UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Axon Enterprise, Inc., Dedrone Holdings, Inc., and Skydio, Inc.

Petitioners,

v.

Airspace Defense, Inc.

Patent Owner

Case No. IPR2025-00629

U.S. Patent No. 10,514,711

PATENT OWNER'S CONTINGENT-IN-PART AND

NON-CONTINGENT IN-PART REVISED MOTION TO AMEND

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CLAIMS APPENDIX 1

List of Patent Owner Exhibits

Exhibit No.	Description
EX2001	U.S. Army Contract No. W15QKN-17-9-1022
EX2002	Smithsonian, National Air and Space Museum Letter to Mr. Banga dated March 13, 2024
EX2003	Z. Yang and R. Sinnott, "Snake Detection and Classification using Deep Learning," in Proceedings of Hawaii International Conference on System Sciences (2021), https://scholarspace.manoa.hawaii.edu/server/api/core/-bitstreams/f9f2de4d-ddaa-4984-9fc3-9bbca4e27247/content
EX2004	Q. Ji, "Object Detection and Recognition," https://sites.ecse.rpi.edu/~qji/CV/ObjectDetRecog2.pdf
EX2005	The National Science Foundation, "How to Radars Work?," https://www.eol.ucar.edu/content/how-do-radars-work
EX2006	Principles of Doppler Radar, http://ww2010.atmos.uiuc.edu/(Gh)/guides/rs/rad/basics/dpmod.rxml
EX2007	https://developer.apple.com/documentation/corelocation/-configuring-your-app-to-use-location-services
EX2008	https://developer.apple.com/documentation/corelocation/-cllocation
EX2009	https://developer.android.com/develop/sensors-and-location/location/retrieve-current
EX2010	https://developer.android.com/reference/android/location-/Location
EX2011	https://www.merriam-webster.com/dictionary/autonomous

Exhibit No.	Description
EX2012	https://dictionary.cambridge.org/us/dictionary/english/-autonomous
EX2013	Declaration of Noah Moore
EX2014	Airspace Interceptor, Fully Autonomous Physical Mitigation System Designed to Detect, Capture or Ram Drone, https://www.airspace.co/airspace-interceptor/
EX2015	Smithsonian National Air and Space Museum, Donate a Personal Item, https://airandspace.si.edu/donate-item
EX2016	Smithsonian National Air and Space Museum, Roger Connor Bio, https://airandspace.si.edu/people/staff/roger-connor
EX2017	Smithsonian National Air and Space Museum, About the Collection, available at https://airandspace.si.edu/collections/about-collection (last visited July 14, 2025)
EX2018	Jointly Proposed Protective Order
EX2019	U.S. Patent App. No. 16/142,452 (from which U.S. Patent No. 10,514,711 issued), as filed
EX2020	Streaming, Definition of Streaming by Merriam-Webster (2016)
EX2021	Streaming definition and meaning, Collins English Dictionary (2018)
EX2022	R. Wang et al., "An Effective Image Denoising Method for UAV Images via Improved Generative Adversarial Networks," Sensors vol. 18(7):1985 (2018), doi:10.3390/s18071985.
EX2023	A. Ahmad et al., "Noise and Restoration of UAV Remote Sensing Images." *International Journal of Advanced Computer Science*

Exhibit No.	Description
	and Applications, vol. 11, no. 12 (2020) doi:10.14569/ijacsa.2020.0111222
EX2024	Curriculum Vitae of Dr. Nikolaos Papanikolopoulos
EX2025	Declaration of Nikolaos Papanikolopoulos, Ph.D. in Support of Patent Owner's Response and First Motion to Amend
EX2026 (Served; Not filed)	Frequently Asked Questions, About the Internet Archive Affidavit and the Wayback Machine, https://archive.org/legal/faq
EX2027 (Served; Not filed)	Supplemental Declaration of Nikolos Papaniklopoulos, Ph.D., in support of Patent Owner's Response and Motion to Amend
EX2028	*Number not used*
EX2029	*Number not used*
EX2030	*Number not used*
EX2031	Merriam-Webster, Definition of Autonomous (2017)
EX2032	Cambridge English Dictionary, Definition of Autonomous (2017)
EX2033	Transcript of Deposition of Dr. Singhose (Apr. 15, 2026)
EX2034	E. Biediger and W. Singhose, "Formation Flying Satellite Control Utilizing Input Shaping," in AIAA/AAS Astrodynamics Specialist Conf., Big Sky, Montana (2003).
EX2035	Second Declaration of Nikolos Papaniklopoulos, Ph.D., in support of Patent Owner's Sur-Reply to Petitioners' Reply.

I. INTRODUCTION

Patent Owner Airspace Defense, Inc. respectfully moves under 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121(f) to amend challenged claims 1-4 and 8-20 of U.S. Patent No. 10,514,711 (the '711 patent). This revised motion proposes substitute claims 21-37, and is non-contingent as to challenged claims 1-4, 8-11 and 13-20 and contingent as to challenged claim 12. Patent Owner requests cancellation of challenged claims 5-7. As discussed below, this revised motion complies with all the requirements of 37 C.F.R. §§ 42.121(a) and (f), *Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 (PTAB Feb. 25, 2019) identified in the Scheduling Order, and with the Trial Practice Guide (TPG).

II. LEVEL OF ORDINARY SKILL IN THE ART

At the time of invention of the '711 patent, a POSITA would have had either: (1)(a) at least a bachelor of science in mechanical engineering, electrical engineering, aerospace engineering, or an equivalent field, or (b) at least four years of experience in any of the above disciplines, and (2)(a) at least a bachelor's degree in computer science, or (b) at least four years of experience in the software industry in the field of artificial intelligence / machine learning. EX2025 § VI.

III. PROPOSED SUBSTITUTE CLAIMS COMPLY WITH 37 C.F.R. § 42.121, *LECTROSONICS*, PAPER 15, AND THE TPG

A reasonable number of substitute claims: Per 37 C.F.R. § 121(a)(3), for each of the challenged claims 1-4 and 8-20, Patent Owner proposes only a single

corresponding substitute claim. *See infra* Claims Appendix.

Responsive to a Ground of Unpatentability and Petitioners' Opposition: Proposed substitute claims (PSCs) 21, 24, 36, and 37 were previously amended to respond to the unpatentability Grounds of the Petition per 37 C.F.R. § 121(a)(2)(i). Per 37 C.F.R. § 42.121(f)(2), at least one claim, PSC 37, is amended herein to address the new unpatentability Grounds from the Opposition. PSC 37 is amended to recite selection and application of only one of two neural networks in processing a particular image, which the new Grounds do not teach/suggest. *See infra* § IV.

No enlargement the scope of the challenged claims: Each PSC retains all of the limitations of the corresponding challenged claim, and each proposed independent substitute claim adds further limitations. In PSCs 22, 23, and 25-35, only the dependencies are amended. As such, per 37 C.F.R. § 121(a)(2)(ii), no PSC enlarges the scope of the challenged claims.

No new matter; supported in the original disclosure: Per 37 C.F.R. § 121(a)(2)(ii) and (b), PSCs do not introduce new subject matter and are fully supported by the original disclosure of the '711 patent, as shown in the claim charts below. To show support in the "original disclosure of the application, as filed," the relevant portions of the'452 App. are cited.[1] *Lectrosonics*, Paper 11 at 7-8; 37

[1] The corresponding portions of the '711 patent are also cited.

C.F.R. § 42.121(b)(1)-(2).

Claim Element	Support in the Specification
[[1]]21.[pre] A method of performing a flight control operation of a reference aerial vehicle, comprising:	EX2019, Title ("Flight Control Using Computer Vision"), Abstract ("A **flight control operation** of a **reference aerial vehicle** is performed"), ¶ 34 ("A **flight control operation** is performed"), ¶ 59 ("The CPU may be configured to perform **one or more flight decisions** for the **UAV**" e.g., by provid[ing] one or more **flight commands to a flight controller** module" and "the **CPU** is configured to **autonomously fly** UAV 301"), ¶ 90 ("a **reference system (e.g., interceptor aerial vehicle** 102 of Figure 1)"), Figures 1-3B; EX1001, Title, Abstract, 3:41-42, 9:38-47, 16:13-18, FIGS. 1-3B. *See also*, EX2019, ¶ 74 ("[a]n interdiction control module may provide or suggest course corrections … to maneuver UAV 301 into an ideal interception position autonomously"), ¶¶ 59, 78 ("unmanned aerial vehicle 301 compris[es] computing chassis 302" " to protect the CPU of UAV 301" and the "flight controller module"); EX1001, 9:25-26, 12:64-67, 13:49-61, 14:5-6, FIGS. 2, 3B.
[21.a] receiving <u>at a processor at the reference aerial vehicle</u> an image captured by an image sensor of the reference aerial vehicle;	EX2019, ¶ 90 ("once an **image sensor/camera** on a reference system (e.g., interceptor aerial vehicle 102 of Figure 1) is within range to acquire an image of the target, the reference system is able to more accurately detect [a] target based at least in part on the **image sensor/camera data**. [O]nce the reference system … image sensor/camera is pointing towards the direction of the received location, **captured images are analyzed using a processor of the reference system** in an attempt to detect the target aerial vehicle in the image using computer machine vision"), FIG. 4; EX1001, 16:11-25, FIG. 4. EX2019, ¶ 55 ("Unmanned Aerial Vehicle 200 may include a **camera system 212** … used to visually detect a UAV [and/or] an object and provide visual data (e.g., pixel data) to one of the one or more

Claim Element	Support in the Specification
	machine learning models 205"), ¶ 94 ("an **image sensor/camera** of the interceptor aerial vehicle continually **captures a stream of images**" and "**detection of the target** in the captured image may be performed **using machine/computer vision**"), Figures 2, 5; EX1001, 8:48-52, 17:20-27, FIGS. 2, 5. Thus, a camera on-board a UAV includes an "image sensor of the reference aerial vehicle." The processor on board the UAV receives and analyzes the images captured by the camera using machine vision, i.e., by applying a machine learning (ML) model to the captured images.
[21.b] detecting <u>at the reference aerial vehicle</u> a target in the image including by applying <u>at the reference aerial vehicle</u> a machine learning model to the image<u>,</u> to identify <u>a bounding box outlining</u> a portion of the image that includes <u>detected features of</u> the target<u>, and to identify a classification of the detected target</u>;	EX2019, ¶ 86 ("Figure 4 is a flowchart" of "a process for automatically controlling flight of a vehicle. [T]he **process of Figure 4 is performed by interceptor aerial vehicle 102** of FIG. 1. UAV 200 of FIG. 2, and/or UAV 301 of FIGS. 3A and 3B"), ¶ 90 ("[a]t 406, a relative **location of the target is detected** using a captured image. …. [O]nce the reference system is within a predetermined distance (e.g., 20 meters) from the received location … **captured images are analyzed using a processor of the reference system in an attempt to detect the target** aerial vehicle in the image using computer machine vision"), Figure 4; EX1001, 15:27-31, 16:11-25, FIG. 4. EX2019, ¶ 94 ("[t]he **detection of the target** in the captured image may be performed using machine/computer vision [e.g.,] using a **machine learning model**" and the "output from applying the machine learning model[] may include a **bounding box outlining an area within the image that includes the image portion with the target** (e.g., bounding box outlines the minimum sized box that **includes detected features of the target)** and/or **a classification of the detected target** (e.g., type, model, class, manufacturer, size, etc. of the detected target)"); EX1001, 17:25-38. The process of Figure 4 is performed at the reference

Claim Element	Support in the Specification
	aerial vehicle. Per that process, captured images are analyzed by applying an ML model to detect a target in the image. The ML model implementing, e.g., a neural network (NN), identifies a bounding box outlining a portion of the captured image where that portion incudes the target and its detected features and target classification.
[21.c] determining <u>at the reference aerial vehicle</u> a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image including by determining a distance to the target based at least in part on a size of the <u>bounding box of</u> the target detected within the image <u>and on a physical size corresponding to the classification of the target detected within the image</u>; and	EX2019, ¶ 93 ("Figure 5 is a flowchart" of "a process for determining a vector associated with a target. [T]he **process of Figure 5 is performed by interceptor aerial vehicle 102** of FIG. 1, UAV 200 of FIG. 2, and/or UAV 301 of FIGS. 3Aand 3B. In some embodiments, at least a portion of the process of FIG. 5 is performed in 406 and/or 408 of Figure 4"), Figures 4, 5; EX1001, 17:8-14, FIGS. 4, 5. EX2019, ¶ 34 ("[a] **three-dimensional relative location** of the target aerial vehicle is determined with respect to a reference aerial vehicle **based on the image**"), ¶ 90 ("[a] **distance value to the target** ... may also be **specified for the relative location**") , ¶ 96 ("[a]t 504, a relative direction to the target is determined based on the image" e.g., the "output from applying the machine learning model[] may include a **bounding box identifying an area within the image that includes the target**"), ¶ 97 ("[a]t 506, a vector identifying the **relative location** of the target is **determined using** at least the **determined relative direction** of the target"); EX1001, 3:36-41, 16:42-47, 18:12-37, 18:44-49. EX2019, ¶ 94 (the "output from applying the machine learning model[] may include … a classification … e.g., **type**, model, … etc. of the detected target)"), *id.* ("[a]t 502, a **relative distance** to a target is determined based on a captured image of the target"), ¶ 95 ("the **relative distance** to the target identifies the relative distance between a reference system (e.g., interceptor aerial vehicle) and the target (e.g., target aerial vehicle)" and may be "based on **a size of the bounding**

Claim Element	Support in the Specification
	box within the entire captured image." "[T]he actual **physical size** of the target needs to be taken into account when using the target size within the image as a proxy for relative distance. In some embodiments, the **machine learning model**" is "**able to** classify and **identify the specific type of the detected target aerial vehicle and a corresponding size** profile corresponding to the specific type"), *id.* ("relative distance may be determined based on a size of the bounding box within the entire captured image and a **detected classification of the target**"); *id.* (measurements "of the bounding box" "can be mapped to a **distance value based on a determined size corresponding to the detected type**/classification of the target"); EX1001, 17:17-18, 17:31-58, 17:61-67. Performing the process of Figure 5 at the reference aerial vehicle includes applying an ML model to identify a bounding box for the detected target and to determine a specific type / classification of the target. The process also determines a relative three-dimensional direction and distance to the target from the UAV. The distance is determined using the bounding box and the physical size corresponding to the identified classification or type of the target. The on-board application of the ML model thus identifies the relative direction and distance, i.e., the three-dimensional location of the target relative to that of the UAV.
[21.d] performing <u>at the reference aerial vehicle</u> the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle, wherein performing the flight control operation	EX2019, ¶ 34 ("A **flight control operation** is performed based on three-dimensional relative location"), ¶ 59 ("The CPU may be configured to perform **one or more flight decisions** for the **UAV**. For example, the CPU may provide one or more **flight commands to a flight controller** module" including "a **specified speed** …, a specified flight height …, a particular flight path for the UAV, etc. In response[,] the flight controller module is configured to control the motors associated with the UAV … so that UAV 301

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includes determining a <u>first</u> speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle.	flies in a manner that is consistent with the flight commands" and in some "embodiments, the **CPU** is configured to **autonomously fly** UAV 301"), Figures 3A-B; EX1001, 3:41-42, 9:38-47, FIGS. 3A-B. EX2019, ¶ 97 ("[a]t 506, a **vector** identifying the **relative location** of the target is determined using at least the determined relative direction of the target"); *id*. ("the **vector** is at least in part **defined using** a distance and/or **speed value**. For example, the distance value determined in 502 is mapped to a desired speed of travel to reach the target … and the length of the vector is based on the determined distance and/or speed"), ¶ 98 ("[a]t 508, the **vector is scaled**" where "scaling the vector includes **modifying a speed** and/or acceleration associated with the vector"), Figure 5; EX1001, 18:44-59, 18:65-19:1, FIG. 5. EX2019, ¶ 99 ("**[m]odifying the speed** and/or acceleration associated with the vector includes **adjusting a factor used to control the speed** … of the interceptor aerial vehicle **based on an amount of directional change** specified by the vector. For example, when a large directional change is required … a slower speed is desirable … compared to a faster speed that is desirable … when no or minor directional change is required. [T]he **speed** … factor is **multiplied by one or more scalar values that change in magnitude based on a directional deviation of the vector from a current direction of movement** (e.g., deviation of the target in the image from the center of the image representing the current heading direction of the interceptor aerial vehicle); EX1001, 19:4-20. Thus, the UAV performs its flight-control operations autonomously, including parts of the process of Figure 4, at the UAV, using a processor on-board the UAV and these operations include performing a speed adjustment that depends in part of the magnitude of the angle of the direction pointing to the target's three dimensional location relative to the UAV's heading,

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	i.e., the UAV's current flight direction.
22. The method of claim 21, wherein the reference aerial vehicle is a multirotor unmanned aerial vehicle and the target is an aerial vehicle.	EX2019, ¶ 35 ("Examples of **interceptor aerial vehicle 102** include a drone, a **multirotor** aircraft"), ¶ 36 ("unauthorized aerial vehicle is target aerial vehicle 110 (e.g., a drone"), ¶ 57 ("**Unmanned aerial vehicle** 301 is an **example of** UAV 200 of Figure 2 and/or **aerial vehicle 102** of Figure 1"), at 73 (claim 2), Figures 1, 2; EX1001, 3:46-50, 9:7-10, FIGS. 1, 2. Thus, the '452 App. disclose as an interceptor vehicle (a reference aerial vehicle), a multirotor UAV. The '452 App. also discloses a target that is an aerial vehicle or a drone.
23. The method of claim 21, wherein performing the flight control operation includes one or more of the following: turning the reference aerial vehicle towards the target, adjusting a speed of the reference aerial vehicle, or engaging a mechanism to capture the target.	EX2019, ¶ 91 ("[a]t 408, a flight operation is performed based on the detected relative location of the target. [A] flight **direction and/or speed** of an interceptor aerial vehicle are automatically and autonomously **adjusted** based on a location and size of the target within the captured image (e.g., **adjust direction to center the target** within subsequently captured images). This allows the flight path of the interceptor aerial vehicle to be dynamically adjusted to **track and follow a moving target**, allowing the interceptor aerial vehicle to come within a threshold distance where an interdiction/capture system (e.g., **a net fired from the interceptor aerial vehicle**) can be effectively deployed. [A] scaled three-dimensional vector based on the relative location of the target … is used to adjust a flight path of the interceptor aerial vehicle in the direction and intensity of the three-dimensional vector. For example, the three-dimensional vector specifies directional and speed/acceleration changes to be performed by the interceptor aerial vehicle to **direct the flight path of the interceptor aerial vehicle** … **towards the target aerial vehicle**"), Figure 4; EX1001, 16:49-17:3, FIG. 4. *See* EX2019 ¶ 33 ("when a threatening UAV is detected, the interceptor aerial vehicle may be

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	deployed to fly to the target UAV and capture it (e.g., **using a net** fired from the interceptor aerial vehicle over the target to **capture the target in the net**"), ¶ 97 ("the distance value determined in 502 is mapped to a **desired speed** of travel **to reach the target**"), at 73 (claim 3), Figure 2; EX1001, 3:16-21, 7:55-56; 18:54-59, FIG. 2. Thus, the '452 App. teaches changing the direction/speed of an interceptor (reference) aerial vehicle, to direct it towards the target aerial vehicle, and thus to reach the target. As such, the '452 App. teaches "turning the reference aerial vehicle towards the target," and "adjusting a speed of the reference aerial vehicle." The '452 App. also teaches "using a net fired from the interceptor aerial vehicle over the target to capture the target in the net," i.e., "engaging a mechanism to capture the target."
24. The method of claim 21, wherein detecting the target in the image including by applying at the reference aerial vehicle the machine learning model to the image includes identifying a model type of the target based on the classification of the detected target.	EX2019, ¶ 94 (the "detection of the target in the captured image may be performed using machine/computer vision. For example, **using a machine learning model** trained using training data of various different images of targets, the captured image is analyzed to identify the target aerial vehicle in the image. The output of the image analysis (e.g., **output from applying the machine learning model) may include** … a classification of the detected target (e.g., **type**, **model**, class, manufacturer, size, etc. **of the detected target**)"); EX1001, 17:25-38. EX2019, ¶ 95 ("the machine learning model has been trained using different examples of types of aerial vehicles (e.g., **different models**, types, manufacturers, sizes, etc.) to be able to **classify** and identify the specific type of the detected target aerial vehicle"); EX1001, 17:53-58.
[[8]]25. The method of claim [[7]]21 wherein performing the flight control operation	EX2019, ¶ 90 ("[a]t 406, a **relative location** of the target is detected using a captured image"); *id*. ¶ 91 ("[a]t 408, a **flight operation** is performed based on the detected **relative location** of the target"); *id*. ¶ 90

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includes determining a second speed adjustment factor based on the determined distance to the target.	("the **relative location** is **specified by** a three-dimensional **vector**"), ¶ 91 ("a **scaled** three-dimensional **vector** based on the relative location of the target … is used to **adjust a flight path** of the interceptor aerial vehicle in the direction and intensity of the three-dimensional vector. For example, the three-dimensional vector specifies **directional and speed/acceleration changes** to be performed by the interceptor aerial vehicle to **direct the flight path** of the interceptor aerial vehicle at a desired rate of change **towards the target aerial vehicle**"), Figure 4; EX1001, 16:11-12, 44-47, 16:49-50, 16:60-17:3, FIG. 4. EX2019, ¶ 97 ("[a]t 506, **a vector** identifying the relative location of the target is determined using at least the determined relative direction of the target"); *id*. ("the **vector is defined by** … **a factor based on an associated distance or speed**"); *id*. ("the **vector** is at least in part defined using a distance and/or speed value. [T]he **distance** value determined in 502 is **mapped to a desired speed** of travel to reach the target (e.g., greater speed desired for further distance and slower speed desired for shorter distance …)"), at 73 (claim 8), Figure 5; EX1001, 18:44-64, FIG. 5. Thus, the '452 App. describes a vector for performing flight control operations, where the vector includes a factor based on speed that is based on the distance to the target.
[[9]]26. The method of claim 21, wherein determining the three-dimensional relative location of the target includes determining a direction of the target with respect to the reference aerial vehicle.	EX2019, ¶ 34 ("[a] **three-dimensional relative location** of the target aerial vehicle is determined **with respect to a reference aerial vehicle** based on the image. For example, **azimuth and attitude directions** … are determined based on the image"), ¶ 90 ("[a]t 406, a **relative location** of the target is detected using a captured image"); *id*. ¶ 91 ("[a]t 408, a **flight operation** is performed based on the detected **relative location** of the target"); *id*. ¶ 90 ("the **relative location** is **specified by** a **three-dimensional**

Claim Element	Support in the Specification
	vector"), ¶ 97 ("[a]t 506, a vector identifying the **relative location** of the target is determined using at least the determined **relative direction of the target**. [D]etermined angular directions (e.g., **azimuth angle and altitude angle**) can be mapped to a three-dimensional vector identified by three axial components"), at 74 (claim 9), Figures 4, 5; EX1001, 3:36-41, 16:11-12, 16:44-50, 18:44-49, FIGS. 4, 5. Thus, the '452 App. discloses that the three-dimensional relative location of the target is based on, in part, the relative direction of the target with respect to the reference aerial vehicle, e.g., in terms of the azimuth and altitude angles.
[[10]]27. The method of claim 21, wherein determining the three-dimensional relative location of the target includes determining an azimuth angle and an altitude angle to the target from the reference aerial vehicle.	*See supra* PSC 26 (describing determining the three-dimensional relative location of the target is based on, in part, the azimuth and altitude angles); EX2019 at 74 (claim 10).
[[11]]28. The method of claim 21, wherein determining the three-dimensional relative location of the target includes converting a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location.	EX2019, ¶ 103 ("Figure 7 is an illustration illustrating an example of a **three dimensional vector determined using two dimensional measurements**. **3D vector** 700 comprises a target 702, a UD factor 704, an LR factor 706, and an FB factor 708. Target 702, which is **associated with a 2D vector**, has a 3D vector determined, which may comprise the UD factor 704, the LR factor 706, and the FB factor 708. The UD factor 704, the LR factor 706, and the FB factor 708 may be calculated using the example equations shown in Figure 8"), ¶ 104 ("Figure 8 shows example equations that can be utilized to determine a **three dimensional vector**. The equations are based on measurements for two axes of an image, such as an x-axis (degX) and a y-axis (degY). An **initial 2D vector**

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	may be determined based on the location of the target pixels. The 2D vector is then **converted into a 3D vector** comprising three factors: an up/down factor (UD), a front/back factor (FB), and a left/right factor (LR).”), at 74 (claim 11), Figures 7, 8; EX1001, 20:29-46, FIGS. 7, 8.
[[12]29.[pre] The method of claim 21, further comprising:	*See supra* PSC 21.
[29.a] receiving a geographical location associated with the target detected at least in part using a ground-based sensor;	EX2019, ¶ 87 (“[a]t 402, a **location** of a target is **received**” and in “some embodiments, the location is a **geographical location** coordinate that has been **determined using one or more remote sensors**. For example, the location of target aerial vehicle 110 is provided by **ground station** 104 via a wireless communication to interceptor aerial vehicle 102, and ground station 104 has determined the location based on information from **sensors of ground station** 104 and/or **ground-based sensor 106** of Figure 1. In some embodiments, the location is received directly … from one or more **ground-based sensors**[]”), at 74-75 (claim 17), Figure 4; EX1001, 15:32-45, FIG. 4.
[29.b] autonomously navigating the reference aerial vehicle towards the received geographical location; and	EX2019, ¶ 89 (“[a]t 404, the received location is utilized to navigate towards the received location. For example, the location is received at ... an interceptor aerial vehicle and the direction and/or speed of the aerial vehicle is automatically and **autonomously** adjusted to turn and **fly towards the received location** in a navigation mode based on the received location”), at 74-75 (claim 17), Figure 4; EX1001, 15:64-16:3, FIG. 4.
[29.c] determining to allow image-based navigation.	EX2019, ¶ 89 (navigation based on the received location “allows the interceptor aerial vehicle to … become closer to the vicinity of the target. [T]he received location may not represent the exact location of a moving target”), ¶ 90 (“[a]t 406, a relative **location** of the target is **detected using a captured image**. [O]nce an image sensor/camera on a reference

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	system (e.g., interceptor aerial vehicle 102 of Figure 1) is **within range to acquire an image** of the target, the reference system is able to more accurately detect and automatically navigate to the location of the target based at least in part on the image sensor/camera data. [O]nce the reference system is within a **predetermined distance** (e.g., 20 meters) from the received location … **captured images are analyzed** using a processor of the reference system in an attempt to detect the target aerial vehicle in the image using computer machine vision. …. [O]nce the **target is detected in a captured** image, the **navigation** of the reference system may now be performed **based on the image**"), at 74-75 (claim 17), Figure 4; EX1001, EX1001, 16:3-31, FIG. 4. *See also, infra* (PSC 35) (describing switching from received location based navigation to captured imaged based navigation, when the reference aerial vehicle is within a predetermined / threshold distance from the received location). Thus, the '452 App. teaches allowing image-based navigation when a target is detected in the image and/or when the reference aerial vehicle is within a predetermined/threshold distance from the received location.
[[13]]30. The method of claim 21, wherein the speed adjustment factor is greater for a smaller magnitude of deviation as compared to for a greater magnitude of deviation.	EX2019, ¶ 99 ("the speed and/or acceleration factor is multiplied by one or more scalar values that change in **magnitude based on a directional deviation** of the vector from a current direction of movement (e.g., deviation of the target in the image from the center of the image representing the current heading direction of the interceptor aerial vehicle)"); *id*. ("[m]odifying the speed and/or acceleration associated with the vector includes **adjusting a factor used to control the speed** … of the interceptor aerial vehicle based on an **amount of directional change** specified by the vector. For example, when a **large directional change** is required by the interceptor aerial vehicle to fly towards

Claim Element	Support in the Specification
	the target, a **slower speed** is desirable to allow the directional change to take place at a slower speed over a shorter distance as compared to a **faster speed** that is desirable to reach the target quicker when **no or minor directional change** is required"), at 74 (claim 13); EX1001, 19:4-14. Thus, the '452 App. teaches adjusting the speed adjustment factor opposite of the required directional change, i.e., a greater speed adjustment for a smaller directional change and vice versa.
[[14]]31. The method of claim 21, wherein performing the flight control operation includes scaling [[a]the speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle.	*See supra* PSC 25 (describing that performing the flight control operation uses a vector relating to the target location); EX2019, ¶ 91 ("the three-dimensional **vector** specifies directional and **speed**/acceleration **changes** to be performed by the interceptor aerial vehicle to direct the flight path of the interceptor aerial vehicle at a desired rate of change towards the target aerial vehicle"), ¶ 98 ("[a]t 508, the vector is scaled. **[S]caling the vector** includes **modifying a speed** and/or acceleration associated with the vector as well as **smoothing and limiting** the rate of change associated with the vector"), ¶ 99 ("the **factor used to control the speed** and/or acceleration of the interceptor aerial vehicle includes **limiting** its rate of change and/or value (e.g., either by a **reduction scalar** or a maximum change limit) so that the interceptor aerial vehicle does not change its speed in a manner that is too sudden or difficult to achieve given flight hardware limitations"), at 74 (claim 14), Figure 5; EX1001, 16:65-17:3, 18:65-19:1, 19:36-42, FIG. 5. A factor used to control the speed and to scale the vector to modify the speed to avoid sudden speed changes is an adjustment factor that smooths/limits the rate of change of the reference aerial vehicles speed.
[[15]]32. The method of claim 21, wherein performing the flight control operation	*See supra* PSC 25 (describing that performing the flight control operation uses a vector relating to the target location); EX2019, ¶ 100 ("the scaling the vector includes modifying one or more **directional**

Claim Element	Support in the Specification
includes determining a direction adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle.	**component values** of the vector" and "the one or more component values of the vector are **multiplied** by one or more **scalar values** that change in magnitude based on a **deviation** of the corresponding component value from a center reference value (e.g., **corresponding to a current direction of movement**)"), at 74 (claim 15), Figure 5; EX1001, 19:1-3, 19:14-20, FIG. 5. Determining a scalar value that is multiplied with a direction component value is a "direction adjustment factor." The scalar value is determined based on a deviation of the direction component value, i.e., deviation of direction, corresponding to a current direction of movement, i.e., "direction of the three-dimensional relative location" of the target "with respect to a current flight direction of the reference aerial vehicle."
[[16]]33. The method of claim [[15]]32, wherein performing the flight control operation includes scaling the direction adjustment factor to smooth and limit a rate of change of a direction of the reference aerial vehicle.	*See supra* PSC 25 (describing that performing the flight control operation uses a vector relating to the target location); EX2019, ¶ 98 ("[a]t 508, the **vector is scaled**" where "**scaling** the vector includes … as **smoothing and limiting** the rate of change associated with the vector"), ¶ 100 ("the **scaling the vector** includes modifying one or more **directional component values** of the vector. For example, a rate of change and/or a value of one or more components of the vector is **limited** (e.g., either by a **reduction scalar value** or a limit) so that the interceptor aerial vehicle **does not change directions** in a manner that is **too sudden** or difficult to achieve." "[A] magnitude of change of a component value of the vector is limited by a predetermined maximum limit. In some embodiments, the one or more component values of the vector are **multiplied by one or more scalar values** that change in magnitude based on a deviation of the corresponding component value from a center reference value (e.g., corresponding to a current direction of movement)"), at 74 (claim 16), Figure 5; EX1001, 18:65-19:3, 19:45-59, FIG. 5.

Claim Element	Support in the Specification
	A scalar value multiplied with a direction component value to avoid sudden direction changes is an adjustment factor that smooths and limits the rate of change of direction.
[[17]]34. The method of claim 21, wherein the distance to the target is determined based at least in part using a radar.	EX2019, ¶ 87 ("[a]t 402, a location of a target is received. …. In some embodiments, the location is relative to a reference aerial vehicle" and "the **location** (e.g., **including** azimuth angle, altitude angle, **distance**) is **determined** using an on-vehicle sensor (e.g., **radar** sensor of UAV 301)"), Figures 3A-B, 4; EX1001, 3:46-50, 3:56-61, 3:64-67, 15:43-49.
[[18]]35. The method of claim 21, wherein it is determined to allow the image-based navigation based on whether the reference aerial vehicle is within a threshold distance away from the received geographical location.	EX2019, ¶ 56 ("UAV 200 may use radar system 202 to detect an object that is greater than a threshold distance away. UAV 200 may **use camera** system 212 **to detect an object** that is less than or equal to the **threshold distance** away"), ¶ 90 ("once the reference system is within a **predetermined distance** (e.g., 20 meters) from the **received location** and the image sensor/camera is pointing towards the direction of the received location, captured images are analyzed using a processor of the reference system in an attempt to detect the target aerial vehicle in the image using computer machine vision. …. [O]nce the target is detected in a captured image, the **navigation** of the reference system may now be performed **based on the image**"), at 75 (claim 18), Figures 2, 4; EX1001, 8:66-9:2, 16:18-31, FIGS. 2, 4. EX2019, ¶ 90 ("once an image sensor/camera on a reference system (e.g., interceptor aerial vehicle 102 of Figure 1) is **within range** to acquire an image of the target, the reference system is able to more accurately detect and automatically **navigate to the location** of the target **based** at least in part **on the image sensor/camera data**"), Figure 4; EX1001 16:12-18. Thus, the '452 App. describes using a camera on-board a UAV to detect a target when the UAV is within a predetermined/threshold distance from the received location of the target, and thereafter performing

Claim Element	Support in the Specification
	navigation using target location obtained from the captured images.
[[19]]36.[pre] A reference aerial vehicle, comprising:	EX2019, Abstract ("A flight control operation of a reference aerial vehicle is performed"), ¶ 34 ("A three-dimensional relative location of the target aerial vehicle is determined with respect to a **reference aerial vehicle**"), ¶ 90 ("a reference system (e.g., interceptor aerial vehicle 102 of Figure 1)"), FIGS. 1-3B; EX1001, Abstract, 3:36-39, 16:11-18. Thus, the '452 App. discloses determining the relative location of a target UAV with respect to a reference aerial vehicle. The '452 App. also discloses an interceptor aerial vehicle as a "reference" system.
[36.a] an image sensor configured to capture an image;	EX2019, ¶ 90 ("[a]t 406, a relative location of the target is detected using a **captured image**. [O]nce an **image sensor/camera** on a reference system (e.g., interceptor aerial vehicle 102…) is within range to **acquire an image** of the target, the reference system is able to more accurately detect and automatically navigate to the location of the target based at least in part on the image sensor/camera data"), ¶ 94 ("For example, an **image sensor/camera** of the interceptor aerial vehicle continually **captures a stream of images**"), FIG. 4; EX1001, 16:11-18, 17:20-25. *See also* EX2019, ¶ 55 ("Unmanned Aerial Vehicle 200 may include a camera system 212. Camera system 212 may be used to visually detect a UAV"), ¶ 76 ("UAV 301 may include visual detection system 311. Visual detection system 311 may include one or more cameras"), FIGS. 2, 3A-B; EX1001, 8:48-50, 13:26-27, FIGS. 2, 3A-B.
[36.b1] a processor configured to: detect at the reference aerial vehicle a target in the image; and	*See supra* element [21.b] (reciting "detecting at the reference aerial vehicle a target in the image). It is disclosed in connection with claim element [21.b] that the detection is performed by a processor at the UAV.
[36.b2] determine at	*See supra* element [21.c] (reciting substantially similar

Claim Element	Support in the Specification
the reference aerial vehicle a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image; and	limitations).
[36.c] a flight controller configured to perform a flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle, wherein the flight controller is configured to perform the flight control operation including by being configured to determine a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle[[.]],	*See* EX2019, ¶ 78 (describing "unmanned aerial vehicle 301 comprising computing chassis 302, UI panel 350, **flight controller module** 352"), ¶ 59 (Computing chassis 302 is configured to protect the CPU of UAV 301), ¶ 80 ("Flight controller module 352 is **configured to control a flight of UAV** 301"), FIGS. 2 (processor 211), 3A-B; EX1001, 13:49-61, 9:25-26, 14:5-6, FIGS 2, 3A-B. *See supra* elements [21.pre], [21.d]. Thus, a flight controller that performs flight control operations according to flight commands specified by a CPU on-board the UAV is disclosed. Additionally, claim elements [36.c] and [21.d] are substantially similar.
[36.d] wherein the detecting of the target in the image is performed by applying at the reference aerial vehicle a first neural network at a first robustness and a first compute cost, and the determining of the	EX2019, ¶ 34 ("an image is received and a **target aerial vehicle is detected** in the image" where "a stream of images" "is analyzed using deep learning, **neural networks**," "to **recognize a target** aerial vehicle in the captured image"); EX1001, 3:31-36. EX2019, ¶ 109 ("Deep **neural networks** (DNN) may be executed to periodically **detect objects** and distinguish targets"), ¶ 110 ("Once an object is detected in high-resolution mode" "a tracker algorithm

Claim Element	Support in the Specification
three-dimensional relative location of the target in the image comprises incrementally predicting the location of the target in the image by applying at the reference aerial vehicle a second neural network at a second robustness and a second compute cost, the first robustness and the first compute cost being greater, respectively, than the second robustness and the second compute cost.	takes control and maintains lock on the target"); *id*. ("**DNN based detections** of a target in the video frame provides **robustness at a high compute cost**. A reduced resource background tracker may **incrementally predict the location** of a target in the frame with **low compute cost and average robustness**"); EX1001, 22:3-7. EX2019, ¶ 145 ("processing schemes can be grouped as: (i) **High cost** (low refresh rate), **high robustness** algorithm … (iii) **Low cost** (high refresh rate), **low robustness algorithms**"), ¶ 150 ("Processing scheme examples for a group (i) **High cost (low refresh rate) – high robustness** can include modified tiny You only look once (YOLO) ... (**CNN**)" "a modified **SSD** … **CNN**" "a modified Faster **R-CNN**," "segmentation analysis of the frame+ classifier for each candidate, etc."); EX1001, 27:53-64, 28:40-47. EX2019, ¶ 151 ("Processing scheme examples for a **group (ii) & (iii)** can include using **SqueezeNet super fast rejection CNN**"), ¶ 152 ("**Group (iii) Low-cost – low robustness** processing scheme examples can include: **extrapolation of location of object from past locations** …; **SqueezeNet** super fast rejection **CNN**; **template matching**"); EX1001, 28:48-51, 28:64-29:3. EX2019, ¶ 113 ("the set of processing schemes process the video data stream using different resolutions"), ¶ 121 ("Figure 15 illustrates a tracking system 1500" that "may be utilized **in 406 of Figure 4**" and that "comprises [] cameras 1528 producing multi-camera views 1518" "to populate a pixel domain 1516" "divided into nodes … that are then analyzed by a high resolution tracker 1502" and its output "is input to a **fast, low power consumption low resolution tracker 1510**. In this example, the node 1506 comprises an anomaly 1522" that the "high resolution tracker 1502 identifies … as a **detected object 1524, which is then tracked by the low resolution tracker 1510**"), Figure

Claim Element	Support in the Specification
	15; EX1001, 22:39-41, 24:13-27, FIG. 15. Thus, detecting a target by analyzing one or more images using an ML model configured to implement an NN is disclosed. The ’452 App. further discloses that a high robustness, high compute-cost NN (e.g., DNN), may be used initially to detect a target, and thereafter, the target location may be predicted incrementally using a low robustness, low cost technique, such as a low resolution tracker / NN.
[[20]]37.[pre] A computer program product for performing a flight control operation of a reference aerial vehicle, the computer program product being embodied in a non-transitory computer readable storage medium housed in a reference aerial vehicle and comprising computer instructions for:	EX2019, ¶ 30 (“The invention can be implemented in numerous ways, including as a process; an apparatus; a system; a composition of matter; a **computer program product** embodied on a **computer readable storage medium**; and/or a processor, such as a processor configured to execute **instructions** stored on and/or provided by a **memory coupled to the processor**); EX1001, 2:36-41. *See supra* preamble [21.pre]. Thus, the ’452 application discloses memory e.g., a non-transitory storage medium, coupled to a processor on-board an reference aerial vehicle, where the non-transitory storage medium includes instructions for the processor. Additionally, the respective preambles of PSCs 21 and 40 are substantially similar.
[37.a] receiving a current image captured by an image sensor of the reference aerial vehicle;	*See supra* element [21.a] (reciting substantially similar limitations).
[37.b] detecting at the reference aerial vehicle a target in the current image including by applying a machine learning model to the current image to identify a portion of the current	*See supra* element [21.a] (reciting substantially similar limitations).

Claim Element	Support in the Specification
image that includes the target;	
[37.c] determining at the reference aerial vehicle a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the current image including by determining a distance to the target based at least in part on a size of the target detected within the current image; and	*See supra* element [21.c] (reciting substantially similar limitations).
[37.d] performing at the reference aerial vehicle the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle, wherein performing the flight control operation includes determining a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle[[.]],	*See supra* element [21.d] (reciting substantially similar limitations).
[37.e1] wherein a first neural network or a second neural network	EX2019, ¶ 141 ("**processing schemes** include localization algorithms that process video frames" and "**produce a prediction of objects** within the video

Claim Element	Support in the Specification
was applied to an immediately preceding image, and the detecting of the target in the current image further comprises making a selection, from between the first and the second neural networks, of only one of the first and the second neural networks, based on a confidence level for a detection of the target in the current image;	fame, as well as a **confidence number that is a measure of qualify for that prediction**"); EX1001, 27:26-32. EX2019, ¶ 146 ("a set of processing schemes (e.g., algorithms) are examined from group to group, and **the process cycles through the processing schemes to produce a detection of an object**. According to the example implementations, **if the confidence number is higher** than an activation number, an action is performed to **stop or change a running group (i)** and select or switch to group (ii). For example, a processing scheme from the group of (i) High cost **(low refresh rate), high robustness** algorithm can select a cheaper processing scheme from the group of (ii) Medium cost, medium robustness algorithms. Medium cost algorithms can be rum from group (ii) in higher refresh rate, while **monitoring the confidence level of the result**"), ¶ 147 ("a voting system is provided that fuses estimations from high confidence results …. If the **confidence is below low threshold**, falls outside of a range, or the validation method fails, **group (i) processing** is performed. If the **confidence is determined to be high**, then **group (iii) algorithms can be applied** to optimize resources"); EX1001, 27:65-28:18. Thus, the '452 App. discloses various "processing schemes" that "produce a prediction of objects" also called "a detection of an object." The processing schemes include high cost, high robustness, low refreshment rate techniques including NNs, and low/medium cost, low/medium robustness, high refreshment rate techniques including NNs. A "confidence number that is a measure of quality of that prediction," a measure of quality of the detection of the object, i.e., a "confidence level," is also computed for the different processing schemes.
[37.e2] wherein the first neural network has a first	EX2019, ¶ 141 ("**processing schemes** ... that process … one or more video data streams" to "produce a

Claim Element	Support in the Specification
robustness and a first refresh rate, and the second neural network has a second robustness and a second refresh rate, the first robustness being greater than the second robustness and the first refresh rate being less than the second refresh rate, and	prediction of objects within the video fame, as well as a **confidence number** that is a measure of quality for that prediction"), ¶ 145 ("processing schemes can be grouped as: (i) High cost **(low refresh rate**), **high robustness** algorithm … ; (ii) Medium cost, **medium robustness** algorithms … (iii) Low cost **(high refresh rate), low robustness** algorithms"); EX1001, 27:27-32, 27:53-64. EX2019, ¶ 150 ("examples for a **group (i)** High cost (**low refresh rate) – high robustness** can include modified tiny You only look once (YOLO) Convolutional Neural Networks (**CNN**)" "a modified **SSD** (Single Shot Detection) **CNN**" "a modified Faster **R-CNN** (Region Proposal Networks), segmentation analysis of the frame+ classifier for each candidate, etc."); EX1001, 28:40-47. EX2019, ¶ 151 ("Processing scheme examples for a **group (ii) & (iii)** can include using **SqueezeNet super fast rejection CNN** as the validation method on the estimated location produced by the algorithms"); EX1001, 28:48-51. EX2019, ¶ 152 ("**Group (iii)** Low-cost – **low robustness** processing scheme examples can include: extrapolation of location of object from past locations …; **SqueezeNet** super fast rejection **CNN**; template matching to the last known object appearance based on past detections, etc.); EX1001, 28:64-29:3. Thus, the '452 App. discloses: (1) detecting a target by analyzing image(s) using an ML implementing an NN; (2) that a high-cost, high robustness but low refresh rate NN detect a target; and (3) that a medium/low robustness, medium/low cost, but medium/high refresh rate NN may be used for subsequent / continuing target detection. The cost of an NN, e.g., the processing load or the number of processing cycles, relates to the processing time. A high robustness, high cost NN takes relatively more time for processing an image compared to a medium / low

Claim Element	Support in the Specification
	robustness, medium / low cost NN. As such, the rate at which a high robustness NN can process images, i.e., the refresh rate tends to be lower. The opposite is generally true for a low /medium robustness, low / medium cost NN, which typically has a relatively high refresh rate. The ’452 App. discloses using all three types of NNs for target detection.
[37.e3] when the second neural network was selected and applied to the immediately preceding image, making the selection comprises: (i) selecting and applying the first neural network to the current image when the confidence level is below a first threshold of a range defined by the first threshold and a second threshold higher than the first threshold, and otherwise (ii) selecting and applying the second neural network to the current image, and	EX2019, ¶ 146 (“a set of processing schemes (e.g., algorithms) are examined from group to group, and the process **cycles through the processing schemes** to produce a detection of an object. According to the example implementations, **if the confidence number is higher than an activation number, an action is performed to stop or change a running group (i) and select or switch to group (ii)**”); EX1001, 27:65-28-5. EX2019, ¶ 147 (“a voting system is provided that fuses estimations from high confidence results …. **If the confidence is below low threshold**, falls outside of **a range**,… **group (i) processing is performed**. If the **confidence is determined to be high, then group (iii) algorithms can be applied** to optimize resources”); EX1001, 28:11-18. Thus, the ’452 App. teaches that when a low robustness, high refresh rate NN was used for target detection, if the confidence level is low, subsequent target detection may be performed using a high robustness, low refresh rate NN. This switch allows slower but more accurate target detection. This is beneficial when the target moves abruptly, suddenly changing direction and or speed.
[37.e4] when the first neural network was selected and applied to the immediately preceding image, making the selection comprises: (i) selecting and applying	*See supra* Element [37.e3] In this case, when a high robustness, low refresh rate NN is used for target detection, if the confidence level is high, subsequent object detection may be performed using a low robustness, high refresh rate NN, i.e., at a faster rate, as long as the confidence level remains

Claim Element	Support in the Specification
the second neural network to the current image when the confidence level is above the second threshold, and otherwise (ii) selecting and applying the first neural network to the current image.	high.

IV. PROPOSED SUBSTITUTE CLAIMS ARE PATENTABLE

Patent Owner respectfully submits that the PSCs are patentable over the Grounds asserted in this IPR proceeding, including those asserted in the Opposition. These Grounds do not disclose "a machine learning model" "to identify a bounding box outlining … detected features of the target" (PSC 21); and applying first/second neural networks to an image for detecting a target / incrementally predicting its location (PSC 36). PSC 37 is amended to require for target detection applying to an image only one or the other of two neural networks – a limitation that none of the new Grounds in the Opposition teaches/suggests. As such, PSCs 21, 36, 37, and their dependent claims are patentable.

V. CONCLUSION

In light of the foregoing, Patent Owner respectfully requests that the Board grant this revised motion to amend.

Respectfully submitted,

Dated: April 20, 2026

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CLAIMS APPENDIX

Proposed substitute claims are shown in the marked-up form below:

[[1]]21.[pre] A method of performing a flight control operation of a reference aerial vehicle, comprising:

[21.a] receiving at a processor at the reference aerial vehicle an image captured by an image sensor of the reference aerial vehicle;

[21.b] detecting at the reference aerial vehicle a target in the image including by applying at the reference aerial vehicle a machine learning model to the image, to identify a bounding box outlining a portion of the image that includes detected features of the target, and to identify a classification of the detected target;

[21.c] determining at the reference aerial vehicle a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image including by determining a distance to the target based at least in part on a size of the bounding box of the target detected within the image and on a physical size corresponding to the classification of the target detected within the image; and

[21.d] performing at the reference aerial vehicle the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle, wherein performing the flight control operation includes determining a first speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle.

22. The method of claim 21, wherein the reference aerial vehicle is a multirotor unmanned aerial vehicle and the target is an aerial vehicle.

23. The method of claim 21, wherein performing the flight control operation

includes one or more of the following: turning the reference aerial vehicle towards the target, adjusting a speed of the reference aerial vehicle, or engaging a mechanism to capture the target.

24. The method of claim 21, wherein detecting the target in the image including by applying at the reference aerial vehicle the machine learning model to the image includes identifying a model type of the target based on the classification of the detected target.

[[8]]25. The method of claim [[7]]21 wherein performing the flight control operation includes determining a second speed adjustment factor based on the determined distance to the target.

[[9]]26. The method of claim 21, wherein determining the three-dimensional relative location of the target includes determining a direction of the target with respect to the reference aerial vehicle.

[[10]27. The method of claim 21, wherein determining the three-dimensional relative location of the target includes determining an azimuth angle and an altitude angle to the target from the reference aerial vehicle.

[[11]]28. The method of claim 21, wherein determining the three-dimensional relative location of the target includes converting a two-dimensional vector to a three-dimensional vector representing the three-dimensional relative location.

[[12]29.[pre] The method of claim 21, further comprising:

[29.a] receiving a geographical location associated with the target detected at least in part using a ground-based sensor;

[29.b] autonomously navigating the reference aerial vehicle towards the received geographical location; and

[29.c] determining to allow image-based navigation.

[[13]]30. The method of claim 21, wherein the speed adjustment factor is greater for a smaller magnitude of deviation as compared to for a greater magnitude of deviation.

[[14]]31. The method of claim 21, wherein performing the flight control operation includes scaling [[a]the speed adjustment factor to smooth and limit a rate of change of a speed of the reference aerial vehicle.

[[15]]32. The method of claim 21, wherein performing the flight control operation includes determining a direction adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle.

[[16]]33. The method of claim [[15]]32, wherein performing the flight control operation includes scaling the direction adjustment factor to smooth and limit a rate of change of a direction of the reference aerial vehicle.

[[17]]34. The method of claim 21, wherein the distance to the target is determined based at least in part using a radar.

[[18]]35. The method of claim 21, wherein it is determined to allow the image-based navigation based on whether the reference aerial vehicle is within a threshold distance away from the received geographical location.

[[19]]36.[pre] A reference aerial vehicle, comprising:

[36.a] an image sensor configured to capture an image;

[36.b1] a processor configured to: detect at the reference aerial vehicle a target in the image; and

[36.b2] determine at the reference aerial vehicle a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the image; and

[36.c] a flight controller configured to perform a flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle, wherein the flight controller is configured to perform the flight control operation including by being configured to determine a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle[[.]],

[36.d] wherein the detecting of the target in the image is performed by applying at the reference aerial vehicle a first neural network at a first robustness and a first compute cost, and the determining of the three-dimensional relative location of the target in the image comprises incrementally predicting the location of the target in the image by applying at the reference aerial vehicle a second neural network at a second robustness and a second compute cost, the first robustness and the first compute cost being greater, respectively, than the second robustness and the second compute cost.

[[20]]37.[pre] A computer program product for performing a flight control operation of a reference aerial vehicle, the computer program product being embodied in a non-transitory computer readable storage medium housed in a reference aerial vehicle and comprising computer instructions for:

[37.a] receiving a current image captured by an image sensor of the reference aerial vehicle;

[37.b] detecting at the reference aerial vehicle a target in the current image including by applying a machine learning model to the current image to identify a portion of the current image that includes the target;

[37.c] determining at the reference aerial vehicle a three-dimensional relative location of the target with respect to the reference aerial vehicle based on the

current image including by determining a distance to the target based at least in part on a size of the target detected within the current image; and

[37.d] performing at the reference aerial vehicle the flight control operation based on the three-dimensional relative location of the target with respect to the reference aerial vehicle, wherein performing the flight control operation includes determining a speed adjustment factor based on a magnitude of deviation of a direction of the three-dimensional relative location with respect to a current flight direction of the reference aerial vehicle[[.]],

[37.e1] wherein a first neural network or a second neural network was applied to an immediately preceding image, and the detecting of the target in the current image further comprises making a selection, from between the first and the second neural networks, of only one of the first and the second neural networks, based on a confidence level for a detection of the target in the current image;

[37.e2] wherein the first neural network has a first robustness and a first refresh rate, and the second neural network has a second robustness and a second refresh rate, the first robustness being greater than the second robustness and the first refresh rate being less than the second refresh rate, and

[37.e3] when the second neural network was selected and applied to the immediately preceding image, making the selection comprises: (i) selecting and applying the first neural network to the current image when the confidence level is below a first threshold of a range defined by the first threshold and a second threshold higher than the first threshold, and otherwise (ii) selecting and applying the second neural network to the current image, and

[37.e4] when the first neural network was selected and applied to the immediately preceding image, making the selection comprises: (i) selecting and applying the second neural network to the current image when the

confidence level is above the second threshold, and otherwise (ii) selecting and applying the first neural network to the current image.

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I hereby certify that on April 20, 2026, a copy of the foregoing Patent Owner's Revised Motion to Amend (not accompanying any exhibits), was served via email on April 20, 2026 (per counsel's consent) to lead and backup counsel of record for Petitioners as follows:

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