations from a mean for the detection plane to generate a statistical detection score for every pixel in every image, although other manners and types of scores could be determined." Pl. Claim Constr. Br. at 19-20; '489 Patent at 4:62-4:67 (emphasis supplied).

Consistent with its position on other claim terms that involve the term "score," the government argues that the value associated with the terms "statistical score" and "statistical

detection score(s)" must be numerical to define the scope of the claims. Def. Claim Constr. Br. at 17-18. To support this view, the government observes that the language in Claim 1 provides that each pixel will be ranked by "its statistical score." '498 Patent at 6:58-6:67. And so, the government contends that it is not clear how the pixels could be ranked under Claim 1 if the statistical score is not a numerical value. Def. Resp. at 9.

b. Extrinsic Evidence

Both parties presented expert testimony to support their proposed construction of the terms "statistical score" and "statistical detection score" during the claim construction hearing. Dr. Basener testified that a "statistical score" or a "statistical detection score" is "just the output of the target detection algorithm" and "this score is giving you information about some quantity of data [, that] is all . . . ." Claim Constr. Tr. at 80:18-9:2. Dr. Basener also testified that, contrary to the government's construction, "statistics don't have to be numeric and scores don't have to be numeric." Id. at 81:6-81:7. In addition, Dr. Basener testified that "it's explicit that [a standard deviation algorithm is] only used as one possible way that you could compute to the statistical scores." Id. at 83:16-83:18.

Dr. Nasrabadi testified that a "statistical score" or a "statistical detection score" has "to do with what is the target detection algorithm you use, the first stage." Id. at 129:16-129:18. And so, Dr. Nasrabadi opined that "you don't have to construct anything" to understand the [meaning of] a statistical score or statistical detection score. Id. at 130:22-130:23.

Dr. Meola testified that "a statistical score, again, would be a numerical value, and in this case computed in some sort of statistical method." Id. at 150:20-150:22. Dr. Meola also testified that "the scope isn't that well defined on this because the range of research for statistical processing algorithms is very large." Id. at 151:5-151:7. And so, Dr. Meola opined that "the scope [of what is claimed in the '489 Patent] may be unclear to a POSITA based upon just the generality of saying a statistical score without specifying how that [score is] computed." Id. at 151:10-151:12.

c. Claim Construction

Based on intrinsic and extrinsic evidence, the Court concurs with GTA that the terms "statistical score" and "statistical detection score(s)" are not limited to numeric values, nor

limited to the method of standard deviation. Construing this term as the government suggests would also require the Court to improperly read "particular embodiments and examples appearing in the specification" into the claim. See Constant v. Advanced Micro-Devices, Inc., 848 F.2d 1560, 1571 (Fed. Cir. 1988). And so, the Court construes the terms "statistical score," as it appears in Claims 1, 10 and 19, and "statistical detection score(s)," as it appears in Claims 4-5, 13-14, 22-23 and 28-33, to mean "a ranked or statistically compared or determined target detection score."

V. CONCLUSION

For the reasons discussed above, the terms or phrases of the '489 Patent identified by the parties as requiring construction shall be construed as stated.

IT IS SO ORDERED.

s/ Lydia Kay Griggsby
LYDIA KAY GRIGGSBY