

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Axon Enterprise, Inc. and Dedrone Holdings, Inc.

Petitioners,

v.

Airspace Defense, Inc.

Patent Owner

Case No. IPR2025-00525

U.S. Patent No. 10,713,959

**SECOND DECLARATION OF NIKOLAOS PAPANIKOLOPOULOS, PH.D.
IN SUPPORT OF PATENT OWNER’S REPLY TO
PETITIONERS’ OPPOSITION TO
PATENT OWNER’S REVISED MOTION TO AMEND**

TABLE OF CONTENTS

I.	INTRODUCTION	6
II.	COMPENSATION	7
III.	MATERIALS CONSIDERED.....	8
IV.	LEGAL PRINCIPLES.....	9
<i>A.</i>	<i>Enablement, Written Description, and Indefiniteness.....</i>	<i>9</i>
1.	Claim Enablement.....	9
2.	Written Description Support	10
3.	Indefiniteness.....	11
<i>B.</i>	<i>Invalidity Based on Prior Art</i>	<i>12</i>
1.	Prior Art.....	12
2.	Anticipation.....	13
3.	Obviousness.....	15
4.	Enablement of Prior Art	19
5.	Proposed Substitute Claims.....	20
V.	SUMMARY OF MY OPINIONS.....	21
VI.	THE '959 PATENT – INNOVATIVE ASPECTS OF PROPOSED SUBSTITUTE CLAIM 22.....	24
VII.	PRIORITY DATE FOR SC 22 IS THE FILING DATE OF THE '153 PROVISIONAL.....	29
VIII.	SC 22 DOES NOT ENLARGE SCOPE OF ISSUED CLAIM 21	30
IX.	SC 22 IS FULLY SUPPORTED BY WRITTEN DESCRIPTION	31
<i>A.</i>	<i>'959 Patent and '153 Provisional Fully Support Claim Elements [22.e] and [22.f]</i>	<i>31</i>
1.	“Secure Identifiers” of '959 Patent and '153 Provisional Have Different (or Even No) Directionalities	32

2.	'959 Patent and '153 Provisional Disclose Duplex RF Communication Similar to Two-Way Light-Based Communication.....	36
3.	'959 Patent and '153 Provisional Disclose RF Excitation Causing a Change in UAA Behavior	38
4.	'959 Patent and '153 Provisional Disclose that Changed UAA Behavior in Response to RF Excitation Is Used for Disambiguation.....	41
5.	The Specified Excitation Is a Secure Identifier per Board's Construction	42
X.	SC 22 PROPERLY CLAIMS PRIORITY TO '153 PROVISIONAL	47
XI.	SC 22 IS PATENTABLE	49
<i>A.</i>	<i>SC 22 Is Clear, Not Indefinite.....</i>	<i>49</i>
1.	Specification Defines "Low Altitude Aircraft"	49
2.	"The Received Information" Is Clear	49
<i>B.</i>	<i>SC 22 Is Not Obvious</i>	<i>51</i>
1.	Key Elements of Proposed Substitute Claim (SC) 22.....	51
2.	Viggiano-Hayes Combination Does Not Teach or Suggest At Least the Limitations of Claim Elements [22.e], [22.f], and [22.i]	53
3.	The Asserted Grounds	57
XII.	CONCLUSION.....	57

List of Patent Owner Exhibits

Exhibit No.	Description
EX2001	PCT Request, International (PCT) Application No. PCT/US16/37071, filed on June 10, 2016
EX2002	PDF Copies of MPEP Editions and Revisions 1948 – 2023, https://www.uspto.gov/web/offices/pac/mpep/old/index.htm .
EX2003	Chapter 200 Types, Cross-Noting, and Status of Application, Manual of Patent Examining Procedure (MPEP) (1994)
EX2004	Chapter 200 Types and Status of Application; Benefit and Priority Claims, Manual of Patent Examining Procedure (MPEP) (2018)
EX2005	J. Ablon (Airmap), “Remote Identification,” https://www.icao.int/Meetings/UAS2017/-Documents/Jared%20Ablon_Stream%20A.pdf .
EX2006	Recommendation ITU-T X.509 (2016)
EX2007	P. Syverson, “A Taxonomy of Replay Attacks [cryptographic protocols],” Proceedings of the Computer Security Foundations Workshop VII, pp. 187-191 (1994), doi: 10.1109/CSFW.1994.315935.
EX2008	A.M. Espinoza, W.J. Tolley, and J.R. Crandall, “Alice and Bob, Who the FOCI Are They?: Analysis of End-to-End Encryption in the LINE Messaging Application,” 7th USENIX Workshop on Free and Open Communications on the Internet (FOCI 17) (2017), https://www.usenix.org/system/files/conference/foci17/foci17-paper-espinoza.pdf .

Exhibit No.	Description
EX2009	M.A. Harris and K. Patten, “Mobile Device Security Considerations for Small-and Medium-Sized Enterprise Business Mobility,” INFORMATION MANAGEMENT & COMPUTER SECURITY 22(1) 97-114 (2014), https://www.researchgate.net/profile/Mark-Harris-10/publication/263245514_Mobile_device_security_considerations_for_small-_and_medium-sized_enterprise_business_mobility/links/-5697cc4108ae1c427905200b/Mobile-device-security-considerations-for-small-and-medium-sized-enterprise-business-mobility.pdf.
EX2010	M. Cunche, M.A. Kaafar, and R. Boreli, “I Know Who You Will Meet this Evening! Linking Wireless Devices using Wi-Fi Probe Requests,” IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM) (2012).
EX2011	J. Lindqvist et al., “Privacy-Preserving 802.11 Access-Point Discovery,” Microsoft Research Technical Report, MSR-TR-2009-7 at (2009), https://aaltodoc.aalto.fi/server/api/core/bitstreams/-7c421d1b-9ecd-45ee-8481-52f24ca272e5/content.
EX2012	M. Cunche, “I Know Your MAC Address: Targeted Tracking of Individual Using Wi-Fi,” 10 J. COMPUT. VIROL. HACK TECH. 219–227 (2014), https://doi.org/10.1007/s11416-013-0196-1.

Exhibit No.	Description
EX2013	W.S. Bhaya and S.A. AlAsady, "Prevention of Spoofing Attacks in the Infrastructure Wireless Networks," J. COMPUTER SCIENCE, 8(10) 1769-1779 (2012), https://web.archive.org/web/20150621205916id_-http://novintarjome.com/wp-content/uploads/2014/10/Prevention-of-Spoofing-Attacks.pdf .
EX2014	Declaration of Nikolaos Papanikolopoulos, Ph.D., in support of this First Motion to Amend
EX2015	U.S. Patent Application No. 16/215,406 (from which U.S. Patent No. 10,713,959 issued) (annotated to include line nos.) (the "'406 App.")
EX2016	U.S. Provisional Patent Application No. 62/175,153 (annotated to include page and paragraph nos.) (the "'153 Prov.")
EX2017	Curriculum Vitae of Dr. Nikolaos Papanikolopoulos
EX2018	Second Declaration of Nikolaos Papanikolopoulos, Ph.D.
EX2019	Declaration of June Munford
EX2020	Curriculum Vitae of June Munford
EX2021	NIST, Electronic Authentication Guideline, Special Publication 800-63-2 (2013), <i>available at</i> https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-63-2.pdf
EX2022	Definition of "disambiguate," Oxford Advanced Learner's Dictionary, as obtained from the Internet Archive's Wayback Machine, <i>available at</i> https://web.archive.Org/web/20140513174533

Exhibit No.	Description
	/http://www.oxfordlearnersdictionaries.com:80/us /definition/english/disambiguate
EX2023	Definition of “isolate,” Oxford Advanced Learner’s Dictionary, as obtained from the Internet Archive’s Wayback Machine, <i>available at</i> https://web.archive.org/web/20140401114908 /http://www.oxfordlearnersdictionaries.com /us/definition/english/isolate
EX2024	Definition of “credentials,” Oxford Advanced Learner’s Dictionary, as obtained from the Internet Archive’s Wayback Machine, <i>available at</i> https://web.archive.org/web/20150616091333 /http://www.oxfordlearnersdictionaries.com /us/definition/english/credentials
EX2025	Shannon, Claude E., and Warren Weaver. "A mathematic theory of communication." <i>Bell Syst. Tech. J</i> 27.3 (1948): 379-423.
EX2026	NIST, Electronic Authentication Guideline, Special Publication 800-63-2 (2013), <i>available at</i> https://web.archive.org/web/20140330034434/http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-63-2.pdf
EX2027	Definition of “disambiguate,” Oxford Advanced Learner’s Dictionary, as obtained from the Internet Archive’s Wayback Machine, <i>available at</i> https://web.archive.org/web/20140513174533

Exhibit No.	Description
	/http://www.oxfordlearnersdictionaries.com:80/us /definition/english/disambiguate
EX2028	Definition of “isolate,” Oxford Advanced Learner’s Dictionary, as obtained from the Internet Archive’s Wayback Machine, <i>available at</i> https://web.archive.org/web/20140401114908 /http://www.oxfordlearnersdictionaries.com /us/definition/english/isolate
EX2029	Definition of “credentials,” Oxford Advanced Learner’s Dictionary, as obtained from the Internet Archive’s Wayback Machine, <i>available at</i> https://web.archive.org/web/20150616091333 /http://www.oxfordlearnersdictionaries.com /us/definition/english/credentials
EX2030	A library catalog MARC record describing <i>Bell Systems Technical Journal</i> , available from Penn State University Library at https://catalog.libraries.psu.edu/catalog/51521158
EX2031	Shannon, Claude E., and Warren Weaver. "A mathematic theory of communication." <i>Bell Syst. Tech. J</i> 27.3 (1948): 379-423, <i>as sourced from Penn State University Library’s collection.</i>

I, Nikolaos Papanikolopoulos, of Minneapolis, Minnesota, declare that:

I. INTRODUCTION

1. I have been retained by Patent Owner Airspace Defense, Inc. in this *inter partes* review (IPR) proceeding number IPR2025-00525, filed by Petitioners Axon Enterprise, Inc. and Dedrone Holdings, Inc. I understand that this IPR proceeding relates to U.S. Patent No. 10,713,959 (the '959 patent).

2. I was asked to provide my objective, independent analysis of the '959 patent in view of the prior art references cited in the Petition and to provide my opinion regarding the allegations in the Petition and substitute claims proposed by Patent Owner. To this end, I provided a declaration (EX2014) (the "Initial Declaration"), setting forth my opinions. I incorporate the Initial Declaration herein, by reference, in its entirety.

3. I am further asked to provide my objective, independent analysis of the '959 patent and the proposed substitute claims in view of Petitioners' Opposition to Patent Owner's Motion to Amend and the prior art references cited in the Opposition, and to provide my opinions regarding the allegations in the Opposition. My response is set forth herein in this Second Declaration.

4. I have based my opinions on the information available to me as of the date of this declaration. I understand that additional information may become available after this declaration is submitted. If I become aware of additional

information following my submission of this declaration I may, if I am permitted, offer additional opinions (including by amending and/or supplementing this declaration) taking into account such new information.

5. I am not currently, nor have I ever been, an employee of Airspace Defense, Inc., its predecessors, subsidiaries, parent organizations, or affiliates. I received no compensation for this declaration beyond my normal hourly compensation based on my time actually spent working on this IPR. I will not receive any added compensation based on the outcome of this or any other IPR, or any other proceeding, involving the '959 patent.

II. COMPENSATION

6. I am being compensated as an expert witness in this case at my standard hourly rate in addition to out-of-pocket expenses. I have received no additional compensation for my work on this matter and my compensation does not depend, and has not ever depended in any way, on my opinion as expressed in this declaration and in any testimony that I may give, or on the outcome of this matter. I have no financial stake in Airspace Defense, Inc., its predecessors, subsidiaries, parent organizations, or affiliates, the '959 patent, or the outcome of this IPR or any other matter involving the '959 patent.

III. MATERIALS CONSIDERED

7. In formulating my opinions, I have relied upon my training, knowledge, and experience that are relevant to the '959 patent. I have also considered the '959 patent, patent applications identified in the priority claim of the '959 patent, and its file history. In addition, I have reviewed the Petition ("Pet.") and attached exhibits, including the first declaration by Dr. Chowdhary (EX1003), the prior art cited by Petitioners, and Patent Owner's Preliminary Response (POPR). Moreover, I have considered the Board's Institution Decision, Patent Owner's Motion to Amend (MTA), and substitute claims that were initially proposed by Patent Owner in the MTA.

8. Additionally, I have reviewed Petitioner's Opposition ("Opp.") to the MTA, the second declaration by Dr. Chowdhary, the new prior art cited by Petitioners. I also reviewed transcripts of my own deposition, and the Preliminary Guidance ("PG") that the Board provided.

9. Furthermore, I have reviewed Patent Owner's Revised Motion to Amend (RMTA), substitute claims that were proposed by Patent Owner in the RMTA, the third declaration by Dr. Chowdhary, and additional new prior art cited by Petitioners.

10. For the sake of convenience and quick reference, I have reproduced above updated Patent Owner's Exhibit List, listing some of the materials that I considered.

IV. LEGAL PRINCIPLES

11. I am not an attorney. I have been asked to provide opinions on patentability of the claims challenged by Petitioners and substitute claims proposed by Patent Owner. To this end, I relied on certain legal principles that were provided to me by counsel and are summarized below.

A. Enablement, Written Description, and Indefiniteness

1. Claim Enablement

12. I am informed by Counsel and understand that 35 U.S.C. §112(a), requires the patent disclosure as filed to be full and clear so as to enable a POSITA to make and use the invention. I am further informed by Counsel and understand that the Federal Circuit has interpreted the statutory requirement to mean that a POSITA should be able to make and use the invention without "undue experimentation." *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988). The Court stated that a "patent need not disclose what is well known in the art," and that some experimentation may be necessary. *Id.* at 735, 737. I am informed by Counsel and understand that what is "undue" may be determined via an eight-factor analysis. *Id.* at 737.

2. Written Description Support

13. Moreover, I am informed by Counsel and understand that the specification reasonably conveys to a POSITA “that the inventor had possession of the claimed subject matter.” *Ariad Pharmaceuticals, Inc. v. Eli Lilly and Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010). To show possession, “the specification must describe an invention understandable to [an] skilled artisan and show that the inventor actually invented the invention claimed.” *Id.* “A ‘mere wish or plan’ to obtain the claimed invention is not sufficient.” *Novozymes A/s v. DuPont Nutrition Biosciences APS*, 723 F.3d 1336, 1346 (Fed. Cir. 2013). The test of sufficiency of written description “requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art.” *Ariad*, 598 F.3d at 1351.

14. I am also informed by Counsel and understand, however, “it is unnecessary to spell out every detail of the invention in the specification; only enough must be included to convince a person of skill in the art that the inventor possessed the invention and to enable such a person to make and use the invention without undue experimentation.” *LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336, 1345 (Fed. Cir. 2005). Moreover, a “claim will not be invalidated on section 112 grounds simply because the embodiments of the specification do not contain examples explicitly covering the full scope of the claim language.” *Id.*;

see Flash-Control, LLC v. Intel Corporation, Case No. 2020-2141 at 10 (“A patent owner cannot show written description support by picking and choosing claim elements from different embodiments that are never linked together in the specification”) (Fed. Cir. 2021) (nonprecedential).

15. In this regard, I am informed by Counsel and understand that in *Union Oil*, “[r]ather than reciting a recipe of specific ingredients,” claims to certain “gasoline compositions” in that case “defined the claimed gasoline compositions in terms of various chemical and physical properties,” and were found to have “adequate written description support.” *Novozymes*, 723 F.3d 1347-48 (citing *Union Oil Co. of California v. Atlantic Richfield Co.*, 208 F.3d 989 (Fed. Cir.2000)).

3. Indefiniteness

16. Additionally, I am informed by Counsel and understand that 35 U.S.C. §112(b), requires a patentee to present claim(s) that particularly point out and distinctly claim the subject matter which the inventor(s) regard as the invention. I am informed by Counsel and understand that the Supreme Court has interpreted this requirement to mean that a claim, “read in light of the specification ... and the prosecution history,” must “inform, with reasonable certainty, those skilled in the art about the scope of the invention.” *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 US 898 (2014).

B. Invalidity Based on Prior Art

17. I am informed by Counsel and understand that each claim of an issued patent is presumed to be valid. In an IPR proceeding, a party challenging the validity of a patent claim, whether an issued claim or a proposed substitute claim, must present a preponderance of the evidence to demonstrate invalidity of that claim.

1. Prior Art

18. I am informed by counsel and understand that in an IPR proceeding, a Petitioner can only rely upon a patent or other publication as prior art. I also understand that a particular patent may claim priority to one or more earlier filed patent applications, and that subject to meeting certain conditions, the effective filing date of that particular patent can be the actual filing date of the earliest patent application in the priority claim of that particular patent. I am also informed by Counsel and understand that the earliest priority date of a patent is the effective filing date of that patent.¹

19. I understand further that with respect to a challenged patent, a U.S. or foreign patent may qualify as prior art if the date of issuance of the patent is prior

¹ I am informed by Counsel that in certain cases, if the effective filing date is earlier than March 16, 2013, the earliest priority date of that patent may be the date of invention of the claimed invention of that patent.

to the effective filing date of the challenged patent. A particular U.S. patent that issued after the effective filing date of a challenged patent may qualify as prior art to the challenged patent if the effective filing date of that particular patent is earlier than the effective filing date of the challenged patent.

20. I also understand that a printed publication, such as an article published in a magazine, academic journal, conference proceedings, or trade publication, or U.S. or foreign published patent application qualifies as prior art to a challenged patent if the date of publication of that printed publication is prior to the effective filing date of the challenged patent. Additionally, I am informed by Counsel and understand that to qualify as prior art, a reference, whether a patent, published patent application, or another printed publication, must contain an enabling disclosure that allows one of ordinary skill to practice the claims without undue experimentation.

2. Anticipation

21. I understand that, once a claim of a challenged patent has been properly construed, the next step in determining whether that claim is anticipated by a prior art reference under 35 U.S.C. § 102 requires a comparison of the properly construed claim language to the prior art reference on a limitation-by-limitation basis.

22. I understand that a prior art reference “anticipates” a challenged claim, and therefore renders the claim invalid, if all elements of the claim are disclosed in that prior art reference, either expressly or inherently (i.e., necessarily present), arranged in the same way as in the claim. I understand that, for inherent anticipation, it is required that the missing descriptive material is necessarily present in the prior art reference, and not merely probable.

23. I also understand that to anticipate a challenged claim, an allegedly anticipatory prior art reference must provide a disclosure that enables the challenged claim. I understand an enabling disclosure describes the invention of the challenged claim in sufficient detail that would allow a POSITA to make and use that invention without undue experimentation.

24. I understand that for the purposes of an IPR proceeding, a patent claim is anticipated if there is proof that, more than one year before the priority date of that claim, the claimed invention was: patented anywhere in the world or described in a printed publication anywhere in the world. This I am informed by Counsel is called a statutory bar.

25. I have written this declaration with the understanding that, in an IPR, anticipation must be shown by a preponderance of the evidence. I understand that a preponderance of the evidence means that it is more likely than not that the prior art reference discloses all of the elements of a challenged claim.

3. Obviousness

26. I am informed by Counsel and understand that even if a challenged claim is not anticipated, it may still be invalid pursuant to 35 U.S.C. § 103 as obvious, if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a POSITA.

27. I understand that a POSITA provides a reference point from which the prior art and claimed invention should be viewed. This reference point prevents one from using his or her own insight or hindsight in deciding whether a claim is obvious. I also understand that an obviousness determination includes the consideration of various factors such as (1) the scope and content of the prior art, (2) the differences between the prior art and the challenged claim, (3) the level of ordinary skill in the pertinent art, and (4) the existence of secondary considerations (also called objective indicia of non-obviousness).

28. I am further informed by Counsel and understand that a claim is not proved obvious merely by demonstrating that each of the elements was independently known in the prior art. I understand that many inventions rely on known building blocks, and that claimed inventions, often of necessity, can be combinations of what was already known. I understand that it is therefore important to identify whether a reason existed at the time of the invention that

would have prompted a POSITA to combine such known elements in the way the claimed invention does. Such reasons are typically described as the motivation to combine two or more prior art references.

29. I understand that an obviousness evaluation can be based on a combination of several prior art references. I understand that the prior art references themselves may sometimes provide a suggestion, motivation, or reason to combine, but at other times the nexus linking two or more prior art references can be based on the ordinary understandings available to a POSITA. I further understand that obviousness analysis recognizes that market demand, rather than scientific literature, often drives innovation, and that a motivation to combine references may be supplied by the direction of the marketplace.

30. I am also informed by Counsel and understand that the use of hindsight must be avoided when considering whether the alleged invention would have been obvious to a POSITA. In assessing obviousness, I have been instructed to consider the distortion caused by hindsight bias, guard against slipping into the use of hindsight, to be cautious of arguments that rely upon after-the-fact reasoning, and to avoid the temptation to read into the prior art the teachings of the invention in issue.

31. I further understand that secondary considerations of non-obviousness (also known as objective indicia of non-obviousness) may include: (1) a long felt

but unsolved need; (2) commercial success; (3) unexpected results; (4) industry praise; (5) licensing; and (6) copying by others. I also understand that there must be a relationship or nexus between any such secondary considerations and the claimed invention. Where the offered secondary consideration results from something other than what is both claimed and novel in a challenged claim, there is no nexus to the merits of the claimed invention.

32. I understand that a nexus is presumed where the secondary considerations are tied to a particular product which: (i) embodies the claimed invention and (ii) is coextensive with the claimed invention. In analyzing whether a product is coextensive with the claimed invention, I understand that there is no requirement for a perfect correspondence between the claims and the product, and that the presumption of a nexus can still apply when unclaimed features present in the product amount to nothing more than additional insignificant features.

33. I further understand that Patent Owner bears the burden of demonstrating that the relevant secondary indicia are attributable to the claimed invention, as opposed to other economic and commercial factors unrelated to the technical quality of the patented subject matter. I also understand that contemporaneous and independent invention by others is a secondary consideration supporting an obviousness determination. Additionally, I understand that, as a

safeguard against hindsight bias, all secondary considerations of non-obviousness must be considered prior to reaching an obviousness conclusion.

34. It is further my understanding, as informed by Counsel, that a proper obviousness analysis focuses on what was known or obvious to a POSITA, not just Patent Owner. Accordingly, I understand that any need or problem known in the field of endeavor at the time of invention and addressed by the challenged patent can provide a reason for combining the elements in the manner claimed.

35. I understand that whether a prior art reference “teaches away” from the claimed invention is a fact to be considered in determining obviousness. I understand that it is improper to combine references where the references teach away from their combination. I understand, however, that the nature of the teaching is highly relevant and must be weighed in substance; a challenged claim may be obvious over a combination of prior art teachings even if one of those teachings has been described as somewhat inferior to some other teachings. Furthermore, I understand that the prior art’s mere disclosure of more than one alternative does not constitute a teaching away from a particular alternative when such disclosure does not criticize, discredit, or otherwise discourage the use of that alternative.

36. I understand that, in an IPR proceeding, obviousness must be proven by a preponderance of the evidence such that a POSITA at the time of the alleged invention would have had a reason (or reasons) for combining the teachings of

those prior art references to achieve the claimed invention, and that the POSITA would have had a reasonable expectation of success of achieving the claimed invention by combining those teachings.

4. Enablement of Prior Art

37. I am informed by Counsel and understand that to “render a claim obvious, the prior art, taken as a whole, must enable a skilled artisan to make and use the claimed invention.” *Raytheon Technologies v. General Electric Co.*, 993 F.3d 1374, 1380 (Fed. Cir. 2021). A “prior art reference asserted under § 103 does not necessarily have to enable its own disclosure, i.e., be ‘self-enabling,’ to be relevant to the obviousness inquiry.” *Id.* “But even though a non-enabling reference can play a role in an obviousness analysis, the evidence of record must still establish that a skilled artisan could have made the claimed invention.” *Id.* at 1381.

38. I am also informed by Counsel and understand that “[e]nablement requires that the prior art reference must teach one of ordinary skill in the art to make or carry out the claimed invention *without undue experimentation*.” *Elan Pharmaceuticals v. Mayo Foundation*, 346 F.3d 1051, 1054 (Fed. Cir. 2003) (internal quotation marks omitted). “[W]hat constitutes undue experimentation” regarding the disclosure of a prior art reference can be determined using the eight

factors described in *In re Wands*.” *Id.* at 1054-55 (citing *In re Wands*, 858 F.2d 731 (Fed. Cir. 1988)).

39. I am further informed by Counsel and understand that in *Raytheon*, it was an error to “focus[] only on whether [a skilled artisan] is provided with sufficient parameters in [a prior art reference] to determine, without undue experimentation,” the claimed limitation, “rather than determining whether [that prior art reference] enabled a skilled artisan to make and use the claimed invention.” *Raytheon*, 993 F.3d at 1380. A prior art reference’s “self-enablement (or lack thereof) is not only relevant to the enablement analysis, ... it is dispositive” when “no [] other evidence [is] presented” “to establish that a skilled artisan could have made the claimed” invention. *Id.* at 1382.

5. Proposed Substitute Claims

40. I am informed by Counsel and understand that in a motion to amend, Patent Owner may cancel any challenged claim or propose a reasonable number of proposed substitute claims for each challenged claim. 35 U.S.C. § 316(d)(1). I am also informed by Counsel and understand that there is a rebuttable presumption that a reasonable number of proposed substitute claims per challenged claim is one. 37 C.F.R. § 42.121(a)(3).

41. I am also informed by Counsel and understand that per the applicable rules, a motion to amend may be denied if it does not respond to a ground of

unpatentability involved in the trial. 37 C.F.R. § 42.121(a)(3). I am further informed by Counsel and understand that the “rule does not require ... that every word added to or removed from a claim in a motion to amend be solely for the purpose of overcoming an instituted ground,” and that additional modifications may be included. *Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 (Information and Guidance on Motions to Amend) at 5-6.

42. Additionally, I am informed by Counsel and understand that no proposed substitute claim may enlarge the scope of the claims of the challenged patent. 35 U.S.C. § 316(d)(3); 37 C.F.R. § 42.121(a)(2)(ii). Finally, I am informed by Counsel and understand that no proposed substitute claim may introduce new subject matter. 35 U.S.C. § 316(d)(3); 37 C.F.R. § 42.121(a)(2)(ii).

V. SUMMARY OF MY OPINIONS

43. Petitioners have challenged the sole proposed independent substitute claim 22 on various grounds. This claim recites a particular “secure identifier,” i.e., one “comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft.” Petitioners allege that the specification of the ’959 patent does not disclose a secure identifier that is transmitted via radio frequency (RF) transmission from a ground-based detection system to a low-altitude aircraft. Petitioners further allege that all secure identifiers

of the '959 patent are transmitted only from a low-altitude aircraft to the ground device.

44. I show below, that both of these allegations are false. The specification of the '959 patent and the '153 provisional to which the '959 patent claims priority, disclose that (I) a secure identifier can be transmitted from a low-altitude aircraft to a ground device, (II) from a ground device to a low-altitude aircraft, and (III) the secure identifier transmitted from the ground device to the low-altitude aircraft comprises a specified excitation enabling disambiguation (“excitation signal”). As I explain below, this facilitates authentication of the aircraft and its identifier.

45. The '153 provisional describes excitation signals including a light beam or an RF signal. The '153 provisional discloses explicitly that: (i) optical devices at the low-altitude aircraft and within the ground device allow for “two-way communication”; (ii) RF transmitters and receivers at the aircraft and within the ground device facilitate “duplex communication” for exchanging information, and (III) the information exchanged as part of a RF duplex communication includes the excitation signal. In fact, the '153 provisional even discloses that a response to even a light-beam excitation can be received via RF. As such, the excitation signal itself may also be transmitted via RF, as part of a duplex RF communication. Thus, the '153 provisional discloses a “secure identifier

comprising a specified excitation” that is transmitted using RF by a radio communication module. For these and additional reasons discussed below, Petitioners’ arguments that SC 22 is not supported by the specification and is indefinite fail.

46. Regarding prior art based invalidity grounds, all of the combinations of Petitioners’ grounds rely on the teachings of a combination of Viggiano and Hayes. I show below that the Viggiano-Hayes combination does not teach the transmission of an excitation signal that “causes the first low-altitude aircraft to change a behavior thereof,” so as to cause disambiguation of the first low-altitude aircraft from other low-altitude aircraft, as the proposed substitute claim 22 recites. The closest Viggiano-Hayes comes to sending an excitation signal so as to cause disambiguation of the first low-altitude aircraft from other low-altitude aircraft, is when it flags the identifier of one of many low-altitude aircraft as unauthentic, and teaches removing the identifiers of all detected aircraft other than the unauthentically identified aircraft from a screen. The combination thus teaches isolation of a targeted low-altitude aircraft, not “disambiguation,” of that aircraft from all other low-altitude aircraft, as the proposed substitute claim 22 recites.

47. Furthermore, the Viggiano-Hayes combination does not disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft using an excitation signal, ... *“based on the changed behavior of the first low-altitude*

aircraft,” as recited in proposed substitute claim 22. In that combination, the determination that a UAV is unauthentically identified results from consecutive failures of the UAV to accurately respond to a challenge in a challenge-response protocol. Thus, in the Viggiano-Hayes combination, the isolation of a particular UAV from other UAVs occurs because that UAV *did not change* its behavior as was expected. This is the opposite of “disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft ... *based on the changed behavior* of the first low-altitude aircraft,” that the proposed substitute claim 22 recites.

48. For the foregoing reasons, the Viggiano-Hayes combination does not teach all of the limitations of the proposed substitute claim 22. Because all of the prior art based grounds rely on the Viggiano-Hayes combination, all those grounds fail. As such, in my opinion, the proposed substitute claim is valid.

VI. THE '959 PATENT – INNOVATIVE ASPECTS OF PROPOSED SUBSTITUTE CLAIM 22

49. I discussed the innovative aspects of the '959 in my Initial Declaration. EX2014, § VIII.C. Upon reviewing Petitioners' Opposition (Opp.) to Patent Owner's Revised Motion to Amend (RMTA), and the Third Declaration by Dr. Chowdhary (EX1027), it appears to me that the Petitioners have misunderstood certain key innovative aspects disclosed in the '959 patent and claimed in the proposed independent substitute claim (hereinafter, “SC”) 22. I therefore describe these key aspects below.

50. The '959 patent discloses and claims “a low altitude aircraft identification system,” as a response to the risk of damage or injury caused by such unregulated systems. EX1001, Abstract, 17:17-18:17, 1:35-2:3 (describing that due to the proliferating use of unmanned aerial vehicles (UAVs), there is an increased risk of “damage and/or injury due to the[] altitude, speed and weight” of the UAVs, “there is [a] need to manage ... UAVs,” and that “an identification solution is needed”). The '959 patent describes that the conventional techniques for identifying and managing road vehicles and large aircraft are not suitable for UAVs for various reasons. *See id.*, 1:45-55. The '959 patent further states that an identification solution that “allow[s] detection [of a UAV] in an automated manner using a device” is needed. *See id.*, 1:66-2:3.

51. A significant problem that exists in the context of identification of an entity (e.g., a low-altitude aircraft (LAA)) is that a rogue entity that controls a rogue LAA can learn the identifier of another entity (e.g., an authorized LAA), and then associate the learned authorized identifier with its own rogue LAA. This is generally known as spoofing or cloning. The '959 patent, including its earliest filed parent application (U.S. Provisional Patent Application No. 62/175,153 (the “'153 provisional”)) disclose several different techniques to combat spoofing. All of these techniques rely on the use of what is called a “secure identifier” in the claims

of the '959 patent. I have summarized these different techniques / embodiments below.

Table 1: Disclosed Embodiments of Secure Identifier

Disclosure No.	Technique Used	Disclosure Citations	Relation to “Secure Identifier”
1	• LAA transmits one identifier • Ground-based detection device identifies the location / position of the LAA and compares that to a pre-registered LAA route	EX1001, 5:15-18 (RF module transmits a code), 6:20-33 (location module determines the aircraft position and using that position obtains an “id verification message”), FIGS. 2, 3A, 3B, 6. EX2015 at 8:21-27, FIG. 6. EX2016, ¶32, at 14 (depicting “aircraft route confirmation process 62”).	The location / position detected by the ground device functions as a “secure identifier” because: • a rogue LAA cannot spoof what is determined by the ground device, and • the detected location / position is used to confirm that the LAA is located where it should be, per the LAA route, increasing the likelihood that the

Disclosure No.	Technique Used	Disclosure Citations	Relation to “Secure Identifier”
			detected LAA is authentic.
2	• LAA transmits two identifiers • Ground-based detection device cross-checks the two identifiers	EX1001, 5:15-18 (RF module transmits a code), 2:56-59 (a transponder transmits “a code similar”), 3:41-44 (“verify the authenticity” by connecting two information sources). EX2015 at 7:3-5, 3:4-5, 4:15-19. EX2016, ¶¶8, 11, 29.	One of the two identifiers is a “secure identifier” because the likelihood that not one but two corresponding identifiers can be spoofed is low
3	• LAA transmits an identifier • Ground-based detection device transmits an excitation signal	EX1001, 5:15-18 (RF module transmits a code), 6:43-49 (two-way communication, e.g., excitation and response, using light), 6:59-67 (duplex communication via	The excitation is a “secure identifier” because: • Only the authentic LAA would: (i) recognize the excitation, (ii) know how to

Disclosure No.	Technique Used	Disclosure Citations	Relation to “Secure Identifier”
	LAA changes its behavior in a way that is predictable to the ground station, e.g., based on the contents of the identifier it transmitted	RF), FIG. 8 (depicting excitation flow 82). EX2015 at 7:3-5, 9:6-12, 9:15-20, FIG. 8. EX2016, ¶¶29, 34, 36, at 16 (depicting the excitation flow).	respond to the excitation, i.e., by changing its behavior, but in a manner the ground-based detection device expects A rogue LAA may not even recognize the excitation, and, regardless, would likely not change its behavior in a manner the ground-based detection device expects
4	LAA transmits a series of predictably changing identifiers, such as rotating SSIDs	EX1001, 11:17-24, 11:29-31, 11:40-45, 12:44-50, FIG. 13.	A predictably changing identifier is a “secure identifier,” because it is less likely that a rogue

Disclosure No.	Technique Used	Disclosure Citations	Relation to “Secure Identifier”
		EX2015 at 15:29-16:3, 16:7-8, 16:14-17, 18:1-5, FIG. 13.	entity can steal and spoof an entire series

52. To summarize, the '959 patent discloses several different ways in which a “secured identifier” is used to minimize the risk that an identifier received from a detected UAV is fake or spoofed. These include: (i) determining an additional identifier by the ground-based detection system itself; (ii) having the LAA transmit two corresponding identifiers; (iii) sending an excitation to the LAA, prompting it to change its behavior, where the occurrence of an expected change in behavior can be detected; and (iv) having the LAA transmit rotating, or changing identifiers. The first three of these techniques are fully disclosed in the '153 provisional. SC 22 is directed to Technique No. 3, highlighted blue in the table above, and its innovative features are fully disclosed in both the '959 patent and the '153 provisional.

VII. PRIORITY DATE FOR SC 22 IS THE FILING DATE OF THE '153 PROVISIONAL

53. Petitioners allege that SC 22 is not entitled to claim priority to the '153 provisional. Opp. at 4; EX1027, ¶22. To show support for each and every element of SC 22, the RMTA includes a claim chart in which PO cites and quotes the relevant portions of U.S. Patent Application No. 16/215,406 (the '406 app.)

from which the '959 patent issued, and also cites the corresponding portions of '153 provisional, where substantially the same subject matter is disclosed. *See* RMTA at 3-10. That claim chart clearly shows that each and every element of SC 22 is fully supported by the '153 provisional. As such, in my opinion, SC 22 is entitled to claim priority to the actual filing date of the '153 provisional, i.e., June 12, 2015. In addition, in the discussion below, I have quoted and cited the relevant portions of the '153 provisional in connection with the claim elements that Petitioners allege are not supported by the specification of the '959 patent.

VIII. SC 22 DOES NOT ENLARGE SCOPE OF ISSUED CLAIM 21

54. Petitioners argue that deletion of “received” in the claim term “configured to receive a *received* radio signal” enlarges scope of SC 22. Opp. at 7; EX1027, ¶29. The Board has already considered and rejected this argument. Paper 23 (Preliminary Guidance) at 4-5. As the Board correctly noted, the “original language of claim 21 – ‘receive a received radio signal’” was “redundant” because once the radio communication module receives a radio signal, that signal “would have to be a received radio signal.” *Id.* at 5.

55. Nevertheless, in support of their argument, Petitioners allege that the “modifier ‘*received*’ in the original claim limited the *radio communication module* to receiving only those radio signals that the claimed *device* had actually received.” EX1027, ¶29. This is circular or redundant – a module cannot further receive an

already received radio signal. As such, and as the Board stated, such a received signal “would have to be a received radio signal.” Paper 23 at 5.

56. Petitioners also argue that the received signals “were signals of a compatible ‘type’ and ‘range’ receivable by the *device*” and that by “deleting *received*, the amendment removes that limitation.” EX1027, ¶29. This argument is flawed. As a threshold matter, issued claim 21 did not recite “compatible” signals of any type or range. Moreover, the ’959 patent discloses cellular, WiFi, and Bluetooth signals, *see* EX1001, 13:23-29, all of which are *radio* signals that the device of issued claim 21 could receive, and so can the device of SC 22.

57. Each of the claimed devices of claim 21 and SC 22 includes a “radio communication module.” The radio communication module from *both* claims is configured to receive radio signals, which include signals of the different types listed above. As such, contrary to Petitioners’ allegation, the device of SC 22 is not configured to receive radio signals that the device of claim 21 could not receive. As such, the removal of “received” does not enlarge the scope.

IX. SC 22 IS FULLY SUPPORTED BY WRITTEN DESCRIPTION

A. ’959 Patent and ’153 Provisional Fully Support Claim Elements [22.e] and [22.f]

58. Petitioners assert that PO “(1) seek[s] to reverse the only described directional flow of the secure identifier and (2) rely upon light array embodiments that do not support the claimed requirement that the secure identifier be received by

the radio communication module.” Opp. at 1 (emphasis omitted); EX1027, ¶30.

Both of these assertions are incorrect.

1. “Secure Identifiers” of ’959 Patent and ’153 Provisional Have Different (or Even No) Directionalities

59. In support of its first assertion – the alleged “revers[al of] the only described directional flow of the secure identifier” – Petitioners also argue that “term secure identifier does not even appear in the specification,” that the secure identifier of “dependent claim 3 ... comprises a rotating SSID,” and that the rotating SSID is always transmitted from the LAA to the ground station. Opp. at 1; EX1027, ¶30. In this argument, Petitioners ignore the other techniques for authenticating an LAA / identifier thereof, and the corresponding embodiments of a secure identifier that the ’959 patent and the ’153 provisional disclose.² I summarized those embodiments in Table 1 above. *See supra* § VI. The direction of the transmission of a secure identifier is not always from the LAA to the ground station; the direction varies as shown in Table 2 below.

Table 2: Directions of Flow (Transmission) of Secure Identifiers of Table 1

Sr. No.	Technique to Mitigate Spoofing / Secure Identifier	Direction of Flow
1	Determining <i>location / position</i> of a detected LAA by the ground-based detection system	Not communicated – the location / position used

² The ’153 provisional does not disclose the rotating identifiers embodiment.

Sr. No.	Technique to Mitigate Spoofing / Secure Identifier	Direction of Flow
	itself, and used for route verification, to authenticate the LAA / identifier thereof. EX2015, 8:21-27, 11:21-12:13; EX2016, ¶¶ 12, Fig. 6; <i>see also</i> Table 1, <i>supra</i> .	for route verification is neither received from the LAA nor transmitted thereto
2	Having the LAA transmit two corresponding identifiers that are cross-checked to determine authenticity. EX2016, ¶¶ 11-12; EX2015, 4:14-30; <i>see also</i> Table 1, <i>supra</i> .	From the LAA to the ground-based detection system
3	Sending an excitation to the LAA, prompting it to change its behavior, where the occurrence of an expected change in behavior can be detected. EX2015, 3:22-4:4, 7:9-13, 13:1-15, Fig. 7; EX2016, ¶¶ 9, 29, p. 15; <i>see also</i> Table 1, <i>supra</i> .	From the ground-based detection system to the LAA
4	Sending changing or rotating LAA identifiers. EX2015, 2:1-6, 15:29-18:13, Figs. 9-12, cl. 3; <i>see also</i> Table 1, <i>supra</i> .	From the LAA to the ground-based detection system

60. I am informed by Counsel and understand that “the exact terms appearing in the claim ‘need not be used *in haec verba*.’” *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1345 (Fed. Cir. 2016). I am also informed by Counsel and understand that “[b]y definition, an independent claim is broader than a claim that depends from it.” *Littelfuse, Inc. v. Mersen USA EP Corp.*, 29 F.4th

1376, 1380 (Fed. Cir. 2022). Additionally, I am informed by Counsel and understand that “the presence of a dependent claim that adds a particular limitation raises a presumption that the limitation in question is not found in the independent claim.” *Liebel-Flarsheim Company v. Medrad, Inc.*, 358 F.3d 898, 910 (Fed. Cir. 2004). In light of these legal principles, it follows that “secure identifier” that claim 1 (which is not challenged) recites is broader, and not limited to the “rotating SSID” limitation that dependent claim 3 recites.

61. Table 2 above shows that the ’959 patent and the ’153 provisional transmissions of secure identifiers do not necessarily go from the LAA to the ground station, as required by claim 3. Alternatives to rotating secure identifiers in which a secure identifier is: transmitted from the ground station to the LAA, are also disclosed, and are covered by the “secure identifier” recited in claim 1. Just as claim 3 limits the direction of the transmitted secure identifier, SC 22 also narrows its direction. As the table above shows, the specification supports both embodiments.

62. More specifically, the ’153 provisional discloses transmitting “identification information” from a low-altitude aircraft (LAA), e.g., a “code” that can be transmitted using light or RF. EX2015 at 2:11-17. In addition, the LAA can transmit a “code similar,” by light or RF, to the detection system. EX2015 at 3:4-5. The “code similar” is one type of “secure identifier,” as described in the first MTA.

MTA at 5-6. In this case, the secure identifier is transmitted from the LAA to the ground-based detection system.

63. The '153 provisional also describes that “data-to-vehicle association” can be established by “*directing a specific wavelength and modulated light beam emitter to one of the aircrafts*, and the aircraft will thus modify its behavior and its transmitted data, allowing the data-to-vehicle association.” EX2015 at 3:31-4:4; EX2016, ¶9; EX1001, 3:14-21. The '153 provisional further describes that such a transmission occurs from a ground device to the LAA:

To activate (e.g., *excite*) the identification box light sensor 19 [of the LAA], the *ground device has* a light beam emitter 23 connected to a light beam modulator 35, shown as emitter 31 in FIG. 4. The *light beam excitation* flow 82 is executed by the ground device 21. This beam, when captured by the light sensor 19 [of the LAA] will *change the data transmitted by the [LAA's] identification box RF module 16*. This *difference in the data is detected* by the ground device RF module 37, and the light excited *aircraft id* presented in the field 55 will be *shown in a distinguishable form*, for example but not by way of limitation, *bold-text*.”

EX2015 at 9:6-12, FIG. 4; EX2016, ¶34, FIG. 4; EX1001, 6:43-53, FIG. 4.

64. Thus, aircraft to detection station is not the only direction of transmission of a secure identifier that the '153 provisional discloses. To the contrary, the '153 provisional explicitly discloses a ground device transmitting a

“light beam excitation” to an aircraft, where the reception of the excitation by the aircraft causes it to change its behavior, e.g., by “chang[ing] the data transmitted by the LAA’s “identification box RF module 16.” As such, Petitioners’ first assertion above is incorrect.

2. ’959 Patent and ’153 Provisional Disclose Duplex RF Communication Similar to Two-Way Light-Based Communication

65. Petitioner’s second assertion, that PO relies upon “*light array*” embodiments that do not support the claimed requirement that the *secure identifier* be received by *the radio communication module*,” Opp. at 1; EX1027, ¶30, is also incorrect. The excitation transmission is not limited to a light beam and its receipt thus is not limited to a light detection sensor . The ’153 provisional states:

The identification box light emitters 3 and light sensor 4 create a *two-way communication* system. Similarly, the ground device camera 22 and light beam emitter 23 also create the *same kind of communication*. The *RF receiver and transmitter 16 and 37* in both devices *also create[] a duplex communication*. Therefore, the identification box 1 and ground device 21 together can *exchange information through light or RF*.

EX2015 at 9:18-21; EX2016 ¶ 36; EX1001, 5:18-23, 6:63-7:2. In my opinion, as indicated by the phrase “or RF,” POSITA would understand this disclosure as conveying embodiments which exchange information solely through RF.

66. Moreover, the '153 provisional discloses that the “light emitters 3” on-board an LAA “and the ground device camera 22” can communicate, where the LAA sends information to the ground device. Additionally, the '153 provisional discloses that the “light sensor 4” on-board the LAA and the “light beam emitter 23” of the ground device can also communicate, where the ground device sends information to the LAA, thereby allowing for “two-way communication” between the LAA and the ground device. The '153 provisional further teaches explicitly:

The RF receiver and transmitter 16 and 37 in both devices also create[] a duplex communication. Therefore, the identification box 1 and ground device 21 together can exchange information through light or RF.

EX2015 at 9:18-21; EX2016 ¶ 36; EX1001, 5:18-23, 6:63-7:2.

67. The foregoing disclosure clearly would have informed a POSITA that just as the light-based components of an LAA and a ground station can engage in a “two-way communication,” where the ground station sends an excitation to the LAA, the “RF receiver and transmitter 16 and 37 in both devices” can also engage in “a duplex communication” and “exchange information,” where an excitation is transmitted from the ground station to the LAA “through ... RF.” In fact, the '153 provisional discloses that a response to even a light-beam excitation can be received via RF. EX2016, ¶34 (the light beam providing the excitation, “when captured by the light sensor 19 [of the LAA] will change the data transmitted by

the [LAA's] identification box *RF module 16*"). Thus, a POSITA would immediately understand from the specification that, in the RF-only embodiments, the excitation itself may also be transmitted via RF, as part of a duplex RF communication.

68. As such, both of Petitioners' assertions above are wrong. The specification of the '959 patent and the '153 provisional fully supports the limitations recited in claim element [22.e].

3. '959 Patent and '153 Provisional Disclose RF Excitation Causing a Change in LAA Behavior

69. In contending that the specification does not support the limitations of claim element [22.f] (reciting that "the specified excitation causes the first low-altitude aircraft to change a behavior thereof"), Petitioners argue that "PO points solely to descriptions of a light beam – disconnected from any discussion of a secure identifier." Opp. at 3; EX1027, ¶34. This argument is erroneous; PO does not point only to descriptions of a light beam in presenting specification support of this claim element.

70. First, I explained (as I did above) that the '153 provisional discloses that the light emitters on-board an LAA and at a ground station, and a ground device camera and a light sensor on-board the LAA allow for "two-way communication" between the LAA and the ground device. *See supra* ¶¶49-52, 59-64. The light emitter of the ground device transmits an excitation to the LAA, as

PO pointed out in the RMTA. RMTA at 5-6 (discussing claim elements [22.d] and [22.e]).

71. Second, I explained that the '153 provisional also discloses just as in the light-based “two-way communication,” that the “RF receiver and transmitter 16 and 37 in both devices” can also engage in “a duplex communication” and “exchange information,” where an excitation is transmitted from the ground station to the LAA “through ... RF.” *See supra* ¶¶49-52, 59-68. PO pointed out the same. RMTA at 5-6. Thus, in the RMTA PO did not rely solely on the light-based embodiments. PO quoted and cited the relevant portions of the specification that disclose that the excitation and response thereto can be accomplished using RF signals.

72. The specification states that this excitation signal, whether transmitted via light or via RF, causes the LAA to change its behavior, e.g., causes the LAA to change the RF transmitted data in a manner that is expected by the ground station. In particular, the '153 provisional states:

In order to excite the identification box light sensor 19, the ground device has a light beam emitter 23 connected to a light beam modulator 35. The light beam excitation flow 82 is executed by the ground device 21. This beam, when captured by the light sensor 19 *will change the data transmitted* by the identification box RF module 16. This *difference in the data is detected* by the ground device RF

module 37, and the light excited aircraft ID presented in the field 55 will be shown in a distinguishable form (e.g., bolded).

EX2016, ¶34; RMTA at 5-6.

73. The '153 provisional also discloses:

[I]t is just a matter of directing a specific wavelength light beam emitter to one of the aircrafts and the *aircraft will thus modify its behavior* and its transmitted data, *allowing the data-to-vehicle association*.

EX2016, ¶9; RMTA at 5-6 (expected difference in data transmitted by the LAA or an expected change in behavior allows the “data-to-vehicle association”).

74. While the examples above causing an LAA to change its behavior employ a light beam for excitation, the '153 provisional explicitly discloses duplex communication between an LAA and a ground station, and states further that the two “can exchange information through *light or RF*.” EX2016, ¶36; *see supra* ¶¶62, 65. Excitation is a type of information, and can thus be transmitted by the ground station through RF. Thus, the '153 provisional fully discloses the limitations of claim element [22.f] (reciting that “the specified excitation causes the first low-altitude aircraft to change a behavior thereof”).

4. '959 Patent and '153 Provisional Disclose that Changed UAA Behavior in Response to RF Excitation Is Used for Disambiguation

75. The '153 provisional also discloses how the excitation signal can mitigate the risk of spoofing and thus function as a secure identifier. In particular, upon detecting the change in behavior associated with the excitation signal it transmitted, the ground station distinguishes, i.e., disambiguates, the responding LAA from the other LAAs that were also detected. EX2016, ¶34 (“difference in the data” transmitted by the LAA in response to an excitation “is detected by the ground device RF module 37, and the light excited *aircraft ID presented in the field 55 will be shown in a distinguishable form* (e.g., bolded)”); RMTA at 9 (discussing claim element [22.i]).

76. This allows for enhanced security because only a trusted aircraft would respond to an excitation signal transmitted by the ground signal by changing its behavior in a manner the ground station expected. An untrusted aircraft may not even recognize the excitation and/or may not be able to change its behavior in a manner expected by the ground station. This allows the ground station to distinguish between trusted and untrusted aircraft, and as such, the specified excitation functions as a secure identifier that enables “disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft,” as claim element [22.e] recites.

5. The Specified Excitation Is a Secure Identifier per Board's Construction

77. The specified excitation, as a secure identifier, is “a credential that can be used to securely verify the identity of a device, such as an airborne object or a ground-based transmitter.” *See* Paper 13 (Institution Decision) at 9; *see* EX2024 (defining in 2015 “credentials” as “documents ... that prove that you are who you claim to be, and can therefore be trusted”). A specified excitation performs satisfies the Board's construction, as discussed below.

78. Suppose a rogue LAA, having its own identification information “X,” stole the identification information “A” of an authentic LAA, and passed the identification information “A” as its own. Upon detecting the rogue LAA and receiving the identification information “A” therefrom, the ground device would send a specified excitation, and would expect a certain change in behavior, such as the LAA changing its orientation for a preselected time, or transmitting a modified version of the identification information A, etc. *See* EX2016, ¶¶9, 34. The rogue LAA may not respond at all or at least may not change its behavior in the expected manner. The ground station would then not distinguish the LAA and the purported identification information received therefrom as authentic. In contrast, if the LAA in the scenario above were authentic, that LAA would respond in an expected manner, and the ground station would recognize the expected change. EX2016,

¶¶9, 34. The ground station would then distinguish the LAA and its identification information as authentic, EX2016, ¶34.

79. In the scenarios above, the excitation is “specified.” For example, the ’153 provisional states that the “identification box [of the LAA] also has a photo sensor to receive external signals. When the photo sensor is *excited* with a high luminous *beam in a specific wavelength* (e.g., a laser beam), the identification box can change its operational behavior.” *Id.* EX2016, ¶¶9, 29. Similarly, in depicting the flow 72 in the provisional the LAA “verifies” the light beam before changing behavior. EX2016 at p. 15; EX2015, Fig. 7. The ’153 provisional also states that a “user selects [a] command ... and the light beam modulator 35 turns the light beam emitter 12 *on and off in a defined frequency and protocol.*” ¶38. “The identification box light sensor 4 detects the *modulated* light beam.” *Id.* A POSITA would understand that “modulation” means that information is being sent to the aircraft, as modulation is typically used in communications to encode data on a carrier signal.

80. Thus, the ’153 provisional describes using a “specific wavelength” and sending a binary “on and off” pattern, where the light beam is turned on and off at a particular frequency or according to a particular protocol. Only an authorized or trusted LAA may recognize that a signal received via the “specific wavelength,” or a signal that includes light beam transmissions turning on and off

according to a “defined frequency or protocol,” as a signal requesting the LAA to change its behavior. Moreover, the “specific wavelength” or a particular frequency at which the light beam turns on/off may inform the LAA how it should change its behavior. From all of these disclosures, a POSITA would understand the ’153 Provisional as conveying that the light beam’s signal (including the data modulated in the signal) for changing the LAA’s behavior comprises “a credential that can be used to securely verify the identity of a device, such as an airborne object or a ground-based transmitter,” i.e. a secure identifier as construed by the Board. That is, it is specifically designed to only cause the targeted LAA to change behavior.

81. A rogue LAA transmitting a stolen, fake identifier, may simply be unable to even recognize the specified excitation as asking the LAA to change its behavior in a certain way. Alternatively, the LAA may know that it needs to respond, but may not know how to respond to the excitation. In either case, the rogue LAA would not be able to respond in away the ground device expects. The ground device would then determine that although a particular UAV transmitted its identification information, that identification information may not be genuine and may be stolen.

82. In the alternative, upon determining that the LAA did respond in an expected way, the ground device may designate the identification information of the LAA transmitting that identification information as authenticated. Thus, the

“specified excitation enabling disambiguation” that claim element [22.e] recites, is “a credential that can be used to securely verify the identity of a device, such as an airborne object or a ground-based transmitter,” per the Board’s interpretation of “secure identifier.” The authentication occurs securely because the “specified excitation” can preclude unauthentic entities from responding in an expected way and continue masquerading via the transmission of a stolen identification information.

83. The examples discussed above describe a “specific wavelength” for a beam of light or a defined frequency for turning the light beam on and off, as a way of communicating with an LAA and providing information (more specially, coded information) to the LAA. But, the ’153 provisional also discloses both light and RF based duplex communications, *see id.* ¶36. In fact, the ’153 provisional states:

The **RF receiver and transmitter** 16 and 37 in both devices also creates a **duplex communication**. Therefore, the identification box 1 and ground device 21 together can **exchange information through light or RF**.

Id. ¶36.

84. It was well-known before the priority date of the ’959 patent that just as a “specific wavelength” of light can be selected, a “specific wavelength” of an RF signal can also be selected. It is well-known that the frequency of an electromagnetic signal is simply the speed of light divided by the wavelength.

Similarly, just as light beam can be turned on and off according to a particular frequency and protocol, so can an RF wave be. In fact, a form of that technique is well-known as Morse code. Accordingly, a POSITA would understand that, in the embodiments where RF is used for communications between the LAA and the ground device (discussed above), the RF signal would be similarly modulated to convey information in an specified excitation. Because the signal at a “*specific wavelength and modulation*” is used by the ground device to recognize a change in the LAA’s behavior to allow “data-to-vehicle association” and “duplex communications” (EX2016, ¶ 9), a POSITA would immediately understand that the information sent to the LAA in the signal “*specific wavelength and modulation*” would be one that is specifically designed to only cause that specific LAA to change its behavior, i.e. it is a credential that only the target LAA can recognize.

85. Thus, the “specified excitation enabling disambiguation” that claim element [22.e] recites, when transmitted as an RF signal, is also “a credential that can be used to securely verify the identity of a device, such as an airborne object or a ground-based transmitter,” per the Board’s interpretation of “secure identifier.”

86. In sum, the specification of the ’959 patent and the ’153 provisional, fully disclose the limitations recited in claim elements [22.e] and [22.f].

X. SC 22 PROPERLY CLAIMS PRIORITY TO '153 PROVISIONAL

87. Petitioner contends that “that for the same reasons discussed in the Petition, element [22.e] is not adequately supported by the '153 Prov.” Opp. at 4; EX1027, ¶37. In support of its contention, Petitioners argue that SC 22 “recites the same ‘secure identifier’ as original claim 21 and limitations [22.e] and [22.f] describe what the secure identifier also “comprises” and how it is “utilized” – not what the term itself means (as construed in the ID).”

88. I am informed by Counsel and I understand that “[c]laims must be interpreted with an eye toward giving effect to *all terms* in the claim.” *Bayer Pharma Aktiengesellschaft v. Mylan Pharm.*, 152 F.4th 1400, 1406 (Fed. Cir. 2025). I am further informed by Counsel and understand that “characteristics specifically described in a claim are [not] superfluous.” *Bicon, Inc. v. Straumann Co.*, 441 F.3d 945, 950 (Fed. Cir. 2006).

89. In light of these and the legal principles of *Littelfuse* and *Liebel-Flarsheim* stated above, *see supra* ¶60, I find Petitioners’ contentions and arguments erroneous. Specifically, as Petitioners acknowledge, SC 22 is different from issued claim 21 in that SC 22 recites a “secure identifier *comprising* a specified excitation enabling disambiguation.” Thus, the meaning of “secure identifier” recited in SC 22 must account for the additional terms that SC 22 recites and that further define the “secure identifier.” Those additional terms should not be

rendered superfluous. As such, Petitioners’ argument that the further limitation of claim element [22.e] did not modify the meaning of “secure identifier” is incorrect. Regardless, I note that the secure identifier of SC 22 complies with the Board’s construction of the secure identifier of claim 21, which did not recite the additional limitations of SC 22. *See supra* § IX.A.5.

90. SC 22 is also entitled to claim priority to the ’153 provisional. With respect to the “secure identifier,” claims 1 and 21 are understood as genus claims because they do not limit the secure identifier to any particular embodiment disclosed in the ’959 patent. Claims 3 and SC 22, on the other hand, are species claims; each is directed to a respective embodiment of a secure identifier. I am informed by Counsel and understand that the disclosure of one or more species may not adequately support a claim to a broader genus. *Ariad Pharmaceuticals*, 598 F.3d at 1350 (“a sufficient description of a genus instead requires the disclosure of either a representative number of species falling within the scope of the genus or structural features common to the members of the genus so that one of skill in the art can ‘visualize or recognize’ the members of the genus”).

91. The ’153 provisional does not disclose all the different embodiments of a secure identifier that the ’959 patent describes. In particular, the ’153 provisional does not disclose a rotating SSID as a secure identifier. *See generally* EX2016; *but see* EX2015 at 15:29-16:3. However, SC 22 is directed to a specific

embodiment of a secure identifier – an embodiment that is fully disclosed in the ’153 provisional. *See supra* § IX.A. Therefore, in my opinion, SC 22 is entitled to claim priority to the ’153 provisional.

XI. SC 22 IS PATENTABLE

A. SC 22 Is Clear, Not Indefinite

1. Specification Defines “Low Altitude Aircraft”

92. Petitioners state that “low altitude” “is a term of degree, and the specification does not provide an objective standard for determining what constitutes low altitude.” Opp. at 5; EX1027, ¶38. This assertion is wrong. The specification describes “small UASs,” i.e., unmanned aerial systems, as “aircrafts up to 25 pounds flying up to 500 ft of the low altitude airspace.” Thus, the specification clearly describes a low altitude aircraft as one flying in low altitude airspace, e.g., “up to 500 ft of the low altitude airspace.” The meaning of “low-altitude aircraft” as that term is recited in SC 22, is this clear.

2. “The Received Information” Is Clear

93. Regarding this claim term, Petitioners first argue that “the received information” lacks antecedent basis, making the claim term indefinite. Opp. at 6-7; EX1027, ¶40. Second, Petitioners also argue “that the radio signal that is receive[d]” is not the “received information” and specifically that a POSITA “would not have considered these the same because they are different terms,

connoting different meanings.” Opp. at 6-7; EX1027, ¶40. Third, Petitioners further allege and argue that the distinction between the “identification information” recited in SC 22 and “the received information” is unclear. Opp. at 6-7; EX1027, ¶40.

94. The Board has already addressed the first and third arguments, so I will first discuss Petitioner’s second argument. In his seminal article on information theory, which has been cited over 50,000 times, Claude Shannon noted that signals carry information. EX2025 at 2 (“An information source [] produces a message or sequence of messages to be communicated to the receiving terminal” and a “transmitter [] operates on the message in some way to produce a signal suitable for transmission over the channel”), FIG. 1 (depicting a transmitter converting a message from an information source into a signal). Claim element [22.c] recites “receiv[ing] a radio signal.” Accordingly, a POSITA would understand that such signal contains information, which is received when the radio signal is received, i.e. “received information.” Indeed, the “radio communication module is configured to ... store” the information in the received signal, i.e., “the received information,” “in a storage.”

95. Regarding Petitioners’ first argument, the Board explained that “a claim is indefinite if it fails to inform those skilled in the art about the scope of the invention with reasonable certainty.” Paper 23 at 9 (internal citations and quotation

marks omitted). Here, a POSITA would have clearly understood that “the received information” means the information contained in the received signal.

96. Regarding Petitioners’ third argument, as the Board explained, a POSITA would not conflate “the transmitted radio signal” and “a radio signal” that is received. *Id.* at 9-10. Moreover, claim element [22.b] recites that “identification information associated with the first low-altitude aircraft” is transmitted “through a transmitted radio signal.” Thus, claim element [22.b] describes that the information contained in the transmitted radio signal is or includes the “identification information.” Thus, a POSITA would have clearly understood that “the received information” recited in claim element [22.c] is not the same as the “identification information.” As the Board further explains, a POSITA would have understood that “the ‘radio communication module,’ in the context of claim 22, would not be used to receive information that it has itself transmitted.” *Id.* at 10.

97. Accordingly, a POSITA would not have found SC 22 indefinite.

B. SC 22 Is Not Obvious

1. Key Elements of Proposed Substitute Claim (SC) 22

98. The key elements of SC22 include:

[22.e] “the secure identifier comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft”

[22.f] “the specified excitation causes the first low-altitude aircraft to change a behavior thereof”

[22.i] “the remote portable detection system is configured to disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft of the plurality based on the changed behavior of the first low-altitude aircraft.”

99. The “secure identifier” is a signal, is transmitted from the ground station to the first LAA (low-altitude aircraft). It enables “disambiguation of the first LAA from other detected” LAA as follows:

1. By default, the first LAA transmits its ID.
2. Other LAAs also transmit their respective IDs, and all the detected aircraft, including the first LAA, are displayed on a user interface at a detection system, which can be ground based.
3. If the detection system wishes to distinguish between “friendly” and “foe” LAA, the detection system transmits to the first LAA “a specified excitation.”
4. Only a “friendly” LAA would know how to respond to the “specified excitation.”
 - a. In response, the first LAA changes its behavior. For example, instead of its ID, it may transmit a variation of the ID that the detection

system can recognize. Other changes in behavior include dropping / increasing the altitude, adjusting the orientation (pitch, roll, yaw), etc.

5. The detection system can detect this change in behavior, and would recognize the first LAA as “friendly.”
6. Other “foe” LAA would not recognize the “specified excitation” and may not change their behavior at all.
7. Based on this, the detection system would “disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft of the plurality based on the changed behavior of the first low-altitude aircraft.”

2. Viggiano-Hayes Combination Does Not Teach or Suggest At Least the Limitations of Claim Elements [22.e], [22.f], and [22.i]

100. Regarding claim element [22.e], Petitioners allege that Viggiano’s “challenge 12 (*secure identifier*) is or includes an excitation because it causes Beard’s RF transceiver to prepare and transmit the challenge response (*secure identifier comprising a specified excitation*).” Opp. at 14; EX1027, ¶58. For claim element [22.f] Petitioners allege that “this excitation [i.e., the challenge 12] causes the first UAS to change a behavior in that the first UAS is triggered to prepare and transmit a challenge response.” Opp. at 15-16; EX1027 ¶61.

101. For claim element [22.i], to show that “challenge 12” “enable[es] disambiguation of the first low-altitude aircraft from other detected low-altitude

aircraft,” Petitioners allege that “[c]onsecutive failures of the authentication causes issuance of ‘an alert’ that triggers a modification of the displayed user interface of Beard’s receiver, causing other detected and displayed UASs to be removed from the interface and the first UAS to thus be more clearly displayed.” Opp. at 16-17; EX1027 ¶59.

102. These arguments are flawed. First, the challenge 12 did not cause a change in behavior. In a challenge-response authentication system, responding to a challenge *is* the default, expected behavior. EX2021³ at 7 (defining the “Challenge-Response Protocol”); Ex. 1024 ¶ 14. Therefore, Viggiano’s UAS responding to the challenge is not causing the UAS to “change a behavior thereof,” as claim element [22.f] recites.

103. Second, to the extent responding to the challenge caused Viggiano’s UAS to change its behavior, challenge 12, by itself, did not enable disambiguation. Rather, “two or more consecutive” failures, *see* EX1024, ¶15, require at least two transmissions of challenge 12. Thus, to enable disambiguation, a single challenge is not sufficient; only a series of at least two challenges, and the failure to respond to those challenges, can enable disambiguation. Thus, a single challenge is not “a specified excitation enabling disambiguation.” Petitioners do not allege that a

³ NIST Special Publication (SP) 800-63-2, Electronic Authentication Guideline (2013).

series of two or more excitations constitutes a challenge. See Opp. at 13-15; EX1027 ¶¶58-61.

104. Third, a POSITA would not find the removal of all the detected UAVs except for the one that failed to respond to be a disambiguation *of the UAV that received the excitation signal*. EX2016, ¶33. Rather, a POSITA would understand such removal of all other UAVs as isolation of the non-responding UAV, not disambiguating the UAV that received the excitation signal. *Compare* EX2023⁴ (defining “isolate” as “to separate ... something physically from other ... things”) *with* EX2022⁵ (defining “disambiguate” as “to show clearly the difference between two or more words, phrases, etc.,” such as LAA identifiers). Indeed, the claim requires a “user interface configured to provide to a user, information associated with a plurality of different” LAAs. But Petitioner’s theory—removing the other LAAs to only show the LAA that failed to respond to the challenges—is not a “user interface” with a “*plurality* of different” LAAs where the LAA whose behavior changed is “disambiguate[d]” from the other LAAs.

⁴ <https://web.archive.org/web/20140401114908/>

<https://www.oxfordlearnersdictionaries.com/us/definition/english/isolate>

⁵ [disambiguate - Definition and pronunciation | Oxford Advanced Learner's Dictionary at OxfordLearnersDictionaries.com](#)

105. Fourth, in the system of the proposed combination, the disambiguation occurred because *there was no change in behavior* in the target aircraft – Viggiano’s UAS either continued to not respond with any ID at all or continued to respond with an unauthentic ID, at least twice, which led to consecutive failures. Indeed, in Petitioner’s theory, the challenge itself is not used to disambiguate the aircraft—rather it is the failure to properly respond to multiple challenges (what Dr. Chowdhary calls “consecutive authentication failures”) that causes an alert to issue. Ex. 1027 ¶¶ 51, 61, 63, 73; Ex. 1024 ¶ 15. But, “consecutive authentication failures” encompasses the aircraft simply not broadcasting responses at all—which is the default status of the aircraft before the challenge is sent (i.e. the aircraft is not transmitting before the challenge and is not transmitting after the challenge). Not broadcasting before challenge 12 and not broadcasting after challenge 12 is plainly not a “change in behavior.” As such, the disambiguation is not “*based on* the changed behavior of the first low-altitude aircraft,” as claim element [22.i] recites. Rather, it is the opposite—the changed behavior of *other* UAVs (i.e. successfully responding to the authentication challenge)—that causes any alleged disambiguation in the system of the proposed combination.

106. Accordingly, Viggiano in combination with Hayes does not teach or even suggest at least claim elements [22.e], [22.f], and [22.i].

3. The Asserted Grounds

107. Petitioners have asserted 8 grounds, namely, Ground 5B through 12B. Grounds 5B and 9B rely on Beard (EX1008) and Beard provisional (EX1009), which was filed on March 31, 2017, i.e., after June 12, 2015, the filing date of the '153 provisional. As shown above, SC 22 is fully supported by the '153 provisional, and as such entitled to the priority date of June 12, 2015. Therefore, Beard and Beard provisional do not qualify as prior art. Grounds 5B and 9B fail at least for that reason.

108. Regardless, each of the asserted Grounds relies only on Viggiano and Hayes regarding claim elements [22.e], [22.f], and [22.i]. Opp. at 9-12, 17, 21, EX1027, ¶¶42, 58-61, 63, 67-71, 73, 76-79, 81, 85, 87, 89. Therefore, each of these Grounds fails, because Viggiano in combination with Hayes does not teach or even suggest at least claim elements [22.e], [22.f], and [22.i]. *See supra* § XI.B.2. Therefore, SC 22 is patentable.

XII. CONCLUSION

109. For the foregoing reasons, it is my opinion that the proposed substitute claim 22 is patentable.

110. I currently hold the opinions that I have expressed in this declaration. My analysis may continue, however, as I may acquire or receive additional

information or insights that may result in revised or supplemental observations or opinions.

111. I understand this declaration may be used as evidence in the instant IPR proceeding before the PTAB.

112. I declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the '959 patent.

113. I declare under penalty of perjury that the foregoing is true and correct.

Dated: June 22, 2026

Respectfully submitted,



Dr. Nikolaos Papanikolopoulos

Appendix A: Authentication and Foundation for Cited Exhibits

114. Exhibit EX2021 is a document published by the U.S. Department of Commerce. It bears the seal of the U.S. Department of Commerce, and the signatures of the Acting Secretary of the Department of Commerce, and of the Under Secretary of Commerce for Standards and Technology. I downloaded the document identified as EX2021 on June 15, 2026. Based on my review of the document, I believe it is what it purports to be. I am informed by Counsel and understand that this document is self-authenticating under F.R.E. 902(1).