

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TESLA, INC.

Petitioner,

v.

INTELLECTUAL VENTURES II LLC

Patent Owner.

Case No. IPR2025-00340

U.S. Patent No. 6,894,639

PATENT OWNER'S PRELIMINARY RESPONSE

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PATENT OWNER'S EXHIBIT LIST

EX2001	Petitioner's Answer to Complaint and Counterclaim, dated June 20, 2024, in <i>Intellectual Ventures II LLC v. Tesla, Inc.</i> , C.A. 1:24-cv-00884-ADA (W.D. Tex.)
EX2002	Docket from District Court Litigation, <i>Intellectual Ventures II LLC v. Tesla, Inc.</i> , C.A. 1:24-cv-00884-ADA (W.D. Tex.)
EX2003	Scheduling Order from District Court Litigation, <i>Intellectual Ventures II LLC v. Tesla, Inc.</i> , C.A. 1:24-cv-00884-ADA (W.D. Tex.)
EX2004	Defendant's Second Supplemental Preliminary Invalidity Contentions, dated January 9, 2025, in District Court Litigation, <i>Intellectual Ventures II LLC v. Tesla, Inc.</i> , C.A. 1:24-cv-00884-ADA (W.D. Tex.)
EX2005	Letter from Patent Owner to Associate General Counsel for Petitioner, dated August 20, 2020, enclosing copy of U.S. Pat. No. 7,181,143 and Claim Chart Presentation
EX2006	Sanger, T. D. "Optimal Unsupervised Learning." Neural Networks vol. 2, pp. 459-473 (1989)
EX2007	Declaration of Dr. Majumder In Support Of Patent Owner's Preliminary Response.
EX2008	CV of Dr. Majumder

I. INTRODUCTION

The Petition (Paper 2) challenging claims 1-7 (the “Challenged Claims”) of US Patent 6,894,639 (the “‘639 Patent) does not demonstrate a reasonable likelihood of success on the merits and therefore should be denied.

The challenged claims are directed to a novel method for distinguishing specific targets from background clutter using “target specific feature information”—features selected and applied based on their discriminative value for a particular target class. This innovation is not taught or suggested by the prior art relied upon in the Petition. Instead, Petitioner improperly attempts to fill critical gaps in the cited references with conclusory expert assertions that are not grounded in the disclosures themselves.

Every ground asserted in the Petition relies on Barnard as a foundational reference. However, Barnard does not disclose selecting features tailored to a particular type of target, nor does it preserve or analyze background clutter in the manner required by the claims. On the contrary, Barnard removes background clutter during analog preprocessing, before feature selection or classification even begins, and processes all potential targets uniformly. Petitioner’s effort to recast Barnard as performing target-specific feature selection is not supported by the reference and fails as a matter of law. The additional references relied upon—Lawrence and Knecht—do not remedy these deficiencies. Neither reference teaches class-based

feature selection or background discrimination as required by the claims, nor does the Petition explain how they could.

In addition to these technical and legal deficiencies, the extraordinary prosecution history of the ‘639 Patent reinforces its non-obviousness. After the patent application was filed in 1991, the United States Air Force imposed a Secrecy Order under 35 U.S.C. § 181, determining that the invention disclosed “critical technology with military or space application, the unauthorized disclosure of which would be detrimental to national security.” The Secrecy Order was renewed annually—over the Applicant’s objection—for more than a decade, and was not lifted until 2003. This long-standing classification, repeatedly reaffirmed by the Air Force, demonstrates that the invention was far from routine or conventional. It reflects the government’s recognition that the claimed subject matter embodied an innovative and strategically sensitive advance—one that was not already known or obvious in the field.

In light of these substantial failings in the asserted grounds and the compelling evidence of the invention’s novelty and importance, Petitioner has not met its burden under 35 U.S.C. § 314(a). Institution should be denied.

II. THE ‘639 PATENT

A. Overview

The ‘639 Patent is directed to systems and methods for detecting targets in environments where background clutter can obscure or resemble signals of interest. In many real-world scenarios—such as surveillance, missile tracking, or remote sensing—objects of interest may exhibit signal characteristics that overlap with those of non-target sources, making reliable detection difficult. The ‘639 Patent addresses this challenge by introducing a novel approach that generates and applies target-specific feature information—i.e., features that are selected based on their discriminative value for identifying a particular class of target. EX2007, ¶¶28-29.

Instead of applying uniform detection criteria to all potential targets, the disclosed system selects features that are uniquely suited to distinguishing a specific type of target from surrounding clutter. For example, the system may analyze statistical descriptors from known target data to identify features that are especially useful in separating a given target class (such as a missile or aircraft) from background signals (such as clouds, birds, or terrain). This target-specific information is then used during the detection process to improve classification accuracy and reduce false positives. EX2007, ¶30.

The architecture claimed in the ‘639 Patent includes several key steps. The system first receives input data, such as sensor measurements, and calculates statistical properties of that data. Based on these statistics, it then selects or generates features that are specifically relevant to the target class of interest. These features

are subsequently used to classify the input signals as belonging to either a target or the background. Crucially, the system is configured to output both target and background information, enabling more nuanced analysis and integration with downstream systems or decision-making frameworks. EX2007, ¶33.

This approach provides substantial advantages in detection performance, particularly in cluttered or ambiguous environments. By selecting features that are optimized for identifying a particular target class—and by preserving and processing both target and background data—the system allows for more reliable and adaptive discrimination. The ‘639 Patent thus offers a flexible and data-driven detection framework that enables accurate separation of targets from complex backgrounds, even when signal characteristics overlap. The claims accordingly capture an inventive concept centered on adaptive feature selection and classification using target-specific criteria. EX2007, ¶32.

B. Sanger, T. D. “Optimal Unsupervised Learning.”(EX2006)

The “639 Patent states:

“With respect to the feature selection process, the preferred embodiment uses target statistics and a neural network that implements a generalized Hebbian learning algorithm **to select and generate features specific to a given target class. The generalized Hebbian learning algorithm employed, which was discussed in the Sanger, T. D. “Optimal Unsupervised Learning.” Neural Networks vol. 2, pp. 459-473 (1989), selects features for automatic target recognition from the inputted imagery.** The generalized Hebbian Learning algorithm generates principal components or receptive features

that resemble those found in Linsker's work, discussed supra. Inter alia, Sanger shows that the GHA determines the principal components of the data set in order of decreasing eigenvalue, which is important because the higher eigenvalue components are generally the most important or prominent features." EX1001, 7:46-62

Accordingly, the '639 Patent makes clear that in the preferred embodiment a generalized Hebbian learning algorithm, as taught in Sanger (EX2006), is used to select and generate features specific to a given target class.

Sanger describes a method of training a neural network to perform unsupervised learning by identifying the most informative patterns present in input data. The method centers on the Generalized Hebbian Algorithm (GHA), which is designed to adapt the weights of a single-layer linear network so that the network outputs represent the dominant statistical components—known as eigenvectors—of the input distribution. These outputs are ordered by their respective contribution to explaining variance in the input data, allowing for efficient dimensionality reduction. The GHA operates without requiring labeled training data and does not require computation of the full input correlation matrix. Instead, the algorithm incrementally updates the network weights using only the current input and output values, ensuring convergence to the optimal set of weight vectors that span the principal subspace of the input data. For instance, the article demonstrates that when the network is trained on image patches, the learned weights resemble filters found in the mammalian visual system, including those responsive to edges and spatial frequencies. These

results support the assertion that the Generalized Hebbian Algorithm enables a network to discover significant structure in data without supervision, and that it does so using only localized, biologically plausible computations. EX2007, ¶¶37-41.

As Dr. Majumder explains

“A POSITA would understand that the ‘639 Patent implements Sanger’s GHA both conceptually and algorithmically. It uses GHA to train a neural network on image patches containing target examples, learns principal components of those patches, treats those components as discriminative filters, and uses the resulting features for automatic target recognition in cluttered scenes. The implementation reflects Sanger’s model in structure (single-layer feedforward network), in learning rule (GHA update equation), and in purpose (unsupervised, online extraction of ordered principal components).”
EX2007, ¶42.

Therefore, Sanger provides the foundation for the ‘639 Patent feature selection process, applying it to learn and generate features specific to a given target class. By adapting the GHA to train a neural network on unlabeled image data, the system identifies the principal components of target-containing patches, which are then used as filters for automatic target recognition. This approach allows the network to extract the most informative and discriminative features from target imagery without relying on labeled training data or exhaustive preprocessing.

C. Prosecution History

The ‘639 Patent concerns technology for identifying targets—such as missiles or fighter jets—in radar samples and was subject to a Secrecy Order imposed by the

United States Air Force. See EX1001, 5:19–20; EX1002, 162–166, 93–101, 82. Following the filing of the patent application in 1991, the Department of the Air Force determined that the disclosed invention involved “critical technology with military or space application, the unauthorized disclosure of which would be detrimental to the national security and which is subject to export control.” EX1002, 162. Under 35 U.S.C. § 181, a Secrecy Order is effective for one year but may be renewed annually upon an agency’s affirmative determination that continued secrecy remains necessary. Despite the Applicant’s objection (EX1002, 108), the Air Force renewed the Secrecy Order repeatedly—in 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2001, and 2002—before finally rescinding it in 2003. See EX1002, 70–71, 73–82, 86–91, 93–98, 100–101.

This decade-long sequence of secrecy renewals underscores the significance and non-obviousness of the invention. Each year, the Air Force reaffirmed that the technology disclosed in the application remained critical to national defense and was not appropriate for public dissemination. Such sustained classification would have been unnecessary if the subject matter were already known or obvious in view of the prior art. On the contrary, the repeated imposition of the Secrecy Order reflects the government’s recognition that the invention embodied novel and sensitive capabilities. That the Secrecy Order persisted through eleven annual reviews provides compelling evidence that the technology was far from routine or

conventional—casting serious doubt on any hindsight-based assertion of obviousness in this IPR.

D. Claims of the ‘639 Patent

Claim 1 of the ‘639 Patent is the only independent claim among the challenged claims. Claim 1 recites

1. A method for distinguishing targets from background clutter, comprising the steps of
 - (a) inputting data;
 - (b) calculating data statistics from said data and using said data statistics to select target specific feature information to distinguish specific targets from background clutter;
 - (c) generating said target feature information from said data statistics;
 - (d) extracting said target specific feature information from said data;
 - (e) using said target specific feature information to distinguish specific targets from background clutter; and
 - (f) outputting target and background clutter information.

EX1001,12:2-16.

Claim 1 captures the novelty of the invention by reciting a structured method that transforms raw input data into actionable target recognition outputs through a series of steps centered on selecting and applying target specific feature information. Unlike conventional approaches that apply uniform filters or heuristics, the claimed method uses statistical analysis of the data itself to select and generate features that are tailored to distinguish a particular class of targets—such as a missile—from background clutter. These tailored features are not only derived from the underlying

data statistics, but are also explicitly extracted and applied to discriminate between target and non-target signals, culminating in a distinct output of both target and background information. This closed-loop process—rooted in adaptive feature selection based on statistical relevance to a specific target class—marks a departure from prior art systems and embodies the technical advance recognized in the ‘639 Patent.

III. CLAIM CONSTRUCTION

The Petition states “no claim term requires express construction.” Petition, 10. However, the Petitioner withheld that it took an inconsistent claim construction position in the district court.

Independent claim 1 of the ‘639 Patent recites “generating said target feature information from said data statistics.” In the parallel district court litigation, Petitioner has taken the position that this claim language is indefinite. Specifically, in its Second Supplemental Preliminary Invalidity Contentions in the Parallel Litigation (served *before* Petitioner filed this IPR), Petitioner alleged:

A. Indefiniteness Under 35 U.S.C. § 112, ¶ 2 and 112(b)

Subject to the reservation of rights above, Tesla provides below an identification of Asserted Claims along with an identification of the specific limitations that are invalid pursuant to 35 U.S.C. § 112 ¶ 2 or 112(b) as indefinite. Specifically, at least the following terms are not explained in the specifications of the Asserted Patents such that a POSITA would be able to determine their meaning and scope with reasonable certainty:

1. The '639 Patent

Claim(s)	Claim Language
1[c]	“generating said target feature information from said data statistics”
7	“said feature information is further used to distinguish two target classes or a plurality of target classes from one another”

EX2004, 227-228

Despite maintaining an indefiniteness theory in district court, Petitioner failed to disclose that position to the Board in this proceeding. On the contrary, Petitioner’s expert expressly adopted the opposite view, testifying that each claim term should be given its ordinary and customary meaning in light of the specification and prosecution history. For example, Petitioner’s expert stated:

38. It is my understanding that in order to properly evaluate the ‘639 Patent, the terms of the claims must first be interpreted. It is my understanding that for the purposes of this *inter partes* review, the claims are to be given their ordinary and customary meaning as would be understood by one of ordinary skill in the art at the time of invention in light of the specification and prosecution history, unless the inventor has set forth a special meaning for a term.

39. It is my opinion that none of the claim terms require a specific construction for the purposes of my analysis in this

declaration, and all will be given their ordinary and customary meaning in light of the specification and prosecution history of the '639 Patent. EX1003, ¶¶38-39 (emphasis added).

These two positions cannot be reconciled. In the parallel litigation, Petitioner contends that a person of ordinary skill in the art would not be able to ascertain the meaning of the claim language. Yet in this IPR, Petitioner's expert assumes that such a person would understand the terms according to their ordinary and customary meaning. This contradiction undermines the reliability of Petitioner's claim construction position and deprives the Board of the full and accurate record required under 37 C.F.R. § 42.104(b)(3).

It is improper for Petitioner to argue that the claims are obvious under their plain and ordinary meaning while simultaneously asserting in district court that the very same claim terms are indefinite and lack a reasonably certain scope. Because Petitioner's claim construction theory in this proceeding rests on a meaning it disputes elsewhere, the Petition fails to satisfy the requirement to provide a clear and consistent articulation of how the challenged claims are to be construed. Institution should be denied on this basis alone.

IV. REFERENCES RELIED ON IN THE PETITION

A. Barnard - U.S. Patent No. 5,027,413 (EX1005)

Barnard is directed to a target detection system that identifies objects based on variations in infrared radiation received from a scene. The system uses a line-

scanning infrared sensor to collect analog signals corresponding to radiance across the field of view, which are then subjected to standard preprocessing techniques to remove detector artifacts and background clutter. This preprocessing includes applying filters—such as prewhitening or bandpass filters—to suppress signal components associated with background noise. Following this analog preprocessing, the remaining signals are digitized, stored, and subjected to further analysis to identify high-contrast features suggestive of potential targets. EX2007, ¶45.

Barnard’s detection pipeline primarily relies on thresholding techniques applied to these preprocessed signals, as well as statistical measures such as variance and distribution width, to determine which features are retained for additional evaluation. The system discards features that exhibit excessive variability or statistical inconsistency, thereby functioning as a generic filter that excludes unreliable data. While Barnard refers to various potential sources of infrared radiation—such as sea-skimming missiles, point sources, wave crests, and seagulls—it applies the same feature evaluation criteria uniformly across all such objects, without tailoring feature selection to any specific target type. The reference does not describe, suggest, or imply a method for selecting features based on their discriminative power for particular classes of targets, nor does it disclose using target-specific training data to guide feature generation or application. EX2007, ¶48.

Thus, Barnard describes a system oriented toward general-purpose target detection through uniform signal filtering and thresholding, without the adaptive, target-specific feature selection and analysis required by the challenged claims of the ‘639 Patent.

B. Lawrence- PCT Application Publication WO 90/16038 (EX1006)

Lawrence is directed to a predictive modeling system that employs a self-organizing neural network to forecast time-varying data. The system is primarily concerned with learning and predicting temporal patterns by monitoring changes in input signals over time. Lawrence’s architecture is based on a two-dimensional lattice of predictive units, each of which receives and processes local input signals to generate an “innovation signal”—a measure of the difference between predicted and actual inputs. These innovation signals are then compared across the network to identify unexpected changes in input behavior, which may indicate novel or anomalous events.

While the system may be used for event detection, anomaly recognition, or forecasting in dynamic environments, Lawrence does not disclose or suggest selecting features based on their ability to differentiate between particular classes of physical objects. As Dr. Majumder explains:

“..there is no discussion in Lawrence of distinguishing specific types of targets from background clutter, nor is there any indication that the system uses training data labeled by target class. Instead, the network passively observes temporal signal

patterns and adapts its internal model based on prediction error, without class-specific feature optimization or classification mechanisms.”
EX2007, ¶53.

Accordingly, while Lawrence describes a predictive learning architecture, it does not teach or suggest the claimed use of “target specific feature information to distinguish specific targets from background clutter.” The reference lacks any teaching of selecting or applying features tailored to specific target classes, and is thus inapposite to the technology claimed in the ‘639 Patent.

V. THE PETITION FAILS TO DEMONSTRATE A REASONABLE LIKELIHOOD OF SUCCESS ON THE MERITS

Each of Petitioner’s asserted grounds relies on Barnard as the foundational reference for teaching the limitations of the challenged claims. But as demonstrated below, Barnard does not disclose, suggest, or support the core functionalities required by the claims, including the selection and use of “target specific feature information” to distinguish specific targets from background clutter. Rather than tailoring features based on target class, Barnard applies a uniform analysis to all signals, lacking any mechanism for discriminating between different types of targets. Petitioner’s expert attempts to compensate for this omission through unsupported testimony, but these conclusory assertions cannot substitute for what is absent from the reference itself.

Compounding these deficiencies, Barnard’s system is fundamentally incompatible with the claimed invention. As explained in detail, Barnard eliminates background clutter through analog preprocessing before any digital feature extraction occurs. This design choice precludes Barnard from performing the very analysis the claims require—namely, using target-specific features to distinguish between targets and clutter. The remaining references cited in Grounds 2 through 4 (Knecht and Lawrence) do not cure these deficiencies, as neither addresses the missing feature selection or background analysis capabilities absent in Barnard. Because the Petition fails to demonstrate that the prior art teaches or suggests the full scope of the challenged claims, institution should be denied.

A. Ground 1 Is Deficient Because Barnard Lacks the Feature Selection and Background Analysis Capabilities Required by the Challenged Claims

Petitioner contends that Barnard teaches the use of “target specific feature information” to distinguish specific targets from background clutter, as required by the challenged claims. But as detailed below, Barnard does not disclose, suggest, or support this key limitation. Rather than selecting and applying features tailored to particular target types, Barnard processes all potential targets using a uniform approach that does not account for target class. To compensate for this omission, Petitioner improperly relies on expert testimony to fill critical gaps in the reference’s disclosure—gaps that cannot be bridged by conclusory assertions.

In addition, Barnard’s architecture is fundamentally incompatible with the claimed invention. The system described in Barnard eliminates background clutter during analog preprocessing, before any feature information is extracted or applied. As a result, Barnard lacks access to the background information that the claims expressly require to be distinguished from target signals using target-specific features. Because Barnard does not preserve, analyze, or output background clutter in the manner required by the challenged claims, it cannot satisfy their core limitations.

The following sections explain, in detail, why Barnard fails to teach the claimed selection and use of target-specific feature information. These deficiencies, both in technical capability and disclosure, underscore why Petitioner has not demonstrated a reasonable likelihood that it will prevail on the asserted grounds.

1. Barnard Fails to Disclose Selection of Target-Specific Feature Information and Petitioner Improperly Relies on Expert Opinion to Fill this Critical Gap

Petitioner asserts that Barnard teaches the use of “target specific feature information” to distinguish specific targets from background clutter, as required by the challenged claims. Petition, 20-21. But a careful review of Barnard reveals no disclosure of selecting features tailored to particular types or classes of targets. Instead, Barnard describes a uniform approach that treats all potential targets the same, without adapting its feature selection based on target identity or category.

Petitioner’s expert attempts to fill this gap by attributing functionality to Barnard that is neither described nor suggested in the reference, relying on conclusory testimony that cannot substitute for the necessary disclosure. As explained below, Barnard lacks the core architecture and functionality required by the claims and therefore cannot support institution.

a) Barnard Describes Generic Feature Filtering, Not Target-Specific Feature Selection

The challenged claims require the generation and use of “target specific feature information”—that is, feature information selected based on its discriminative value for a particular class of target (e.g., a seagull vs. a sea-skimming missile). Barnard contains no such teaching.

To compensate for the absence of this required functionality in the prior art, Petitioner’s expert relies on Barnard and its Figure 2 to assert that the reference discloses the selection of target specific features based on statistical analysis. However, as demonstrated below, the cited portions of Barnard describe only a statistical filtering process that generically excludes features irrespective of target type (or class) based on excessive distribution width or variability. As explained by Dr. Majumder:

Barnard does not disclose any mechanism for selecting features based on their statistical discriminability for a particular class of target. It treats all possible sources of infrared radiation—missiles, birds, wave crests, etc.—using the same global feature definitions and thresholding logic. There is no training phase in

which features are selected or ranked based on how well they distinguish one class of target from another. Nor is there any suggestion that Barnard's system is capable of adapting its feature selection criteria based on the unique characteristics of a specific target type.

EX2007, ¶65.

In fact, Petitioner's expert fails to identify any portion of Barnard that teaches or suggests the claimed use of statistical analysis to affirmatively select target specific features used to distinguish specific types of targets. Rather, the expert attempts to fill a fundamental gap in the reference by reading in limitations not found in the text, thereby improperly using expert testimony to substitute for the required disclosure.

For example, Petitioner's expert alleges that in "Fig. 2, Barnard provides the specific example of distinguishing specific targets, such as a point source 15 and a sea-skimming source 16 (e.g., a sea-skimming missile), from background clutter, such as wave crests 17." EX1003, ¶70, citing EX1005,1:24-36, 3:34-41.

However, as shown below, Barnard at 2:28-36.and 3:34-41 (reproduced below) offers no example or description that target specific features are selected to distinguish the point source 15. Similarly, the cited portions are silent with regard to selection of target specific features to distinguish the sea-skimming source 16.

"A target detection system in accordance with the invention may be characterised in that means are provided to calculate the width of the statistical distributions of the background and

target features and to discard a feature as a threshold parameter if the width of the statistical distribution of that feature exceeds a predetermined amount, or if the feature mean varies by more than a preset amount over a succession of scene images. EX1005, 2:28-36..

“As shown in FIG. 2, 30 mr above the horizon and 45 mr below the horizon are 35 covered. Thus a point source 15 some 5 mr above the horizon is seen against a sky background and a closer sea-skimming source 16 some 10 mr below the horizon is seen against a sea background. Wave crests 17 closer to the apparatus can also constitute point sources of 40 radiation, as can a seagull 18.” EX1005, 3:34-41.

As Dr. Majumder explains, “[w]hile the above passages (and Barnard as a whole) refer to identification of generic target features (such as edges), there is no mention of “target specific” features, e.g., ones tailored to a particular target type or class.” EX2007, ¶68. Instead, the cited portion is merely disclosing that if a statistical distribution associated with a generic target feature or area is too wide or its average value varies too much across, the target feature or area can be discarded and not subjected to further analysis. *See also*, EX1005, 1:24-39. Absent from Barnard is any disclosure involving the selection of target specific features.

Accordingly, there is absolutely nothing in Barnard to support the assertion of Petitioner’s that the reference discloses the use of “the calculated data statistics to select target specific feature information—the set of features and associated target

detection threshold—used to distinguish specific targets from background clutter.” EX1003, ¶69.

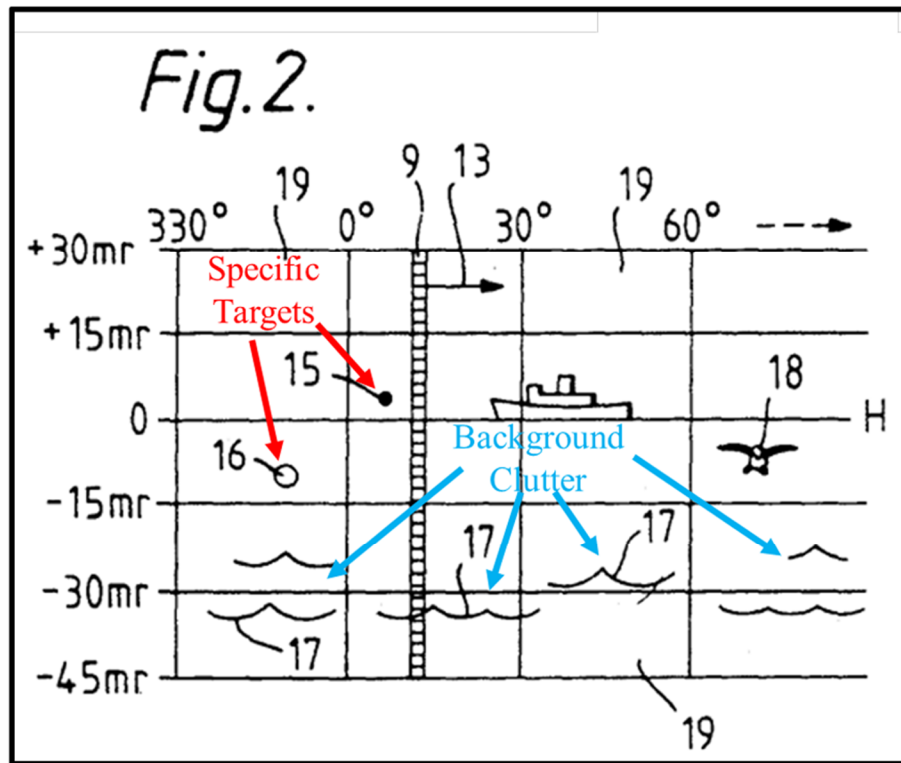
b) Petitioner’s Expert Improperly Fills Gaps in the Prior Art with Conclusory Testimony

In an effort to overcome Barnard’s silence on this key limitation, Petitioner’s expert cites Figure 2 and asserts that Barnard discloses selecting features to distinguish “a point source 15 and a sea-skimming source 16 (e.g., a sea-skimming missile) from background clutter, such as wave crests 17.” (EX1003 ¶70, citing EX1005 at 1:24–36, 3:34–41). However, this testimony fails on both procedural and substantive grounds.

Procedurally, it is improper for Petitioner to use expert testimony to rewrite a reference rather than interpret what it actually says. The Federal Circuit has made clear, “conclusory statements and unspecific expert testimony do not qualify as substantial evidence that could support the Board’s conclusions regarding obviousness.” *TQ Delta, LLC v. Cisco Sys.*, 942 F.3d 1352, 1360–61 (Fed. Cir. 2019). Likewise, the USPTO has recognized that expert declarations “merely offer[ing] conclusory assertions without underlying factual support” are entitled to little, if any, weight. *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 at 15–17 (PTAB Aug. 24, 2022) (precedential). The reference simply notes that various objects—e.g., a point source, a sea-skimming missile, a wave crest, or a seagull—may appear in

the infrared imagery. (EX1005 at 3:34–41). That is not a disclosure of selecting different features to distinguish among those targets.

Indeed, the expert does not assert—and cannot show—that Barnard selects different features to distinguish a seagull from a missile or a point source. There is no discussion in Barnard of how such a feature selection would be made, nor is there any disclosure of generating feature information from target-specific training data. At best, Barnard generically applies the same set of features to all potential targets, and then filters out those deemed unreliable due to statistical variance. As Dr. Majumder explains, “[t]his is not the same as selecting features based on their discriminative power for specific target classes, as required by the claims.” EX2007, ¶71.



Barnard, Fig. 2 (annotated).

Instead, Fig. 2 shows the amount of radiation in milliradians (mr) that are received from a point source 15, a sea-skimming missile 16, a seagull 18, and wave crests 17. Petitioner’s expert does not assert that in Barnard the target features selected for target 15 (a point source) are any different from the target features selected for target 16 (a missile) or target 18 (a seagull), nor does he provide any explanation as to how the figure shows a selection of “target specific feature information to distinguish specific targets from background clutter,” as required by the challenged claims.

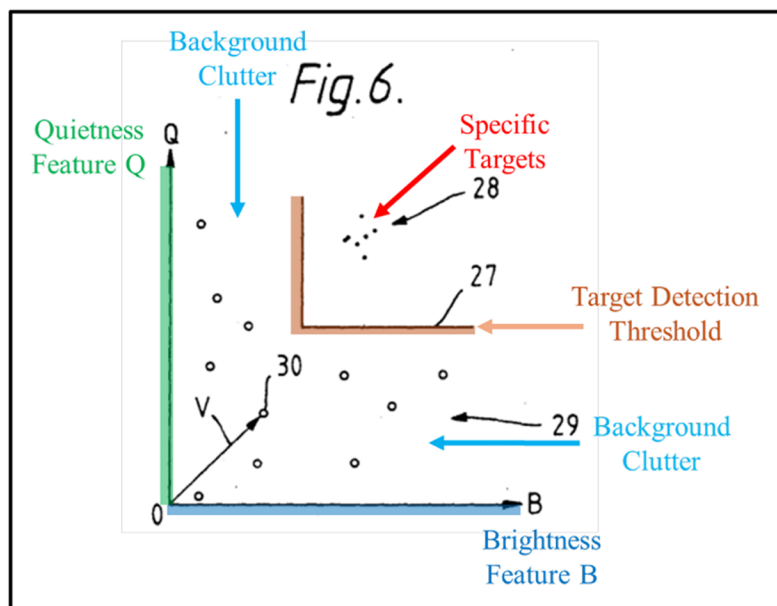
As a result, Petitioner’s argument that Barnard discloses the selection of “target specific feature information to distinguish specific targets from background clutter” is simply not supported by the reference. The passages relied upon by Petitioner’s expert merely describe a statistical filtering process in which features generic to all targets are discarded based on the width of their statistical distribution or variability across images—i.e., a process for excluding generic features, not selecting target-specific ones. Indeed, as Dr. Majumder explains, “Barnard is silent as to any selection of target specific features for the purpose of distinguishing targets such as the point source 15 or sea-skimming source 16 from background clutter.” EX2007, ¶73.

Therefore, the Petitioner fails to identify any disclosure in Figure 2 (or elsewhere) that provides a target specific feature selection, nor does the Petitioner’s expert provide any technical rationale for reading such a limitation into Barnard. Instead, the cited portions of Barnard demonstrate that the system filters out inconsistent or statistically noisy data or generic target features, not that it performs any target specific feature selection as required by the challenged claims.

c) Petitioner’s Reliance on Barnard’s Figure 6 Is Similarly Misplaced

Petitioner further cites Barnard’s Figure 6 (reproduced below) and accompanying discussion of a “threshold hypersurface” to suggest that the system

selects features capable of separating targets from background clutter. (EX1003 ¶68, citing EX1005 at 5:13–19). This argument again mischaracterizes the reference.



Barnard, Fig. 6 (annotated).

However, Petitioner’s expert provides no explanation of how the hypersurface 27 is a target specific feature, e.g., one associated with a particular target type or class -- as opposed to a generic feature applicable to targets in general. For example, Petitioner does not assert that Barnard’s hypersurface 27 is selected for seagulls 18 as compared to sea skimming missile 16. That is because the reference lacks any disclosure of selection of target specific features.

In fact, Petitioner’s expert provides no explanation as to how Barnard’s hypersurface 27 constitutes or involves “target specific feature information.” There is no disclosure that different hypersurfaces or feature sets are used for different

types of targets—such as a seagull versus a sea-skimming missile. Nor does Barnard suggest that the selection of features is driven by training data labeled by target class. Rather, the hypersurface in Figure 6 is a static boundary applied to generic feature vectors, not a reflection of dynamic or class-specific feature selection. EX2007, ¶¶76-78.

Accordingly, Petitioner’s reliance on Barnard’s Figure 6 and associated discussion of a “threshold hypersurface” does not support the claimed limitation of selecting target specific feature information. The reference makes no distinction between different types of targets and does not describe using different feature sets or decision boundaries tailored to particular target classes. The hypersurface depicted in Barnard is based on generic features and applies uniformly across all potential targets, without regard to their identity or classification. Petitioner’s expert fails to identify any disclosure in Barnard that teaches or suggests selecting features based on target class, and offers no technical rationale for interpreting the hypersurface as target-specific.

d) The Claimed Feature Selection Process Is Fundamentally Absent from Barnard’s Architecture

To further illustrate the fundamental distinction between Barnard and the claimed invention, Dr. Majumder offers a helpful analogy that captures the difference between generic filtering and the claimed target-specific feature selection. This comparison underscores why Barnard’s disclosure falls far short of what the

challenged claims require and why Petitioner's effort to equate the two—relying solely on expert assertion without supporting disclosure—is both technically and legally unsound. As Dr. Majumder explains:

The difference between Barnard's system and the claimed invention is analogous to the difference between using a generic noise filter and using a voice recognition system trained to identify a specific speaker.

Barnard's approach is akin to a system that removes background noise from an audio recording by discarding sounds that fluctuate too much or fall outside of an expected range—regardless of the source of those sounds. It treats all incoming signals the same and simply filters out the statistically inconsistent ones. While this may clean up the signal, it does not help identify who is speaking.

By contrast, the claimed invention is more like a system that is trained to recognize a particular speaker's voice—using recordings of that speaker to learn distinctive vocal patterns, and then selecting features tailored to that voice to distinguish it from other sounds. This speaker-specific system not only filters out irrelevant audio but affirmatively selects and uses features that are uniquely suited to recognizing the speaker of interest.

EX2007, 79-81.

Petitioner attempts to equate Barnard's generic filtering system with the claimed target-specific selection process, but the two operate on fundamentally different principles. Barnard discards unreliable data based on variability, without regard to what kind of target is present. The '639 Patent, by contrast, selects features based on their ability to differentiate a particular class of target from clutter, using

statistical information derived from representative target-only data. Just as a noise filter cannot substitute for a trained voice recognition system, Barnard's generic filtering cannot satisfy the claimed requirement of selecting target-specific feature information.

Petitioner's expert fails to bridge this gap, offering only conclusory assertions unsupported by the reference itself. As a result, the Petition rests on an impermissible attempt to retrofit Barnard to meet the claims, and the Board should decline institution.

e) Barnard Is Limited to Single-Target Detection and Fails to Address the Multi-Target Distinction Required by the Challenged Claims

Even apart from its failure to disclose the use of target-specific feature information, Barnard also fails to meet the requirements of the challenged claims because it is directed to detecting the presence of a target—not distinguishing among different types of targets based on tailored feature selection.

As reflected in the claim language, the challenged claims require “using said target specific feature information to distinguish specific targets from background clutter,” where “specific targets” necessarily implies an ability to discriminate among different types or classes of targets. This is reinforced by the requirement that the feature information be “target specific”—i.e., selected based on its utility in identifying one class of target versus others. A system that merely detects the

presence of any target, without distinguishing among different target types, cannot satisfy this limitation.

Barnard, by contrast, is directed to a system that attempts to separate a target—presumed to exhibit high-contrast features such as brightness or edge definition—from background clutter. The entire detection pipeline is oriented toward detecting whether a single object, such as a missile, is present in the field of view. There is no suggestion that Barnard is capable of distinguishing a missile from, for example, a seagull, a flare, or other infrared-emitting objects. Nor is there any indication that Barnard selects features differently depending on the type of target it is attempting to detect. EX2007, ¶84.

Indeed, the description of Barnard’s Figure 2 reinforces that the system treats all high-emission sources—whether a sea-skimming missile, a point source, a wave crest, or a seagull—uniformly. EX1005, 3:34–41. The system may apply thresholds to filter out background clutter, but it does not perform any selection or classification based on the nature or class of the target. Therefore, Barnard lacks any mechanism for training or tailoring feature selection to one type of target versus another. EX2007, ¶85.

This is in stark contrast to the claimed invention, which uses target-specific feature information to distinguish particular classes of targets from background clutter. As Dr. Majumder explains, “the system disclosed in the ‘639 Patent does not

merely detect the presence of any target—it learns and selects features that are optimal for identifying a specific class of target, such as a missile, while suppressing responses to, or distinguishing it from, other infrared-emitting objects, such as seagulls or environmental clutter.” EX2007, ¶88.

Because Barnard is fundamentally directed to a generic target detection model and makes no provision for distinguishing among multiple target types using tailored feature sets, it cannot meet the limitations of the challenged claims. Petitioner’s reliance on Barnard therefore fails not only due to the absence of target-specific feature selection, but also because Barnard lacks any architecture or functionality for distinguishing multiple target classes in the manner required by the claims. Accordingly, institution should be denied.

f) Barnard Fails to Teach the Claimed Target-Specific Feature Selection and Use

Barnard does not disclose, and cannot be reasonably read to suggest, the selection or use of target-specific feature information to distinguish specific targets from background clutter, as required by the challenged claims. Instead, Barnard describes a generic filtering approach in which statistically unstable features are discarded without regard to target identity or class. The system applies uniform thresholds and filtering based on feature variability, not on discriminative value for different target types. This fundamental disconnect is not cured by Petitioner’s

expert, who improperly attempts to fill the evidentiary gap through conclusory assertions untethered to any actual disclosure in the reference.

Moreover, Barnard lacks any mechanism for distinguishing among multiple target classes using tailored features—a key aspect of the claimed invention. The system is designed to detect whether a target, any sort of target, is present, not to determine what type of target it is or to select features optimized for a specific class of target. As the cited portions of Barnard make clear, objects as varied as missiles, wave crests, and seagulls are treated uniformly within the system’s processing framework. In contrast, the ‘639 Patent employs learning-based methods to generate feature sets that are specifically adapted to identifying a particular class of target while suppressing responses to others. Petitioner’s attempt to equate Barnard’s one-size-fits-all filtering with the claim’s target-specific discrimination reflects a misunderstanding of both the reference and the invention.

Because Barnard fails to disclose either the selection of target-specific features or the use of such features to distinguish among multiple classes of targets, it does not teach or suggest the limitations of the challenged claims. Petitioner’s reliance on expert opinion to rewrite the reference *post hoc* cannot substitute for the required disclosure. As such, Petitioner has failed to establish a reasonable likelihood of success, and the Board should deny institution.

2. Barnard Removes Background Clutter Prior to Feature Processing and Cannot Satisfy the Claimed Limitations

Petitioner contends that Barnard discloses the claim limitations requiring the use of “target specific feature information to distinguish specific targets from background clutter” and “outputting target and background clutter information.” However, as explained below, Barnard appears to take a fundamentally different approach—one in which background clutter is intentionally removed through analog preprocessing prior to digital feature analysis.

The Challenged Claims require “using said target specific feature information to distinguish specific targets from background clutter” and “outputting target and background clutter information.” However, Barnard cannot possibly satisfy these elements because the background is purposely removed prior to being processed by Barnard’s system. Specifically, Barnard states:

“The target detection system in accordance with the invention is applied to the results of this prior processing, these results being contained in a store having a store location for each pixel in the whole horizon image. Each store location will contain the value of that pixel... Thus the present situation of each pixel and its neighbours are available to be subjected to the target detection processes to be described.” EX1005, 3:59-68.

Specifically, Barnard describes the prior processing system by stating:

“... each detector in the linear array traces out a horizontal path in the scene at a constant angular elevation or depression and provides an analogue signal proportional to the infrared

radiance of the scene details it encounters. Such line scanning thermal imaging apparatus is well known in the art of thermal target detection. Also well known is the processing of the output of each detector in the array to remove detector artefacts and the majority of the background clutter signals using a prewhitening filter such as a bandpass filter. Each detector output is then sampled to provide picture element (pixel) values, digitised, and a matched filter applied tailored to the expected target signal profile. A d.c. threshold is then usually applied to the matched filter output and the surviving pixel values retained in a store preserving their relative positions. These processes will not be described further since they are not relevant to the present invention and are well known in the art.”
EX1005, 42-59

Accordingly, the above passages explain that before applying Barnard’s detection technique, the raw signals undergo standard preprocessing steps that are well known in the field. These include filtering the detector outputs to suppress noise and background clutter, typically using a prewhitening or bandpass filter, followed by sampling the filtered signals to produce discrete pixel values. After filtering, a fixed threshold is applied to remove low-value pixels that are unlikely to correspond to real targets. The remaining pixel values—those that survive thresholding—are stored in a memory structure that preserves their spatial arrangement within the overall scene.

Therefore, in Barnard’s system, background clutter is removed by processing the analog signal prior to being digitally sampled. As Dr. Majumder explains, “digitization of analog signals was computationally expensive in 1989, and therefore, a common goal was to decrease the amount of digital processing required.” EX2007,

¶94. The fact that Barnard utilizes filtering to remove the background clutter prior to digitization is further confirmed by Barnard itself. Specifically, Barnard states:

“The target detection system may be further characterised in that means **are provided for applying a filter to the picture signals before the features are calculated**, the filter being **chosen to attenuate those signal frequencies characteristic of background signals**.” EX1005, 40-44 (emphasis added)

As a result, as Dr. Majumder explains “Barnard removes background clutter from the analog signal before digitization and feature calculation, it does not—and cannot—perform the claimed step of using target specific feature information to distinguish targets from background clutter.” EX2007, ¶96.

Accordingly, Barnard cannot satisfy the claim limitation requiring the use of “target specific feature information to distinguish specific targets from background clutter” because its system intentionally eliminates that background clutter during analog preprocessing, prior to any feature calculation or classification. As the reference makes explicit, Barnard applies filtering techniques—such as prewhitening or matched filters—to suppress or remove background signals before converting the analog data into digital form. These preprocessing steps, which are stated to be “not relevant to the present invention,” occur upstream of Barnard’s target detection system and result in a data set that no longer contains the very background clutter that the challenged claims require to be distinguished using target-specific features.

Thus, rather than analyzing and distinguishing targets *from* background clutter, Barnard operates on a filtered signal that has already had background components removed. As Dr. Majumder explains, this architectural decision reflects the technological limitations of the era, where minimizing digital processing by eliminating extraneous analog data was standard practice. EX2007, ¶94. But this design choice also forecloses any possibility that Barnard’s system could perform the type of target-specific discrimination required by the claims. Because Barnard lacks background clutter at the point of feature processing, it necessarily cannot “use said target specific feature information to distinguish specific targets from background clutter,” nor can it “output[] target and background clutter information,” as recited in the challenged claims. For this reason alone, the Petition fails to establish that Barnard discloses or suggests these limitations, and institution should be denied.

B. Ground 2 Is Deficient Because Claim 7 Remains Patentable Over Barnard and Knecht for the Same Reasons as Claim 1

Petitioner’s Ground 2 asserts that claim 7 would have been obvious over Barnard in view of Knecht. However, this ground fails for at least the reasons discussed above with respect to independent claim 1, from which claim 7 depends. As explained in detail, Barnard does not disclose or suggest the use of “target specific feature information” to distinguish specific targets from background clutter.

Rather than selecting features tailored to particular target types or classes, Barnard applies a uniform filtering approach to all objects, treating missiles, wave crests, and seagulls identically. Petitioner's expert attempts to supply the missing claim limitation through unsupported testimony, but fails to identify any passage in Barnard that describes or suggests selecting features based on their ability to differentiate one class of target from another. Because claim 7 depends on claim 1 and incorporates its limitations, Petitioner's failure to demonstrate the unpatentability of claim 1 necessarily undermines its challenge to claim 7.

The Petition does not allege, nor does Knecht remedy this deficiency. Accordingly, because neither Barnard nor Knecht, alone or in combination, teaches or suggests selecting different feature sets for different target types, as required by the claims, Petitioner's combination fails to disclose the full scope of claim 7. Accordingly, claim 7 remains patentable, and institution should be denied.

C. Ground 3 Is Deficient Because Lawrence Does Not Cure Barnard's Failure to Disclose Target-Specific Feature Selection or Background Discrimination

Petitioner's Ground 3 asserts that all challenged claims would have been obvious over Barnard in view of Lawrence. However, this argument fails for at least two independent reasons. First, as explained in detail above, Barnard does not disclose or suggest the use of "target specific feature information" to distinguish specific targets from background clutter. Barnard applies a uniform approach to all

potential targets, without tailoring its feature selection to differentiate between target types such as missiles, birds, or wave crests. The Petition relies heavily on conclusory expert assertions to imply the presence of a feature selection mechanism that is neither described nor suggested in Barnard.

Second, Barnard's architecture renders it structurally incapable of performing the claimed functionality. As discussed above, Barnard removes background clutter through analog preprocessing before any digital feature analysis occurs. Its signal pipeline filters out background signals using a prewhitening or bandpass filter prior to digitization and subsequent target detection. Because the background clutter is eliminated before feature information is even extracted, Barnard lacks the necessary data at the feature analysis stage to distinguish targets from clutter using "target specific feature information," as required by the claims. This alone forecloses Petitioner's reliance on Barnard as a valid base reference for the asserted grounds.

Lawrence does not address, let alone cure, these deficiencies. Petitioner does not identify—and Lawrence does not disclose—any process for selecting features based on target class. Lawrence describes a neural prediction system that evaluates innovation signals across a lattice network to detect unexpected events or patterns. While this may be useful for novelty detection or temporal signal modeling, it is silent with respect to selecting different features tailored to different classes of physical targets. There is no discussion in Lawrence of how to generate or apply

features differently depending on whether the target is, for example, a missile versus environmental clutter.

Accordingly, the combination of Barnard and Lawrence fails to teach or suggest the use of target-specific feature information to distinguish specific targets from background clutter. Because neither reference discloses the claimed feature selection process, and Barnard in particular lacks access to background clutter at the feature processing stage, the asserted combination cannot satisfy the limitations of the challenged claims. Ground 3 should therefore be rejected, and institution denied.

D. Ground 4 Is Deficient Because Lawrence Does Not Cure Barnard's Failure to Disclose Target-Specific Feature Selection or Background Discrimination

Petitioner's Ground 4 asserts that claim 7 would have been obvious over Barnard in view of Lawrence and Knecht. This argument fails for at least the same reasons discussed above with respect to claim 1, from which claim 7 depends. As explained in detail, Barnard does not disclose or suggest the use of "target specific feature information" to distinguish specific targets from background clutter. Barnard applies the same analysis to all potential targets, without selecting or tailoring features based on target identity or type. Moreover, as discussed in V(A)(2), Barnard removes background clutter during analog preprocessing—prior to any feature extraction—making it structurally incapable of distinguishing between target and background based on feature analysis. Because these core limitations are not

disclosed or suggested in Barnard, Petitioner cannot demonstrate that claim 1 is unpatentable, and the same is true of dependent claim 7.

Neither Lawrence nor Knecht remedies these deficiencies. Lawrence does not disclose selecting different features based on target class, and provides no mechanism for using class-differentiating information to distinguish between specific targets and background clutter. Similarly, Knecht describes spectral feature extraction from infrared imagery, but applies the same process to all targets without adapting the feature selection to specific target types. Because neither reference addresses the missing limitations in Barnard—and because the combination does not collectively teach or suggest the use of target-specific feature information—Petitioner’s challenge to claim 7 necessarily fails. Accordingly, Ground 4 should be rejected, and institution should be denied.

VI. SUMMARY OF ARGUMENTS ON THE MERITS

Petitioner has failed to establish a reasonable likelihood of prevailing on any of the asserted grounds. Each proposed ground relies on Barnard as the primary reference, but Barnard does not disclose, suggest, or support critical limitations of the challenged claims—most notably, the selection and use of “target specific feature information” to distinguish specific targets from background clutter. Barnard describes a system that treats all objects generically, without tailoring feature selection to particular target types, and eliminates background clutter in analog

preprocessing prior to digital feature extraction. As such, Barnard lacks the core architecture and functionality required by the claims and cannot satisfy their limitations.

To compensate for these shortcomings, Petitioner relies on expert testimony that attempts to fill in what Barnard does not disclose. However, as both the Federal Circuit and the Board have consistently held, conclusory expert assertions that are unsupported by the cited reference do not constitute substantial evidence and cannot supply missing claim limitations. Here, Petitioner's expert does not identify any passage in Barnard that teaches or suggests target-specific feature selection. Instead, the expert attempts to import teachings into Barnard based solely on speculation, which is procedurally improper and legally insufficient under well-established precedent.

Petitioner's addition of Knecht and Lawrence in Grounds 2 through 4 does not remedy these deficiencies. Neither reference discloses or suggests selecting features based on their discriminative value for different target types, nor do they provide any mechanism for distinguishing between targets and background clutter using class-specific features. Lawrence is directed to a predictive neural architecture for novelty detection based on innovation signals, not target recognition across multiple classes. Knecht discusses feature extraction from infrared data but, like Barnard, applies the same process uniformly to all objects. Neither reference

addresses, let alone cures, Barnard's failure to preserve and process background clutter or select features based on target identity. Accordingly, the proposed combinations fall far short of teaching or suggesting the full scope of the challenged claims.

In addition, the record contains rare and powerful objective indicia of non-obviousness. The '639 Patent was subject to a secrecy order by the U.S. Air Force for over a decade. What Petitioner now, more than 30 years later, claims would have been obvious, the U.S. Air Force then, annually confirmed was critical defense technology whose unauthorized release would harm national security. These determinations—made repeatedly by the federal government—strongly indicate that the invention was not only novel but also non-obvious at the time of filing. No reasonable inference can be drawn that the claimed invention was routine or publicly available, as Petitioner now argues. Instead, the record shows that the invention was recognized by national defense authorities as technically significant, sensitive, and beyond the scope of what was publicly known or obvious.

In sum, Petitioner's reliance on prior art that does not disclose the claimed limitations, its improper use of expert testimony to fill gaps in the references, and its failure to address compelling evidence of the invention's novelty and significance all undermine the Petition. Because Petitioner has failed to demonstrate that any

claim is unpatentable by a preponderance of the evidence, institution should be denied.

VII. CONCLUSION

For the above reasons, Patent Owner respectfully requests that the Board deny institution of the Petition.

Respectfully submitted,

Dated: May 27, 2025

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CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this **PATENT OWNER'S PRELIMINARY RESPONSE** complies with the type-volume limits set forth in the Memorandum and 37 C.F.R. § 42.24 because it contains 8,538 words, excluding the parts of the Brief that are exempted by 37 C.F.R. § 42.24(a), according to the word processing system used to prepare this Brief.

Respectfully submitted,

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CERTIFICATE OF SERVICE

The undersigned certifies that pursuant to 37 C.F.R. § 42.6(e), a copy of the foregoing **PATENT OWNER'S PRELIMINARY RESPONSE** was served via email (as consented to by counsel) on May 27, 2025 to lead and backup counsel of record for Petitioner as follows:

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