

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Axon Enterprise, Inc. and Dedrone Holdings, Inc.

Petitioners,

v.

Airspace Systems, Inc.

Patent Owner

Case No. IPR2025-00525

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

**DECLARATION OF NIKOLAOS PAPANIKOLOPOULOS, PH.D.
IN SUPPORT OF PATENT OWNER'S MOTION TO AMEND**

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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 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

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

I. INTRODUCTION

1. I have been retained by Patent Owner Airspace Systems, 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 have been 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.

3. 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.

4. I am not currently, nor have I ever been, an employee of Airspace Systems, Inc., its 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. BACKGROUND AND QUALIFICATIONS

5. My qualifications are most accurately reflected in my curriculum vitae (EX [REDACTED]). The following is a brief summary of some of my relevant experience and qualifications.

6. I am the McKnight Presidential Endowed Professor and Distinguished McKnight University Professor in the Department of Computer Science and Engineering of the University of Minnesota in Minneapolis, Minnesota. I am also the Director for the Minnesota Robotics Institute.

7. I have been a professor at the University of Minnesota (originally as an assistant professor, and then as an associate professor) since the Fall 1992. Between Fall 2001 and Spring 2004, and between Fall 2010 and Spring 2013, I was the Director of Undergraduate Studies of the Department of Computer Science and Engineering.

8. In 1992, I received my Ph.D. in Electrical and Computer Engineering from Carnegie Mellon University. My thesis was entitled "Controlled Active Vision" and focused on using computer vision in a controlled fashion to detect, track, and manipulate objects in the environment. In 1988, I also received my M.S. in Electrical and Computer Engineering from Carnegie Mellon University. My

B.S. in Electrical and Computer Engineering was received in 1987 from the National Technical University in Athens, Greece.

9. For over thirty years, my research and teaching work has focused on robotics, image processing, computer vision, and intelligent transportation systems. This research has included a wide variety of topics ranging from drones to detection and tracking of humans and objects such as faces using information from stationary or moving cameras. It has also included object detection and recognition including work with artificial intelligence and pattern recognition systems for surveillance applications.

10. I currently teach or have been teaching three courses related to image processing and computer vision: (i) CSci 5561 Computer Vision, (ii) CSci 5511 Artificial Intelligence, and (iii) CSci 5551 Introduction to Intelligent Robotic Systems. In particular, I have been teaching the class in Computer Vision since 1992.

11. I am currently serving as a Senior Editor in the IEEE Transactions on Intelligent Transportation Systems with responsibility in the area of imaging. I was Associate Editor in the same journal for twelve years.

12. I have received research grants for various projects involving robotics, computer vision and image processing as applied to medicine and surveillance, including face detection and tracking of humans. My industrial experience

includes founding a robotics company in 2005 named ReconRobotics Inc. that develops different robotic platforms. I have also been a consultant since 1997 for numerous companies and provided technical expertise in developing computer vision algorithms for human tracking, object recognition, fingerprint recognition, vehicle tracking, camera calibration, inspection, and precision agriculture.

13. In one of my consulting assignments, I developed computer vision algorithms for inspection of industrial parts by using different illumination sources (Banner Engineering). I have licensed my algorithms to several industries with the most recent one being Sentera Inc., which is using image processing and image segmentation for precision agriculture.

14. My research has produced more than 400 journal and conference publications. More than 90 publications are in refereed journals including top journals in robotics and imaging such as IEEE Trans. on Robotics and Automation, IEEE Trans. on Pattern Analysis and Machine Intelligence, IEEE Trans. on Image Processing, and International Journal of Computer Vision. Many of my publications and research grants relate to drones and human detection and tracking systems.

15. Some examples include:

- Henderson, T., Favour, R., Hamlen, B., Mitha, I., Bowe, E., and Papanikolopoulos, N.P., "Hovering Locomotion for UAVs with Thrust-Vectoring Control Surfaces", IEEE Robotics and Automation Letters, Volume

7, No. 2, April 2022, PP. 5214-5221. The paper was also presented at the 2022 IEEE Int. Conference on Robotics and Automation.

- D'Sa, R., and Papanikolopoulos, N., "Design and Experiments for Multi-Section-Transformable (MIST)-UAV", Proceedings of the 2019 IEEE Int. Conference on Robotics and Automation, Montreal, Canada, May 20-24, 2019, PP. 1878-1883.
- Walczak, N., Fasching, J., Cullen, K., Morellas, V., and Papanikolopoulos, N.P., "Toward Identifying Behavioral Risk Markers for Mental Health Disorders: An Assistive System for Monitoring Children's Movements in a Preschool Classroom," Machine Vision and Applications, Volume 29, No. 4, May 2018, PP. 703-717.
- Andersh, J., Cherian, A., Mettler, B., and Papanikolopoulos, N.P., "A Vision Based Ensemble Approach to Velocity Estimation for Miniature Rotorcraft", Autonomous Robots, Volume 39, No. 2, August 2015, PP. 123-138.
- Cook, D., Morris, T., Morellas, V., and Papanikolopoulos, N., "An Automated System for Persistent Real-Time Truck Parking Detection and Information Dissemination," Proceedings of the 2014 IEEE Int. Conference on Robotics and Automation, Hong Kong, China, May 31 – June 7, 2014, PP. 3989-3994.
- Somasundaram, G., Sivalingam, R., Morellas, V., and Papanikolopoulos, N.P., "Classification and Counting of Composite Objects in Traffic Scenes Using Global and Local Image Analysis", IEEE Trans. on Intelligent Transportation Systems, Volume 14, No. 1, March 2013, PP. 69-81.
- Masoud, O., and Papanikolopoulos, N.P., "A Novel Method for Tracking and Counting Pedestrians in Real-time Using a Single Camera," IEEE Trans. on Vehicular Technology, Volume 50, No. 5, September 2001, PP. 1267-1278.

- Singh, S., and Papanikolopoulos, N. P., “Monitoring Driver Fatigue Using Facial Analysis Techniques,” Proceedings of the 1999 IEEE/IEEE/JSAI International Conference on Intelligent Transportation Systems, PP. 314- 318, Tokyo, Japan, October 5-8, 1999.

16. My UAV research focused on solar-powered drones capable of flying for multiple days continuously and transformable multi-section UAV designs. My work includes developing the world's smallest solar-powered UAV with applications in precision agriculture for maximizing crop yield, and detecting harmful algae growth in aquatic ecosystems. I have developed the Multi-Section-Transformable (MIST) UAV, a shape-shifting Vertical Take-Off and Landing platform that can transform in-air between multi-rotor, tail-sitter, and fixed-wing configurations. We have applied UAV technology to robot-based precision agriculture, specifically developing high-altitude aerial image analysis systems for weed detection and classification. My research combines robotics, computer vision, and machine learning to create practical UAV solutions for agriculture, environmental monitoring, and transportation systems.

17. My work in vehicle detection and tracking has focused on using image and video processing techniques, including object detection, tracking, and recognition, to accurately track vehicles in real-time. These algorithms have been applied to different scenarios, such as urban traffic monitoring and surveillance.

Moreover, machine learning techniques have helped in the improvement of these methodologies.

18. My paper “Detection and Classification of Vehicles,” published in the IEEE Transactions on Intelligent Transportation Systems in March 2002, is one of the most cited papers in the history of this journal (more than one-thousand citations). The paper, among other contributions, shows how to segment the main object from videos and images in low-light conditions. I also hold nine patents in pertinent areas. One of them is the “Crowd Counting and Monitoring” with P. Kilambi and O. Masoud. It discloses a system and method for accurately estimating the number of people in a crowded area and monitoring their behavior. The invention utilizes computer vision techniques and machine learning algorithms to analyze video feeds from cameras overlooking the target area. It employs techniques such as background subtraction, main object detection, and tracking to identify individual people within the crowd.

19. My research work (individually and with my collaborators) has been funded by several government funding agencies. For example, we have received funding from the Department of Homeland Security to monitor threats at Mass Transit Sites like the 30th Street Station in Philadelphia, PA, and the Light Rail Station in the Minneapolis-Saint Paul International Airport. Tracking humans was

an essential task for which we developed a variety of image processing algorithms and tools.

20. I have received numerous honors and awards for my research and contributions. I have been a Distinguished McKnight University Professor at the University of Minnesota since 2007 and have been a McKnight Presidential Endowed Professor in Computer Science since 2016. Also in 2007, I was nominated and became an IEEE Fellow. In 2016, I received the IEEE RAS George Saridis Leadership Award in Robotics and Automation as well as the Center for Transportation Studies Research Partnership Award. I have also received the IEEE VTS 2001 Best Land Transportation Paper Award for the paper “A Novel Method for Tracking and Counting Pedestrians in Real-Time Using a Single Camera” (with Osama Masoud). Most recently (2025), I was elected to become a Fellow of the National Academy of Inventors.

21. As a result of my work and research, I am familiar with the design, operation, and functionality of unmanned aerial vehicles (UAVs), also known as drones, such as those described in the '959 patent.

III. COMPENSATION

22. 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 Systems, Inc., its subsidiaries, parent organizations, or affiliates, the '959 patent, or the outcome of this IPR or any other matter involving the '959 patent.

IV. MATERIALS CONSIDERED

23. 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 declaration by Dr. Chowdhary and the prior art cited by Petitioners. Moreover, I have considered the Patent Owner Preliminary Response (POPR) and attached exhibits, the Board's Institution Decision, Patent Owner Response (POR) and attached exhibits, and the substitute claim proposed by Patent Owner. For the sake of convenience and quick reference, I have reproduced above Patent Owner's Exhibit List, listing some of the materials that I considered.

V. LEGAL PRINCIPLES

24. 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 that are summarized below.

A. Claim Construction

25. I am informed by counsel and understand that “claim construction” is the interpretation of the meaning of patent claims. I understand that words of a claim are generally given their ordinary and customary meaning, which is the meaning the term or phrase would have to a person of ordinary skill in the art (POSITA) at the time of the invention. I understand that both intrinsic and extrinsic evidence can be used to assist in understanding the meaning of a claim. Intrinsic evidence includes the claim language, language in other claims of the patent, the specification, and the prosecution history.

26. I further understand that, unless required by the claim language or specification, claims should generally not be limited to embodiments in the specification, including preferred embodiments. I understand that extrinsic evidence, which consists of all evidence external to the patent and prosecution history including expert and inventor testimony, dictionaries, and learned treatises, may also be relevant to claim construction.

B. Invalidity Based on Prior Art

27. I am informed 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

28. 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 and understand that the earliest priority date of a patent is the effective filing date of that patent.¹

29. 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 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.

¹ I am informed 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.

30. 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 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

31. 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.

32. 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.

33. 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.

34. 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 is called a statutory bar.

35. 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

36. I 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.

37. 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).

38. 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.

39. 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.

40. 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.

41. 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.

42. 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.

43. 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.

44. 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.

45. 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 alternatives when such disclosure does not criticize, discredit, or otherwise discourage the use of that alternative.

46. 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. Proposed Substitute Claims

47. 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).

48. 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 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.

49. 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).

VI. LEVEL OF ORDINARY SKILL IN THE ART

50. My opinions herein are based from my standpoint of a POSITA at the time of invention of the '959 patent.

51. The earliest filed patent application to which the '959 patent claims priority is U.S. Provisional Pat. App. No. 62/175,153 (filed on June 12, 2015) (the "'153 Prov."). In my opinion, the sole proposed substitute claim is entitled to claim priority to the filing date of the '153 Prov. My opinions herein would not change even if the proposed substitute claim is determined not to be entitled to that priority date.

52. I understand that Petitioners and their expert Dr. Chowdhary have stated that a POSITA would have had "either (1) at least a Bachelor of Science in Mechanical Engineering, Electrical Engineering, Aerospace engineering, or an equivalent field, as well as at least 2 years of academic or industry experience in the aerospace, avionics, telecommunications, or electronic device manufacturing industry fields, or (2) at least four years of experience in any of the above industries." Pet. at 21; EX. 1003 ¶ 47. I agree that the qualifications stated above would indicate the level of ordinary skill in the art with respect to the '959 patent.

53. I understand that the Board, for the purpose of deciding whether or not to institute IPR, adopted Petitioners' definition of a POSITA. *See* Paper 13 at 5-6. Under the above-stated definition of the level of ordinary skill in the art, at

the relevant time frame, I was a person of more than ordinary skill in the art. I also worked with and managed many people who fit the characteristics of a POSITA, and I am familiar with their level of skill.

VII. SUMMARY OF MY OPINIONS

54. Petitioners have challenged claim 21 of the '959 patent on 4 Grounds. I explain below that proposed substitute claim 22 is fully supported by the specification of the '959 patent and the '153 Prov., and as such, no new matter is introduced. Proposed substitute claim 22 narrows the scope of the corresponding challenged claim 21, by adding further limitations. These further limitations distinguish proposed substitute claim 22 from the cited prior art, individually or in combination with other cited prior art. As such, proposed substitute claim 22 is responsive to the Grounds asserted in the Petition, and is patentable.

55. In particular, before allowing a UAV to operate within a restricted airspace, communicating and exchanging information with a UAV, etc., it is highly beneficial to ascertain that the detected UAV is genuine and not a masquerader. The '959 patent disclosed a solution by providing for authenticating the UAV identifier. More specifically, the authentication can be done by using another identifier, called a secure identifier, that is used for crosschecking or cross-verifying the UAV identifier.

56. Accordingly, the sole proposed substitute claim 22 recites that a “radio communication module is configured to utilize a secure identifier” “wherein, utilizing the secure identifier comprises transmitting the secure identifier to the remote portable detection system for cross-verifying the secure identifier and transmitted identification information, to verify authenticity of the transmitted identification information.” None of the prior art cited by Petitioners teaches or suggests utilizing a secure identifier in this manner to authenticate the UAV identifier. Therefore, in my opinion, proposed substitute claim 22 is patentable.

VIII. THE ’959 PATENT

A. Administrative Overview

57. I have reviewed and agree with the administrative overview of the ’959 patent that Patent Owner provided in the Patent Owner’s Preliminary Response (POPR). Therefore, I reproduce that administrative overview herein.

58. The ’959 patent issued from U.S. Patent Application No. 16/215,406 (the ’406 Application”), that was filed on December 10, 2018. EX1001, face page. The ’406 Application is a continuation of U.S. Patent Application No. 15/839,661 (the ’661 Application), filed on December 12, 2017, which is stated as a “continuation of” International Patent Application No. PCT/US2016/037071 (the ’071 PCT Application), filed on June 10, 2016. The ’071 PCT Application claims priority to U.S. Provisional Patent Application No. 62/175,153 (the ’153

Provisional), filed on June 12, 2015. The '661 Application also claims priority to U.S. Provisional Patent Application No. 62/566,450, filed on October 1, 2017. *See* EX1001, 1:7-22; Paper 10 at 1-2.

B. Prosecution History

59. I have reviewed and agree with the prosecution history of the '959 patent that Patent Owner provided in the POPR. Therefore, I reproduce that prosecution history herein.

60. During the prosecution of the '406 Application, the first Non-Final Office Action issued on August 7, 2019. EX1002 at 111. In that Office Action all pending claims (Claims 1-20)² were rejected on the ground of non-statutory double patenting based on Claims 1-20 of U.S. Patent No. 10,192,451. *Id.* at 113-114. In response to the filing of a terminal disclaimer by the Applicant, the pending claims were allowed. *See id.* at 61-68, 98-99; Paper 10 at 2.

C. Subject Matter

61. I have reviewed and agree with certain portions of the discussion of the subject matter of the '959 patent that Patent Owner provided in the POPR. Therefore, I reproduce those portions of the discussion of the subject matter herein. *See* Paper 10 at 2-5.

² A numbering error in the allowed claims was corrected during issuance. As such, the allowed claim 20 issued as claim 21. *See* EX1002 at 48, 107 (claim 18).

62. The '959 patent discloses and claims a “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.

63. The automated detection techniques that the '959 patent describes for detecting the identification information transmitted by a UAV can be classified as light-based techniques or radio frequency based (RF)-based techniques. *See generally, id.* The only challenged claim, claim 21, is directed to a device that uses RF-based technique for communicating information about a UAV, including its identification, to a UAV detection system. *See id.* 17:17-18:17.

64. Challenged claim 21 recites that the radio communications module of a UAV utilizes a “secure identifier.” The secure identifier helps ensure the authenticity of the transmitted UAV identification information. The '959 patent

and the '153 Prov. describe performing such authentication, so that the risk of cloning and/or spoofing by a rogue, masquerading UAV is mitigated.

65. One way of authentication is to verify the authenticity of the UAV identifier using another identifier that is associated with the UAV and that is used to crosscheck or cross-verify the UAV identifier. *See* EX1001, 3:50-55 (“if the remote (e.g., ground) user wants to check if one specific vehicle has the flight permission to fly in that area, that user directs the identification device in the vicinity of the aircraft. The identification device automatically handles the identification and **crosschecks with the identification database**”); EX2016 ¶ 12. The other identifier used for crosschecking serves as a “secure identifier.”

66. As one example, the '959 patent states: “[i]nstead of the related art approach of stamping letters and numbers on the aircraft, the present example implementation is directed to a light array that blinks a defined color pattern sequence for each aircraft.” EX1001, 2:30-33; EX2016 ¶ 6. “The number of colors used and the number of blinks may define the quantity of codes possible.” EX1001, 2:39-40; EX2016 ¶ 6. The '959 patent further states that the “[t]ogether with the light array, the electronic identification box has a position logger and a transponder.” EX1001, 2:41-42; EX2016 ¶ 7. “The transponder may transmit a code similar to the one generated (e.g., blinked) by the light arrays but through the

RF frequency, allowing automatic identification by any RF receiver on land.”

EX1001, 2:56-59; EX2016 ¶ 8.

67. The ’959 patent further states:

Since the electronic identification box relies on visual information, the ground device is equipped with a camera, lens and image processing algorithms to capture the color sequence. In addition, this device has an RF receiver capable of receiving the identification box RF signal to **connect both information sources and to verify the authenticity.**

EX1001, 3:38-44; EX2016 ¶ 11 (“**cross** both information and verify the authenticity”).

68. A code corresponding to the “color sequence” for a particular UAV is the UAV identifier. EX1001, 2:14-15 (“[t]he identification code can be transmitted by a visible light color sequence”); EX2016 ¶ 6 (“unique color pattern sequence”), A code “similar to the one generated (e.g., blinked) by the light arrays” is the other identifier used for crosschecking / cross-verification, and is the “secure identifier.” A rogue, masquerading UAV likely would not know that the detection station authenticates the UAV identifier using another identifier (secure identifier) for crosschecking / cross-verification of the UAV identifier. Even if the rogue UAV knows that a ground station performs such authentication, the rogue UAV may not be equipped to transmit two identifiers, and hence, may not pass authentication.

The threat of spoofing, e.g., a UAV transmitting a stolen, cloned identifier is thus mitigated.

69. The '959 patent discloses situations in which the light array does not transmit the “color sequence” for a particular UAV (also called code), i.e., the UAV identifier, and instead, sends other information. In this case, the RF module transmits both the UAV identifier and the additional identifier, i.e., the secure identifier.

70. In particular, the '959 patent describes that the ground station can send commands to the UAV and that after “the command execution, the identification box 1 sends the **execution results** (e.g. an ACK, or an error status code) to the ground identification unit 21 ... and it can also change the color sequence to **show the result visually.**” EX1001, 7:66-8:3; EX2016 ¶ 38. During the time period in which the light array transmits the results of command execution, it does not send the UAV identifier.

71. But, the '959 patent discloses that the transponder / RF module sends the UAV identifier. The '959 patent states: “[t]he identification box 1 also has a radio antenna 5 connected to a **RF module 16** shown in FIG. 2 as being connected to RF antenna 12, that **transmits the same code** or a modified version of the code through a radio signal.” EX1001, 5:15-18; EX2016 ¶ 29. Thus, the RF module sends the “same code,” i.e., the UAV identifier and also “a code **similar to** the one

generated (e.g., blinked) by the light arrays,” EX1001, 2:56-59; EX2016 ¶ 8, i.e., the “secure identifier” used for crosschecking / cross-verifying the UAV identifier. As discussed above, the crosschecking / cross-verifying mitigates the risk of spoofing via stolen UAV identifiers.

IX. CLAIM CONSTRUCTION

72. I am informed by counsel and understand that in an *inter-partes* review proceeding, as in a Federal Court, the claims are interpreted according to the *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*) standard. In other words, I am informed and understand, that the claim terms are interpreted according to their “ordinary and customary meaning” also referred to as the plain and ordinary meaning. I have adopted this standard in my analysis of both the issued claims and the proposed substitute claims.

X. PROPOSED SUBSTITUTE CLAIMS COMPLY WITH LAWS AND REGULATIONS PERTAINING TO A MOTION TO AMEND

A. Patent Owner Has Proposed a Reasonable Number of Proposed substitute claims

73. In the motion to amend, for the sole challenged claim 21, Patent Owner has proposed only a single corresponding proposed substitute claim. I believe this is a reasonable number of proposed substitute claims.

B. Each Proposed substitute claim Responds to a Ground of Unpatentability

74. The sole proposed substitute claim 22 retains all of the limitations of the corresponding challenged claim 21, and adds further limitations. As I explain below, none of the prior art cited under any of Petitioners' 6 Grounds teaches or suggests, individually or in combination with other cited prior art, one or more of these **further limitations**. *See infra* § XI. Therefore, in my opinion, proposed substitute claim 22 responds to one or more Grounds of unpatentability.

C. No Proposed Substitute Claim Enlarges the Scope of the Claims of the '959 Patent

75. As stated above, the sole proposed substitute claim, claim 22, retains all of the limitations of the corresponding challenged claim. Proposed substitute claim 22 is amended to recite further limitations. As such, in my opinion, proposed substitute claim 22 does not enlarge the scope of the claims of the '959 patent.

D. No Proposed substitute claim Introduces New Subject Matter and Is Fully Supported by the Original Disclosure of the '959 Patent

76. I discuss below that the feature(s) recited in each claim element are fully disclosed in the patent application as filed, i.e., the '406 App. In addition, these features are also disclosed in the '153 Prov. to which the '959 patent claims priority. This disclosure includes a written description (and drawings), that would enable a POSITA to make and use a device that can be mounted to a UAV to facilitate detection of the UAV as claimed. *See* 35 U.S.C. § 112.

77. In the discussion below, for each claim element I point out the portions of the specification that support the corresponding feature(s) of that claim element. I cite the relevant portions from both the '406 App. and the '153 Prov. Because all of the claim elements of the proposed substitute claims are fully disclosed in the application as filed and in the corresponding priority application, in my opinion, the proposed substitute claims do not introduce new subject matter and also meet the written description and enablement requirements.

1. Proposed substitute claim 22 (Substitute for Claim 21)

a [22.pre] “A device configured to communicate identification information associated with a low-altitude aircraft, the device comprising:”

78. Support for the preamble is found in the '406 App. and the '153 Prov. at least at the portions cited below.

Claim Element	Support in the Specification
[[21]]22.[pre] A device configured to communicate identification information associated with a low-altitude aircraft, the device comprising:	EX2015 at 2:11-17 (“a low altitude aircraft identification system composed by three components: a small aircraft electronic identification box with an embedded logger, a ground identification equipment to automatically identify the aircraft just pointing at it, and a central identification code database server. The identification code can be transmitted by a visible light color sequence or by a radio frequency signal ”), at 2:27-29 (“[i]nstead of the related art approach of stamping letters and numbers in the aircraft, the present example implementation is directed to a light array that blinks a defined color pattern sequence for each aircraft ”), at 7:3-5

Claim Element	Support in the Specification
	(“[t]he identification box 1 also has a radio antenna 5 connected to a RF module 16 shown in FIG. 2 as being connected to RF antenna 12, that transmits the same code or a modified version of the code through a radio signal ”); FIG. 1; EX2016 ¶¶ 3, 6, 8 (Abstract), 29, at 9 (FIG. 1); EX1001, 2:7-15, 2:30-33, 5:15-18, FIG. 1.

79. Thus, the '406 App. and the '153 Prov. both teach an “identification code,” that can identify a low-altitude aircraft, as the identification information. The “same code,” i.e., identification information, can be communicated using light and/or RF frequency. Therefore, each of the '303 App. and the '838 Prov. teaches the preamble of claim 1.

b [22.a] “a radio frequency communication antenna; and”

80. Support for this claim element is found in the '406 App. and the '153 Prov. at least at the portions cited below.

Claim Element	Support in the Specification
[22.a] a radio frequency communication antenna; and	EX2015 at 7:3-5 (“[t]he identification box 1 also has a radio antenna 5 connected to a RF module 16 shown in FIG. 2 as being connected to RF antenna 12 , that transmits the same code or a modified version of the code through a radio signal”), FIGS. 1, 2; EX2016 ¶ 29, at 9-10 (FIGS. 1, 2); EX1001, 5:15-18, FIGS. 1, 2.

81. The '406 App. and the '153 Prov. each discloses that the identification box includes an RF (radio frequency) module that is coupled to an RF antenna that

is shown as antenna 5 in FIG. 1 and as antenna 12 in FIG. 2. Accordingly, each of the '303 App. and the '838 Prov teaches claim element [22.a].

c [22.b] “a radio communication module coupled to the radio frequency communication antenna and configured to transmit identification information associated with the low-altitude aircraft through a transmitted radio signal,”

82. Support for this claim element is found in the '406 App. and the '153 Prov. at least at the portions cited below.

Claim Element	Support in the Specification
[22.b] a radio communication module coupled to the radio frequency communication antenna and configured to transmit identification information associated with the low-altitude aircraft through a transmitted radio signal,	EX2015 at 7:3-8 (“[t]he identification box 1 also has a radio antenna 5 connected to a RF module 16 shown in FIG. 2 as being connected to RF antenna 12 , that transmits the same code or a modified version of the code through a radio signal. The RF module 16 can receive the RF signal from identification boxes (e.g. nearby) installed in other aircrafts”), FIGS. 1 and 2; EX2016 ¶ 29, at 9-10 (FIGS. 1, 2); EX1001, 5:15-23, FIGS. 1, 2.

83. The '406 App. and the '153 Prov. each discloses that the RF module can transmit and receive signals, and is thus a communication module, that is coupled to the RF antenna 12. The RF module transmits the code, i.e., the identification information associated with the low-altitude aircraft, through the RF antenna that transmits a radio signal. Accordingly, each of the '303 App. and the '838 Prov teaches claim element [22.b].

d [22.c] “wherein the radio communication module is configured to receive a radio signal and store the received information in a storage,”

84. Support for this claim element is found in the ’406 App. and the ’153 Prov. at least at the portions cited below.

Claim Element	Support in the Specification
[22.c] wherein the radio communication module is configured to receive a [[received]] radio signal and store the <u>received</u> information in a storage,	EX2015 at 7:5-8 (“[t]he RF module 16 can receive the RF signal from identification boxes (e.g. nearby) installed in other aircrafts, and save this information in the non-volatile storage module 15 that is connected to the memory card installed in the memory card slot 7”), 9:18-21 (“[t]he RF receiver and transmitter 16 and 37 in both the identification box 1 and the ground device 21 creates a duplex communication. Therefore, the identification box 1 and ground device 21 together can exchange information through light or RF . This feature allows other applications. One example application may be to send data to an UAV through light and RF ”); EX2016 ¶ 36; EX1001, 5:18-23, 6:63-7:2.

85. Thus, the ’406 App. and the ’153 Prov. each teaches that the RF module of the identification box can receive information from the respective identification boxes of the nearby aircraft, and can also receive data from a ground device. The information received via RF signals is stored in a storage module / memory. Accordingly, each of the ’303 App. and the ’838 Prov teaches claim element [22.c].

e [22.d] “wherein the radio frequency communication antenna is coupled to the low-altitude aircraft and”

86. Support for this claim element is found in the ’406 App. and the ’153 Prov. at least at the portions cited below.

Claim Element	Support in the Specification
[22.d] wherein the radio frequency communication antenna is coupled to the low-altitude aircraft and	EX2015 at 12:13-14 (“FIG 7 shows the identification box software flow, according to the example implementation”), at 13:1-6 (“[a]s shown in flow 72 ... at 721, light sensor detects a light beam. For example, the light beam may be received from the ground device. At 722, the central control module receives the light beam information, and verifies the wavelength of the light beam. Based on the wavelength of light beam, it is determined whether the received light beam is a light beam associated with an instruction for that aircraft associated with the identification box that is attached to the aircraft”), FIG. 7; EX2016 ¶ 3 (“an identification box attached to the aircraft[]”), at 15 (FIG. 7); EX1001, 8:60-61, 9:18-26, FIG. 7. <i>See supra</i> element [22.b] (disclosing that the identification box includes the RF module 16, which is coupled to the RF antenna 12).

87. Thus, both the ’406 App. and the ’153 Prov. disclose that the identification box is attached to the low-altitude aircraft. Because the RF antenna is coupled to the RF module, which is included in the identification box that is attached to the low-altitude aircraft, the RF antenna is coupled to the low-altitude aircraft. Accordingly, each of the ’303 App. and the ’838 Prov teaches claim element [22.d].

f [22.e] “the radio communication module is configured to utilize a secure identifier, and”

88. Support for this claim element is found in the ’406 App. and the ’153 Prov. at least at the portions cited below.

Claim Element	Support in the Specification
[22.e] the radio communication module is configured to utilize a secure identifier, and	EX2015 at 4:14-20 (“[t]he example implementation includes a remote (e.g., ground) device to assist the aircraft identification. Since the electronic identification box relies on visual information, the ground device is equipped with a camera, lens and image processing algorithms to capture the color sequence. In addition, this device has an RF receiver capable of receiving the identification box RF signal to connect both information sources and to verify the authenticity”); at 4:25-26 ([t]he identification device automatically handles the identification and crosschecks with the identification database”), EX2016 ¶¶ 11 (“cross both information and verify the authenticity”), 12; EX1001, 3:37-44, 3:53-55. EX2015 at 3:4-5 (“the electronic identification box has a position logger and a transponder”), at 3:14-16 (“[t]he transponder may transmit a code similar to the one generated (e.g., blinked) by the light arrays but through the RF frequency, allowing automatic identification by any RF receiver on land, or installed in other aircrafts”); EX2016 ¶¶ 7, 8; EX1001, 2:41-42, 2:56-59.

89. Thus, the ’406 App. and the ’153 Prov. both teach that the ground station crosschecks / cross-verifies two identifiers – the “code,” i.e., the transmitted identification information, which can be transmitted through RF, and another “similar” code, i.e., the security identifier. *See infra* element [22.i]

(describing cross-verification of transmitted identification information and the security code). Accordingly, each of the '303 App. and the '838 Prov teaches claim element [22.e].

g [22.f] “the radio communication module is configured for two-way communication with a remote portable detection system; and”

90. Support for this claim element is found in the '406 App. and the '153 Prov. at least at the portions cited below.

Claim Element	Support in the Specification
[22.f] the radio communication module is configured for two-way communication with a remote portable detection system; and	EX2015 at 8:1-3 (“[t]he other component of the example implementation is the ground identification device 21, which is remote from the UAV or UAS, as shown in left and right perspective in FIG[S]. 3A and 3B respectively, and with its internal schematic in FIG. 4”), at 8:6-9 (“the ground identification device 21 may be a mobile communication device (e.g., smartphone”), ”); FIGS. 3A-5; EX2016 ¶¶ 32, ¶¶ 4 (“a ground identification device to identify the aircraft by just pointing at it”), 12 (“if the ground user wants to check if one specific vehicle has permission to fly in that area, he just points the identification device to the aircraft”), 36 (“[t]he user goes outside, points the ground device 21 to the UAV”), 37 (“the ground device 21 is attached to an aircraft”), at 11-13 (FIGS. 3A-5); EX1001, 5:55-59, 5:63-67, FIGS. 3A-5. EX2015 at 8:28-30 (“[t]he ground identification device 21 also can detect aircrafts through the RF signal transmitted from the identification box RF module 16. The signal is received by the RF receiver antenna 26 connected to the RF receiver module 37, shown as antenna 33 in FIG. 4”), at 9:18-21 (“[t]he RF receiver and transmitter 16 and 37 in both the

Claim Element	Support in the Specification
	identification box 1 and the ground device 21 creates a duplex communication. Therefore, the identification box 1 and ground device 21 together can exchange information through light or RF"); EX2016 ¶¶ 33, 36; EX1001, 6:31-35, 6:63-67. <i>See supra</i> element [22.b] (disclosing that the RF module 16, i.e., the radio communication module, includes the RF antenna 12).

91. Thus, the '406 App. and the '153 Prov. discloses a ground identification device that is remote and that can be a mobile device such as a smartphone and/or a device that can be pointed at a low-altitude aircraft by a user and that can be attached to such an aircraft. As such, the ground detection device is a remote portable detection system. Moreover, RF receiver and transmitter, i.e., RF antennas 16 (in the RF module of the identification box) and 37 (in the ground identification device) create duplex, i.e., two-way communication between the RF module 16 (the radio communication module) and the ground identification device (the remote portable detection system). Accordingly, each of the '303 App. and the '838 Prov teaches claim element [22.f].

h [22.g] "wherein the device is coupled to the low-altitude aircraft and"

92. Support for this claim element is found in the '406 App. and the '153 Prov. at least at the portions cited below.

Claim Element	Support in the Specification
[22.g] wherein the device is coupled to the low-altitude aircraft and	EX2015 at 13:1-6 (“[a]s shown in flow 72 ... at 721, light sensor detects a light beam. For example, the light beam may be received from the ground device. At 722, the central control module receives the light beam information, and verifies the wavelength of the light beam. Based on the wavelength of light beam, it is determined whether the received light beam is a light beam associated with an instruction for that aircraft associated with the identification box that is attached to the aircraft ”); EX2016 ¶ 3 (“an identification box attached to the aircraft[]”); EX1001, 9:18-26.

93. The ’406 App. and the ’153 Prov. describe that the identification box, i.e., the device, is attached to the low-altitude aircraft. Accordingly, each of the ’303 App. and the ’838 Prov teaches claim element [22.g].

i [22.h] “the remote portable detection system includes a user interface configured to provide to a user, information associated with a plurality of different low-altitude aircrafts detected by the remote portable detection system, and”

94. Support for this claim element is found in the ’406 App. and the ’153 Prov. at least at the portions cited below.

Claim Element	Support in the Specification
[22.h] the remote portable detection system includes a user interface configured to provide to a user, information associated with a plurality of different low-altitude aircrafts detected by the	EX2015 at 8:1-3 (“[t]he other component of the example implementation is the ground identification device 21, which is remote from the UAV or UAS, as shown in left and right perspective in FIG[S]. 3A and 3B respectively, and with its internal schematic in FIG. 4. In addition, the main user interface is shown in FIG. 5”), at 8:16-18 (“[i]n case of a successful detection, the detected code is informed to the

Claim Element	Support in the Specification
remote portable detection system[[.]], and	touchscreen 24, in the field 51 as shown in FIG. 5. A detection window 54 will be shown around the detected aircraft”), FIG. 5; EX2016 ¶¶ 17, 23, 32, at 13 (FIG. 5); EX1001, 5:55-60, 6:13-16, FIG. 5 EX2015 at 8:28-9:5 (“[t]he ground identification device 21 also can detect aircrafts through the RF signal transmitted from the identification box RF module 16. The signal is received by the RF receiver antenna 26 connected to the RF receiver module 37, shown as antenna 33 in FIG. 4. Since many signals can be received at the substantially same time by the receiver module 37, the detected ids are presented in the field 55 in a list format. If at any time the user decides to use the touchscreen 24 to select (e.g., click) on any id number, a request will be made to a server following the aircraft information flow 61 of FIG. 6, to show more information about that aircraft”), FIGS. 4-6; EX2016 ¶ 33, at 12-14 (FIGS. 4-6); EX1001, 6:31-42, FIGS. 4-6.

95. Thus, the ’406 App. and the ’153 Prov. each discloses that the ground detection device has a user interface, and that the ground detection device can detect several low-altitude aircraft at the same time, and display their respective IDs in the user interface, thus provide information associated with the several detected low-altitude aircraft to the user. Accordingly, each of the ’303 App. and the ’838 Prov teaches claim element [22.h].

j [22.i] “wherein, utilizing the secure identifier comprises transmitting the secure identifier to the remote portable detection system for cross-verifying the secure identifier and the transmitted identification information, to verify authenticity of the transmitted identification information.”

96. Support for this claim element is found in the ’406 App. and the ’153

Prov. at least at the portions cited below.

Claim Element	Support in the Specification
<u>[22.i] wherein, utilizing the secure identifier comprises transmitting the secure identifier to the remote portable detection system for cross-verifying the secure identifier and the transmitted identification information, to verify authenticity of the transmitted identification information.</u>	<i>See supra</i> element [22.pre] (the “identification code,” that can identify a low-altitude aircraft, is the identification information. The “same code,” i.e., identification information, can be communicated using RF frequency). <i>See supra</i> element [22.e] (security identifier comprises a code that is “similar” to the code that is the “transmitted identification information, and the RF module transmits the similar code, i.e., the security identifier). EX2015 at 8:28-30 (“[t]he ground identification device 21 also can detect aircrafts through the RF signal transmitted from the identification box RF module 16. The signal is received by the RF receiver antenna 26 connected to the RF receiver module 37, shown as antenna 33 in FIG. 4”); EX2016 ¶ 33; EX1001, 6:31-35. EX2015, 4:15-19 (“[s]ince the electronic identification box relies on visual information, the ground device is equipped with a camera, lens and image processing algorithms to capture the color sequence. In addition, this device has an RF receiver capable of receiving the identification box RF signal to connect both information sources and to verify the authenticity”); EX2016 ¶ 11 (“cross both information and verify the authenticity”); EX1001, 38-44.

Claim Element	Support in the Specification
	EX2015 at 10 (“the ground device 21 can modulate data through the light beam modulator 35. The identification box central control module 18 can demodulate the light beam in order to execute commands. The light beam command transmit flow 83 shown in FIG. 8 is executed by the ground device 21. The user selects the command on the screen 24, and the light beam modulator 35 turns the light beam emitter 23 on and off in a defined frequency and protocol. The identification box light sensor 4 detects the modulated light beam and send the binary data to the central control unit 18 that [] execut[es] the light beam command execution flow 73 shown in FIG. 7. After the command execution, the identification box 1 sends the execution results (e.g. an ACK, or an error status code) to the ground identification unit 21 through the RF module 16 and it can also change the color sequence to show the result visually. For instance, the light controller module 17 can turn the red color on for a while in case of an invalid command, and the green light in case of a successfully executed command”), FIGS. 7, 8; EX2016 ¶ 38, at 15, 16 (FIGS. 7, 8); EX1001, 7:54-8:6, FIGS. 7, 8.

97. Thus, the '406 App. and the '153 Prov. each discloses that the ground device crosschecks / cross-verifies the “code,” i.e., the transmitted identification information and a code similar to the code, i.e., the secure identifier, to verify authenticity of the transmitted identification information. When the light array transmits the command execution results, the light array does not transmit the code, i.e., the identification information.

98. In that event, the RF module of the identification box transmits to the ground device, using RF, the “same code,” i.e., the identification information and a “similar” code, i.e., the secure identifier. The ground device cross-verifies these received codes, i.e., the transmitted identification information and the secure identifier, to verify authenticity of the transmitted identification information. Accordingly, each of the ’303 App. and the ’838 Prov teaches claim element [22.i].

99. In summary, the ’406 App. and the ’153 Prov. individually disclose all of the limitations recited in proposed substitute claim 22.

100. In light of the foregoing, it is my opinion that the sole proposed substitute claim 22 is fully supported by the original disclosure of the ’959 patent and the ’153 App., and that this proposed substitute claim does not add new subject matter.

XI. PROPOSED SUBSTITUTE CLAIMS ARE PATENTABLE

101. I am informed by counsel and understand that Petitioners “bear[] the burden of persuasion to show, by a preponderance of the evidence, that any proposed substitute claims are unpatentable.” 37 C.F.R. § 42.121(d)(2). Nevertheless, I discuss below that the sole proposed substitute claim 22 is patentable over the prior art cited in the Grounds asserted this IPR proceeding. I have not been provided with any particular combinations of the cited prior art as allegedly rendering proposed independent substitute claim 10 obvious. Therefore,

at this time I do not present any opinion about the motivation to combine, or lack thereof, the references that I discuss below.

102. In this IPR, the sole challenged claim is claim 21. In Ground 1, Petitioners contend that claim 21 is unpatentable over Beard-Provisional. *See* Pet. at 24-40. In Ground 2, Petitioners contend that claim 21 is unpatentable over the combination of Taveira, Wang, and Gong. *See id.* at 40-60. In Ground 3, Petitioners contend that claim 21 is unpatentable over the combination of Taveira, Qi, and Gong. *See id.* at 60-64. In Ground 4, Petitioners contend that claim 21 is unpatentable over the combination of Gong and Wang-II. *See id.* at 64-78.

103. I discussed below, combination of these references that the Petitioners presented in the context of the limitations of the sole proposed substitute claim 22. In particular, proposed independent substitute claim 22 recites “utilizing the secure identifier comprises transmitting the secure identifier to the remote portable detection system for cross-verifying the secure identifier and transmitted identification information, to verify authenticity of the transmitted identification information.”

104. Among the IPR Prior Art, Beard-Provisional in my opinion is not prior art with respect to proposed substitute claim 22. In the Institution Decision, the Board determined, based on an interpretation of the claim term “secure identifier,” that the ’959 patent is not entitled to claim priority to the ’153

provisional. Paper 13 at 12. I acknowledge the Board’s preliminary construction of “secure identifier,” *id.* at 10.

105. In proposed substitute claim 22, “utilize secure identifier” is defined in a manner that is consistent with the Board’s interpretation and that is fully supported by both the ’406 App. and the ’153 provisional. *See supra* § IV. All other limitations of proposed substitute claim 22 are also fully disclosed by both the ’406 App. and the ’153 provisional. *See id.* Therefore, in my opinion, proposed substitute claim 22 is entitled to claim priority to the ’153 provisional. Therefore, Beard-Provisional is not prior art.

106. Regarding Taveira and Wong, Petitioners allege that their combination teaches the “secure identifier” because Taveira’s SSIDs and MAC addresses may be encrypted as taught by Wang. *See Pet.* at 40, 53-54. Patent Owner’s Preliminary Response discussed that a POSITA would not combine Taveira and Wang. *See Paper 10* at 36-42. In this declaration, I do not opine on the motivation to combine Taveira and Wong.

107. To the extent Taveira’s SSID and MAC addresses can or would be encrypted per Wang’s teachings, the Taveira-Wang combination does not teach or suggest “transmit[ing] identification information” and “transmitting the secure identifier to the remote portable detection system,” as proposed substitute claim 22 recites. The Taveira-Wang combination also does not teach or suggest “cross-

verifying the secure identifier and transmitted identification information, to verify authenticity of the transmitted identification information” as proposed substitute claim 22 further recites.

108. Regarding Taveira, Qi, and Gong, Petitioners allege that their combination teaches the “secure identifier” because Taveira’s SSIDs and MAC addresses may be updated periodically as taught by Qi. *See* Pet. at 60-61. Patent Owner’s Preliminary Response discussed that a POSITA would not combine Taveira, Qi, and Gong. *See* Paper 10 at 49-51. In this declaration, I do not opine on the motivation to combine Taveira, Q, and Gong. Even if Taveira, Qi, and Gong could or would be combined, neither of these references teaches or suggests the above-discussed limitations that proposed substitute claim 22 recites.

109. Regarding Gong and Wang-II, Petitioners allege that in the Gong-Wang-II combination, Gong teaches the “secure identifier.” Gong’s UAV identifier may be encrypted. *See* Pet. at 74. Patent Owner’s Preliminary Response discussed why a POSITA would not combine Gong and Wang-II. *See* Paper 10 at 56-57. In this declaration, I do not opine on the motivation to combine Gong and Wang-II.

110. Even if Gong and Wang-II could or would be combined, neither of these references teaches or suggests “transmit[ting] identification information” and also “transmitting the secure identifier to the remote portable detection system,” as proposed substitute claim 22 recites. In my opinion, the Gong-Wang -II

combination also does not teach or suggest “cross-verifying the secure identifier and transmitted identification information, to verify authenticity of the transmitted identification information” as proposed substitute claim 22 further recites.

111. Because none of the IPR Prior Art teaches or suggests at least the above-stated limitations of proposed substitute claim 22, it is my opinion that proposed substitute claim 22 claim is patentable.

XII. CONCLUSION

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

113. 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.

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

115. 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 or Title 18 of the United State Code, and that such willful false statements may jeopardize the validity of the '959 patent.

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

Dated: December 19, 2025

Respectfully submitted,

A handwritten signature in black ink, appearing to be 'N. Papanikolopoulos', written over a light gray rectangular background.

Dr. Nikolaos Papanikolopoulos