Petitioners Axon Enterprise, Inc. and Dedrone Holdings, Inc. Hearing Presentation for IPR2025-00525

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

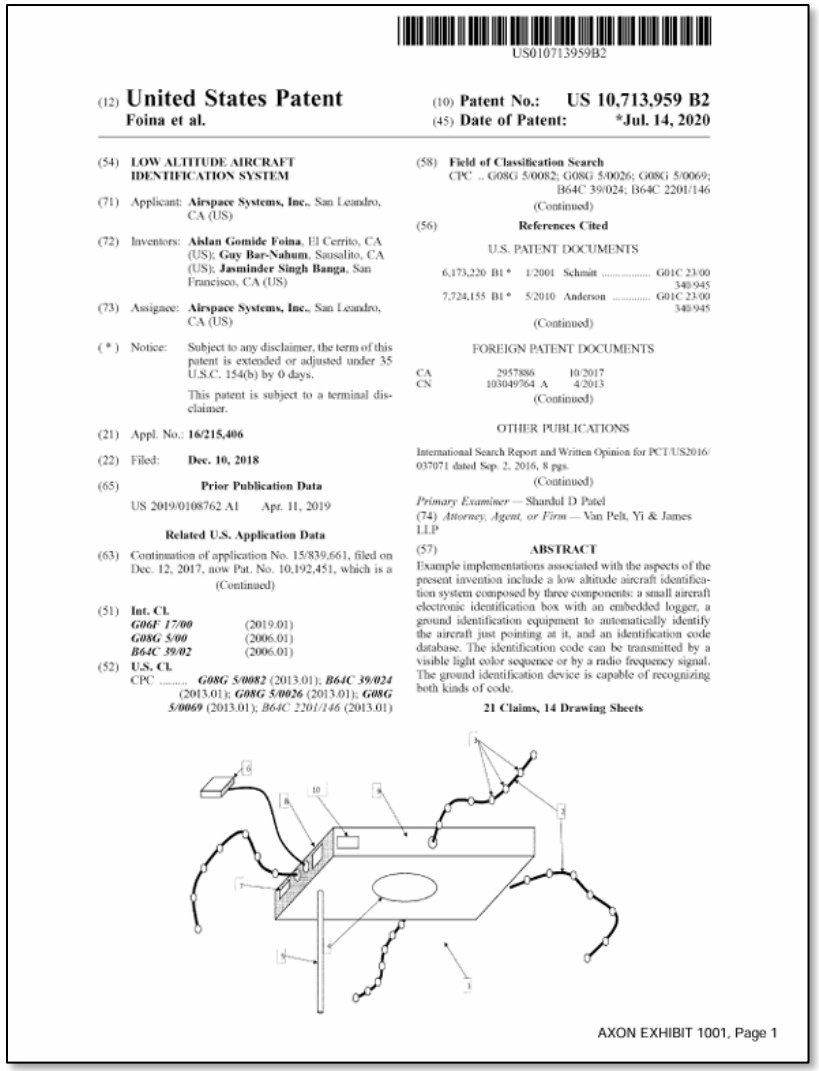
Outline of Arguments: IPR2025-00525 ('959 Patent)

I. **Overview of the '959 Patent and Procedural History**
II. **Dispute Overview**
III. **Substitute Claim 22 Lacks Written Description**
IV. **Substitute Claim 22 is Indefinite**
V. **The Amendments Impermissibly Broaden Substitute Claim 22**
VI. **Obviousness of Substitute Claim 22: Ground 5B**
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'959 Patent Overview



US010713959B2

(12) **United States Patent**
Foina et al.

(10) **Patent No.: US 10,713,959 B2**
(45) **Date of Patent: *Jul. 14, 2020**

(54) **LOW ALTITUDE AIRCRAFT IDENTIFICATION SYSTEM**

(71) Applicant: **Airspace Systems, Inc.**, San Leandro, CA (US)

(72) Inventors: **Aislan Gomide Foina**, El Cerrito, CA (US); **Guy Bar-Nahum**, Sausalito, CA (US); **Jasminder Singh Banga**, San Francisco, CA (US)

(73) Assignee: **Airspace Systems, Inc.**, San Leandro, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **16/215,406**

(22) Filed: **Dec. 10, 2018**

(65) **Prior Publication Data**

US 2019/0108762 A1 Apr. 11, 2019

Related U.S. Application Data

(63) Continuation of application No. 15/839,661, filed on Dec. 12, 2017, now Pat. No. 10,192,451, which is a (Continued)

(51) **Int. Cl.**
G06F 17/00 (2019.01)
G08G 5/00 (2006.01)
B64C 39/02 (2006.01)

(52) **U.S. Cl.**
CPC ***G08G 5/0082*** (2013.01); ***B64C 39/024*** (2013.01); ***G08G 5/0026*** (2013.01); ***G08G 5/0069*** (2013.01); *B64C 2201/146* (2013.01)

(58) **Field of Classification Search**
CPC .. G08G 5/0082; G08G 5/0026; G08G 5/0069; B64C 39/024; B64C 2201/146
(Continued)

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(57) **ABSTRACT**

Example implementations associated with the aspects of the present invention include 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 an identification code database. The identification code can be transmitted by a visible light color sequence or by a radio frequency signal. The ground identification device is capable of recognizing both kinds of code.

21 Claims, 14 Drawing Sheets

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continuation of application No. PCT/US2016/037071, filed on Jun. 10, 2016.

(60) Provisional application No. 62/175,153, filed on Jun. 12, 2015, provisional application No. 62/566,450, filed on Oct. 1, 2017.

Patent Owner cites to the '406 application and '153 Provisional to support the substitute claims

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Pet. (Paper 1) at 2-5; Revised Motion to Amend ("RMTA") (Paper 26) at 1-2; EX1001, Cover

'959 Patent: Overview of Original Independent Claim 21

A device configured to communicate identification information associated with a low-altitude aircraft, the device comprising:

a radio frequency communication antenna;

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,

wherein the radio communication module is configured to receive a received radio signal and store the information in a storage,

wherein the radio frequency communication antenna is coupled to the low-altitude aircraft and

the radio communication module is configured to utilize a secure identifier,

and the radio communication module is configured for two-way communication with a remote portable detection system;

and wherein the device is coupled to the low-altitude aircraft and

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.

EX1015; EX1001, Claim 21

Procedural History: '959 Patent

- The Petition (Paper 1) challenged claim 21 of the '959 Patent over the following grounds:

Ground	Claim	Basis (35 U.S.C. §)	Prior Art
1	21	103	*Beard*
2	21	103	*Taveira, Wang, Gong*
3	21	103	*Taveira, Qi, Gong*
4	21	103	*Gong, Wang-II*

  - The Petition further demonstrated that the '959 Patent is not entitled to claim priority to the '153 Provisional or the '071 PCT Application, and that its priority is no earlier than October 1, 2017.

- Patent Owner filed a Preliminary Response (POPR) (Paper 10)

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Pet. (Paper 1) at 7-16, 21; POPR (Paper 10)

Procedural History: '959 Patent

- The Board instituted trial (Paper 13)
  - The Board construed "**secure identifier**" as "**a credential that can be used to securely verify the identity of a device, such as an airborne object or ground-based transmitter**."
  - The Board determined that claim 21 is **not entitled** to claim priority to the '153 Provisional or the '071 PCT Application, and that its priority is no earlier than October 1, 2017.
  - The Board agreed that Ground 1 (Beard) demonstrated a reasonable likelihood of success that claim 21 is unpatentable, and further instituted Grounds 2-4.

Institution Decision (I.D.) (Paper 13) at 6-15

Procedural History: '959 Patent

- Patent Owner filed a Non-Contingent Motion to Amend (Paper 16) presenting Substitute Claim 22
  - Patent Owner did not file a Patent Owner's Response
- Petitioners filed an Opposition to Motion to Amend (Paper 21)
- The Board issued Preliminary Guidance (Paper 23) finding that:
  - "Patent Owner has not shown a reasonable likelihood that the original disclosure of the '959 patent, as identified in the '406 application, provides adequate written description support for all the limitations of proposed substitute claim 22."
  - "Petitioner has shown a reasonable likelihood that proposed substitute claim 22 would have been obvious[.]"

Preliminary Guidance (Paper 23) ("PG") at 8, 10-14

Procedural History: '959 Patent

- Patent Owner filed a Non-Contingent Revised Motion to Amend (Paper 26) presenting a revised Substitute Claim 22
- Petitioners filed an Opposition to Revised Motion to Amend (Paper 33)
- Patent Owner filed a Reply to the Opposition (Paper 35)
- Petitioners filed a Sur-Reply to the Reply (Paper 37)

'959 Patent: Overview of Substitute Independent Claim 22

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

[22.a] a radio frequency communication antenna; and

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

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

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

[22.e] the radio communication module is configured to utilize a secure identifier, the secure identifier comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft, [[and]]

[22.f] wherein utilizing the secure identifier comprises receiving by the radio communication module the specified excitation from a remote portable detection system, wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof,

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

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

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

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RMTA, Appx. at 1-2

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Dispute Overview

- **PO Disputes**:
  - Whether *the radio communication module is configured to utilize a secure identifier, the secure identifier comprising a specified excitation enabling disambiguation…, wherein utilizing the secure identifier comprises receiving by the radio communication module the specified excitation from a remote portable detection system…***lacks written description support**
  - Whether *low altitude aircraft* is **indefinite**
  - Whether *the received information* is **indefinite**
  - Whether SC 22 **enlarges claim scope**
  - Whether Grounds 5B-12B **teach** *to change a behavior*
  - Whether Grounds 5B-12B **teach** *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*

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See generally **RMTA; PO Reply to Pet. Opp. To RMTA (Paper 29) ("PO Reply"); Pet. Sur-Reply (Paper 37) ("Sur-Reply")**

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Substitute Claim 22 requires a "secure identifier" that (i) is transmitted from a remote portable detection system to an aircraft and (ii) comprises a specified excitation (elements [22e] and [22.f])

- The claimed *radio communication module* on-board the aircraft *utilize[s]* the *secure identifier* by receiving the *specified excitation*.

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

[22.a] a radio frequency communication antenna; and

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

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

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

[22.e] the radio communication module is configured to utilize a secure identifier, the secure identifier comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft, [[and]]

[22.f] wherein utilizing the secure identifier comprises receiving by the radio communication module the specified excitation from a remote portable detection system, wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof,

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RMTA, Appx. at 1

No Written-Description Support Exists

- PO **cannot** show sufficient support because the amendments:
  - seek to **reverse** the only disclosed directional flow of the secure identifier
  - rely upon **light array embodiments** that do not support the claimed requirement that the secure identifier be received by the **radio communication module**; and
  - conflate the secure identifier with **generic light beam disclosures**.

Pet. Opp. to RMTA ("Oppo.") at 1

The specification lacks any description of a secure identifier being received by an aircraft on the uplink from a remote portable detection system

- The term "secure identifier" never appears in the specification.
  - A **generic identification code** is **not** a *secure identifier*

- The only contextual clue of the intrinsic record is in the patent's dependent claim 3, which states that the "secure identifier" comprises a rotating SSID.

> 3. The device of claim 1, further comprising a housing that protects the device against impact and weather, wherein a light detection sensor is coupled to the low-altitude aircraft, and the secure identifier comprises a rotating Service Set Identifier (SSID) associated with headers of packets sent over a wireless local-area network.

- **Nowhere does the patent describe the SSID—or any "secure identifier"—as transmitted from a remote portable detection system up to the aircraft, as PO tries to claim.**

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Oppo. at 1; Sur-Reply at 1-2; Preliminary Guidance ("PG") (Paper 23) at 7; EX1001 at Claim 3

PO improperly relies on optical embodiments to satisfy limitations tied to a radio receiver

- SC 22 requires that the radio communication module receives the specified excitation that forms the secure identifier.

- **Every disclosure** PO cites to support this element relates to receiving a physical beam **via a photo sensor or light array**.

  - **Receiving excitation through a photo or light sensor does not support reception by a radio communication module as claimed.**

Oppo. at 2-3; Sur-Reply at 2-3

PO improperly relies on optical embodiments to satisfy limitations tied to a radio receiver

- EX2015 at 3:22-26

> The identification box has a photo sensor configured to receive external signals. In case the photo sensor is excited with a high luminous beam in a specific wavelength and modulation, such as a laser beam, the identification box may change its operational behavior. The identification box can, for instance, change its light brightness, send commands to the autopilot, increase the data storage frequency, but is not limited thereto.

- *Id.*, 3:31-4:4

> transmitting each identification code. Therefore, it is just a matter of 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. This feature creates a duplex communication, allowing the identification box to send broadcast data by its color light emitters, and receive directional data through the light sensor.

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Oppo. at 2-3; Sur-Reply at 2-3

PO improperly relies on optical embodiments to satisfy limitations tied to a radio receiver

- *Id.*, 9:6-12

In order to activate (e.g., excite) the identification box light sensor 19, 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 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, for example but not by way of limitation, bold-text.

The ground device internal components are protected by a weather proof

- *Id.*, 9:15-21

The identification box light emitters 3 and light sensor 4 of the identification box 1 create a two-way communication system. Similarly, the ground device camera 22 and light beam emitter 23 of the ground device 21 also create a two-way communication system. The 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.

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Oppo. at 2-3; Sur-Reply at 2-3

Exchanging generic information over RF does not provide support

– Exchanging generic information over RF does not disclose receiving the specifically-claimed secure identifier comprising a specified excitation.

- EX2015, 9:15-21

> The identification box light emitters 3 and light sensor 4 of the identification box 1 create a two-way communication system. Similarly, the ground device camera 22 and light beam emitter 23 of the ground device 21 also create a two-way communication system. The 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.

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Oppo. at 2-3; Sur-Reply at 3-5; EX2015 at 9:15-21; EX1027, ¶¶31-33

PO incorrectly conflates two completely distinct concepts: the claimed secure identifier and disclosures about a generic light beam

- **PO's citations to generic light beams do not support a secure identifier.**
  - PO cannot rely on obviousness to establish written description.
  - *L.A. Biomedical Rsch. Inst. at Harbor-UCLA Med. Ctr. v. Eli Lilly & Co.*, 849 F.3d 1049, 1057 (Fed. Cir. 2017) ("L.A. Biomed.")

- Patent Owner relies solely on passages describing how a "**photo sensor is excited with a high luminous beam**" to trigger a behavior change.
  - Citing EX2015 at 3:22-26, 3:31-4:4, 9:6-12, 9:15-21 (discussed previously).

- An aircraft **receiving a laser beam or light beam** to provoke a physical reaction **does not support the reception, by the claimed radio communication module, of a secure identifier** or, as construed, a "**credential that can be used to securely verify** the identity of a device."

Oppo. at 3-4; Sur-Reply at 3-6

PO incorrectly conflates two completely distinct concepts: the claimed secure identifier and disclosures about a generic light beam

- PO's wrongly argues a POSITA would recognize optical disclosures are "equally applicable to the RF-only embodiments"
  - **PO makes an <u>unsupported leap of impermissible obvious</u>**
  - The specification **provides no RF-only embodiments** and **<u>does not say</u>** that **optical embodiments would be implemented by RF**
  - ***<u>Written description requires demonstrating possession of the invention via the intrinsic record, and not expert conjecture about obvious design choices or "equally applicable" modifications</u>***

Oppo. at 3-4; Sur-Reply at 3-6

The claimed secure identifier lacks support in the '153 Provisional and the priority claim to the '071 PCT application is deficient for the same reasons discussed in the Petition and ID

- The **Institution Decision** construed secure identifier as a "**credential that can be used to securely verify the identity of a device**."
  - PO **did not challenge** the Board's construction
  - Nothing in the patent connects the secure identifier, or that term as construed, to the claimed excitation and change in aircraft behavior.

- The Petition demonstrated "secure identifier" is not adequately supported by the '153 Prov. (EX2016), and not entitled to claim priority to PCT/US2016/037071 ("the '071 Application").
- The Board agreed in the ID, and the same secure identifier limitation is recited by the SC.

> Based on our review of the '153 Provisional and '071 Application, we preliminarily conclude that neither of these applications would have reasonably conveyed to a person of ordinary skill in the art that the inventor then had possession of the concept of the "secure identifier" that was later claimed in the '959 Patent.

- The RMTA does not properly address the Board's analysis of the ID or the priority issues raised by the Petition.

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Oppo. at 3-5; Sur-Reply at 3-6; Institution Decision (ID) (Paper 13) at 6-14; Petition (Paper 1) (Pet.) at 7-16

Conclusion: Elements [22.e] and [22.f] are Not Supported

- **SC 22 requires a secure identifier that comprises a specified excitation and that causes the first low-altitude aircraft to change a behavior thereof.**

- PO points **solely to descriptions of a light beam—disconnected from any discussion of a secure identifier**—as providing support.
  - But this new combination of concepts appears nowhere in the specification, and PO's attempt to stitch it together fails.

- **The patent <u>never describes</u> a secure identifier as comprising an excitation enabling disambiguation of the aircraft and that causes the first low-altitude aircraft to change a behavior thereof.**

Oppo. at 3-4; Sur-Reply at 3-5

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Substitute Claim 22 is Indefinite – "low altitude aircraft"

- Substitute Claim 22 recites "**low altitude** aircraft"

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

[22.a] a radio frequency communication antenna; and

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

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

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

[22.e] the radio communication module is configured to utilize a secure identifier, the secure identifier comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft, [[and]]

[22.f] wherein utilizing the secure identifier comprises receiving by the radio communication module the specified excitation from a remote portable detection system, wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof,

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

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

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

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RMTA, Appx. at 1-2

"low altitude" is a term of degree without objective boundaries

- The specification provides **no objective standard** for determining what constitutes a *"low altitude" aircraft*.

- For terms of degree, "the patent must provide 'some standard for measuring that degree.'"

  – Relative modifiers like "high" (and "low") are terms of degree that have been held **indefinite when the intrinsic record lacks objective guidance**.

Oppo. at 5-6

"low altitude" is a term of degree without objective boundaries

- "**Low altitude**" aircraft is a classic **term of degree**; whether an altitude is low or not is a matter of degree.

- The specification **does not provide any objective boundaries or guidance** for determining when an altitude is "low" or not in the context of aircraft.
  - EX1001, 1:29-31, 4:37-40

> Aspects of the example implementations are directed to methods and systems for identification of airborne objects at a low altitude, and more specifically, to systems and methods for identification of low-altitude aircraft.

> Described herein are example embodiments of systems, devices, and methods that enable identification of airborne objects at a low altitude, and more specifically, to systems and methods for identification of low-altitude aircraft.

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Oppo. at 5-6

PO and its expert demonstrate indefiniteness

- PO says "[t]he 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.'"
  - EX1001, 1:50-52

> system for related art UAVs and/or UASs. For related art small UASs (e.g., aircrafts up to 25 pounds flying up to 500 ft of the low altitude airspace), related art tail numbers that are used in commercial aircraft are too large in size (e.g., area) to be provided on these vehicles, or they will be too small to allow the small UAS identification.

- This **does not say what the meaning of "low altitude" is** and only refers to a **portion (500 ft)**"of the "low altitude airspace."
  - The specification **does not reveal** what the remaining portion is.

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Oppo. at 5-6; PO Reply at 5; Sur-Reply at 6-8

PO Never Reveals its Position on the Meaning of "Low Altitude Aircraft"

- The entirety of PO's Reply on this issue:

> A. The meaning of "low altitude aircraft" is clear to a POSITA
>
> A POSITA would readily apprehend the meaning of "low altitude aircraft." EX2018, ¶92. 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." EX1001, 1:50-52; *see also id.*, 2:35-36. Thus, the meaning of "low-altitude aircraft" as recited in SC 22, is clear. *See also* 14 C.F.R. § 91.119(c).

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PO Reply at 5

PO and its expert demonstrate indefiniteness

- The specification's **lack of description and objective boundaries** thus renders the SC indefinite.
  - *Hall. v U.S.W.S.*, IPR2022-00074, Paper 56 at 23-34 (PTAB 2023) ("high pressure" indefinite due to lack of "objective boundaries" in the specification, which thus failed to inform POSITAs about invention scope with reasonable certainty).

Oppo. at 5-6; PO Reply at 5; Sur-Reply at 6-8

PO and its expert demonstrate indefiniteness

- PO's citation to 14 C.F.R. § 91.119(c) demonstrates indefiniteness
  - Subsection (c) [cited by PO] says that in "other than congested areas" **the minimum altitude is 500 feet**
  - Subsection (b) [not cited by PO] says that in "congested areas" the **minimum altitude is "1000 feet** above the highest obstacle" within a 2000 feet horizontal radius

Oppo. at 5-6; PO Reply at 5; Sur-Reply at 6-8; EX1032; EX1031, 27:22-31:17

PO and its expert demonstrate indefiniteness

- What is PO's position on the meaning of *low altitude aircraft*?
  - Aircraft flying **below** 500 feet?
  - Aircraft flying **above** 500 feet?
  - Aircraft flying **above** 1000 feet?

- Does the meaning of *low altitude aircraft* change depending on whether it is operated in "congested areas" or "other than congested areas?"
  - **PO never says.**

Oppo. at 5-6; PO Reply at 5; Sur-Reply at 6-8

PO and its expert demonstrate indefiniteness

- **PO's expert adds further confusion**
  - *low altitude* airspace could go up to 14,000 feet or 18,000 feet, and also changes based on location
  - *low altitude aircraft* "depends on the type of plane"
  - *low altitude aircraft* have a minimum altitude of 500 feet
    - **Contradicts** specification's "up to 500 feet of the low altitude airspace" statement
  - minimum altitudes differ depending on a "highest obstacle" which itself may be "completely different" based on location

- **The lack of objective standard, ambiguity, and different potential meanings of *low altitude aircraft* in different circumstances demonstrates indefiniteness.**
  - *Halliburton Energy Servs., Inc. v. M-I LLC*, 514 F.3d 1244, 1255 (Fed. Cir. 2008)

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Oppo. at 5-6; PO Reply at 5; Sur-Reply at 6-8

PO and its expert demonstrate indefiniteness

- EX1031, 22:16-17

> Q So the low-altitude airspace could go up to 14,000 feet or it could go up to 18,000 feet?
>
> A Per FAA.

- *Id.*, 23:5-6

> A You have to look either at the patent at hand or the FAA rules.

- *Id.*, 23:12-21

> Q If a drone is flying at 600 feet, is it a low-altitude aircraft under the '959 Patent?
>
> A It can be, if we...
>
> (Document Review)
>
> So, for example, something that I have been thinking, to answer your question, is that you can look at this from the other perspective. If it is above 18,000 feet, per FAA rules it won't be -- for sure it won't be a low-altitude aircraft.

AXON EXHIBIT 1035

Oppo. at 5-6; PO Reply at 5; Sur-Reply at 6-8

PO and its expert demonstrate indefiniteness

- *Id.*, 25:9-11

> Q Is an airplane a low-altitude aircraft?
>
> A During landing and during certain phases. Depends on the altitude. And depends also on the type of the plane.

- *Id.*, 29:13-17

> Q Does a low-altitude aircraft under the '959 Patent have a minimum altitude?
>
> A According to FAA, yes.
>
> Q What is that altitude?
>
> A 500 feet.

- *Id.*, 30:15-21

> Q So over a congested area does a low-altitude aircraft as interpreted under the '959 patent claims have a minimum altitude of 1,000 feet over the highest obstacle?
>
> A According to what it says, yes. But I don't know -- I mean, I don't know how specific this case is.

AXON EXHIBIT 1035

Oppo. at 5-6; PO Reply at 5; Sur-Reply at 6-8

PO and its expert demonstrate indefiniteness

- *Id.*, 31:1-6

> A I mean, you have normal operations. And here it says, for example, the highest obstacle. How do you define the highest obstacle? You see like, for example, when we are talking about Minneapolis and New York and Sacramento, the highest obstacle may be completely different.

AXON EXHIBIT 1035

Oppo. at 5-6; PO Reply at 5; Sur-Reply at 6-8

Substitute Claim 22 is Indefinite – "the received information"

- Substitute Claim 22 recites "the received information"

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

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

RMTA, Appx. at 1

"the received information" lacks antecedent basis

- Radio signals **do not** necessarily contain information
  - PO argues "[a] POSITA would readily understand that because radio signals contain information, the received radio signal contains the received information." [Reply, 5-6].
    - This is wrong and PO is contradicted by its own evidence: **noisy radio signals are missing information**
      - EX2025, 19-20

> Evidently the proper correction to apply to the amount of information transmitted is the amount of this information which is missing in the received signal, or alternatively the uncertainty when we have received a signal of what was actually sent. From our previous discussion of entropy as a measure of uncertainty it

AXON EXHIBIT 1035

Oppo. at 6-7; Sur-Reply at 8-9

Outline of Arguments: IPR2025-00525 ('959 Patent)

I. Overview of the '959 Patent and Procedural History
II. Dispute Overview
III. Substitute Claim 22 Lacks Written Description
IV. Substitute Claim 22 is Indefinite
V. **The Amendments Impermissibly Broaden Substitute Claim 22**
VI. Obviousness of Substitute Claim 22: Ground 5B
VII. Obviousness of Substitute Claim 22: Grounds 6B and 7B
VIII. Obviousness of Substitute Claim 22: Ground 8B
IX. Obviousness of Substitute Claim 22: Ground 9B, 10B, 11B, and 12B

The Amendments Impermissibly Broaden Substitute Claim 22

- Original claim 21 recited a device comprising a radio communication module configured to "receive a **received** radio signal." [EX1001, Claim 22]
  - The amendments of SC 22 remove the term "**received**." [RMTA, 4]

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

  - This amendment **changes meaning and impermissibly broadens**.

AXON EXHIBIT 1035

Oppo. at 7; Sur-Reply at 9

The Amendments Impermissibly Broaden Substitute Claim 21

- Removing "received" **no longer limits** the signal received by the radio communication module to radio signals **already received** by the device, its radio frequency communication antenna, or another component.

- The specification describes **multiple components that receive radio signals**, including antenna and components of drone operation logic 1400 in Fig.14, such as digital signal processor 1426. [EX2015, 18:18-19:12, Fig. 14]

- **PO's expert agreed**:
  - EX1031, 14:12-14

> Q Does DSP 1426 send and receive signals between -- to and from main controller 1404?
>
> A Among other things.

- Nothing supports that the amendment addresses "a typographical correction."

AXON EXHIBIT 1035

Oppo. at 7; Sur-Reply at 9; EX1031, 12:19-15:14

Outline of Arguments: IPR2025-00525 ('959 Patent)

I. Overview of the '959 Patent and Procedural History
II. Dispute Overview
III. Substitute Claim 22 Lacks Written Description
IV. Substitute Claim 22 is Indefinite
V. The Amendments Impermissibly Broaden Substitute Claim 22
VI. **Obviousness of Substitute Claim 22: Ground 5B**
VII. Obviousness of Substitute Claim 22: Grounds 6B and 7B
VIII. Obviousness of Substitute Claim 22: Ground 8B
IX. Obviousness of Substitute Claim 22: Ground 9B, 10B, 11B, and 12B

Prior Art Grounds

Ground	SC	35 U.S.C. §	Prior Art
5B	22	103	Beard, Viggiano, and Hayes
6B	22	103	Taveira, Wang, Gong, Viggiano, and Hayes
7B	22	103	Taveira, Qi, Gong, Viggiano, and Hayes
8B	22	103	Gong, Wang-II, Viggiano, and Hayes
9B	22	103	Beard, Viggiano, Hayes, and FF
10B	22	103	Taveira, Wang, Gong, Viggiano, Hayes, and FF
11B	22	103	Taveira, Qi, Gong, Viggiano, Hayes, and FF
12B	22	103	Gong, Wang-II, Viggiano, Hayes, and FF

Oppo. at 8

Prior Art Grounds - Dispute Overview

- **PO Disputes**:
  - Whether Grounds 5B-12B **teach** *to change a behavior*
  - Whether Grounds 5B-12B **teach** *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*

See generally **RMTA; PO Reply to Pet. Opp. To RMTA (Paper 29) ("PO Reply"); Pet. Sur-Reply (Paper 37) ("Sur-Reply")**

Obviousness of Substitute Claim 22: Ground 5B

Ground	SC	35 U.S.C. §	Prior Art
5B	22	103	Beard, Viggiano, Hayes

Substitute Claim 22

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

[22.a] a radio frequency communication antenna; and

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

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

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

[22.e] the radio communication module is configured to utilize a secure identifier, the secure identifier comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft, [[and]]

[22.f] wherein utilizing the secure identifier comprises receiving by the radio communication module the specified excitation from a remote portable detection system, wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof,

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

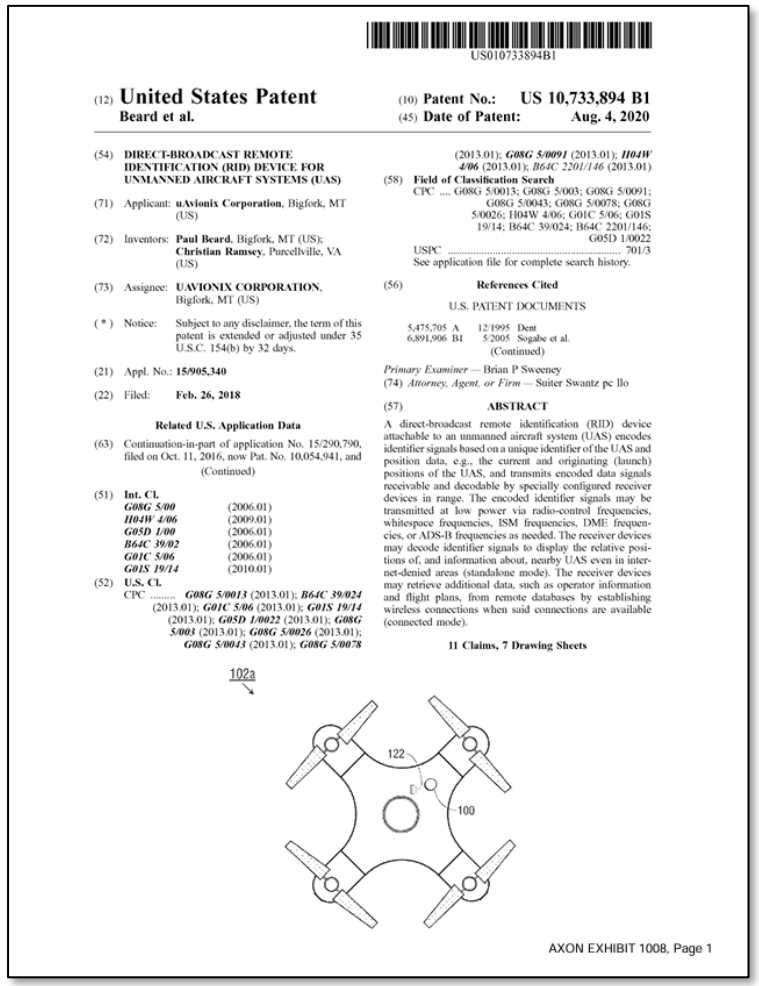
[22.h] wherein the device is coupled to the first low-altitude aircraft and

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

AXON EXHIBIT 1035

RMTA, Appx. at 1-2

Overview of Beard



US010733894B1

(12) **United States Patent**
Beard et al.

(10) **Patent No.: US 10,733,894 B1**
(45) **Date of Patent: Aug. 4, 2020**

(54) **DIRECT-BROADCAST REMOTE IDENTIFICATION (RID) DEVICE FOR UNMANNED AIRCRAFT SYSTEMS (UAS)**

(71) Applicant: **uAvionix Corporation**, Bigfork, MT (US)

(72) Inventors: **Paul Beard**, Bigfork, MT (US); **Christian Ramsey**, Purcellville, VA (US)

(73) Assignee: **UAVIONIX CORPORATION**, Bigfork, MT (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 32 days.

(21) Appl. No.: **15/905,340**

(22) Filed: **Feb. 26, 2018**

Related U.S. Application Data

(63) Continuation-in-part of application No. 15/290,790, filed on Oct. 11, 2016, now Pat. No. 10,054,941, and (Continued)

(51) **Int. Cl.**
G08G 5/00 (2006.01)
H04W 4/06 (2009.01)
G05D 1/00 (2006.01)
B64C 39/02 (2006.01)
G01C 5/06 (2006.01)
G01S 19/14 (2010.01)

(52) **U.S. Cl.**
CPC ***G08G 5/0013*** (2013.01); ***B64C 39/024*** (2013.01); ***G01C 5/06*** (2013.01); ***G01S 19/14*** (2013.01); ***G05D 1/0022*** (2013.01); ***G08G 5/003*** (2013.01); ***G08G 5/0026*** (2013.01); ***G08G 5/0043*** (2013.01); ***G08G 5/0078*** (2013.01); ***G08G 5/0091*** (2013.01); ***H04W 4/06*** (2013.01); *B64C 2201/146* (2013.01)

(58) **Field of Classification Search**
CPC G08G 5/0013; G08G 5/003; G08G 5/0091; G08G 5/0043; G08G 5/0078; G08G 5/0026; H04W 4/06; G01C 5/06; G01S 19/14; B64C 39/024; B64C 2201/146; G05D 1/0022
USPC 701/3
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

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6,891,906 B1 5/2005 Sogabe et al.
(Continued)

Primary Examiner — Brian P Sweeney
(74) *Attorney, Agent, or Firm* — Suiter Swantz pc llo

(57) **ABSTRACT**

A direct-broadcast remote identification (RID) device attachable to an unmanned aircraft system (UAS) encodes identifier signals based on a unique identifier of the UAS and position data, e.g., the current and originating (launch) positions of the UAS, and transmits encoded data signals receivable and decodable by specially configured receiver devices in range. The encoded identifier signals may be transmitted at low power via radio-control frequencies, whitespace frequencies, ISM frequencies, DME frequencies, or ADS-B frequencies as needed. The receiver devices may decode identifier signals to display the relative positions of, and information about, nearby UAS even in internet-denied areas (standalone mode). The receiver devices may retrieve additional data, such as operator information and flight plans, from remote databases by establishing wireless connections when said connections are available (connected mode).

11 Claims, 7 Drawing Sheets

102a

122

100

AXON EXHIBIT 1008, Page 1

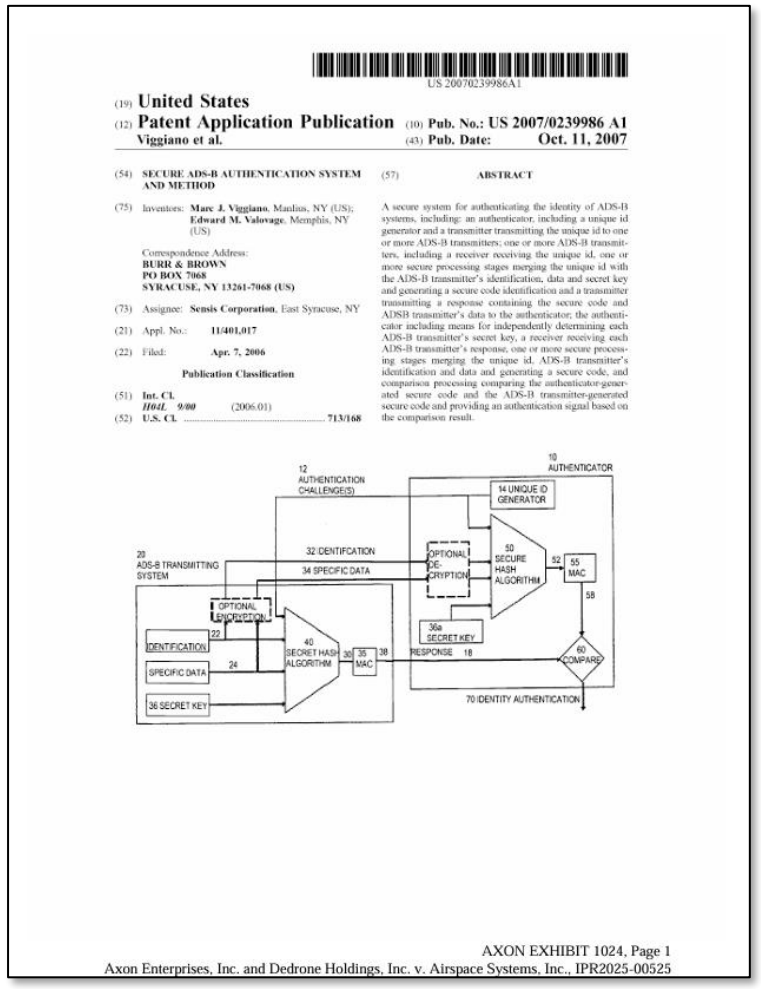
(57) **ABSTRACT**

A direct-broadcast remote identification (RID) device attachable to an unmanned aircraft system (UAS) encodes identifier signals based on a unique identifier of the UAS and position data, e.g., the current and originating (launch) positions of the UAS, and transmits encoded data signals receivable and decodable by specially configured receiver devices in range. The encoded identifier signals may be transmitted at low power via radio-control frequencies, whitespace frequencies, ISM frequencies, DME frequencies, or ADS-B frequencies as needed. The receiver devices may decode identifier signals to display the relative positions of, and information about, nearby UAS even in internet-denied areas (standalone mode). The receiver devices may retrieve additional data, such as operator information and flight plans, from remote databases by establishing wireless connections when said connections are available (connected mode).

AXON EXHIBIT 1035

EX1008 (Beard) at Cover, Abstract; EX1009 at 3, 7-8, 11; Pet. at 17

Overview of Viggiano



US 20070239986A1

(19) **United States**
(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0239986 A1**
Viggiano et al. (43) **Pub. Date: Oct. 11, 2007**

(54) **SECURE ADS-B AUTHENTICATION SYSTEM AND METHOD**

(75) Inventors: **Marc J. Viggiano**, Manlius, NY (US); **Edward M. Valovage**, Memphis, NY (US)

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(73) Assignee: **Sensis Corporation**, East Syracuse, NY

(21) Appl. No.: **11/401,017**

(22) Filed: **Apr. 7, 2006**

Publication Classification

(51) **Int. Cl.**
H04L 9/00 (2006.01)
(52) **U.S. Cl.** **713/168**

(57) **ABSTRACT**

A secure system for authenticating the identity of ADS-B systems, including: an authenticator, including a unique id generator and a transmitter transmitting the unique id to one or more ADS-B transmitters; one or more ADS-B transmitters, including a receiver receiving the unique id, one or more secure processing stages merging the unique id with the ADS-B transmitter's identification, data and secret key and generating a secure code identification and a transmitter transmitting a response containing the secure code and ADSB transmitter's data to the authenticator; the authenticator including means for independently determining each ADS-B transmitter's secret key, a receiver receiving each ADS-B transmitter's response, one or more secure processing stages merging the unique id, ADS-B transmitter's identification and data and generating a secure code, and comparison processing comparing the authenticator-generated secure code and the ADS-B transmitter-generated secure code and providing an authentication signal based on the comparison result.

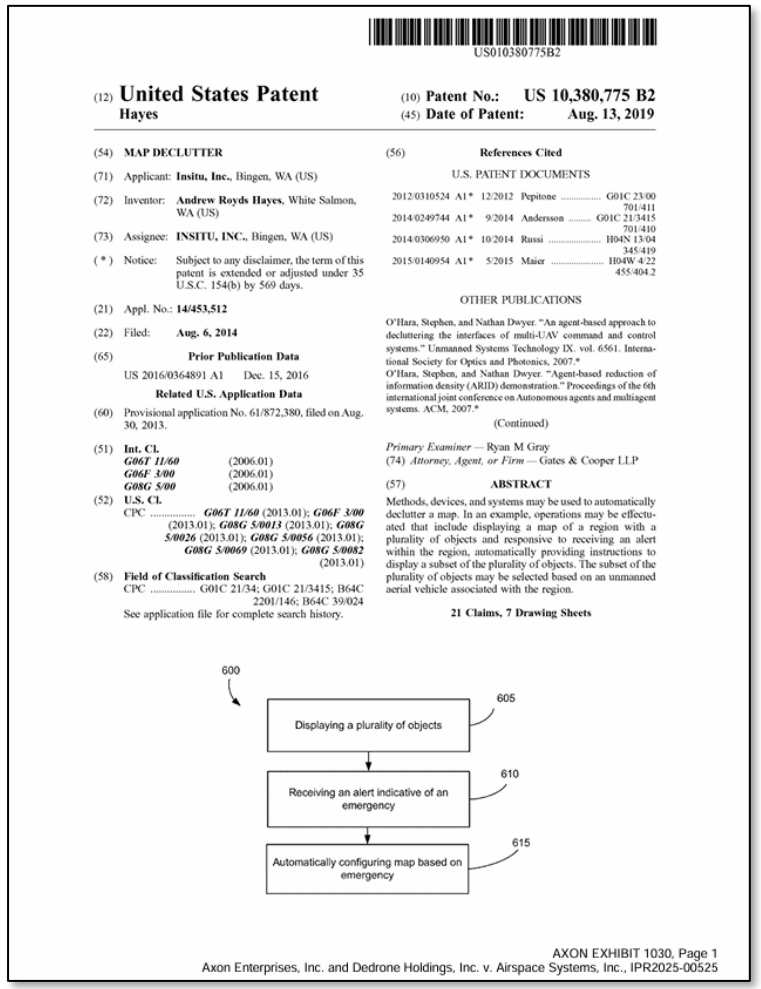
AXON EXHIBIT 1024, Page 1
Axon Enterprises, Inc. and Dedrone Holdings, Inc. v. Airspace Systems, Inc., IPR2025-00525

Viggiano describes authenticating aircraft identity by transmitting a challenge 12 from authenticator 10 to the aircraft to provoke an authentication response. [EX1024, ¶¶0012-0015, Fig. 1]

AXON EXHIBIT 1035

EX1024 (Viggiano) at Cover, Abstract; Oppo. at 9

Overview of Hayes



US010380775B2

(12) **United States Patent**
Hayes

(10) **Patent No.: US 10,380,775 B2**
(45) **Date of Patent: Aug. 13, 2019**

(54) **MAP DECLUTTER**

(71) Applicant: **Insitu, Inc.**, Bingen, WA (US)

(72) Inventor: **Andrew Royds Hayes**, White Salmon, WA (US)

(73) Assignee: **INSITU, INC.**, Bingen, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 569 days.

(21) Appl. No.: **14/453,512**

(22) Filed: **Aug. 6, 2014**

(65) **Prior Publication Data**

US 2016/0364891 A1 Dec. 15, 2016

Related U.S. Application Data

(60) Provisional application No. 61/872,380, filed on Aug. 30, 2013.

(51) **Int. Cl.**

G06T 11/60	(2006.01)
G06F 3/00	(2006.01)
G08G 5/00	(2006.01)

(52) **U.S. Cl.**

CPC ***G06T 11/60*** (2013.01); ***G06F 3/00*** (2013.01); ***G08G 5/0013*** (2013.01); ***G08G 5/0026*** (2013.01); ***G08G 5/0056*** (2013.01); ***G08G 5/0069*** (2013.01); ***G08G 5/0082*** (2013.01)

(58) **Field of Classification Search**

CPC G01C 21/34; G01C 21/3415; B64C 2201/146; B64C 39/024

See application file for complete search history.

(56) **References Cited**

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(Continued)

Primary Examiner — Ryan M Gray
(74) *Attorney, Agent, or Firm* — Gates & Cooper LLP

(57) **ABSTRACT**

Methods, devices, and systems may be used to automatically declutter a map. In an example, operations may be effectuated that include displaying a map of a region with a plurality of objects and responsive to receiving an alert within the region, automatically providing instructions to display a subset of the plurality of objects. The subset of the plurality of objects may be selected based on an unmanned aerial vehicle associated with the region.

21 Claims, 7 Drawing Sheets

AXON EXHIBIT 1030, Page 1
Axon Enterprises, Inc. and Dedrone Holdings, Inc. v. Airspace Systems, Inc., IPR2025-00525

Hayes teaches that a UAV associated with an "alert" is caused to be more clearly displayed on a user interface—by removing other detected and displayed UAVs from the interface so that the UAV associated with the alert is more visible. [EX1030, 5:38-67, Fig. 6]

AXON EXHIBIT 1035

EX1030 (Hayes) at Cover, Abstract; Oppo. at 10

The Ground 5B Combination Renders Obvious [22.e]

[22.e] the radio communication module is configured to utilize a secure identifier, the secure identifier comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft, [[and]]

- Beard's RF transceiver forms the "*radio communication module*."
- The Beard-Viggiano-Hayes combination teaches that Beard's RF transceiver (*the radio communication module*) of the first UAS receives from Beard's receiver ("*remote portable detection system*") an "authentication challenge 12" comprising a "unique identifier" having "random values" generated by a random number generator.
  - The unique identifier and random values provide security such that "an attacker cannot 'learn' a valid response by observing the challenges 12"
- The RF transceiver uses challenge 12 (and its unique identifier) to prepare an authentication challenge response (*the radio communication module is configured to utilize a secure identifier*).

AXON EXHIBIT 1035

Pet. at 29-31, 35-39; Oppo. at 13-15; Sur-Reply, 10-11

The Ground 5B Combination Renders Obvious [22.e]

- By using a unique identifier (e.g., a random number) for each challenge, each challenge 12 is continually different and an attacker cannot learn it, which provides that the challenge 12 is secure. [EX1024, ¶¶0012-0013; EX1027, ¶58].

> **[0013]** In one embodiment of the present invention, the unique identifier generator **14** comprises a random number generator. While the unique identifier can be random values, it need only be unique so that an attacker cannot "learn" a valid response by observing the challenges **12** of the authenticator and the corresponding responses **38**. The Authenticator's system generates a unique identifier and transmits an authentication challenge **12**, which includes the unique identifier to the ADS-B transmitter **20**. The ADS-B trans-

- 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*).
  - The challenge is part of Viggiano's taught "challenge-response methodology" that is used to authenticate aircraft identity.

AXON EXHIBIT 1035

Pet. at 29-31, 35-39; Oppo. at 13-15; Sur-Reply, 10-11

The Ground 5B Combination Renders Obvious [22.e]

- The challenge response transmitted by Beard's RF transceiver allows for the first UAS to be distinguished from among multiple detected UAVs and highlighted for display (*enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft*), as taught by Hayes.
  - The combination teaches that the challenge response is transmitted by Beard's RF transceiver to Beard's receiver, and the receiver attempts authentication of the first UAS's identity based on the response.
  - Consecutive 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.
  - Beard's receiver detects multiple UASs and displays their identification and position data.

Pet. at 29-31, 35-39; Oppo. at 13-15; Sur-Reply, 10-11

The Ground 5B Combination Renders Obvious [22.e]

- Challenge 12 (*secure identifier*) includes the "unique identifier" having "random values" generated by a random number generator.
  - The unique identifier provides that "an attacker cannot 'learn' a valid response by observing the challenges 12.
  - Challenge 12 is used to verify the identity of the first UAS.
  - Challenge 12 thus satisfies the Board's secure identifier construction of "a credential that can be used to securely verify the identity of a device, such as an airborne object or ground-based transmitter."

Pet. at 29-31, 35-39; Oppo. at 13-15; Sur-Reply, 10-11

The Ground 5B Combination enables disambiguation

- PO wrongly argues that challenge 12 does not "enable[] disambiguation" as it is the "absence of responses" that allows a conclusion that authentication has failed
  - As combined, the response allows the first aircraft to be distinguished from among multiple aircraft when the response causes there to have been **multiple failed authentications.**
    - A **challenge and response can each be "consecutive" challenges and responses**—i.e., a second challenge and second response.
    - When **failed authentication results due to this response, modification of a displayed user interface occurs** causing other detected and displayed aircraft to be removed so the first aircraft is more clearly displayed.
- PO also wrongly suggests the combinations do not involve the transmission of a response ("continuing not to broadcast anything")
  - All grounds involve the transmission of a challenge response.

Pet. at 29-31, 35-39; Oppo. at 13-15; Sur-Reply, 10-11

The Ground 5B Combination Renders Obvious [22.f]

[22.f] wherein utilizing the secure identifier comprises receiving by the radio communication module the specified excitation from a remote portable detection system, wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof,

- Beard's receiver forms a "*remote portable detection system*."
- The Beard-Viggiano-Hayes combination teaches utilizing the secure identifier comprises Beard's RF transceiver **receiving challenge 12** that includes the excitation (*comprises receiving by the radio communication module the specified excitation*) from Beard's receiver (*from the remote portable detection system*).
- This excitation (*the specified excitation*) causes the first UAS to **change a behavior in that the first UAS is triggered to prepare and transmit a challenge response** (*wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof*).

AXON EXHIBIT 1035

Pet. at 35-39; Oppo. at 15-16

- PO argues challenge 12 does not change a behavior because "responding to a challenge is the default and expected behavior, not a changed behavior."

- But **responding to the challenge is a change in behavior** because the aircraft is not transmitting a response before receiving the challenge; PO's expert agrees:

19 Q Does the device that is being
20 authenticated only send a response upon receiving
21 a challenge?
22 A That's correct.

1 Q If the device being authenticated does not
2 receive a challenge, then would it send a
3 response?
4 A No.

AXON EXHIBIT 1035

Pet. at 35-39; Oppo. at 15-16; Sur-Reply, 9-10; EX1031, 11:19-22, 12:1-4

The Ground 5B Combination Renders Obvious [22.i]

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

- Beard discloses that "receiver device 120a may include onboard processors (130) and memory (132) as well as a display surface (134) for displaying identifier and position data decoded from identifier signals transmitted by RID device (100a) aboard a proximate UAS 102b."

Pet. at 37-39; Oppo. at 16-17; Sur-Reply, 10-12

The Ground 5B Combination Renders Obvious [22.i]

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

- Figure 4B of Beard and Figure 2 of Beard Provisional depict such display of received UAS data

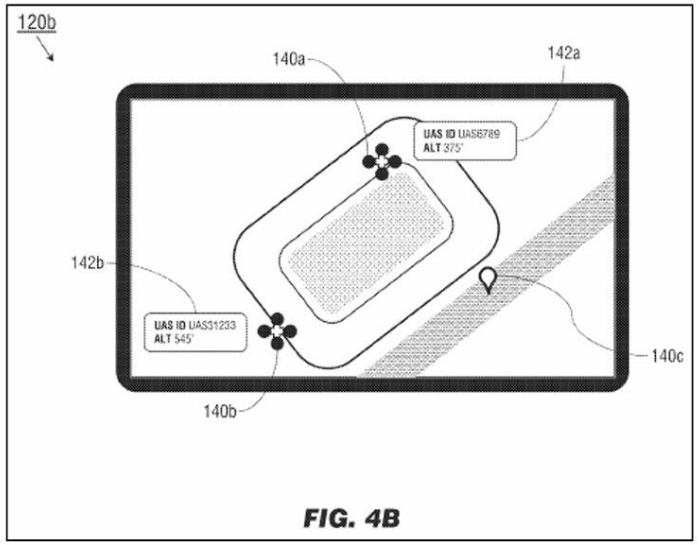


FIG. 4B

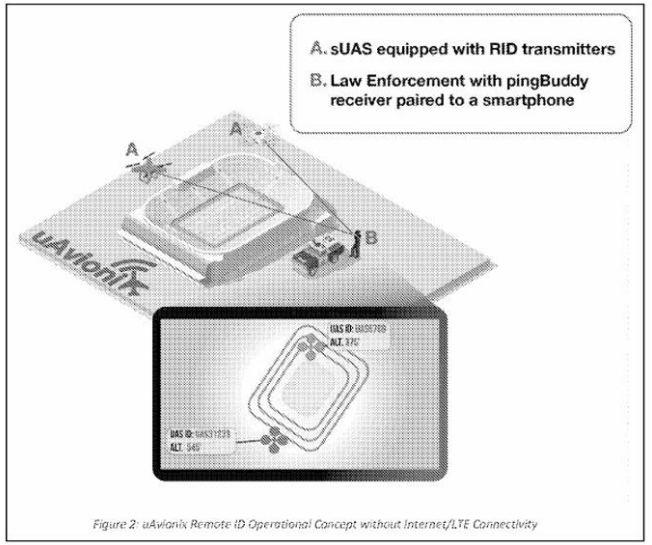


Figure 2: uAvionix Remote ID Operational Concept without Internet/LTE Connectivity

- The mobile displays depict the device ID (e.g., "UAS ID") and altitude (e.g., "ALT") of multiple detected UASs.

AXON EXHIBIT 1035

Pet. at 37-39; Oppo. at 16-17; Sur-Reply, 10-12

The Ground 5B Combination Renders Obvious [22.i]

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

- Beard's receivers and associated mobile devices ("*the remote portable detection system*") display to a user via their user interface displays ("*includes a user interface configured to provide to a user*") at least the device identification and position data of UASs whose identifier signals are received by the receivers ("*information associated with a plurality of different low altitude aircrafts detected by the remote portable detection system*").

Pet. at 37-39; Oppo. at 16-17; Sur-Reply, 10-12

The Ground 5B Combination Renders Obvious [22.i]

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

- Multiple UAS 102 are present in an airspace and detected by Beard's receiver (*forming the plurality of different low altitude aircrafts*), and one of these UAS forms the first low-altitude aircraft, teaching that the *plurality [is] comprising the first low-altitude aircraft*.

- Upon consecutive authentication failures for the first UAS, Beard's receiver (*the remote portable detection system*) modifies its user interface display such that other detected and displayed UAS are removed from the interface and the first UAS is thus more clearly displayed (*is configured to disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft of the plurality*).

AXON EXHIBIT 1035

Pet. at 37-39; Oppo. at 16-17; Sur-Reply, 10-12

The Ground 5B Combination Renders Obvious [22.i]

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

- This changing the form of display such that first UAS is more clearly displayed relative to the other detected UASs (*disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft of the plurality*)
    - is based on the first UAS's triggered authentication response (*based on the changed behavior of the first low-altitude aircraft*) to the authentication challenge that causes the first UAS to have failed consecutive authentications.

Pet. at 37-39; Oppo. at 16-17; Sur-Reply, 10-12

The Ground 5B Combination teaches to disambiguate

- As noted previously, PO argues that challenge 12 does not "enable[] disambiguation" as it is the "absence of responses" that allows a conclusion that authentication has failed
  - As combined, the response allows the first aircraft to be distinguished from among multiple aircraft when the response causes there to have been **multiple failed authentications.**
    - A **challenge and response can each be "consecutive" challenges and responses**—i.e., a second challenge and second response.
    - When **failed authentication results due to this response, modification of a displayed user interface occurs** causing other detected and displayed aircraft to be removed so the first aircraft is more clearly displayed; **the modification is based on the triggered response (changed behavior).**
- PO also wrongly suggests the combinations do not involve the transmission of a response ("continuing not to broadcast anything")
  - All grounds involve the transmission of a challenge response.

Pet. at 37-39; Oppo. at 16-17; Sur-Reply, 10-12

The Ground 5B Combination teaches to disambiguate

- PO further argues that the combinations disclose "isolating" an aircraft instead of "disambiguating" an aircraft.
  - PO appears to adopt an unsupported, **overly narrow disambiguate definition requiring simultaneously displaying a first aircraft and other aircraft at all times and throughout disambiguation**, and the importing of "identifiers" such as "bold text" into the SC.
    - No support for this definition, and PO has not shown or argued that this definition is correct.
  - The combinations teach the receiver's user interface displaying multiple detected aircraft simultaneously, including a first aircraft, and upon consecutive authentication failures for the first aircraft, the user interface is modified such that other detected and displayed aircraft are removed and the first aircraft is thus more clearly displayed (*disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft of the plurality*).

Pet. at 37-39; Oppo. at 16-17, 20-21, 23-24 ([22.i]); Sur-Reply, 10-12

The Ground 5B Combination teaches to disambiguate

- PO's definition of EX2022 is irrelevant as it relates to **"words" and "phrases"** (not aircraft)

Definition of *disambiguate verb* from the Oxford Advanced Learner's Dictionary

disambiguate *verb*

ˌdɪsæmˈbɪgjueɪt ; ˌdɪsæmˈbɪgjueɪt

disambiguate something

(*technical*)

to show clearly the difference between two or more words, phrases, etc. which are similar in meaning

- Regardless, the grounds meet definition, showing a **difference between an aircraft that failed authentication and aircrafts that have not by more clearly displaying the failed-authentication aircraft from others**.

AXON EXHIBIT 1035

Pet. at 37-39; Oppo. at 16-17, 20-21, 23-24 ([22.i]); Sur-Reply, 10-12

Outline of Arguments: IPR2025-00525 ('959 Patent)

I. Overview of the '959 Patent and Procedural History
II. Dispute Overview
III. Substitute Claim 22 Lacks Written Description
IV. Substitute Claim 22 is Indefinite
V. The Amendments Impermissibly Broaden Substitute Claim 22
VI. Obviousness of Substitute Claim 22: Ground 5B
VII. **Obviousness of Substitute Claim 22: Grounds 6B and 7B**
VIII. Obviousness of Substitute Claim 22: Ground 8B
IX. Obviousness of Substitute Claim 22: Ground 9B, 10B, 11B, and 12B

Obviousness of Substitute Claim 22: Grounds 6B and 7B

Ground	SC	35 U.S.C. §	Prior Art
6B	22	103	Taveira, Wang, Gong, Viggiano, and Hayes
7B	22	103	Taveira, Qi, Gong, Viggiano, and Hayes

Oppo. at 3

Outline of Arguments: IPR2025-00525 ('959 Patent)

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VIII. **Obviousness of Substitute Claim 22: Ground 8B**
IX. Obviousness of Substitute Claim 22: Ground 9B, 10B, 11B, and 12B

Obviousness of Substitute Claim 22: Ground 8B

Ground	SC	35 U.S.C. §	Prior Art
8B	22	103	Gong, Wang-II, Viggiano, and Hayes

Outline of Arguments: IPR2025-00525 ('959 Patent)

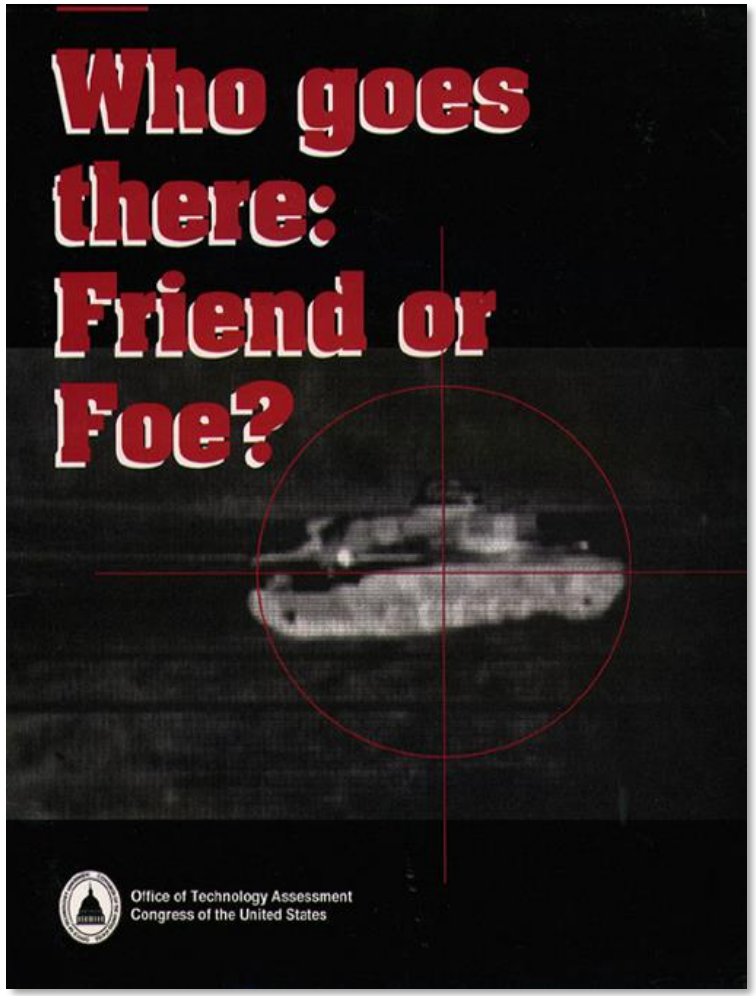
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VIII. Obviousness of Substitute Claim 22: Ground 8B
IX. **Obviousness of Substitute Claim 22: Grounds 9B, 10B, 11B, and 12B**

Obviousness of Substitute Claim 22: Ground 9B, 10B, 11B, and 12B

Ground	SC	35 U.S.C. §	Prior Art
9B	22	103	Beard, Viggiano, Hayes, and FF
10B	22	103	Taveira, Wang, Gong, Viggiano, Hayes, and FF
11B	22	103	Taveira, Qi, Gong, Viggiano, Hayes, and FF
12B	22	103	Gong, Wang-II, Viggiano, Hayes, and FF

Pet. Opp. to RMTA at 3

Overview of Who goes there: Friend or Foe ("FF")



FF discloses "identification friend or foe" authentication techniques used to identify aircraft. EX1028, 31, 49, 62-66. An encrypted "query" (i.e., challenge) is transmitted to an aircraft, asking the aircraft to identify itself, and the aircraft provides a response. *Id*.

AXON EXHIBIT 1035

EX1028 (FF) at Cover, Abstract; Oppo. at 24

Grounds 9B-12B: A POSITA would have been Motivated to Combine FF with the prior art of Grounds 5B-8B to teach a *secure identifier*

- FF discloses "identification friend or foe" authentication techniques used to identify aircraft. [EX1028, 31, 49, 62-66].
  - An encrypted "query" (i.e., challenge) is transmitted to an aircraft, asking the aircraft to identify itself, and the aircraft provides a response. [EX1028, 31, 49, 62-66; EX1027, ¶82].

- As combined, the Beard-Viggiano-Hayes-FF system would have thus provided the predictable result in which challenge 12 is encrypted, and Beard's first unmanned aerial system (UAS) RF transceiver receives from Beard's receiver an encrypted challenge 12. [EX1028, 49, 63-66; EX1027, ¶¶82-84].
  - This provides an additional security layer to the already secure challenge 12, furthering the combination teachings. [EX1024, 0012-0013].

- The combination teaches SC 22 for the same reasons as Ground 5B, and for elements [22.e] and [22.f], further teaches challenge 12 is encrypted, thus forming a *secure identifier* as claimed and construed by the Board. EX1027, ¶¶84-85.

Pet. at 29-31, 35-36; Oppo. at 24-25

Grounds 9B-12B: A POSITA would have been Motivated to Combine FF with the prior art of Grounds 5B-8B to teach a *secure identifier*

- A POSITA would have been motivated to combine Taveira, Wang, Gong, Viggiano, and Hayes (GND 6B)/Taveira, Qi, Gong, Viggiano, and Hayes (GND 7B)/ Gong, Wang-II, Viggiano, and Hayes, and further motivated to combine each combination with FF, for the reasons discussed for FF previously. [EX1027, ¶¶86-89].

- The combinations would have provided the predictable result in which challenge 12 is encrypted.

- The combinations teach SC 22 for the same reasons as discussed, and for elements [22.e] and [22.f], further teach authentication challenge 12 is encrypted, thus forming a *secure identifier* as claimed and construed. EX1027, ¶¶86-89.

Oppo. at 24-25

Backup Slides

"the received information" lacks antecedent basis

- **[T]he received information** lacks antecedent basis.
  - No prior recitation of any information that is received.

- Use of "the received information" causes confusion as the SC previously recites "identification information;"
  - It is unclear whether these pieces of information are the same or different.

Oppo. at 6-7; Sur-Reply at 8-9

"the received information" lacks antecedent basis

- The radio signal **does not provide** antecedent basis for the received information.
  - A POSITA would not have considered these the same because they are **different terms**, connoting different meanings.

- PO wrongly relies on "implication" to address the lack of antecedent basis for "the received information."
  - *Cross Med. Prods.* is distinguishable because the "antecedent basis for 'said longitudinal axis' was by implication the longitudinal axis of the rod" previously recited by the claim at issue.
  - In SC 22: no previously recited element that provides antecedent basis by implication.

Oppo. at 6-7; Sur-Reply at 8-9

"the received information" lacks antecedent basis

- "[R]eceive[d] [] radio signal" thus **cannot provide antecedent basis by implication for the received information**.

- PO's broadening provides that SC 22 encompasses receiving any radio signal, **including noisy signals**.

Oppo. at 6-7; Sur-Reply at 8-9

PO Does Not Contest that a POSITA would have been Motivated to Combine Beard, Viggiano, and Hayes

- Viggiano describes authenticating aircraft identity by transmitting a challenge 12 from authenticator 10 to the aircraft to provoke an authentication response, which is used by the authenticator to authenticate the aircraft identity.

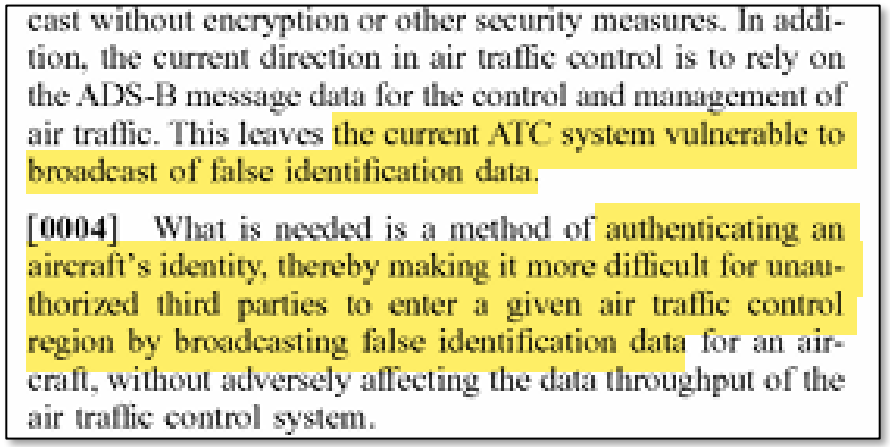
- Hayes teaches that a UAV associated with an "alert" is caused to be more clearly displayed on a user interface—by removing other detected and displayed UAVs from the interface so that the UAV associated with the alert is more visible.

- Thus, as combined, the Beard-Viggiano-Hayes system would have provided the predictable result in which Beard's first unmanned aerial system (UAS) RF transceiver:
  - (1) receives from Beard's receiver a challenge 12,
  - (2) determines to transmit a challenge response, and
  - (3) transmits the challenge response to Beard's receiver, and the receiver—based on the response and a subsequent consecutive authentication failure alert—modifies its displayed user interface, causing other detected and displayed UASs to be removed from the interface so that the first UAS is more clearly displayed.

Oppo. at 9-10; EX1024, ¶¶0012-0015, Fig. 1; EX1030, 5:38-67, Fig. 6

PO Does Not Contest that a POSITA would have been Motivated to Combine Beard, Viggiano, and Hayes

- The use of false or fraudulent identity information by aircrafts was a known problem. EX1024, ¶0004.



cast without encryption or other security measures. In addition, the current direction in air traffic control is to rely on the ADS-B message data for the control and management of air traffic. This leaves the current ATC system vulnerable to broadcast of false identification data.

[0004] What is needed is a method of authenticating an aircraft's identity, thereby making it more difficult for unauthorized third parties to enter a given air traffic control region by broadcasting false identification data for an aircraft, without adversely affecting the data throughput of the air traffic control system.

- Viggiano addresses this problem and furthers Beard's own verification teachings, providing a specific technique for aircraft identity verification that **prevents "unauthorized third parties" from "enter[ing] a given air traffic control region by broadcasting false identification data."**

  - Viggiano and Hayes provide implementation details for performing Beard's verification, using a challenge response technique, and displaying subsequent results, which would have been straightforward and routine to implement, and **provided an additional layer of security.**

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Oppo. at 10-11

PO Does Not Contest that a POSITA would have been Motivated to Combine Beard, Viggiano, and Hayes

- Viggiano also explains that consecutively failed authentications causes issuance of an "alert that is displayed" by a station. EX1024, ¶0015.

tity. If the MAC **38** received from the ADS-B transmitter **20** matches the Authenticator-generated MAC **58**, an authentication signal **70** is produced indicating that the identity of the ADS-B transmitter is authenticated. In one embodiment of the present invention, if an ADS-B transmitter **20** fails two or more consecutive authentication response comparisons, the Authenticator **10** notifies a responsible higher command authority of the authentication failures, so that the responsible higher command authority can respond appropriately. In another embodiment, the Authenticator **10** issues an alert that is displayed to other ADS-B equipped aircraft, vehicles, vessels or stations.

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Oppo. at 11-12; EX1024, ¶¶0014-0015; EX1030, 5:38-67, Fig. 6

PO Does Not Contest that a POSITA would have been Motivated to Combine Beard, Viggiano, and Hayes

- Hayes teaches that a UAV associated with an "alert" is caused to be more clearly displayed on an interface.
  - Other detected and displayed UAVs are removed from the interface so that the UAV associated with the alert is more visible.

or more UAVs. For example, a first UAV may be in an emergency state (e.g., crash landing or on the verge of crash landing) and a second UAV may be selected to respond to the emergency. In another example, a UAV may be selected to respond to search and rescue of a person. At block **615**, responsive to a device receiving the emergency alert, a map may be automatically configured by the device to display on a GUI. The map may show just the objects related with the UAV(s) associated with the emergency alert. In another example, once a threshold number of UAVs are displayed on a map, the map may be automatically configured by the device to display particular information. The amount of

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Oppo. at 11-12; EX1024, ¶¶0014-0015; EX1030, 5:38-67, Fig. 6

PO Does Not Contest that the Ground 5B Combination Renders Obvious [22.pre]

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

- EX1008, Abstract:

(57) **ABSTRACT**

A direct-broadcast remote identification (RID) device attachable to an unmanned aircraft system (UAS) encodes identifier signals based on a unique identifier of the UAS and position data, e.g., the current and originating (launch) positions of the UAS, and transmits encoded data signals receivable and decodable by specially configured receiver devices in range. The encoded identifier signals may be transmitted at low power via radio-control frequencies, whitespace frequencies, ISM frequencies, DME frequencies, or ADS-B frequencies as needed. The receiver devices

- Multiple UAS 102 (102a, 102b, 102c, etc) are present in an airspace and are detected by Beard's receiver, and a **first of these UAS** forms a first low-altitude aircraft as claimed.

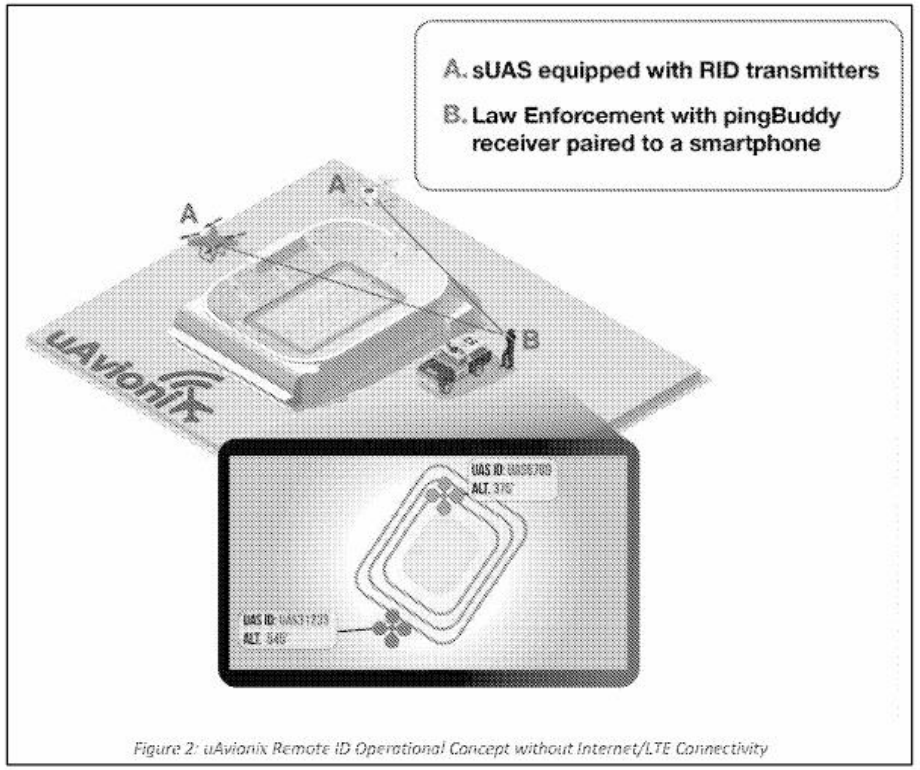


Figure 2: uAvionix Remote ID Operational Concept without Internet/LTE Connectivity

EX1009, Fig. 2

AXON EXHIBIT 1035

Pet. 24-28; Oppo. at 12; EX1003, ¶¶115-117; EX1027, ¶55.

PO Does Not Contest that the Ground 5B Combination Renders Obvious [22.a]

[22.a] a radio frequency communication antenna; and

- Beard's RID device may use for wireless communications "[d]esignated ADS-B frequencies, e.g., 978 MHz (Universal Access Transceiver, or UAT), 1090 MHz (Extended Squitter, or ES), and 1104 MHz" and "[s]elected frequencies within the United States industrial, scientific, and medical (ISM) radio bands, e.g., 315 MHz, 433 MHz, and 915 MHz." [EX1008, 6:23-25, 6:56-60; EX1009, 2]

- A POSITA would have understood that to communicate across these radio frequencies, Beard's RID device would comprise an antenna (*a radio frequency communication antenna*) capable of transmitting and receiving signals on these radio frequencies.

- In the alternative, it would have been obvious to a POSITA that Beard's RID device comprises an antenna element capable of transmitting and receiving signals on ADS-B and ISM radio bands.

Pet. 28-29; Oppo. at 7-8

PO Does Not Contest that the Ground 5B Combination Renders Obvious [22.b]

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

- Beard discloses an RF transceiver (*a radio communication module*), and it would have been obvious for the RF transceiver to be coupled to the antenna to fulfill the transceiver's role in performing wireless communication for the RID device (*coupled to the radio frequency communication antenna*).

- The RF transceiver performs wireless communication and transmits identification data that identifies an associated UAS (*configured to transmit identification information associated with the …low-altitude aircraft through a transmitted radio signal*).

- Beard describes multiple UAS 102 (102a, 102b, 102c, etc) are present in an airspace and are detected by Beard's receiver, and a first of these UAS forms the *first low-altitude aircraft* as claimed.

AXON EXHIBIT 1035

Pet. at 29-31; Oppo. at 12

PO Does Not Contest that the Ground 5B Combination Renders Obvious [22.c]

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

- Beard's remote identification (RID) device attached to an unmanned aircraft system (UAS) includes an RF transceiver (*radio communication module*).
- Beard's RF transceiver (*radio communication module*) can "'listen' for other proximate UAS within range, receiving identifier signals transmitted by another RID device (100a) aboard the proximate UAS and relaying the received signals throughout the RID coverage area of the RID device 100."
- The RID devices can communicate on different radio frequencies.
- Accordingly, Beard teaches "*wherein the radio communication module is configured to receive a radio signal*."

Pet. at 29-31; Oppo. at 12-13

PO Does Not Contest that the Ground 5B Combination Renders Obvious [22.c]

- Beard discloses to "*store the received information in a storage*." Pet., 31-34.
  - If "*the received information*" is interpreted to refer to the "*identification information associated with the first low altitude aircraft*" recited in [22.b], Beard discloses the RID device can "store[] to memory" the "current position of the UAS 102 and identification data" of the UAS associated with the RID device.
  - If "*the received information*" is interpreted to refer to information associated with the "*radio signal*" recited in [22.c], Beard discloses that "memory 106 of the RID device 100 may serve as an ad hoc black box data recorder, storing data regarding the UAS 102 as well as other nearby UAS, based on received identifier signals."

Pet. at 29-31; Oppo. at 12-13

PO Does Not Contest that the Ground 5B Combination Renders Obvious [22.d]

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

- Beard discloses, or at least renders obvious, that its RID device includes an antenna for communicating across various radio frequency bands.
- Further, that RID device is "attachable and connectible to a UAS 102."
- Accordingly, Beard discloses, or at least renders obvious, coupling an antenna ("*the radio frequency communication antenna*") to the first UAS ("*to the first low-altitude aircraft*").

Pet. at 34; Oppo. at 12

PO Does Not Contest that the Ground 5B Combination Renders Obvious [22.g]

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

- Beard's RF transceiver ("*the radio communication module*") transmits identifier signals to "any receivers (120) equipped to receive and decode transmitted identifier signals."
- Such receivers can also "command a directly integrated RID device 100c (e.g., aboard the UAS 102f) to perform various functions," by "remotely transmit[ting] commands to the control system (118, FIG. 1) of the UAS 102f."
- Thus, Beard's disclosure of its RF transceiver both transmitting identifier signals to and receiving command signals from a receiver teaches "*the radio communication module is configured for two-way communication with*" the receiver.

Pet. at 35-39; Oppo. at 16

PO Does Not Contest that the Ground 5B Combination Renders Obvious [22.g]

- Beard's receiver is "*the remote portable detection system*."
- The receiver can be, for example, a "portable communications or computing device (e.g., a smartphone or tablet) carried by authorized personnel."
- The function of the receiver is to receive identifier signals transmitted by RID devices and display the information contained therein, including the identification data of the associated UAS and the UAS's position data.
- Accordingly, Beard's receiver operates as a system for detecting and identifying UASs within its range.

Pet. at 35-39; Oppo. at 16

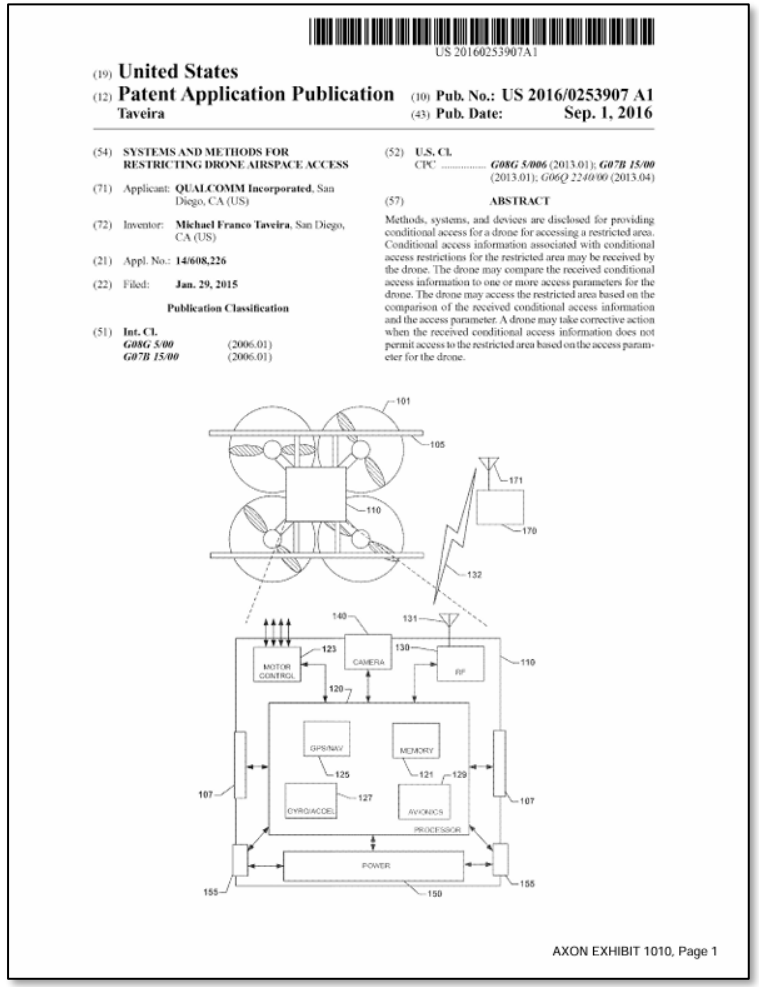
PO Does Not Contest that the Ground 5B Combination Renders Obvious [22.h]

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

- Beard's RID device ("*the device*") is "attachable and connectible to a UAS 102" ("*is coupled to the low-altitude aircraft*"). [EX1008, 5:9-10; EX1009, 5, 11)].

Pet. at 35-39; Oppo. at 7-8

Overview of Taveira



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(54) **SYSTEMS AND METHODS FOR RESTRICTING DRONE AIRSPACE ACCESS**

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(72) Inventor: **Michael Franco Taveira**, San Diego, CA (US)

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(57) **ABSTRACT**

Methods, systems, and devices are disclosed for providing conditional access for a drone for accessing a restricted area. Conditional access information associated with conditional access restrictions for the restricted area may be received by the drone. The drone may compare the received conditional access information to one or more access parameters for the drone. The drone may access the restricted area based on the comparison of the received conditional access information and the access parameter. A drone may take corrective action when the received conditional access information does not permit access to the restricted area based on the access parameter for the drone.

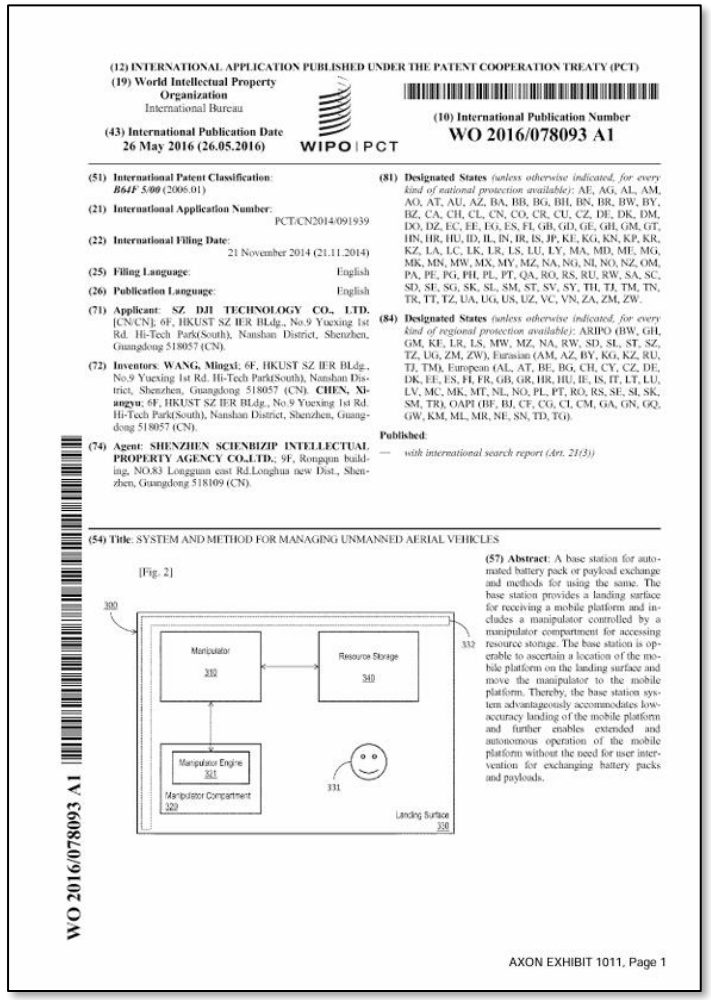
AXON EXHIBIT 1010, Page 1

Taveira discloses "drone 100" that has a "control unit 110" that includes "a processor 120, a radio module 130, and a power module 150." EX1010, ¶0054. "[T]he processor of the drone 100 may provide drone information," such as "a drone identifier," to other devices. *Id.*, ¶¶[0110], [0117]. The drone identifier can be a "unique identifier (ID)" that "may allow the drone to be identified by network components, such as servers…, beacons…, other drones, and so on." *Id.*, ¶[0168].

AXON EXHIBIT 1035

EX1010 (Taveira) at Cover, Abstract; Pet. at 17

Overview of Wang



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(54) Title: SYSTEM AND METHOD FOR MANAGING UNMANNED AERIAL VEHICLES

[Fig. 2]

(57) Abstract: A base station for automated battery pack or payload exchange and methods for using the same. The base station provides a landing surface for receiving a mobile platform and includes a manipulator controlled by a manipulator compartment for accessing resource storage. The base station is operable to ascertain a location of the mobile platform on the landing surface and move the manipulator to the mobile platform. Thereby, the base station system advantageously accommodates low-accuracy landing of the mobile platform and further enables extended and autonomous operation of the mobile platform without the need for user intervention for exchanging battery packs and payloads.

WO 2016/078093 A1

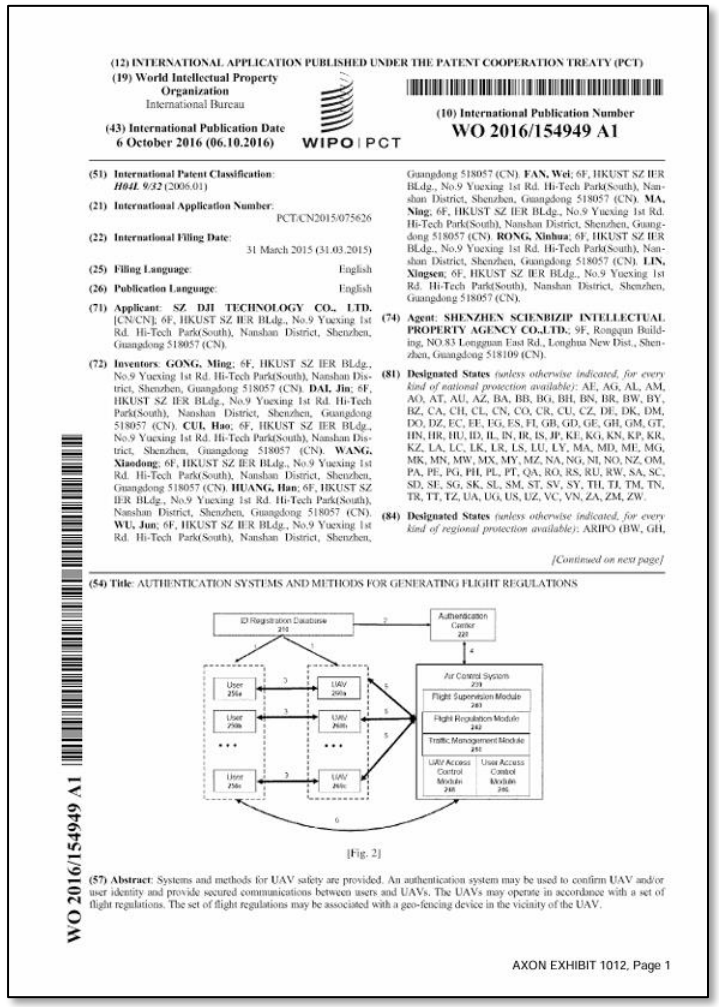
AXON EXHIBIT 1011, Page 1

Wang discloses that wireless communications between a base station 300 and a UAV 201 are encrypted, and that "suitable encryption methods" include "SSID hiding" and "MAC ID filtering." EX1011, ¶[0160], Fig. 1.

AXON EXHIBIT 1035

EX1011 (Wang) at Cover, Abstract; Pet. at 18-19

Overview of Gong



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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH,

[Continued on next page]

(54) Title: AUTHENTICATION SYSTEMS AND METHODS FOR GENERATING FLIGHT REGULATIONS

[Fig. 2]

(57) Abstract: Systems and methods for UAV safety are provided. An authentication system may be used to confirm UAV and/or user identity and provide secured communications between users and UAVs. The UAVs may operate in accordance with a set of flight regulations. The set of flight regulations may be associated with a geo-fencing device in the vicinity of the UAV.

WO 2016/154949 A1

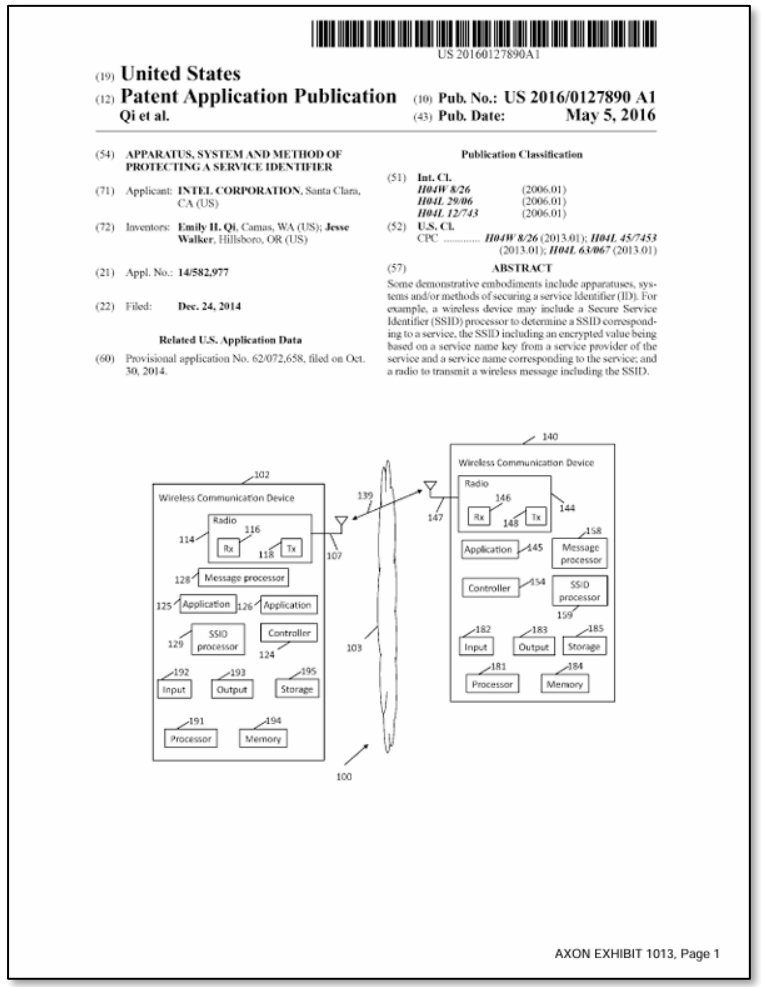
AXON EXHIBIT 1012, Page 1

Gong discloses a UAV that includes a "flight control unit 410," which comprises "identification module 410, which "may be able to uniquely identify and differentiate the UAV from other UAVs," and "may comprise a UAV identifier and a key of the UAV." EX1012, ¶¶[0233], [0235]-[0236].

AXON EXHIBIT 1035

EX1012 (Gong) at Cover, Abstract; Pet. at 19-20

Overview of Qi



US 20160127890A1

(19) **United States**

(12) **Patent Application Publication**
Qi et al.

(10) **Pub. No.: US 2016/0127890 A1**
(43) **Pub. Date: May 5, 2016**

(54) **APPARATUS, SYSTEM AND METHOD OF PROTECTING A SERVICE IDENTIFIER**

(71) Applicant: **INTEL CORPORATION**, Santa Clara, CA (US)

(72) Inventors: **Emily H. Qi**, Camas, WA (US); **Jesse Walker**, Hillsboro, OR (US)

(21) Appl. No.: **14/582,977**

(22) Filed: **Dec. 24, 2014**

Related U.S. Application Data

(60) Provisional application No. 62/072,658, filed on Oct. 30, 2014.

Publication Classification

(51) **Int. Cl.**
H04W 8/26 (2006.01)
H04L 29/06 (2006.01)
H04L 12/743 (2006.01)

(52) **U.S. Cl.**
CPC ***H04W 8/26*** (2013.01); ***H04L 45/7453*** (2013.01); ***H04L 63/067*** (2013.01)

(57) **ABSTRACT**

Some demonstrative embodiments include apparatuses, systems and/or methods of securing a service Identifier (ID). For example, a wireless device may include a Secure Service Identifier (SSID) processor to determine a SSID corresponding to a service, the SSID including an encrypted value being based on a service name key from a service provider of the service and a service name corresponding to the service; and a radio to transmit a wireless message including the SSID.

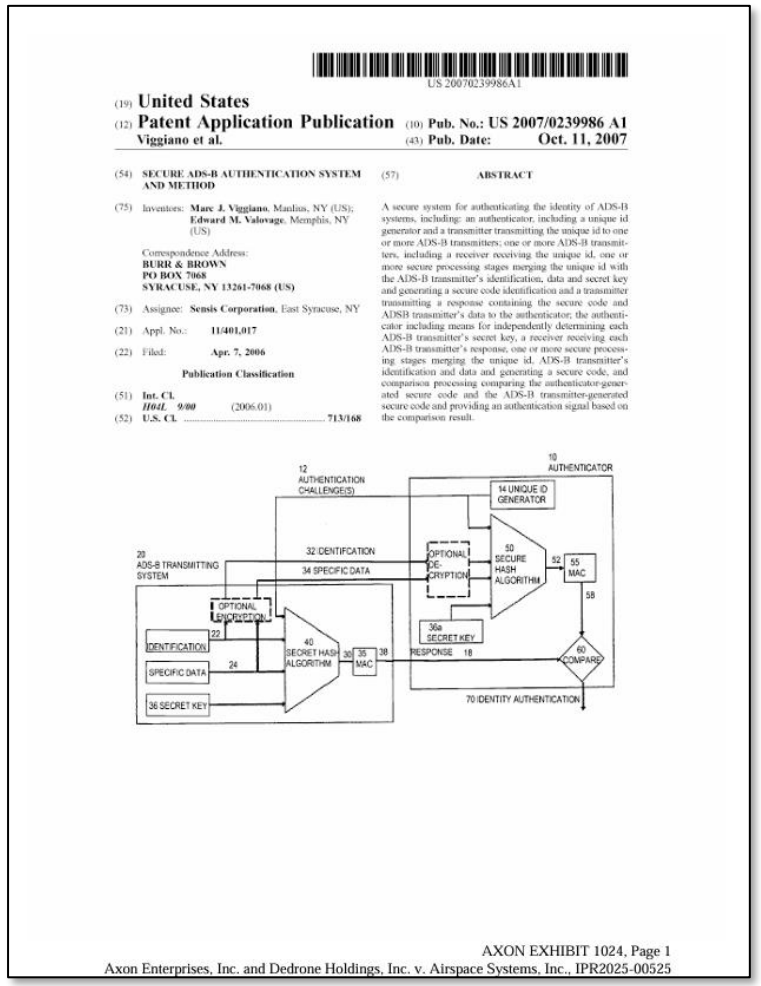
AXON EXHIBIT 1013, Page 1

Qi teaches a system for periodically updating an SSID used in wireless communications, which may increase the security of the SSID. EX1013, ¶¶[0168]-[0170].

AXON EXHIBIT 1035

EX1013 (QI) at Cover, Abstract; Pet. at 20

Overview of Viggiano



US 20070239986A1

(19) **United States**
(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0239986 A1**
Viggiano et al. (43) **Pub. Date: Oct. 11, 2007**

(54) **SECURE ADS-B AUTHENTICATION SYSTEM AND METHOD**

(75) Inventors: **Marc J. Viggiano**, Manlius, NY (US); **Edward M. Valovage**, Memphis, NY (US)

Correspondence Address:
BURR & BROWN
PO BOX 7068
SYRACUSE, NY 13261-7068 (US)

(73) Assignee: **Sensis Corporation**, East Syracuse, NY

(21) Appl. No.: **11/401,017**

(22) Filed: **Apr. 7, 2006**

Publication Classification

(51) **Int. Cl.**
H04L 9/00 (2006.01)
(52) **U.S. Cl.** **713/168**

(57) **ABSTRACT**

A secure system for authenticating the identity of ADS-B systems, including: an authenticator, including a unique id generator and a transmitter transmitting the unique id to one or more ADS-B transmitters; one or more ADS-B transmitters, including a receiver receiving the unique id, one or more secure processing stages merging the unique id with the ADS-B transmitter's identification, data and secret key and generating a secure code identification and a transmitter transmitting a response containing the secure code and ADSB transmitter's data to the authenticator; the authenticator including means for independently determining each ADS-B transmitter's secret key, a receiver receiving each ADS-B transmitter's response, one or more secure processing stages merging the unique id, ADS-B transmitter's identification and data and generating a secure code, and comparison processing comparing the authenticator-generated secure code and the ADS-B transmitter-generated secure code and providing an authentication signal based on the comparison result.

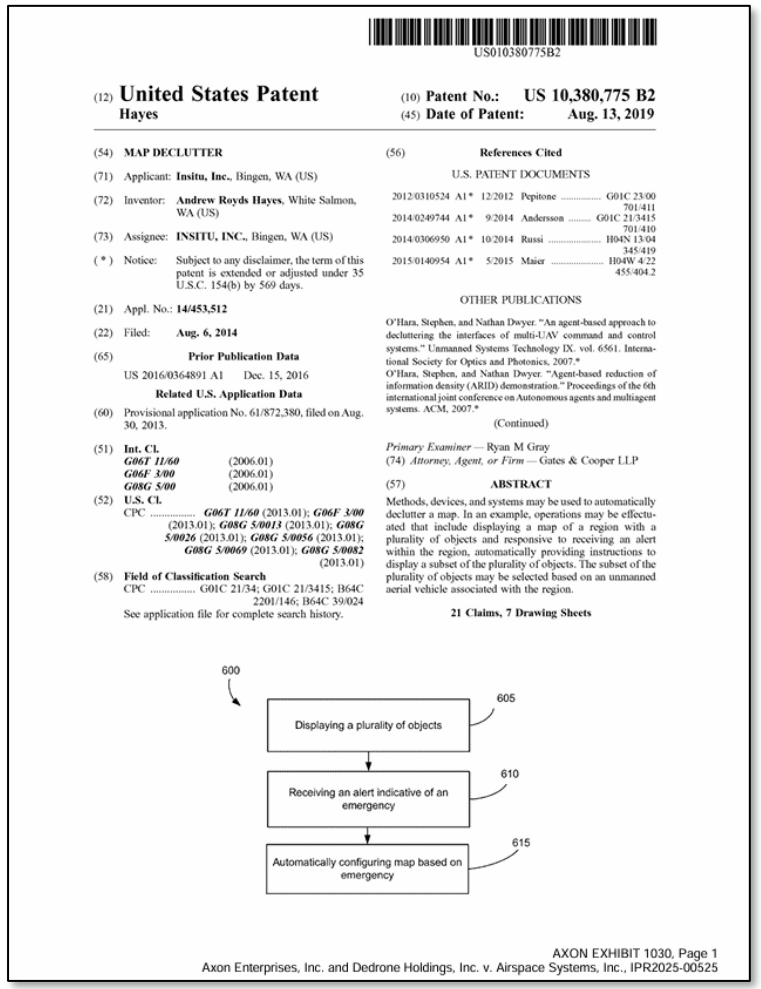
AXON EXHIBIT 1024, Page 1
Axon Enterprises, Inc. and Dedrone Holdings, Inc. v. Airspace Systems, Inc., IPR2025-00525

Viggiano describes authenticating aircraft identity by transmitting a challenge 12 from authenticator 10 to the aircraft to provoke an authentication response. [EX1024, ¶¶0012-0015, Fig. 1]

AXON EXHIBIT 1035

EX1024 (Viggiano) at Cover, Abstract; Oppo. at 9

Overview of Hayes



US010380775B2

(12) **United States Patent**
Hayes

(10) **Patent No.: US 10,380,775 B2**
(45) **Date of Patent: Aug. 13, 2019**

(54) **MAP DECLUTTER**

(71) Applicant: **Insitu, Inc.**, Bingen, WA (US)

(72) Inventor: **Andrew Royds Hayes**, White Salmon, WA (US)

(73) Assignee: **INSITU, INC.**, Bingen, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 569 days.

(21) Appl. No.: **14/453,512**

(22) Filed: **Aug. 6, 2014**

(65) **Prior Publication Data**

US 2016/0364891 A1 Dec. 15, 2016

Related U.S. Application Data

(60) Provisional application No. 61/872,380, filed on Aug. 30, 2013.

(51) **Int. Cl.**

G06T 11/60	(2006.01)
G06F 3/00	(2006.01)
G08G 5/00	(2006.01)

(52) **U.S. Cl.**

CPC ***G06T 11/60*** (2013.01); ***G06F 3/00*** (2013.01); ***G08G 5/0013*** (2013.01); ***G08G 5/0026*** (2013.01); ***G08G 5/0056*** (2013.01); ***G08G 5/0069*** (2013.01); ***G08G 5/0082*** (2013.01)

(58) **Field of Classification Search**

CPC G01C 21/34; G01C 21/3415; B64C 2201/146; B64C 39/024

See application file for complete search history.

(56) **References Cited**

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2015/0140954	A1*	5/2015	Maier	H04W 4/22 455/404.2

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(Continued)

Primary Examiner — Ryan M Gray
(74) *Attorney, Agent, or Firm* — Gates & Cooper LLP

(57) **ABSTRACT**

Methods, devices, and systems may be used to automatically declutter a map. In an example, operations may be effectuated that include displaying a map of a region with a plurality of objects and responsive to receiving an alert within the region, automatically providing instructions to display a subset of the plurality of objects. The subset of the plurality of objects may be selected based on an unmanned aerial vehicle associated with the region.

21 Claims, 7 Drawing Sheets

AXON EXHIBIT 1030, Page 1
Axon Enterprises, Inc. and Dedrone Holdings, Inc. v. Airspace Systems, Inc., IPR2025-00525

Hayes teaches that a UAV associated with an "alert" is caused to be more clearly displayed on a user interface—by removing other detected and displayed UAVs from the interface so that the UAV associated with the alert is more visible. [EX1030, 5:38-67, Fig. 6]

AXON EXHIBIT 1035

EX1030 (Hayes) at Cover, Abstract; Oppo. at 10

Grounds 6B and 7B: A POSITA would have been Motivated to Combine the Cited Prior Art

- A POSITA would have been motivated to combine Taveira, Wang, and Gong/Taveira, Qi, and Gong, and further motivated to combine each combination with Viggiano and Hayes for the same reasons discussed for Viggiano and Hayes in the Ground 5B combination.

- The combinations would have provided the same predictable result as discussed in the Ground 5B combination, except Taveira's first drone 100 having radio module 130 is what receives a challenge 12 from wireless communication device 170 and determines to transmit and transmits a response, and wireless communication device 170 is what receives the response and modifies its displayed user interface based on the response and subsequent alert.

Pet. at 40-45, 49, 60-64; Oppo. at 17

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.pre]

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

- Taveira describes "drone 100" has a "control unit 110" that includes "a processor 120, a radio module 130, and a power module 150." [EX1010, ¶0054].
- Control unit 110 is depicted in Figure 1D of Taveira.
- "[T]he processor of the drone 100 may provide drone information," such as "a drone identifier," to "an access server 240" (EX1010, ¶0110) or a "beacon device" (*id.*, ¶0117).
- The drone identifier can be a "unique. identifier (ID)" that "may allow the drone to be identified by network components." [*Id.*, ¶0168].
- Taveira's control unit 110 discloses a "*device configured to communicate identification information associated with*" drone 100.

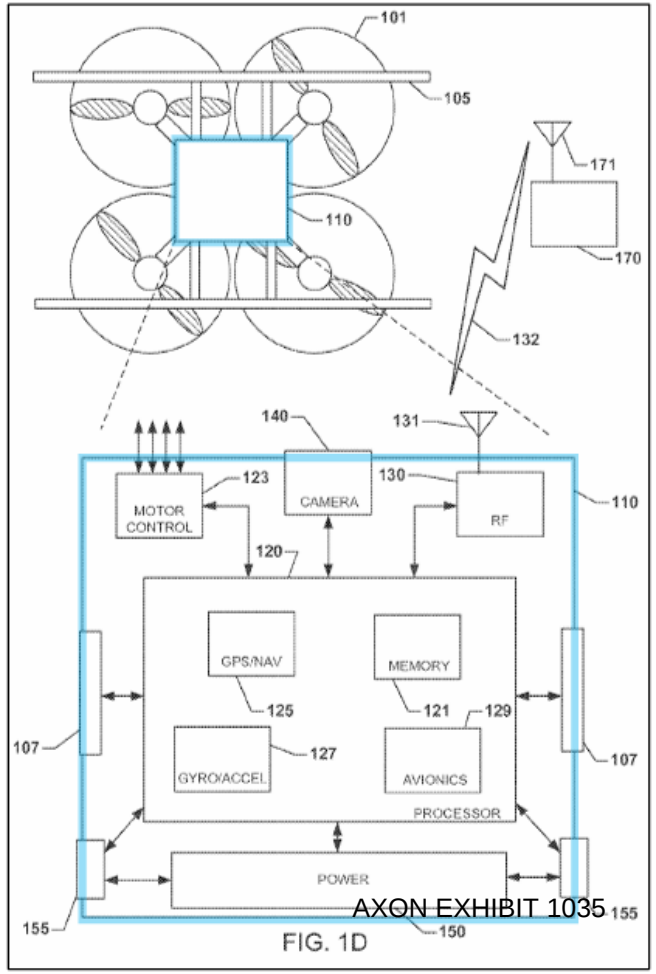


FIG. 1D

AXON EXHIBIT 1035

Pet. 45-50, 53, 55-60, 62; Oppo. at 17

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.pre]

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

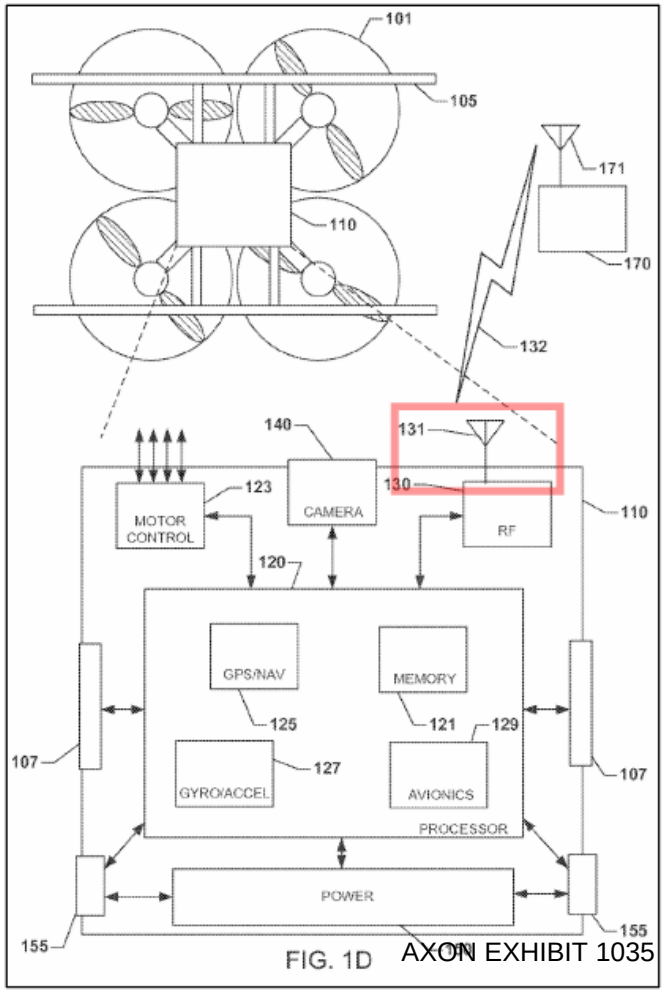
- Taveira explains that "drones may often fly at low altitude (e.g., below 400 feet)." [EX1010, ¶0044.
  - Accordingly, a POSITA would have understood that drone 100 is a "*low-altitude aircraft*," and that Taveira's "drone identifier" is "*identification information associated with a low-altitude aircraft*." [EX1003, ¶149].
  - This understanding is consistent with the '959 Patent, which acknowledges that a "drone" is an example of a "*low altitude aircraft*." See [EX1001, 12:61-62].
- Taveira and Gong teach multiple drones 100 that are detected and displayed by Taveira's wireless communication device 170, and a first of these drones 100 forms a *first low-altitude aircraft* as claimed. [Pet. 45-50, 53, 55-60, 62; EX1027, ¶65].

Pet. 45-50, 53, 55-60, 62; Oppo. at 17

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.a]

[22.a] a radio frequency communication antenna; and

- Taveira's "radio module 130" comprises "transmit/receive antenna 131." [EX1010, ¶0057].
- Taveira, transmit/receive antenna 131 is coupled to radio module 130.
- Radio module 130 utilizes a "bi-directional wireless communication link" to communicate with "wireless communication devices 170" using transmit/receive antenna 131. [EX1010, ¶0057].
- Radio module 130 facilitates the reception of "navigation signals" that are "received from recognizable RF emitters (e.g., AM/FM radio stations, WiFi access points, and cellular network base stations) on the ground." [EX1010, ¶¶0056-0057].
- Given radio module 130's use of various radio frequency (RF) signals to communicate, and POSITA would have understood that transmit/receive antenna 131 is a "*radio frequency communication antenna*." [EX1003, ¶151].



AXON EXHIBIT 1035

Pet. 47-49, 62; Oppo. at 7-8

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.b]

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

- Taveira's radio module 130 is coupled to transmit/receive antenna 131, and radio module 130 communicates via radio frequency (RF) signals using transmit/receive antenna 131, thus disclosing "*a radio communication module coupled to the radio frequency communication antenna and configured to transmit . . . through a transmitted radio signal*."

- Control unit 110 includes a processor that "may provide drone information" such as "a drone identifier" ("*identification information associated with the first low-altitude aircraft*") to "an access server 240" or a "beacon device." [EX1010, ¶¶0054, 0110, 0117].

- Drone 100 transmits "identification, which may include an assigned drone access level." [EX1010, ¶0036].

AXON EXHIBIT 1035

Pet. at 49-50, 62; Oppo. at 17

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.b]

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

- The processor (processor 120 in Figure 1D) uses radio module 130 that "conducts wireless communication" using "[a] bi-directional wireless communication link 132" that is "established between transmit/receive antenna 131 of the radio module 130 and transmit/receive antenna 171 of the wireless communication device 170," where radio frequency (RF) signals are transmitted and received. [EX1010, ¶0057].

- Radio module 130 ("*a radio communication module*") therefore transmits the drone identifier ("*identification information associated with the first low altitude aircraft*") using radio frequency (RF) signals via communication link 132.

Pet. at 49-50, 62; Oppo. at 17

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.c]

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

- Taveira's radio module 130 ("*the radio communication module*") "may be configured to receive navigation signals, such as beacon signals from restricted areas, signals from aviation navigation facilities, etc., and provide such signals to the processor 120 and/or the navigation unit 125 to assist in drone navigation"
  - Such signals include those from "recognizable RF emitters (e.g., AM/FM radio stations, WiFi access points, and cellular network base stations) on the ground." [EX1010, ¶0056].
- Taveira thus teaches the "*radio communication module is configured to receive a radio signal*."

Pet. at 50-53, 62; Oppo. at 18

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.c]

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

- If "*the received information*" refers to information associated with the "*radio signal*" of [22.c], the combinations disclose such information is stored in memory unit 121 of drone 100.
  - Taveira discloses that "the locations, unique identifiers, signal strengths, frequencies, and other characteristic information of such RF emitters may be stored in a database and used to determine position (e.g., via triangulation and/or trilateration) when RF signals are received by the radio module 130," where "such a database of RF emitters may be stored in the memory unit 121 of the drone 100." [EX1010, ¶0056].
  - Because the stored RF emitter information may be used to determine position when "RF signals are received," a POSITA would have understood or at least found obvious that such RF signals are also stored in the memory unit 121 of drone 100 so that the received RF signals can be used with the stored RF emitter information to determine emitter position. [EX1003, ¶155].

AXON EXHIBIT 1035

Pet. at 50-53, 62; Oppo. at 18

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.c]

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

- Additionally, Taveira's drone 100 may have a "database 341 [that] may be stored in memory" of the drone, which may receive "updated database information [] from a server (e.g., 240)." [EX1010, ¶0088].

- Access server 240 is one of the devices with which drone 100 may communicate. [EX1010, ¶0110].

- Accordingly, a POSITA would have understood or at least found obvious that such database information would have been received by radio module 130 via radio signals, because radio module 130 is what receives information that is broadcasted and received by drone 100. [EX1003, ¶156].
  - Because such database information would have been received by radio module 130 and sent by radio module 130 to the processor for storage in the memory of drone 100, a POSITA would have understood that radio module 130 stores the received database information in the memory ("*wherein the radio communication module is configured to… store the information in a storage*"). [EX1010, Fig. 1; EX1003, ¶156].

AXON EXHIBIT 1035

Pet. at 50-53, 62; Oppo. at 18

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.c]

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

- If "*the received information*" refers to the "identification information associated with the low-altitude aircraft" of [22.b], the combinations disclose storing identification data associated with the drone.
  - Drone 100 can transmit "identification, which may include an assigned drone access level," making the drone access level "identification information associated" with drone 100. [EX1010, ¶0036].
  - This access level information of a drone may be stored in "database 341," and that "database 341 may be stored in memory of a drone." [EX1010, ¶¶0079, 0088, Figs. 3C-3E].
  - Database 341 may be updated with database information received by radio module 130, such that a POSITA would have understood that radio module 130 would have sent any received access level information to the processor for storage in memory of drone 100. [EX1010, ¶0088; EX1003, ¶157].

AXON EXHIBIT 1035

Pet. at 50-53, 62; Oppo. at 18

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.d]

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

- Taveira's "transmit/receive antenna 131" is part of control unit 110, and control unit 110 is attached to drone 100. [EX1010, ¶0057, Fig. 1D].
- Thus, transmit/receive antenna 131 ("*the radio frequency communication antenna*") is coupled to drone 100 ("*the first low-altitude aircraft*").

Pet. at 45-50, 53, 55-60, 62; Oppo. at 17

The Grounds 6B and 7B Combinations Render Obvious [22.e]

[22.e] the radio communication module is configured to utilize a secure identifier, the secure identifier comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft, [[and]]

- Radio module 130 (*the radio communication module*) of the first drone 100 receives from wireless communication device 170 ("*remote portable detection system*") an "authentication challenge 12" comprising a "unique identifier" having "random values" generated by a random number generator.
    - The unique identifier provides that "an attacker cannot 'learn' a valid response by observing the challenges 12, and the radio module 130 further uses challenge 12 (and its unique identifier) to prepare an authentication challenge response (*the radio communication module is configured to utilize a secure identifier*). [EX1024, ¶¶0012-0013; EX1027, ¶67].
    - The challenge 12 (*secure identifier*) includes an excitation that causes radio module 130 to prepare and transmit the challenge response (*secure identifier comprising a specified excitation*). [EX1024, ¶¶0012-0013; EX1027, ¶68].

Pet. at 40-45, 49-60, 60-64; Oppo. at 18-19; Sur-Reply, 10-11

The Grounds 6B and 7B Combinations Render Obvious [22.e]

[22.e] the radio communication module is configured to utilize a secure identifier, the secure identifier comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft, [[and]]

- The challenge response transmitted by radio module 130 allows for the first drone 100 to be distinguished from among multiple detected drones 100 and highlighted for display (*enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft*), as taught by Hayes. [EX1030, 5:38-67, Fig. 6].

- The combination teaches that the challenge response is transmitted by radio module 130 to wireless communication device 170, and the wireless communication device 170 attempts authentication of the first drone 100's identity based on the response. [EX1024, ¶¶0012-0015; EX1027, ¶69].

- Consecutive failures of the authentication cause "an alert" to issue that triggers a modification of the displayed user interface of wireless communication device 170, causing other detected and displayed drones 100 to be removed from the interface and the first drone 100 to thus be more clearly displayed. [EX1030, 5:38-67, Fig. 6].

- Challenge 12 (*secure identifier*) satisfies the Board's secure identifier construction for the same reasons discussed previously. [EX1027, ¶70].

AXON EXHIBIT 1035

Pet. at 40-45, 49-60, 60-64; Oppo. at 18-19; Sur-Reply, 10-11

The Grounds 6B and 7B Combinations enable disambiguation

- PO wrongly argues that challenge 12 does not "enable[] disambiguation" as it is the "absence of responses" that allows a conclusion that authentication has failed
  - As combined, the response allows the first aircraft to be distinguished from among multiple aircraft when the response causes there to have been **multiple failed authentications.**
    - A **challenge and response can each be "consecutive" challenges and responses**—i.e., a second challenge and second response.
    - When **failed authentication results due to this response, modification of a displayed user interface occurs** causing other detected and displayed aircraft to be removed so the first aircraft is more clearly displayed.
- PO also wrongly suggests the combinations do not involve the transmission of a response ("continuing not to broadcast anything")
  - All grounds involve the transmission of a challenge response.

AXON EXHIBIT 1035

Pet. at 29-31, 35-39; Oppo. at 13-15; Sur-Reply, 10-11

The Grounds 6B and 7B Combinations Render Obvious [22.f]

[22.f] wherein utilizing the secure identifier comprises receiving by the radio communication module the specified excitation from a remote portable detection system, wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof,

- Wireless communication device 170 forms a "*remote portable detection system*."
- The combinations teach *utilizing the secure identifier* comprises radio module 130 (*the radio communication module*) of the first drone 100 receiving challenge 12 including the excitation (*comprises receiving by the radio communication module the specified excitation*) from wireless communication device 170 (*from the remote portable detection system*). [EX1027, ¶71].
- This excitation (*the specified excitation*) causes the first drone 100 to change a behavior in that the first drone 100 is triggered to prepare and transmit a challenge response (*wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof*). [EX1027, ¶71].

Pet. at 55-60, 64; Oppo. at 19-20; Sur-Reply, 9-10

The Grounds 6B and 7B Combinations Render Obvious [22.f]

[22.f] wherein utilizing the secure identifier comprises receiving by the radio communication module the specified excitation from a remote portable detection system, wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof,

- Wireless communication device 170 forms a "*remote portable detection system*."
- The combinations teach *utilizing the secure identifier* comprises radio module 130 (*the radio communication module*) of the first drone 100 receiving challenge 12 including the excitation (*comprises receiving by the radio communication module the specified excitation*) from wireless communication device 170 (*from the remote portable detection system*). [EX1027, ¶71].
- This excitation (*the specified excitation*) causes the first drone 100 to change a behavior in that the first drone 100 is triggered to prepare and transmit a challenge response (*wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof*). [EX1027, ¶71].

Pet. at 55-60, 64; Oppo. at 19-20; Sur-Reply, 9-10

- PO argues challenge 12 does not change a behavior because "responding to a challenge is the default and expected behavior, not a changed behavior."

  - But **responding to the challenge is a change in behavior** because the aircraft is not transmitting a response before receiving the challenge; PO's expert agrees:

19 Q Does the device that is being
20 authenticated only send a response upon receiving
21 a challenge?
22 A That's correct.

1 Q If the device being authenticated does not
2 receive a challenge, then would it send a
3 response?
4 A No.

AXON EXHIBIT 1035

Pet. at 35-39; Oppo. at 15-16; Sur-Reply, 9-10; EX1031, 11:19-22, 12:1-4

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.g]

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

- Taveira's control unit 110 includes a processor that "may provide drone information" such as "a drone identifier" to "an access server 240." [EX1010, ¶0110].

- The processor (processor 120, Figure 1D) includes radio module 130 that "conduct[s] wireless communication" using "[a] bi-directional wireless communication link 132" that is "established between transmit/receive antenna 131 of the radio module 130 and transmit/receive antenna 171 of the wireless communication device 170," where radio frequency (RF) signals are transmitted and received, and wireless communication device 170 is, for example, a "smartphone" or a "tablet." EX1010, ¶0057.

- Accordingly, Taveira's radio module 130 ("*the radio communication module*") is configured for bi-directional communication ("*two-way communication*") with a wireless communication device 170 ("*a . . . system*").

Pet. at 55-60, 64; Oppo. at 20

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.g]

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

- A POSITA would have understood that wireless communication device 170 is a *remote portable detection system*.
- As noted above, communication device 170 can be a "smartphone" or "tablet," which are well known portable devices, and wireless communication device 170 is located on the ground ("*remote*" from drone 100) and communicates with drone 100 via wireless signals. [EX1010, ¶¶0045, 0057].
- Moreover, wireless communication device 170 "detects" a drone 100 because it has established a bidirectional wireless communication link 132, which a POSITA would have understood, or at least found obvious, to require detecting parameters associated with communication with drone 100. EX1010, ¶¶0057, 0069 (describing establishment of a communication link between a drone and a wireless communication device upon the drone's approach); EX1003, ¶165.

Pet. at 55-60, 64; Oppo. at 20

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.g]

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

- Further, the combination of Taveira and Gong teaches *the remote portable detection system*.
  - Gong describes a "remote device" that may be a "remote controller" that communicates with a UAV using "wireless communications" such as "WiFi" and that shows on a display "a location of [] [a] first UAV" and "may…show a location of [] [a] second UAV." [EX1012, ¶¶0182, 0955].
  - Moreover, Gong's remote controller can be implemented as a "geo-fencing device" that "detect[s] the presence of the UAV" and that the geo-fencing device can be "portable." [EX1012, ¶¶0137, 0593, 0600, 0628].
  - The geo-fence device further interacts with multiple UAVs, providing a "reference point for different sets of flight regulations for different UAVs in different circumstances that may approach the geo-fencing device." [EX1012, ¶¶0864-0869].
  - Thus, in the combination of Taveira and Gong, Taveira's wireless communication device 170, which can be a smartphone or tablet, is enhanced by remotely detecting the presence of one or more drones 100 as taught by Gong, thereby teaching a "*remote portable detection system*."

AXON EXHIBIT 1035

Pet. at 55-60, 64; Oppo. at 20

PO Does Not Contest that the Grounds 6B and 7B Combinations Render Obvious [22.h]

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

- Taveira's control unit 110 ("*the device*") is coupled to drone 100 ("*the first low-altitude aircraft*").

Pet. at 58; Oppo. at 17

The Grounds 6B and 7B Combinations Render Obvious [22.i]

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

- Taveira's wireless communication device 170 *(remote portable detection system)* can be a smartphone or tablet. [EX1010, ¶0057].
- A POSITA would have understood that wireless communication device 170 *(remote portable detection system)* therefore includes a user interface because smartphones and tablets are known to include a user interface (*includes a user interface*). [EX1003, ¶169].
  - Figure 8 depicts tablet 800 that includes a "touch screen display 810." [EX1010, ¶¶0181-0182, 0187].

Pet. at 45-50, 53, 55-60, 62; Oppo. at 20-21; Sur-Reply, 10-12

The Grounds 6B and 7B Combinations Render Obvious [22.i]

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

- Taveira's wireless communication device 170 according to Gong's teachings provides that wireless communication device 170 (*remote portable detection system*) would remotely detect the presence of one or more drones 100 and display such detected drones via a user interface (*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*). [EX1003, ¶171].

Pet. at 45-50, 53, 55-60, 62; Oppo. at 20-21; Sur-Reply, 10-12

The Grounds 6B and 7B Combinations Render Obvious [22.i]

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

- Multiple drones 100 are detected by wireless communication device 170 (*forming the plurality of different low-altitude aircrafts*); one of these drones 100 forms the *first low-altitude aircraft*, teaching *the plurality [is] comprising the first low-altitude aircraft*. [EX1027, ¶73].

- Upon consecutive authentication failures for the first drone 100, wireless communication device 170 (*the remote portable detection system*) modifies its user interface display so other detected and displayed drones 100 are removed from the interface and the first drone 100 is more clearly displayed (*is configured to disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft of the plurality*). [EX1027, ¶73].

- This changing display form so first drone 100 is more clearly displayed relative to the other detected drones (*disambiguate the first low altitude aircraft from the other detected low-altitude aircraft of the plurality*) is based on the first drone's triggered authentication response (*based on the changed behavior of the first low-altitude aircraft*) to the authentication challenge that causes failed authentications. [EX1027, ¶73].

AXON EXHIBIT 1035

Pet. at 45-50, 53, 55-60, 62, 64; Oppo. at 20-21; Sur-Reply, 10-12

The Grounds 6B and 7B Combinations teach to disambiguate

- As noted previously, PO argues that challenge 12 does not "enable[] disambiguation" as it is the "absence of responses" that allows a conclusion that authentication has failed
  - As combined, the response allows the first aircraft to be distinguished from among multiple aircraft when the response causes there to have been **multiple failed authentications.**
    - A **challenge and response can each be "consecutive" challenges and responses**—i.e., a second challenge and second response.
    - When **failed authentication results due to this response, modification of a displayed user interface occurs** causing other detected and displayed aircraft to be removed so the first aircraft is more clearly displayed; **the modification is based on the triggered response (changed behavior).**
- PO also wrongly suggests the combinations do not involve the transmission of a response ("continuing not to broadcast anything")
  - All grounds involve the transmission of a challenge response.

Pet. at 37-39; Oppo. at 16-17; Sur-Reply, 10-12

The Grounds 6B and 7B Combinations teach to disambiguate

- PO further argues that the combinations disclose "isolating" an aircraft instead of "disambiguating" an aircraft.
  - PO appears to adopt an unsupported, **overly narrow disambiguate definition requiring simultaneously displaying a first aircraft and other aircraft at all times and throughout disambiguation**, and the importing of "identifiers" such as "bold text" into the SC.
    - No support for this definition, and PO has not shown or argued that this definition is correct.
  - The combinations teach the receiver's user interface displaying multiple detected aircraft simultaneously, including a first aircraft, and upon consecutive authentication failures for the first aircraft, the user interface is modified such that other detected and displayed aircraft are removed and the first aircraft is thus more clearly displayed (*disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft of the plurality*).

Pet. at 37-39; Oppo. at 16-17, 20-21, 23-24 ([22.i]); Sur-Reply, 10-12

The Grounds 6B and 7B Combinations teach to disambiguate

- PO's definition of EX2022 is irrelevant as it relates to **"words" and "phrases"** (not aircraft)

Definition of *disambiguate verb* from the Oxford Advanced Learner's Dictionary

disambiguate *verb*

ˌdɪsæmˈbɪgjueɪt ; ˌdɪsæmˈbɪgjueɪt

disambiguate something

(*technical*)

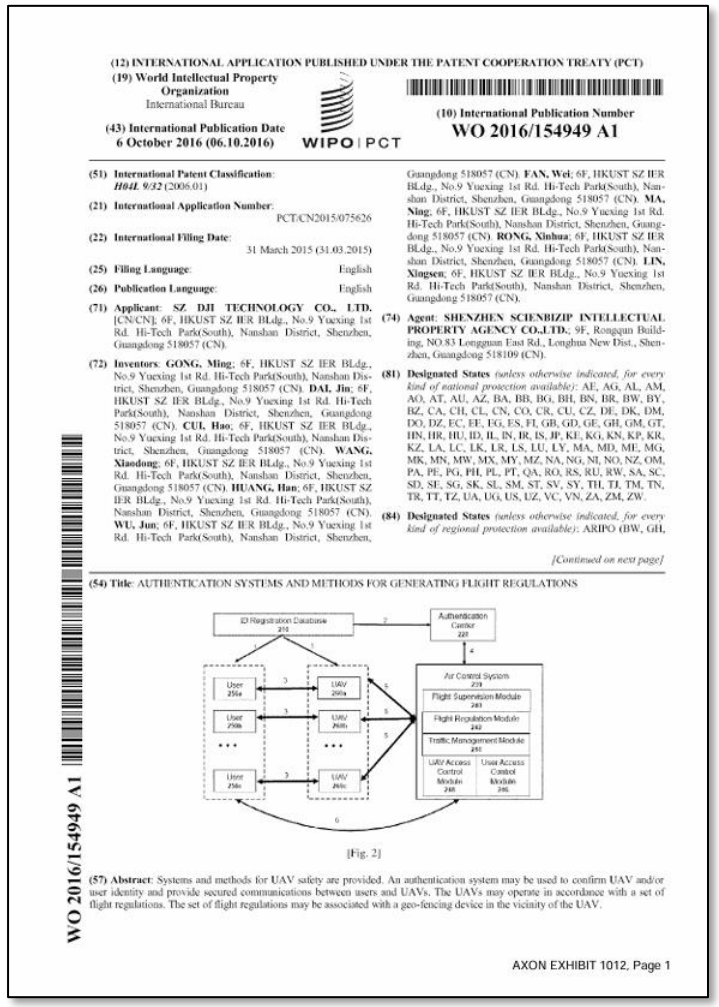
to show clearly the difference between two or more words, phrases, etc. which are similar in meaning

- Regardless, the grounds meet definition, showing a **difference between an aircraft that failed authentication and aircrafts that have not by more clearly displaying the failed-authentication aircraft from others**.

AXON EXHIBIT 1035

Pet. at 37-39; Oppo. at 16-17, 20-21, 23-24 ([22.i]); Sur-Reply, 10-12

Overview of Gong



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[Continued on next page]

(54) Title: AUTHENTICATION SYSTEMS AND METHODS FOR GENERATING FLIGHT REGULATIONS

[Fig. 2]

(57) Abstract: Systems and methods for UAV safety are provided. An authentication system may be used to confirm UAV and/or user identity and provide secured communications between users and UAVs. The UAVs may operate in accordance with a set of flight regulations. The set of flight regulations may be associated with a geo-fencing device in the vicinity of the UAV.

WO 2016/154949 A1

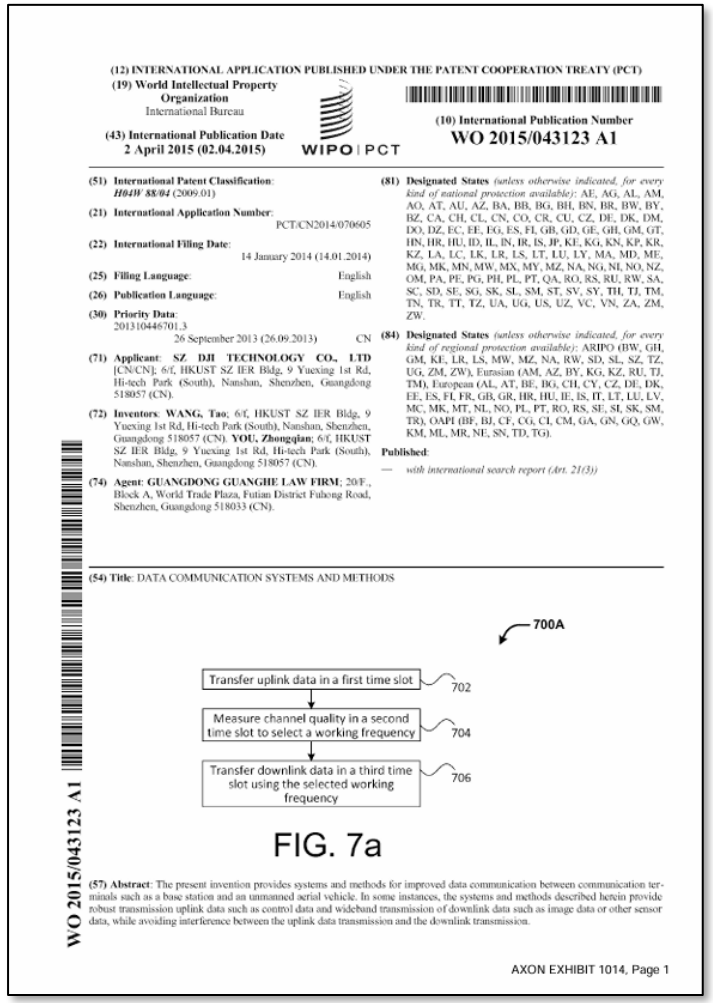
AXON EXHIBIT 1012, Page 1

Gong discloses a UAV that includes a "flight control unit 410," which comprises "identification module 410, which "may be able to uniquely identify and differentiate the UAV from other UAVs," and "may comprise a UAV identifier and a key of the UAV." EX1012, ¶¶[0233], [0235]-[0236].

AXON EXHIBIT 1035

EX1012 (Gong) at Cover, Abstract; Pet. at 19-20

Overview of Wang-II



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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Published:
— *with international search report (Art. 21(3))*

(54) Title: DATA COMMUNICATION SYSTEMS AND METHODS

FIG. 7a

(57) Abstract: The present invention provides systems and methods for improved data communication between communication terminals such as a base station and an unmanned aerial vehicle. In some instances, the systems and methods described herein provide robust transmission uplink data such as control data and wideband transmission of downlink data such as image data or other sensor data, while avoiding interference between the uplink data transmission and the downlink transmission.

WO 2015/043123 A1

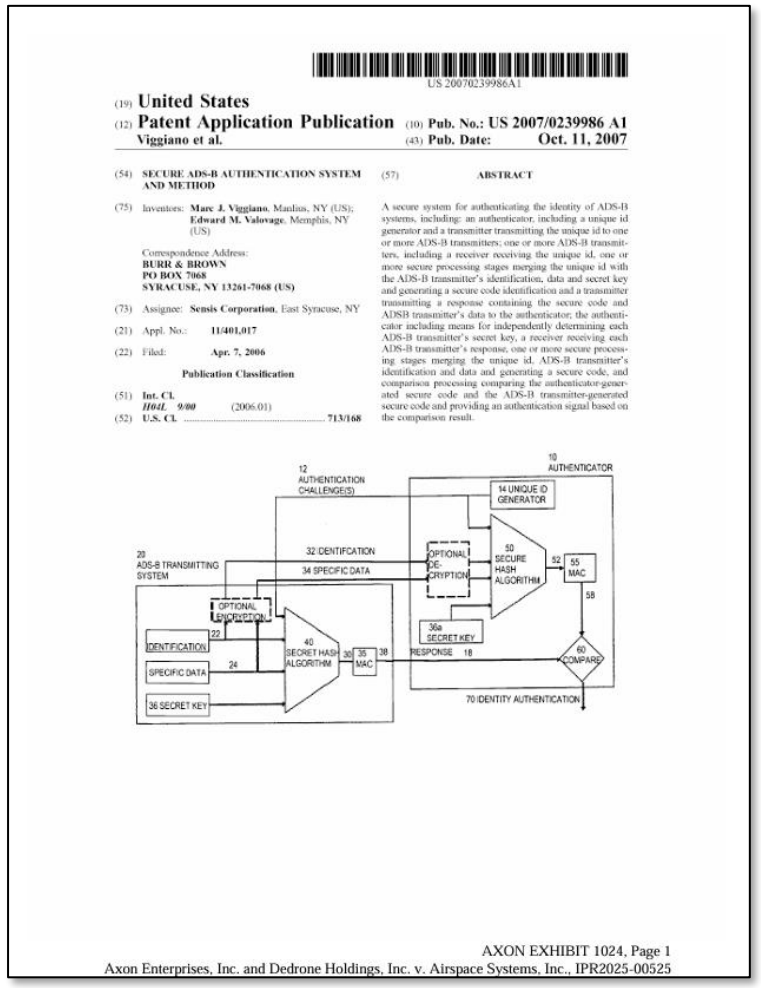
AXON EXHIBIT 1014, Page 1

Wang-II discloses a "communication terminal 1200" capable of bi-directional wireless communication that "includes an uplink receiver 1204, a downlink transmitter 1202, and an antenna 1206." EX1014, ¶[00141].

AXON EXHIBIT 1035

EX1014 (Wang-II) at Cover, Abstract; Pet. at 20-21

Overview of Viggiano



US 20070239986A1

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(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0239986 A1**
Viggiano et al. (43) **Pub. Date: Oct. 11, 2007**

(54) **SECURE ADS-B AUTHENTICATION SYSTEM AND METHOD**

(75) Inventors: **Marc J. Viggiano**, Manlius, NY (US); **Edward M. Valovage**, Memphis, NY (US)

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(21) Appl. No.: **11/401,017**

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H04L 9/00 (2006.01)
(52) **U.S. Cl.** **713/168**

(57) **ABSTRACT**

A secure system for authenticating the identity of ADS-B systems, including: an authenticator, including a unique id generator and a transmitter transmitting the unique id to one or more ADS-B transmitters; one or more ADS-B transmitters, including a receiver receiving the unique id, one or more secure processing stages merging the unique id with the ADS-B transmitter's identification, data and secret key and generating a secure code identification and a transmitter transmitting a response containing the secure code and ADSB transmitter's data to the authenticator; the authenticator including means for independently determining each ADS-B transmitter's secret key, a receiver receiving each ADS-B transmitter's response, one or more secure processing stages merging the unique id, ADS-B transmitter's identification and data and generating a secure code, and comparison processing comparing the authenticator-generated secure code and the ADS-B transmitter-generated secure code and providing an authentication signal based on the comparison result.

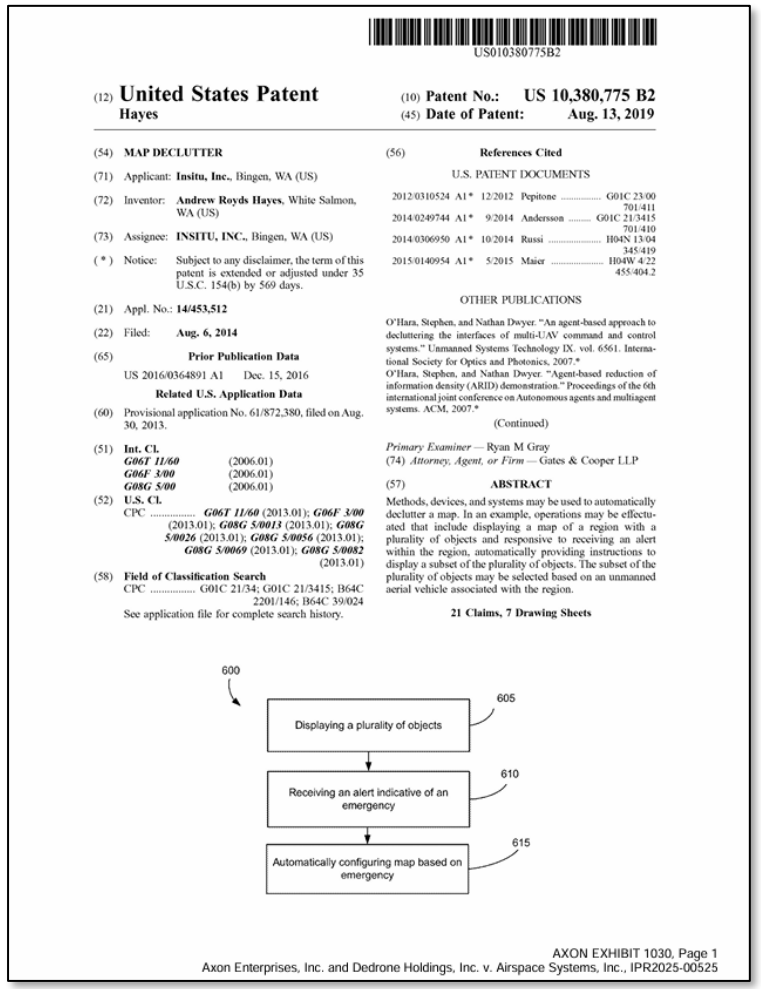
AXON EXHIBIT 1024, Page 1
Axon Enterprises, Inc. and Dedrone Holdings, Inc. v. Airspace Systems, Inc., IPR2025-00525

Viggiano describes authenticating aircraft identity by transmitting a challenge 12 from authenticator 10 to the aircraft to provoke an authentication response. [EX1024, ¶¶0012-0015, Fig. 1]

AXON EXHIBIT 1035

EX1024 (Viggiano) at Cover, Abstract; Oppo. at 9

Overview of Hayes



US010380775B2

(12) **United States Patent**
Hayes

(10) **Patent No.: US 10,380,775 B2**
(45) **Date of Patent: Aug. 13, 2019**

(54) **MAP DECLUTTER**

(71) Applicant: **Insitu, Inc.**, Bingen, WA (US)

(72) Inventor: **Andrew Royds Hayes**, White Salmon, WA (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 569 days.

(21) Appl. No.: **14/453,512**

(22) Filed: **Aug. 6, 2014**

(65) **Prior Publication Data**

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Related U.S. Application Data

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G06F 3/00	(2006.01)
G08G 5/00	(2006.01)

(52) **U.S. Cl.**

CPC ***G06T 11/60*** (2013.01); ***G06F 3/00*** (2013.01); ***G08G 5/0013*** (2013.01); ***G08G 5/0026*** (2013.01); ***G08G 5/0056*** (2013.01); ***G08G 5/0069*** (2013.01); ***G08G 5/0082*** (2013.01)

(58) **Field of Classification Search**

CPC G01C 21/34; G01C 21/3415; B64C 2201/146; B64C 39/024

See application file for complete search history.

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(Continued)

Primary Examiner — Ryan M Gray
(74) *Attorney, Agent, or Firm* — Gates & Cooper LLP

(57) **ABSTRACT**

Methods, devices, and systems may be used to automatically declutter a map. In an example, operations may be effectuated that include displaying a map of a region with a plurality of objects and responsive to receiving an alert within the region, automatically providing instructions to display a subset of the plurality of objects. The subset of the plurality of objects may be selected based on an unmanned aerial vehicle associated with the region.

21 Claims, 7 Drawing Sheets

AXON EXHIBIT 1030, Page 1
Axon Enterprises, Inc. and Dedrone Holdings, Inc. v. Airspace Systems, Inc., IPR2025-00525

Hayes teaches that a UAV associated with an "alert" is caused to be more clearly displayed on a user interface—by removing other detected and displayed UAVs from the interface so that the UAV associated with the alert is more visible. [EX1030, 5:38-67, Fig. 6]

AXON EXHIBIT 1035

EX1030 (Hayes) at Cover, Abstract; Oppo. at 10

Ground 8B: A POSITA would have been Motivated to Combine Gong, Wang-II, Viggiano, and Hayes

- A POSITA would have been motivated to combine Gong and Wang-II, and further motivated to combine with Viggiano and Hayes for the same reasons discussed for Viggiano and Hayes in the Ground 5B combination. [EX1027, ¶74].

- The combination would have provided the same predictable result as discussed in the Ground 5B combination, except Gong's first UAV communication module/unit is what receives a challenge 12 from Gong's geofencing device and determines to transmit and transmits a response, and the geofencing device is what receives the response and modifies its displayed user interface based on the response and subsequent alert. [EX1024, ¶¶0002, 0011-0015, Figs. 1-3, Claims 1, 5, 8, 21, 39; EX1030, 5:38-67, Fig. 6; EX1003, ¶¶188-191; EX1027, ¶74].

Pet. at 64-66, 70-78; Oppo. at 21

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.pre]

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

- Gong discloses a UAV that includes a "flight control unit 410" which comprises "identification module 410, one or more processors 420, and one or more communication modules 430" that receives and transmits wireless communications [EX1012, ¶¶0024, 0233, 0235].
  - "The identification module may be able to uniquely identify and differentiate the UAV from other UAVs," and "may comprise a UAV identifier and a key of the UAV." [EX1012, ¶0236].
  - The "UAV identifier may be unique to the UAV" and "may uniquely differentiate and/or distinguish the UAV from other UAVs." [EX1012, ¶0133].
  - "A UAV may broadcast the UAV identifier during operation." [EX1012, ¶0277].
  - The "flight control unit may control communications of the UAV." [EX1012, ¶0234].
- The flight control unit 410 (*device*) is *configured to communicate*, through communication module/unit 430, a UAV identifier that uniquely identifies the associated UAV ("*identification information associated with a first low-altitude aircraft")*

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Pet. 64-66, 70-78; Oppo. at 21-22

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.pre]

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

- A POSITA would have understood that Gong's UAV is a "*low altitude aircraft*."
  - The UAV "may be a rotorcraft" that comprises multiple rotors that are "capable of rotating to generate lift for the UAV." [EX1012, ¶0126].
  - Gong's UAV may be prevented "from flying above an altitude ceiling that may be fixed or variable." [EX1012, ¶0173].
  - And throughout the figures of Gong, UAVs are depicted as 4-rotor drones, which a POSITA would have understood to be "*low-altitude aircraft*." [EX1003, ¶193; EX1001, 12:61-62, Fig. 12 (depicting drone 1214 as a 4 rotor aircraft)].
- Multiple UAVs are detected and displayed by Gong's geofencing device, and a first of these UAVs forms a *first low-altitude aircraft* as claimed. [EX1027, ¶75].

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Pet. 64-66, 70-78; Oppo. at 21-22

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.a]

[22.a] a radio frequency communication antenna; and

- Gong's flight control unit, through the communication module/unit, is capable of wireless communication, and example of which is when the UAV broadcasts an associated UAV identifier "via a wireless signal (e.g., radio signal, optical signal, or an acoustical signal)." [EX1012, ¶0271].
    - A POSITA would have understood that Gong's communications module/unit includes an antenna capable of transmitting radio signals ("*a radio frequency communication antenna*") in order to perform such broadcasting. [EX1003, ¶197].

Pet. at 69-70; Oppo. at 7-8

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.a]

[22.a] a radio frequency communication antenna; and

- Alternatively, like Gong, Wang-II discloses a "communication terminal 1200 can be implemented by a mobile platform (e.g., UAV) or other remotely-controlled movable object capable of transmitting downlink data and receiving uplink data" in a wireless communication environment. [EX1014, ¶¶0060, 00141].

- Such wireless communications involve the transmission of "electromagnetic signals such as electric voltage, radiowave, microwave, infrared signals, or the like." [EX1014, ¶¶0060, 00141].

- The "communication terminal 1200 includes an uplink receiver 1204, a downlink transmitter 1202, and an antenna 1206," providing that the combination teaches *a radio frequency communication antenna*. [EX1014, ¶00141].

Pet. at 69-70; Oppo. at 7-8

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.b]

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

- Gong discloses broadcasting, by a UAV, a "UAV identifier" that "may uniquely differentiate and/or distinguish the UAV from other UAVs" via "a wireless signal (e.g., radio signal,…)." [EX1012, ¶¶0133, 0236, 0271].
- Gong's communications module/unit is the component responsible for wireless transmissions from the UAV. [EX1012, ¶0024].
- Accordingly, Gong's communications module/unit ("*a radio communication module*") is configured to transmit UAV identifiers via radio signals ("*identification information associated with the first low-altitude aircraft through a transmitted radio signal*").
- A POSITA would have understood that communication module/unit's use of radio signals for such transmission indicates that the communication module/unit is coupled to a "*radio frequency communication antenna*," which a POSITA would have understood to be a well known component for such wireless communications. [EX1003, ¶201].

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Pet. at 64-66, 70-78; Oppo. at 21-22

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.b]

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

- In the alternative, the Gong-Wang-II combination renders obvious Limitation 21[b].
- Wang II's UAV includes a "communication terminal 1200," which includes an uplink receiver 1204, a downlink transmitter 1202, and an antenna 1206."
- A POSITA would have understood that under the Gong-Wang-II combination, Gong's communications module/unit ("*a radio communication module*") would comprise Wang-II's "uplink receiver 1204" and "downlink transmitter 1202" and would be coupled to Wang-II's "antenna 1206" ("*coupled to the radio frequency communication antenna*") as such components would be necessary to effectuate the wireless signal transmission and reception functionality of Gong's communication module/unit. [EX1003, ¶202].

Pet. at 64-66, 70-78; Oppo. at 21-22

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.c]

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

- Gong explains "identification module 410," which, along with communication unit/module, is part of a flight control unit aboard a UAV, may comprise "a UAV identifier" that "uniquely differentiate[s] and/or distinguish[es] the UAV from other UAVs." [EX1012, ¶¶0133, 0233, 0235, 0236].
    - The UAV identifier "may be issued by an ID registration database," which "may be off-board the UAV." [EX1012, ¶0240].
    - The "identification module may be configured to receive the UAV identifier."
    - Because Gong discloses that reception of data from off-board devices is handled by the communication module/unit via radio signals, a POSITA would have understood that the identification module "receives the UAV identifier" via radio signals first received by communications module/unit. EX1003, ¶204.
- Further, Gong's "UAV identifier may be stored in the identification module in an unalterable state" once configured. EX1012, [0237].
- Accordingly, Gong's communications module/unit ("*the radio communication module*") is configured to receive a UAV identifier via a radio signal ("*configured to receive a radio signal*") and store the received UAV identifier in the identification module ("*store the information in a storage*").

Pet. at 72-73; Oppo. at 7-8

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.d]

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

- Gong suggests to a POSITA that its communications unit/module includes an antenna capable of transmitting radio signals in view of Gong's disclosure of communications module/unit performing wireless communications.

- Because the communications module/unit is included in a UAV (as a component of the flight control unit), a POSITA would have understood that the antenna ("*the radio frequency communication antenna*") would also be coupled to the UAV ("*is coupled to the first low-altitude aircraft*"). [EX1012, ¶¶0233 (explaining that the flight control unit is included in the UAV), 0235 (explaining that the communications module/unit is included in the flight control unit); EX1003, ¶205].

Pet. at 64-66, 70-78; Oppo. at 21-22

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.d]

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

- Alternatively, the Gong-Wang-II combination renders obvious this limitation.
- It would have been obvious to a POSITA to incorporate Wang-II's antenna (e.g., antenna 1206) in Gong's communications module/unit to facilitate communication module/unit's wireless communication functionalities.
- And because the communications module/unit is included in a UAV (as a component of the flight control unit), a POSITA would have understood that the antenna ("*the radio frequency communication antenna*") would also be coupled to the UAV ("*coupled to the first low-altitude aircraft*"). [EX1012, ¶0233, 0235 (explaining that the communications module/unit is included in the flight control unit); EX1003, ¶206].

Pet. at 64-66, 70-78; Oppo. at 21-22

The Ground 8B Combination Renders Obvious [22.e]

[22.e] the radio communication module is configured to utilize a secure identifier, the secure identifier comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft, [[and]]

- Gong's communication module/unit (*the radio communication module*) of the first UAV receives from Gong's geofencing device ("*remote portable detection system*") an "authentication challenge 12" having the unique identifier.
  - The communication module/unit further uses challenge 12 (and its unique identifier) to prepare an authentication challenge response (*the radio communication module is configured to utilize a secure identifier*). [EX1028, 63; EX1027, ¶76].
  - The challenge 12 (*secure identifier*) includes an excitation that causes the communication module/unit to prepare and transmit the challenge response (*secure identifier comprising a specified excitation*). [EX1024, ¶¶0012-0013; EX1027, ¶¶76-77].

Pet. at 70-78; Oppo. at 22; Sur-Reply, 10-11

The Ground 8B Combination Renders Obvious [22.e]

[22.e] the radio communication module is configured to utilize a secure identifier, the secure identifier comprising a specified excitation enabling disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft, [[and]]

- The challenge response received by the geofencing device *enable[es] disambiguation of the first low-altitude aircraft from other detected low-altitude aircraft* for the same reasons discussed previously. [EX1030, 5:38-67, Fig. 6].

- The geofencing device attempts authentication of the first UAV's identity based on the response and consecutive failures of the authentication causes issuance of "an alert" that triggers a modification of the displayed user interface, in the same way as discussed previously. [EX1024, ¶¶0012-0015; EX1027, ¶77; EX1030, 5:38-67, Fig. 6].

- The geofencing device detects multiple drones.

- Challenge 12 satisfies the Board's *secure identifier* construction for the same reasons discussed previously. [EX1027, ¶78].

Pet. at 70-78; Oppo. at 22-23; Sur-Reply, 10-11

The Ground 8B Combination enables disambiguation

- PO wrongly argues that challenge 12 does not "enable[] disambiguation" as it is the "absence of responses" that allows a conclusion that authentication has failed
  - As combined, the response allows the first aircraft to be distinguished from among multiple aircraft when the response causes there to have been **multiple failed authentications.**
    - A **challenge and response can each be "consecutive" challenges and responses**—i.e., a second challenge and second response.
    - When **failed authentication results due to this response, modification of a displayed user interface occurs** causing other detected and displayed aircraft to be removed so the first aircraft is more clearly displayed.
- PO also wrongly suggests the combinations do not involve the transmission of a response ("continuing not to broadcast anything")
  - All grounds involve the transmission of a challenge response.

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Pet. at 29-31, 35-39; Oppo. at 13-15; Sur-Reply, 10-11

The Ground 8B Combination Renders Obvious [22.f]

[22.f] wherein utilizing the secure identifier comprises receiving by the radio communication module the specified excitation from a remote portable detection system, wherein the specified excitation causes the first low-altitude aircraft to change a behavior thereof,

- The combination teaches *utilizing the secure identifier* comprises communication module/unit (*the radio communication module*) of the first UAV receiving challenge 12 that includes the excitation (*comprises receiving by the radio communication module the specified excitation*) from geofencing device (*from the remote portable detection system*). [EX1027, ¶79].

- This excitation (*the specified excitation*) causes the first UAV to change a behavior in that the first UAS is triggered to prepare and transmit a challenge response (*wherein the specified excitation causes the first low altitude aircraft to change a behavior thereof*). [EX1027, ¶79].

Pet. at 70-78; Oppo. at 23; Sur-Reply, 9-10

• PO argues challenge 12 does not change a behavior because "responding to a challenge is the default and expected behavior, not a changed behavior."

- But **responding to the challenge is a change in behavior** because the aircraft is not transmitting a response before receiving the challenge; PO's expert agrees:

19	Q Does the device that is being
20	authenticated only send a response upon receiving
21	a challenge?
22	A That's correct.

1	Q If the device being authenticated does not
2	receive a challenge, then would it send a
3	response?
4	A No.

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Pet. at 35-39; Oppo. at 15-16; Sur-Reply, 9-10; EX1031, 11:19-22, 12:1-4

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.g]

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

- Gong discloses that "a UAV device may establish communications with [a] geo-fencing device and an exchange of information may occur," and that such communications "may include one-way communications or two-way communications." [EX1012, ¶0648] (listing examples of the information exchanged between the devices).

- Because Gong's communications module/unit is responsible for the UAV's wireless signal transmission and reception, a POSITA would have understood that the communications module/unit ("*the radio communication module*") is "*configured for two-way communication*." [EX1012, ¶0024; EX1003, ¶208].

Pet. at 75-78; Oppo. at 23

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.g]

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

- Gong's "geo-fencing device" discloses "*the remote portable detection system*."
  - Gong describes a "remote device" that may be a "remote controller" that communicates with a UAV using "wireless communications" such as "WiFi" and "radio" and that shows on a display "a location of [] [a] first UAV" and "may…show a location of [] [a] second UAV." EX1012, ¶¶0182, 0955.
  - The "location of a UAV shown on the remote device may be updated in real-time." [EX1012, ¶0957].
  - Moreover, Gong's remote controller can be implemented as a "geo-fencing device" that "detect[s] the presence of the UAV" and that the geo-fencing device can be "portable." [EX1012, ¶¶0137, 0593, 0600, 0628].
  - The geo-fence device further interacts with multiple UAVs, providing a "reference point for different sets of flight regulations for different UAVs in different circumstances that may approach the geo-fencing device." [EX1012, ¶¶0864-0869].
- Accordingly, Gong's disclosure regarding communication module/unit's ("*the radio communication module*") two-way communications with a geo-fencing device ("*two-way communication with the remote portable detection system*") teaches Limitation 22[g].

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Pet. at 75-78; Oppo. at 23

PO Does Not Contest that the Ground 8B Combination Renders Obvious [22.h]

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

- Gong's flight control unit ("*the device*") is included in the UAV ("*the low-altitude aircraft*").

Pet. at 76; Oppo. at 7-8

The Ground 8B Combination Renders Obvious [22.i]

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

- Gong's "remote device" that shows on a display "a location of [] [a] first UAV" and "may…show a location of [] [a] second UAV." [EX1012, ¶¶0182, 0955].
- The "location of a UAV shown on the remote device may be updated in real-time." [EX1012, ¶0957].
- Gong's remote controller can be implemented as a "geo-fencing device" that "detect[s] the presence of the UAV" and that the geo-fencing device can be "portable." [EX1012, ¶¶0137, 0593, 0600, 0628].
- The geo-fence device further interacts with multiple UAVs, providing a "reference point for different sets of flight regulations for different UAVs in different circumstances that may approach the geo-fencing device." [EX1012, ¶¶0864-0869, Fig. 35].
- Gong this discloses *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.*

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Pet. at 64-66, 70-78; Oppo. at 23-24; Sur-Reply, 10-12

The Ground 8B Combination Renders Obvious [22.i]

[22.i] 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[[.]], the plurality comprising the first low-altitude aircraft and 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.

- Multiple UAVs are detected by Gong's geofencing device (forming *the plurality of different low altitude aircrafts*), and one of these UAVs forms the *first low-altitude aircraft*, teaching that *the plurality [is] comprising the first low-altitude aircraft* as claimed. [EX1027, ¶81].

- Upon consecutive authentication failures for the first UAV, the geofencing device (*the remote portable detection system*) modifies its user interface display such that other detected and displayed UAV are removed from the interface and the first UAV is thus more clearly displayed (*is configured to disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft of the plurality*). [EX1027, ¶81].

- This changing the form of display such that first UAV is more clearly displayed relative to the other detected UAVs (*disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft of the plurality*) is based on the first UAV's triggered authentication response (*based on the changed behavior of the first low-altitude aircraft*) to the authentication challenge that causes failed consecutive authentications. [EX1027, ¶81].

Pet. at 64-66, 70-78; Oppo. at 23-24; Sur-Reply, 10-12

The Ground 8B Combination teaches to disambiguate

- As noted previously, PO argues that challenge 12 does not "enable[] disambiguation" as it is the "absence of responses" that allows a conclusion that authentication has failed
  - As combined, the response allows the first aircraft to be distinguished from among multiple aircraft when the response causes there to have been **multiple failed authentications.**
    - A **challenge and response can each be "consecutive" challenges and responses**—i.e., a second challenge and second response.
    - When **failed authentication results due to this response, modification of a displayed user interface occurs** causing other detected and displayed aircraft to be removed so the first aircraft is more clearly displayed; **the modification is based on the triggered response (changed behavior).**
- PO also wrongly suggests the combinations do not involve the transmission of a response ("continuing not to broadcast anything")
  - All grounds involve the transmission of a challenge response.

Pet. at 37-39; Oppo. at 16-17; Sur-Reply, 10-12

The Ground 8B Combination teaches to disambiguate

- PO further argues that the combinations disclose "isolating" an aircraft instead of "disambiguating" an aircraft.
  - PO appears to adopt an unsupported, **overly narrow disambiguate definition requiring simultaneously displaying a first aircraft and other aircraft at all times and throughout disambiguation**, and the importing of "identifiers" such as "bold text" into the SC.
    - No support for this definition, and PO has not shown or argued that this definition is correct.
  - The combinations teach the receiver's user interface displaying multiple detected aircraft simultaneously, including a first aircraft, and upon consecutive authentication failures for the first aircraft, the user interface is modified such that other detected and displayed aircraft are removed and the first aircraft is thus more clearly displayed (*disambiguate the first low-altitude aircraft from the other detected low-altitude aircraft of the plurality*).

Pet. at 37-39; Oppo. at 16-17, 20-21, 23-24 ([22.i]); Sur-Reply, 10-12

The Ground 8B Combination teaches to disambiguate

- PO's definition of EX2022 is irrelevant as it relates to **"words" and "phrases"** (not aircraft)

Definition of *disambiguate verb* from the Oxford Advanced Learner's Dictionary

disambiguate *verb*

ˌdɪsæmˈbɪgjueɪt ; ˌdɪsæmˈbɪgjueɪt

disambiguate something

(*technical*)

to show clearly the difference between two or more words, phrases, etc. which are similar in meaning

- Regardless, the grounds meet definition, showing a **difference between an aircraft that failed authentication and aircrafts that have not by more clearly displaying the failed-authentication aircraft from others**.

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Pet. at 37-39; Oppo. at 16-17, 20-21, 23-24 ([22.i]); Sur-Reply, 10-12