

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DJI EUROPE B.V.,
Petitioner,

v.

TEXTRON INNOVATIONS INC.,
Patent Owner.

IPR2022-00453
Patent 8,078,395 B2

Before MICHAEL R. ZECHER, SCOTT A. DANIELS and
FREDERICK C. LANEY, *Administrative Patent Judges*.

DANIELS, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

DJI Europe B.V., (“DJI” or “Petitioner”) filed a Petition requesting *inter partes* review (“IPR”) of claims 1–7 and 9–18 of U.S. Patent No. 8,078,395 B2 (Ex. 1001, “the ’395 patent”). Paper 1 (“Pet.”). Textron Innovations, Inc., (“Textron” or “Patent Owner”) filed a Preliminary Response to the Petition. Paper 6 (“Prelim. Resp.”). We also authorized, and Petitioner and Patent Owner filed, a Preliminary Reply and Preliminary Sur-reply narrowly tailored to address Patent Owner’s *Fintiv* arguments in the Preliminary Response. Papers 7, 9.

On August 3, 2022, we instituted trial for claims 1–7 and 9–18 of the ’395 patent on all grounds of unpatentability alleged in the Petition. Paper 10 (“Decision to Institute” or “Inst. Dec.”). After institution of trial, Patent Owner filed a Patent Owner Response. Paper 16 (“PO Resp.”). Petitioner timely filed a Reply. Paper 17 (“Pet. Reply”). Subsequently, Patent Owner filed a Sur-Reply to address certain arguments raised in Petitioner’s Reply. Paper 20 (“PO Sur-Reply”).

A hearing for this proceeding was held on May 11, 2023. The transcript of the hearing has been entered into the record. Paper 26 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a).

For the reasons that follow, we determine that Petitioner has met its burden of showing by a preponderance of the evidence that claims 1–7 and 9–18 are unpatentable.

A. Real Parties in Interest

Petitioner states that DJI Europe B.V., SZ DJI Technology Co. Ltd., DJI Technology, Inc., iFlight Technology Company Limited, and DJI Research LLC are the real parties in interest. Pet. 83. Patent Owner states

that Textron Innovations, Inc., Bell Textron Inc., and Textron Inc. are the real parties in interest. Paper 5, 2 (Patent Owner’s Mandatory Notices).

B. Related Matters

The parties indicate that the ’395 patent has been asserted against Petitioner in *Textron Innovations Inc. v. DJI Europe B.V. et al.*, No. 6:21-cv-00740 in the U.S. District Court for the Western District of Texas. Pet. 83; Paper 5, 2.

Patent Owner indicates that Petitioner has filed additional petitions for *inter partes* review challenging patents held by Patent Owner, IPR2022-00162 for U.S. Patent No. 9,162,752 B2, and IPR2022-00163 B2 for U.S. Patent No. 10,243,647. Paper 5, 2.

C. The ’395 Patent (Ex. 1001)

The ’395 patent, titled “Control System for Automatic Circle Flight,” describes a flight control system for an aircraft “that provides for automatic flight around a circle of a commanded center and radius at a commanded altitude and velocity.” Ex. 1001, 2:22–24. The ’395 patent describes that the system is specifically “for automatically controlling the flight of an aircraft, such that the aircraft flies toward a selected area of interest and circles a selected point in the area at a specified radius, altitude, and velocity.” *Id.* at 3:25–28. The ’395 explains that

[t]he control system requires only one point in space and a radius to define the circle and is useful for controlling the flight of manned and unmanned aircraft of all types, including helicopters, tiltrotors, and fixed-wing aircraft. The system is particularly suited for use in aircraft performing surveillance, search, rescue, and military missions.

Id. at 3:31–37.

Figure 2A of the '395 patent is reproduced below.

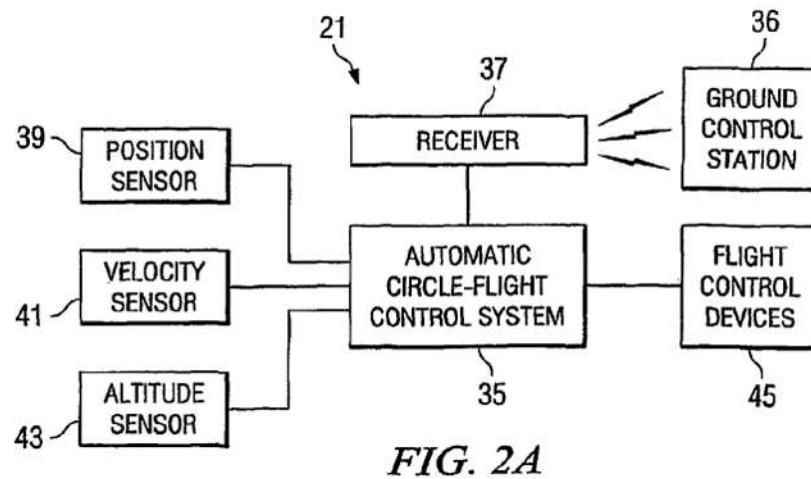


Figure 2A illustrates a schematic view of flight control system 21 “configured for use with a remotely-piloted aircraft.” *Id.* at 2:59–61. Flight control system 21 includes receiver 37 carried on an aircraft 23 (not shown) that receives command data from ground control station 36. *Id.* at 4:19–23. The command data from ground control includes parameters for a desired, i.e. commanded, circling maneuver that is sent from the receiver to automatic circle-flight control system 35. *Id.* at 4:23–24.

As also shown in Figure 2A, position sensor 39, velocity sensor 41, and altitude sensor 43 provide automatic circle-flight control system 35 with “data representing the location, velocity, and altitude of aircraft 23.” *Id.* at 4:24–26. The '395 patent explains that “[s]ystem 35 uses the data provided by sensors 39, 41, 43 and the command data from receiver 37 to operate flight control devices 45 on aircraft 23 for causing aircraft 23 to fly according to the commanded parameters.” *Id.* at 4:37–41. Alternatively, the '395 patent describes that

all commands may be input into system 35 before flight of the aircraft, and this method may be useful when the aircraft is to fly a predetermined route to a circle, fly the circle using the

commanded parameters for a selected amount of time, then return to the launch site or land at an alternate location.

Id. at 6:39–40.

Figure 4 of the '395 patent is reproduced below.

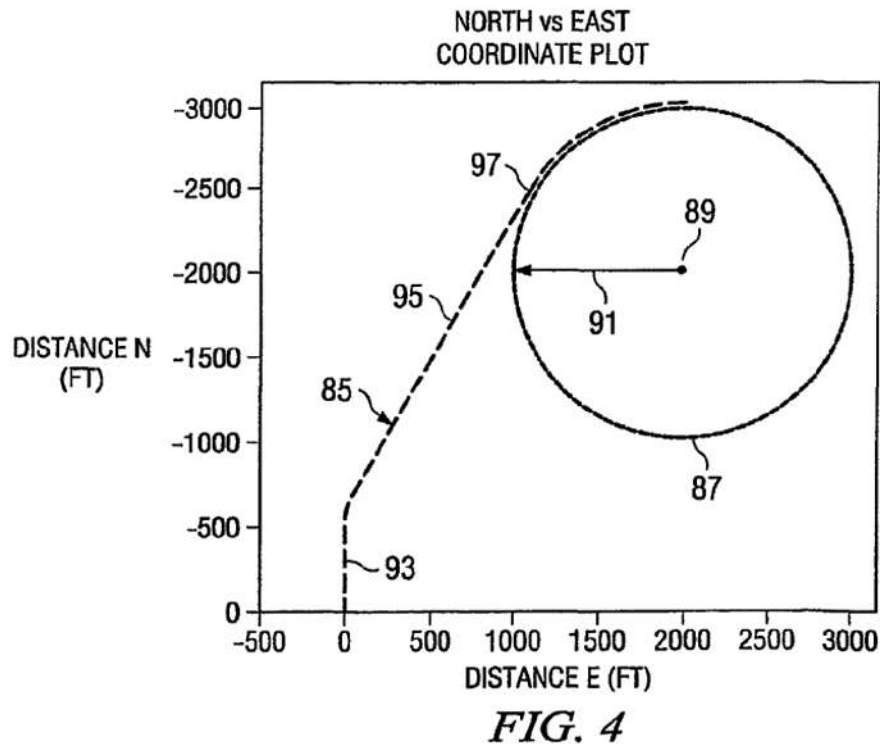


Figure 4 illustrates “a plot of a ground track of the flight of an aircraft, the flight of the aircraft being controlled by the system of FIG. 2A to fly a circular path in a clockwise direction, the aircraft having started outside of the prescribed circle.” *Id.* at 2:66–3:2. Figure 4 depicts groundtrack 85 intercepting circle 87 at tangent point 97 to fly the circle at radius 91 around center 89. *Id.* at 7:39–47. The '395 patent explains, with respect to Figure 4, that “[w]hen the aircraft is within a selected distance of tangent point 97, system 35 provides a bank command that acts to maintain the aircraft flight path at radius 91 around center 89.” *Id.* at 7:51.

The '395 patent describes that the flight control system can be used with any type of manned or unmanned aircraft. *Id.* at 9:10–12. And

additional system features can include “automatic or autonomous search patterns; the ability to detect, follow, and circle a target; collision avoidance capability; and override methods for returning control to a pilot.” *Id.* at 9:13–16.

*D. Challenged Claims*¹

Claims 1, 9, and 14 are independent. Each of claims 2–7, 10–13, and 15–18 ultimately depends from independent claims 1, 9 and 14, respectively. Claims 1 and 2 illustrate the claimed subject matter and are reproduced below with certain limitations of interest in italics:

1. [1pre] A flight control system for an aircraft, the system comprising:

[1a] means for receiving command signals representing commanded values of a location of a geospatial point and a radius about the geospatial point for defining a circular groundtrack;

[1b] means for determining a geospatial location of the aircraft and providing a location signal representing the location of the aircraft; and

[1c] *a controller for commanding flight control devices on the aircraft for controlling the flight of the aircraft*, the controller also being configured to receive the command signals and the location signal;

[1d] wherein the controller uses the command signals and location signal to operate the flight control devices to control the flight of the aircraft for directing the aircraft toward a tangent point of the circular groundtrack for intercepting the circular groundtrack and then generally maintaining a flight path along the circular groundtrack.

¹ For consistency, we utilize Petitioner’s claim limitation numbering scheme for limitations [1pre]–[1d] and [2pre]–[2c]. See Pet. 25–49.

2. [2pre] The flight control system according to claim 1, further comprising:

[2a] means for determining a velocity of the aircraft and providing a velocity signal representing the velocity of the aircraft;

[2b] *wherein the command signals also represent a commanded value of a circle velocity; and*

[2c] wherein the controller is also configured to receive the velocity signal and operate the flight control devices to achieve and generally maintain the circle velocity along the circular groundtrack.

Ex. 1001, 9:29–58.

E. Prior Art and Asserted Grounds

Petitioner asserts that claims 1–7 and 9–18 would have been unpatentable based on the following grounds:²

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1	1–7, 9–18	102(a) or (e) ³	Duggan ⁴
2	1–7, 9–18	103(a)	Duggan
3	2–5, 10–13, 17, 18	103(a)	Duggan and Pate ⁵

² Petitioner supports its challenge with a Declaration of William Singhose, Ph.D. (Ex. 1004) and Patent Owner supports its arguments presented during trial with the Declaration of Dr. C. Douglass Locke, Ph.D (Ex. 2016).

³ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Because the application from which the ’395 patent issued has an effective filing date prior to March 16, 2013, the pre-AIA version of §§ 102 and 103 applies. See Ex. 1001, code (86).

⁴ Ex. 1005, U.S. Pub. Appl. No. US 2005/0004723 A1 (pub. Jan. 6, 2005).

⁵ Pate, Billy B., Ex. 1006, A Rotorcraft Adaptation of Geneva Aerospace’s Variable Autonomy Control System, AMERICAN HELICOPTER SOCIETY 60TH ANNUAL FORUM, Baltimore Maryland, June 7–10, 2004.

II. ANALYSIS

A. Legal Standards

A “prior art reference—in order to anticipate under 35 U.S.C. § 102—must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements ‘arranged as in the claim.’” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)). “A single prior art reference may anticipate without disclosing a feature of the claimed invention if such feature is necessarily present, or inherent, in that reference.” *Allergan, Inc. v. Apotex Inc.*, 754 F.3d 952, 958 (Fed. Cir. 2014).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. 35 U.S.C. § 103(a); *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). “[W]hen a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result.” *KSR*, 550 U.S. at 416 (citing *United States v. Adams*, 383 U.S. 39, 50–51 (1966)). The question of obviousness is resolved based on underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence,

objective evidence of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).⁶

The Supreme Court made clear that we apply “an expansive and flexible approach” to the question of obviousness. *KSR*, 550 U.S. at 415. Whether a patent claiming the combination of prior art elements would have been obvious is determined by whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 417. To support this conclusion, however, it is not enough to show merely that the prior art includes separate references covering each separate limitation in a challenged claim. *Unigene Labs., Inc. v. Apotex, Inc.*, 655 F.3d 1352, 1360 (Fed. Cir. 2011). Rather, obviousness additionally requires that a person of ordinary skill at the time of the invention “would have selected and combined those prior art elements in the normal course of research and development to yield the claimed invention.” *Id.*

Accordingly, an obviousness determination generally requires a finding “that a person of ordinary skill in the art would have been motivated to combine or modify the teachings in the prior art and would have had a reasonable expectation of success in doing so.” *Univ. of Strathclyde v. Clear-Vu Lighting LLC*, 17 F.4th 155, 160 (Fed. Cir. 2021) (citing *OSI Pharms.*, 939 F.3d at 1382 (quoting *Regents of Univ. of Cal. v. Broad Inst., Inc.*, 903 F.3d 1286, 1291 (Fed. Cir. 2018))). “Whether the prior art discloses a claim limitation, whether a skilled artisan would have been motivated to modify or combine teachings in the prior art, and whether she would have had a reasonable expectation of success in doing so are

⁶ The parties do not present evidence or arguments regarding secondary considerations.

questions of fact.” *Strathclyde*, 17 F.4th at 160. In determining whether there would have been a motivation to combine prior art references to arrive at the claimed invention, it is insufficient to simply conclude the combination would have been obvious without identifying any reason why a person of skill in the art would have made the combination. *Metalcraft of Mayville, Inc. v. The Toro Co.*, 848 F.3d 1358, 1366 (Fed. Cir. 2017). Moreover, in determining the differences between the prior art and the claims, the question under 35 U.S.C. § 103(a) is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 164 (Fed. Cir. 1985) (“It is elementary that the claimed invention must be considered as a whole in deciding the question of obviousness.”); *see also Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1537 (Fed. Cir. 1983) (“[T]he question under 35 U.S.C. § 103 is not whether the differences themselves would have been obvious. Consideration of differences, like each of the findings set forth in *Graham*, is but an aid in reaching the ultimate determination of whether the claimed invention *as a whole* would have been obvious.”).

As a factfinder, we also must be aware “of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning.” *KSR*, 550 U.S. at 421. Applying these general principles, we consider the evidence and arguments of the parties.

B. Level of Ordinary Skill in the Art

The level of skill in the art is “a prism or lens” through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). “This reference point prevents . . . factfinders from using their own insight or, worse yet, hindsight, to gauge obviousness.”

Id. Moreover, “the inquiry into whether any ‘differences’ between the invention and the prior art would have rendered the invention obvious to a skilled artisan necessarily depends on such artisan’s knowledge.”

Koninklijke Philips N.V. v. Google LLC, 948 F.3d 1330, 1337 (Fed. Cir. 2020) (citing *Dow Jones & Co. v. Abblaise Ltd.*, 606 F.3d 1338, 1349, 1353 (Fed. Cir. 2010) (affirming the district court’s grant of summary judgment of invalidity in part because the obviousness “analysis requires an assessment of the ‘ . . . background knowledge possessed by a person having ordinary skill in the art’” (emphasis added))).

Factors pertinent to a determination of the level of ordinary skill in the art include: (1) educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of workers active in the field. *Env’t Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696–697 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1381–82 (Fed. Cir. 1983)). Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case. *Id.* Moreover, these factors are not exhaustive but are merely a guide to determining the level of ordinary skill in the art. *Daiichi Sankyo Co. Ltd, Inc. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007).

In determining a level of ordinary skill, we also may look to the prior art, which may reflect an appropriate skill level. *Okajima*, 261 F.3d at 1355.

Additionally, the Supreme Court informs us that “[a] person of ordinary skill is also a person of ordinary creativity, not an automaton.” *KSR*, 550 U.S. at 421.

In our Institution Decision we determined, in accordance with Petitioner’s proposal, that a person of ordinary skill in the art at the time of the ’395 patent

would have had at least an equivalent of a Bachelor’s degree from an accredited institution in mechanical engineering, aerospace engineering, electrical engineering, robotics or any other discipline covering principles of the design or operation of autonomous flight control system for aircraft. A [person of ordinary skill in the art] would also have one year of experience working on the design, development, implementation, or operation of such technologies. Significant work experience could substitute for formal education, and significant education could substitute for work experience.

Inst. Dec. 14 (citing Pet. 18).

Patent Owner indicates that it does not necessarily agree with Petitioner’s proposed level of ordinary skill in the art, but states that “Patent Owner does not believe any differences would impact the conclusions in this *inter partes* review.” PO Resp. 5 (citing Ex. 2016 ¶¶ 32–36).

Because there is no express dispute as to Petitioner’s suggested level of ordinary skill in the art, and because Petitioner’s assessment is consistent with the ’395 patent and asserted prior art, we rely on Petitioner’s proposed level of ordinary skill in the art.

C. Claim Construction

We construe claims using the principles set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–17 (Fed. Cir. 2005) (en banc), and related cases. 37 C.F.R. § 42.100(b) (2021). Under that precedent, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *Phillips*, 415 F.3d at 1312–13.

1. Means-plus-function terms

In our Institution Decision we agreed with Petitioner’s assertion “that the challenged claims include means-plus function limitations ‘presumptively governed by 35 U.S.C. § 112 ¶ 6.’” Inst. Dec. 15 (quoting Pet. 7). Our chart below summarizes the means-plus-function limitations and Petitioner’s proposed corresponding structure. *Id.* 15–19.

Means-plus-function limitations	Petitioner’s proposed corresponding structure
<i>means for receiving command signals representing commanded values (Claims 1 and 14)</i>	the disclosed structure for performing this function encompasses a receiver
<i>means for determining a geospatial location of the aircraft and providing a location signal representing the location of the aircraft (Claims 1 and 14)</i>	the disclosed structure for performing this function encompasses a position sensor or a component that provides data representing the location of the aircraft
<i>means for determining a velocity of the aircraft and providing a velocity signal representing the velocity of the aircraft (Claims 2 and 17)</i>	the disclosed structure for performing this function encompasses a velocity sensor or a component that provides data representing the velocity of aircraft
<i>means for determining an altitude of the aircraft and providing an altitude signal representing the altitude of the aircraft (Claims 4 and 18)</i>	the ’395 patent specification discloses an altitude sensor 43 which provides the altitude data

We explained in our Institution Decision that, “[a]lthough the meaning of these limitations is not disputed at this stage of the proceeding, for purposes of institution, and on the record before us at this point in the proceeding, we are persuaded that Petitioner’s constructions of these terms is accurate.” *Id.* at 19. We also invited the parties to clarify any dispute regarding these terms. *Id.* In its Patent Owner Response, Patent Owner

raised no issue or dispute with respect to these means-plus-function terms. *See generally*, PO Resp. Because there is no dispute in this proceeding that the '395 patent supports the relevant structure Petitioner has proposed as corresponding to these means-plus-function terms and because this Decision does not turn on any differences in constructions proposed by the parties for these terms, we agree with and rely on Petitioner's assertions of corresponding structure for each of the above identified means-plus-function terms.

2. Controller

During trial, a dispute arose pertaining to the term "controller" recited in independent claims 1 and 14. *See* PO Resp. 11–17; Pet. Reply 2–8. The question is whether or not "controller" is also a means-plus-function limitation. For the reasons that follow, we determine that "controller" is *not* a means-plus-function limitation.

In determining whether a claim term invokes 35 U.S.C. § 112(6) "the essential inquiry is not merely the presence or absence of the word 'means' but whether the words of the claim are understood by persons of ordinary skill in the art to have a sufficiently definite meaning as the name for structure." *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1348 (Fed. Cir. 2015) (en banc in relevant part).

Patent Owner contends that the "controller" limitations in claims 1 and 14 require construction because they invoke 35 U.S.C. § 112(6). Patent Owner argues that even though the "controller" limitations do not recite "'means for'. . . it still follows the 'means for' format and only substitutes '**means** for' with 'a **controller** for.'" PO Resp. 12. Patent Owner acknowledges the presumption that "controller" is not a mean-plus-function term, but asserts that the presumption is overcome in this case because "[t]he

‘controller’ limitation of Claims 1 and 14—*e.g.*, ‘a controller for . . . controlling the flight of the aircraft’—is a self-descriptive term that describes an associated function without reciting structure for performing the function.” *Id.* at 13 (citing Ex. 1001, 9:38–41, 11:12–14; Ex. 2016 ¶ 47).

Patent Owner points to deposition testimony from Petitioner’s expert, Dr. Singhose, who was asked, “if something is generating that control signal, it is a controller?” Dr. Singhose responded “[y]eah, I think generally that’s the way we would use the term.” *Id.* at 14 (citing Ex. 2015, 102:18–103:12; Ex. 2016 ¶¶ 49–51). Patent Owner argues, that Dr. Singhose also stated during his deposition that a “controller” could be “electrical,” “mechanical,” “electromechanical,” “chemical,” or “biological.” *Id.* (citing Ex. 2015 at 80:12–81:14; Ex. 2016 ¶ 51). Based on these arguments and Dr. Singhose’s testimony, Patent Owner argues that “controller” is a verbal construct for “anything that can ‘command[] flight control devices on the aircraft.” *Id.* Also, Patent Owner argues, “[c]laims 1 and 14 include express ‘means for’ elements and the ‘controller’ limitation of Claims 1 and 14 simply follows the same means-plus-function format by replacing ‘means’ with an equivalent non-structural term.” *Id.* at 15.

It is well settled that limitations that do not use the word “means” create a rebuttable presumption that 35 U.S.C. § 112(6) does not apply. *See Williamson*, 792 F.3d at 1348 (Fed. Cir. 2015) (The Federal Circuit explaining that “the failure to use the word “means” also creates a rebuttable presumption—this time that § 112, para. 6 does not apply.”). We initially consider a plain reading of claims 1 and 14, which as Patent Owner points out, in addition to “controller,” includes specific “means for receiving” and “means for determining” limitations. Ex. 1001, 9:31–38, 11:5–12, *see also Interactive Gift Exp., Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1331 (Fed.

Cir. 2001) (When construing claims, our “focus must begin and remain centered on the language of the claims themselves.”). Even a cursory review of the claims indicates that the claim drafter clearly understood how to craft a limitation in terms of mean-plus-function language, in that this convention was used for instance in limitations [1a] and [1b]. *Id.* The claim drafter made a conscious decision however, in limitation [1c], *not* to use the same convention, but to recite specifically “a controller.” *Id.* Given this explicit change of convention, we do not discern persuasive evidence in the claim language itself that suggests the drafter intended to use “controller” as simply a nonce word to signify a means-plus-function limitation. In fact, because the drafter expressly did not use “means for” language, it more likely reveals that the drafter *did not* intend to define “controller” as a means-plus-function limitation, but as a specific structural element of the claimed flight control system.

Also, based on the antecedent basis of “a controller,” the claims subsequently recite “the controller.” *Id.* at 9:39–42. A reasonable reading of the claims is that “the controller” is not a nonce word, but references structure, namely a flight control computer, which physically receives signals and, based on those signals, actively controls other flight control devices on the aircraft. For instance, claim one recites “the controller also being configured to receive the command signals and the location signal.” *Id.* Claim 1 further recites the requirement that “the controller uses the command signals and location signal to operate the flight control devices to control the flight of the aircraft. *Id.* at 42–44. Indeed, the Microsoft Computer Dictionary defines “controller” as “[a] device that other devices rely on for access to a computer subsystem.” Ex. 3001, Microsoft Computer Dictionary, Microsoft Press, 2002. It may be, as Dr. Singhose points out,

that a controller can be, technologically speaking, “electrical,” “mechanical,” “electromechanical,” “chemical,” or “biological,” but this does not mean that a person of ordinary skill in the art would not understand a “controller” as a structural article or physical device, i.e., a flight control computer, “to operate the flight control devices to control the flight of the aircraft” as called for in claims 1 and 14. *See Samsung Elecs. Am., Inc. v. Prisia Eng'g Corp.*, 948 F.3d 1342, 1354 (Fed. Cir. 2020) (“The question whether the term ‘digital processing unit’ invokes section 112, paragraph 6, depends on whether persons skilled in the art would understand the claim language to refer to structure, assessed in light of the presumption that flows from the drafter's choice not to employ the word ‘means.’”).

Dr. Singhose clarified his position on this issue during his deposition explaining that “I mean, sometimes it’s called a controller. Sometimes it can -- control block.” Ex. 2015, 64:15–17. When asked in the context of a mechanical prosthetic limb, Dr. Singhose further explained that

[i]n that kind of case, the nerve signals come down and get intercepted by another physical device, a controller down there. And then that controller converts, generally amplifies that signal, and then sends that signal out to the motors that are driving this.

Id. at 77:14–21. Dr. Singhose thus testified that a controller is a physical device. Dr. Singhose further explained that a controller can exist in the context of, e.g., electrical, mechanical and chemical fields. *Id.* at 80:12–81:14. This is not a particular concern because the technological scope of a known structural term does not mean it is not understood as structure by those of skill in the art. *See Skky, Inc. v. MindGeek, s.a.r.l.*, 859 F.3d 1014, 1019 (Fed. Cir. 2017) (The Federal Circuit explaining that “it is sufficient if the claim term is used in common parlance or by persons of skill in the

pertinent art to designate structure, even if the term covers a broad class of structures and even if the term identifies the structures by their function.”).

Patent Owner cites to *Blackboard, Inc. v. Desire2Learn, Inc.*, 574 F.3d 1371, 1382-83 (Fed. Cir. 2009), arguing that just as the Federal Circuit found the term “access control manager” to “simply [be] an abstraction that describes the function of controlling access,” we should similarly construe, “controller” as not “impart[ing] sufficient structure to avoid means-plus function interpretation.” PO Resp. 14–15. Petitioner argues that “controller” and “access control manager” are different terms and that *Blackboard* “does not inform what a skilled artisan would understand a ‘controller’ to be.” Pet. Reply n. 1. Although the Court did consider “access control manager” in a means-plus-function analysis, it did so to determine whether or not there was sufficient corresponding structure recited in the specification regarding the “computer software feature known as the ‘access control manager’” so as to avoid purely functional claiming by the undisputed means-plus-function limitation, i.e., “means for assigning a level of access to and control of each data file.” See *Blackboard*, 574 F.3d at 1382–83 (The Federal Circuit describing that “[t]he ACM is essentially a black box that performs a recited function. But how it does so is left undisclosed.”). In this case, different from *Blackboard*, a person of ordinary skill in the art would understand the claims and the specification to explain that the controller is a special purpose device, i.e., a “flight controller” “for commanding flight control devices on the aircraft,” and “uses the command signals and location signal to operate the flight control devices to control the flight of the aircraft.” See, e.g., Ex. 1001, 2:34–40, 9:38–44, 10:27. Patent Owner does not draw our attention to any cases where a “controller” has been determined a means-plus-function limitation or a nonce word.

On the facts and evidence in this case the presumption *against* means-plus-function treatment is not overcome. The claims themselves are reasonably understood by those of ordinary skill in the art to recite sufficient structure, namely “a controller,” that communicates with flight control devices on the aircraft and is “configured to” perform the ascribed function of “intercepting the circular groundtrack and then generally maintaining a flight path along the circular groundtrack.” Ex. 1001, 9:38–39. Accordingly, with respect to the claimed “controller,” Petitioner is not required under 37 C.F.R. § 42.104(b)(3) to identify the specific portions of the patent specification that describe the structure corresponding to a particular mean-plus-function limitations.

Apart from Patent Owner’s argument that “controller” should be interpreted as a mean-plus-function limitation, the parties do not argue for an express construction of any claim term and our analysis does not turn on any such construction. Accordingly, we determine that it is not necessary to expressly construe any claim term for purposes of this Decision. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (The Court explaining that “only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”).

D. Ground 2: Claims 1–7 and 9–18 – Obviousness over Duggan (Ex. 1005)

Petitioner essentially argues Grounds 1 and 2 together, asserting in the heading for Section VI.A of its Petition that “Claims 1–7 and 9–18 Are Anticipated (Ground 1) and/or Rendered Obvious (Ground 2) by Duggan.” Pet. 19. We initially address the issue of obviousness because it is dispositive of the grounds remaining. On the complete record before us,

Petitioner has shown by a preponderance of the evidence that claims 1–7 and 9–18 would have been obvious over Duggan.

1. Duggan (Ex. 1005)

Titled “Vehicle Control System Including Related Methods and Components,” Duggan relates to control systems and methods for unmanned aerial vehicles (UAVs). Ex. 1005 ¶ 51. Duggan describes that “the present invention generally pertain[s] to a variable autonomy control system (VACS) architecture that enables, among other characteristics, a general simplification of UAV operation and control.” *Id.* ¶ 54. In particular, Duggan describes a UAV flight control system in which the VACS architecture

enables a man-in-the-loop (i.e., the operator) to intuitively assign and deploy one or more UAV’s in accordance with available control behavior parameters . . . [t]he architecture is distributed by design so that appropriate learning, decision-making and action behaviors are resident onboard the vehicle and supported with autonomous functionality when necessary.

Id. ¶ 68. Duggan explains that the VACS can be used in all types of unmanned vehicles, including “airplanes, helicopters, micro air vehicles (MAV’s), missiles, submarines, balloons or dirigibles, wheeled road vehicles, tracked ground vehicles (i.e., tanks), and the like.” *Id.* ¶ 51. Figure 1 of Duggan is reproduced below.

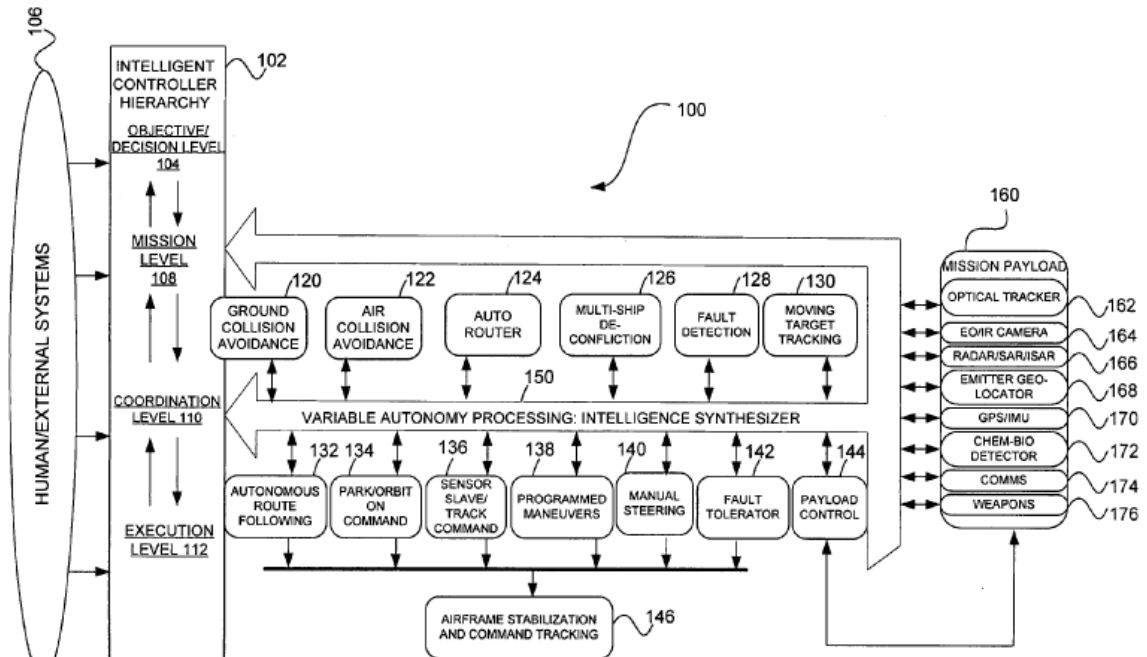


FIG. 1

Figure 1 illustrates diagrammatically the VACS architecture including various sub-components 120–146, such as Park/Orbit On Command 134, that “represent control behaviors available for invocation either automatically or based on operator selection inputs.” *Id.* ¶ 62.

Duggan discloses that, “as indicated by block 134 in [Figure] 1, one provided control mode enables an operator to loiter a vehicle over a given station, for example, to monitor a desired surveillance point.” *Id.* ¶ 190. According to Duggan, “[t]he system illustratively enables the operator to either preprogram a set of orbit patterns embedded within a waypoint route or dynamically insert orbit patterns into an existing route in real-time.” *Id.* In one embodiment, Duggan describes that “[t]he system illustratively enables the operator to select an oval or a constant radius (circular) loiter pattern.” *Id.* ¶ 191. Duggan further describes that

[i]n accordance with one aspect of the present invention, loiter guidance is achieved through two basic guidance laws: 1) Biased pursuit guidance law used to drive the vehicle onto a desired

loiter pattern (illustratively referred to herein as loiter capture); and 2) Elliptical guidance law which serves as an inertial path controller designed to slave the vehicle to an elliptical loiter pattern (illustratively referred to herein as loiter guidance).

Id. ¶ 192.

An example of a UAV loitering over a given station is shown in Figure 22A of Duggan, which is reproduced below.

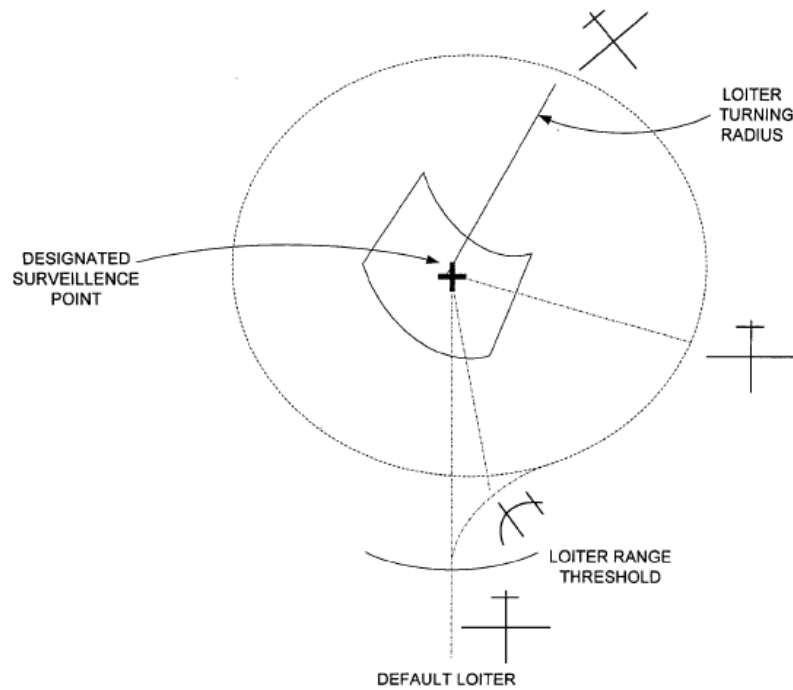


FIG. 22A

Figure 22A illustrates a surveillance-point loiter pattern around a designated surveillance point. *Id.* ¶ 318. In addition, Duggan explains with respect to Figure 18, reproduced below, that for the UAV to attain such a loiter pattern, “the guidance algorithm illustratively solves for the ellipse tangent line that will bring the vehicle onto the ellipse headed in the desired direction of travel along the ellipse.” *Id.* ¶ 212.

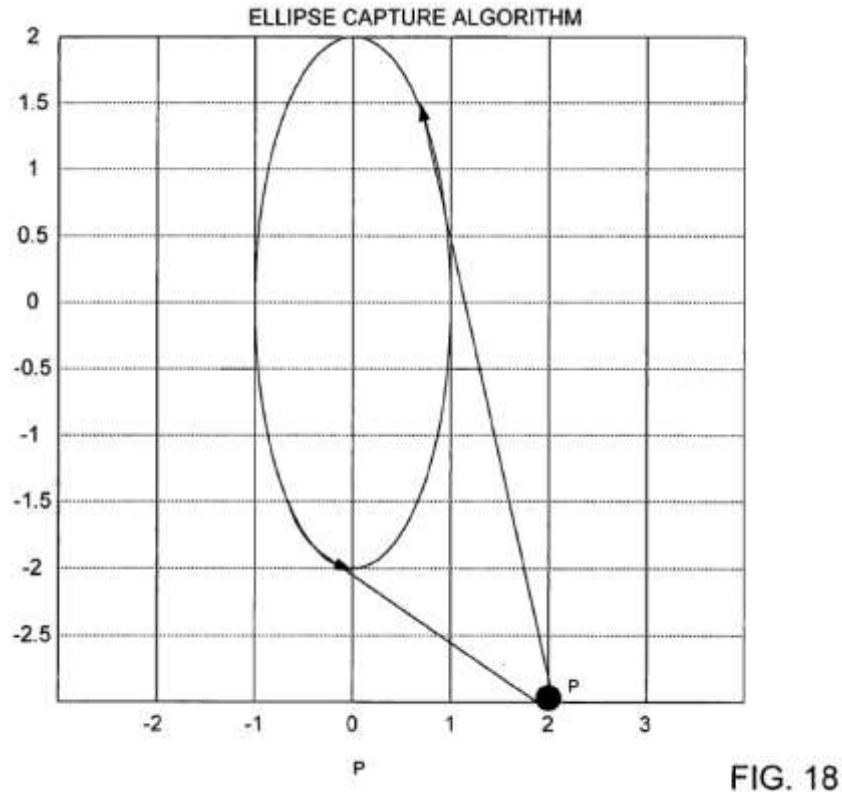


Figure 18 illustrates that the ellipse capture algorithm includes a tangent line extending from point P to an ellipse. *Id.*

2. Independent Claims 1 and 14

Our analysis below focuses on claim 1, but equally applies to claim 14. *See* Pet. 69–70 (with the exception of the preamble of claim 14, Petitioner relies on the same arguments and evidence presented for claim 1 to demonstrate that claim 14 is obvious over Duggan).

(a) *Petitioner's Arguments*

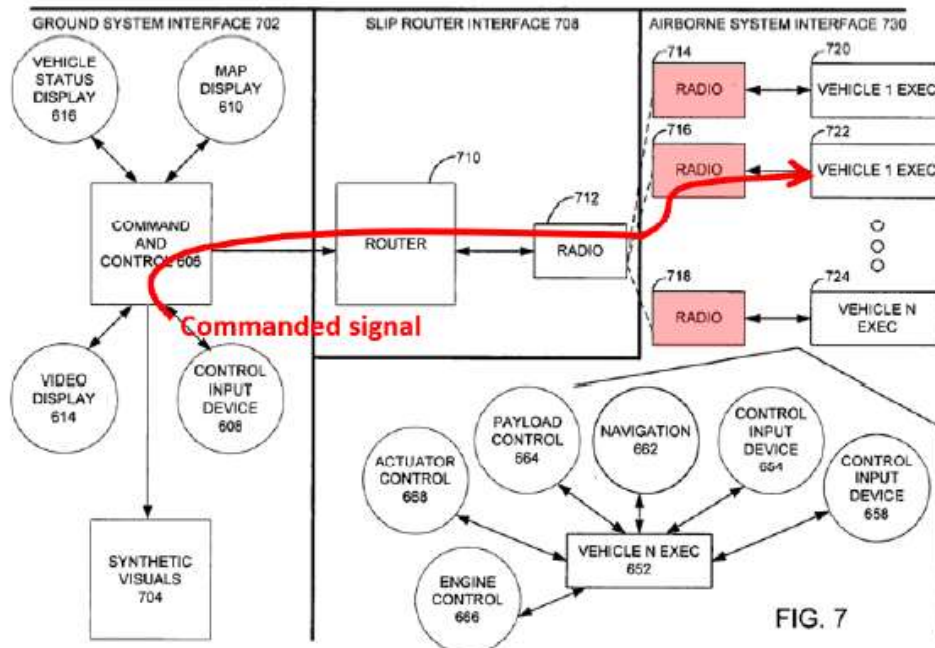
i. *Preamble – [a] flight control system for an aircraft*

To the extent the recitation in the preamble of “[a] flight control system for an aircraft” is limiting, Petitioner argues that Duggan discloses a flight control system “called a ‘variable autonomy control system (VACS).’” Pet. 25 (citing Ex. 1005 ¶ 54). Petitioner argues that “[t]he VACS is

designed for various types of aircraft, including unmanned aerial vehicles (UAVs), airplanes, and helicopters, as well as manned vehicles.” *Id.* (citing Ex. 1005 ¶ 51).

ii. Limitation [1a] – means for receiving command signals representing commanded values of a location of a geospatial point and a radius about the geospatial point for defining a circular groundtrack

Petitioner argues that Duggan discloses datalink 605 that “enables ‘remote communication between the ground station interface and the [aerial] vehicle interface.’” Pet. 26 (quoting Ex. 1005 ¶ 105). More specifically, Petitioner’s declarant, Dr. Singhose, testifies that as shown in Duggan’s Figure 7, as annotated by Petitioner and reproduced below, “‘router 710 works in conjunction with a radio 712 to transfer commands and flight information [the claimed command signals] in a distributed manner to a plurality of radios 714–718,’ which are receivers that receive the commands and flight information and thus, in my opinion, correspond to the claimed means.” Ex. 1004 ¶ 70 (citing Ex. 1005 ¶ 110, Fig. 7).



Duggan’s Figure 7, as annotated by Petitioner and reproduced above, shows a commanded signal (red arrow) that is sent from control input device 608 via router 710 to airborne radio 716 carried on an aircraft, which is to be executed by vehicle 1 exec 722. Dr. Singhose testifies that in Duggan “the commands and flight information received by radios 714–718 constitute the claimed ‘command signals’ because they represent the operator’s commanded values of the orbit pattern.” *Id.* ¶ 71.

With respect to the claimed “radius about the geospatial point for defining a circular groundtrack,” Petitioner argues that “Duggan expressly discloses that a circular loiter pattern can be defined using equal length and width values of an ellipse.” Pet. 31 (citing Ex. 1004 ¶ 190). Because Duggan’s examples mainly illustrate elliptical patterns, Dr. Singhose testifies that a circle is a special type of ellipse having equal length and width parameters, and that person of ordinary skill in the art “would have appreciated that the circle could alternatively be defined by a single radius

value, instead of the equal length and width values.” Ex. 1004 ¶¶ 74, 78. For support, Dr. Singhose cites to Christiansen, (Ex. 1011), a thesis by Reed Siefert Christiansen, titled “Design of an Autopilot for Small Unmanned Aerial Vehicles,” explaining that for an autonomous flight control system “loiter mode commands include an ‘**orbit radius**’ parameter that defines the orbit circle.” See *id.* (citing Ex. 1011, 87, 126–27) (Christiansen stating that “[t]he *Loiter XY* command requires the following parameters: meters east, meters north, altitude (meters), airspeed (meters/second), orbit time (seconds), and orbit radius (meters)).

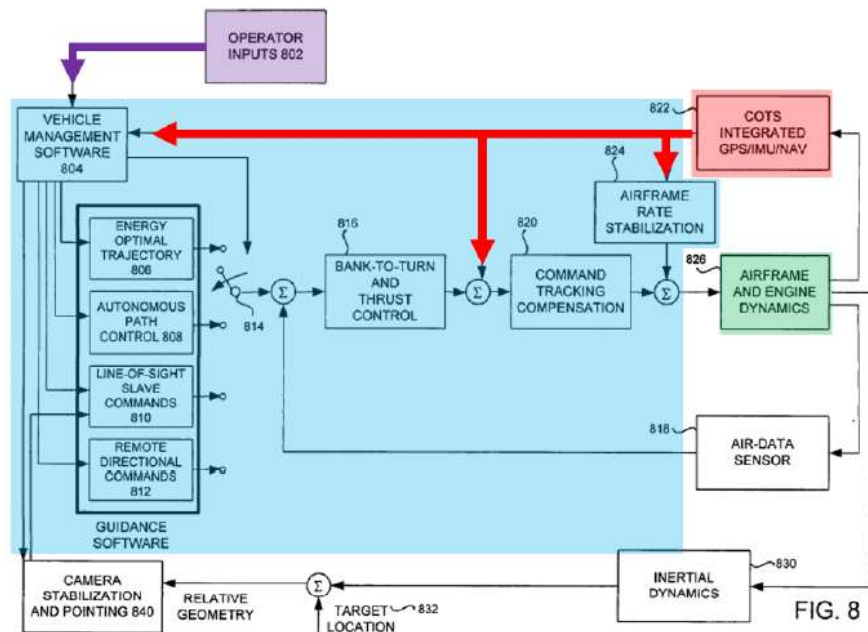
iii. Limitation [1b] – means for determining a geospatial location of the aircraft and providing a location signal representing the location of the aircraft

Petitioner argues that “Duggan’s integrated GPS/IMU/NAV component 822 determines a geospatial location of the aircraft and provides a location signal (e.g., ‘coordinate information from GPS/IMU/NAV systems’) to vehicle management software 804.” Pet. 33 (citing Ex. 1005 ¶ 114). Dr. Singhose testifies that a person of ordinary skill in the art “would [have understood] that the integrated GPS/IMU/NAV component 822 determines a geospatial location of the aircraft and provides a location signal representing three-dimensional location information (e.g., (x, y, z, T)) of the aircraft.” Ex. 1004 ¶¶ 82–83.

iv. Limitation [1c] – a controller for commanding flight control devices on the aircraft for controlling the flight of the aircraft, the controller also being configured to receive the command signals and the location signal

For limitation [1c], Petitioner argues that “Duggan discloses its VACS ‘is implemented in the context of a computing environment (e.g., a PC/104

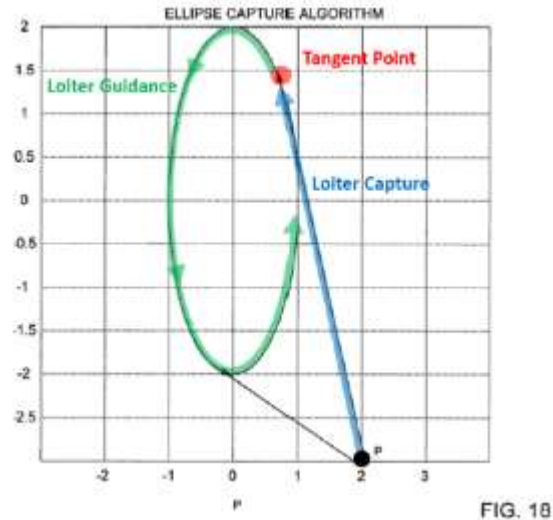
stack) configured for guidance, navigation, and control processing,’ and ‘the airborne system guidance and autopilot software is capable of supporting varying levels of control autonomy.’” Pet. 34 (citing Ex. 1005 ¶¶ 99, 421). Dr. Singhose testifies that Duggan’s Figure 8, as annotated by Petitioner and reproduced below, specifically illustrates a flight controller in the context of vehicle management software 804. Ex. 1004 ¶ 84.



Duggan’s Figure 8, as annotated by Petitioner and reproduced above, illustrates a block diagram command and control scheme receiving, for example, a location signal from integrated GPS/MU/NAV component 822. Figure 8 shows that such commands are eventually summed as an input to airframe and engine dynamics 826. Ex. 1005 ¶ 22. Duggan explains that “box 826 represents the step wherein control command are actually executed and vehicle control surfaces and engine dynamics are actually manipulated based on the commands.” *Id.* ¶ 115.

v. Limitation [1d] – wherein the controller uses the command signals and location signal to operate the flight control devices to control the flight of the aircraft for directing the aircraft toward a tangent point of the circular groundtrack for intercepting the circular groundtrack and then generally maintaining a flight path along the circular groundtrack.

Petitioner argues, as discussed for limitations [1a] and [1c], that “Duggan’s flight controller receives command signals and the location signal to operate the flight control devices on the aircraft to control the flight of the aircraft.” Pet. 36. With respect to “directing the aircraft to a tangent point of the circular groundtrack,” Petitioner asserts that “Duggan’s flight controller performs the same step in loiter control mode, calling it ‘loiter capture.’” *Id.* at 38 (citing Ex. 1005 ¶ 192; Ex. 1004 ¶ 93). Petitioner points to Duggan’s express description, which explains that “[u]pon entrance into loiter capture, the guidance algorithm illustratively solves for the ellipse tangent line that will bring the vehicle onto the ellipse headed in the desired direction of travel along the ellipse.” Ex. 1005 ¶ 212. Dr. Singhose testifies that Duggan expressly computes “[t]he tangent point on the ellipse.” Ex. 1004 ¶ 93 (quoting Ex. 1005 ¶ 218). Duggan explains that subsequent to determining the tangent point, “[t]he desired heading is then computed.” Ex. 1005 ¶ 222. Referencing Duggan’s express disclosure, Dr. Singhose testifies further that, “[u]nder the loiter capture guidance, the aircraft is directed ‘onto the desired ellipse [which includes a circle] at the desired heading utilizing the biased pursuit guidance law and the ellipse *tangent lines*.’” Ex. 1004 ¶ 93 (quoting Ex. 1005 ¶ 211) (alteration in original). Dr. Singhose provides the following annotated version of Duggan’s Figure 18, reproduced below.



This annotated version of Figure 18 illustrates in graphical form, ellipse capture algorithm including loiter capture portion (blue), loiter guidance portion (green), and a tangent point to the ellipse (red), as highlighted by Dr. Singhose. *Id.* ¶ 95. Petitioner also points out that Duggan discloses a circular ground track in Duggan’s Figure 22A, reproduced below.

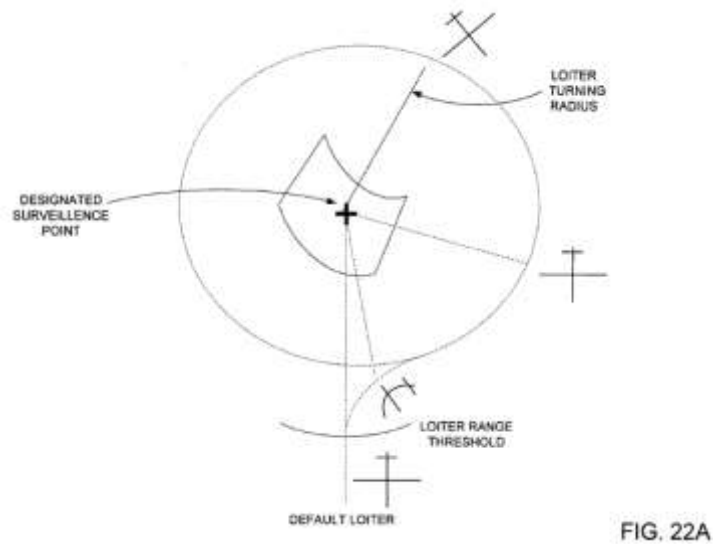


Figure 22A illustrates a schematic diagram of an aircraft line-of-sight-slave control approach depicting an aircraft and a “loiter turning radius” defining a circular ground track around a “designated surveillance point.” Ex. 1005 ¶ 37.

vi. Petitioner's Obviousness Analysis

As noted above, Petitioner essentially argues Ground 1 (anticipation by Duggan) and Ground 2 (obviousness over Duggan) together. *See* Pet. 19 (Petitioner asserting that “Claims 1–7 and 9–18 Are Anticipated (Ground 1) and/or Rendered Obvious (Ground 2) by Duggan.”). In this way, Petitioner initially asserts that Duggan discloses all the limitations of independent claims 1 and 14 for purposes of anticipation, and

to the extent that the Patent Owner argues or the Board finds before or after institution that Duggan’s “Waypoint Speed” does not define the claimed “commanded value of a circle velocity,” it would have at least been obvious for a [person of ordinary skill in the art] to use the “Waypoint Speed” parameter to define the speed of the aircraft during the circular flight.

Id. at 47 (citing Ex. 1004 ¶ 112).

Addressing the “circle velocity” limitations in claims 2 and 17, Petitioner reasons that it would have been obvious to a person of ordinary skill in the art “to command the aircraft to orbit at a speed of 75 kts because [Duggan’s] ‘Waypoint Speed’ parameter is already used for controlling aircraft speed and, as Table 1 describes, those parameters are defined to support various orbit patterns, including circle, racetrack, and ellipse.” Pet. 48 (citing Ex. 1004 ¶ 112). Petitioner argues that Duggan provides an example where once the vehicle reaches the desired orbit, it “then ‘orbit[s] an altitude of 1500-ft. MSL (~1000-ft. AGL) and at a speed of approximately 75 kts.’” *Id.* at 47 (citing Ex. 1005 ¶ 424).

(b) Patent Owner's Arguments

Patent Owner does not concede that Duggan discloses all the limitations of independent claims 1 and 14 but, directs its main arguments and evidence towards the limitations of dependent claims 2 and 17. PO

Resp. 19. Patent Owner’s main argument is that “[t]he Petition fails to establish that *Duggan* expressly discloses or inherently requires that the identified ‘[w]aypoint speed’ correspond to the claimed ‘circle velocity.’”

PO Resp. 22. The claimed “circle velocity” is recited as a limitation in dependent claims 2 and 17, which depend directly from independent claims 1 and 14, respectively. Ex. 1001, 9:48–58, 12:3–12. In addition, with respect to independent claims 1 and 14, Patent Owner argues that *Duggan* fails to expressly or inherently disclose that an “orbit speed” is received as a command signal by the claimed “means for receiving.” PO Resp. 29. Also, somewhat combining these arguments, Patent Owner argues that Petitioner fails to show “waypoint speed” and “orbit speed” are the same. *Id.* at 32.

In addition, and considering obviousness specifically, Patent Owner argues that Petitioner “merely argues that a [person of ordinary skill in the art] would know that the specific modification to *Duggan* set forth in the Petition **could** be done without showing why a [person of ordinary skill in the art] would have been motivated to make that specific modification.” PO Resp. 37. Patent Owner’s position is that Petitioner has not meet its burden and “fails to provide **any basis** for why a [person of ordinary skill in the art] **would** make this proposed modification and is legally insufficient to establish obviousness.” *Id.* at 38. Patent Owner takes aim specifically at Petitioner’s declarant, Dr. Singhose, arguing that “Dr. Singhose fails to correct the deficiencies of the Petition, and his declaration largely parrots the Petition verbatim.” *Id.* at 40 (citing Ex. 1004 ¶ 112). Patent Owner poses this question, “[b]oth the Petition and Dr. Singhose fail to answer this question: ‘Why would a [person of ordinary skill in the art] modify *Duggan* such that the ‘Waypoint Speed’ parameter would **also** apply to an ‘orbit pattern?’” *Id.* at 41.

We address this question and the other arguments and evidence raised by Patent Owner below.

- i. Whether Duggan’s ‘[w]aypoint speed’ would have been understood by a person of ordinary skill in the art as corresponding to the claimed ‘circle velocity’

Patent Owner argues that “waypoint speed” disclosed in Duggan “is the ‘[s]peed setting at a waypoint location,’” and “does not correspond to the claimed ‘circle velocity’ (*e.g.*, an ‘orbit pattern’ of *Duggan*).” PO Resp. 23 (citing Ex. 2016 ¶ 61; Ex. 1005 ¶ 188). In support of this argument, Patent Owner argues that Duggan’s Table 1, reproduced below, “clearly differentiates between “waypoint[s]” and “orbit pattern[s],” and uses distinct terminology to refer to each of them.” *Id.* at 24.

TABLE 1

Event Type	Waypoint, figure 8, racetrack, ellipse (circle is racetrack with equal length and width)
Waypoint latitude	Geodetic latitude of waypoint or orbit pattern center
Waypoint longitude	Geodetic longitude of waypoint or orbit pattern center
Waypoint Altitude	Ellipsoidal altitude of waypoint or orbit pattern center
Waypoint Speed	Speed setting at waypoint location
Orbit pattern length	Length of desired orbit pattern
Orbit pattern width	Width of desired orbit pattern
Orbit pattern orientation	Rotation angle of orbit pattern (relative to true North)
Number of orbit laps	Desired number of orbit laps
Time in orbit	Desired time to maintain orbit pattern (overrides orbit laps if greater than minimum threshold)
Orbit pattern center offset	Offset vector of orbit pattern center from known target location

Duggan’s Table 1 defines “[w]aypoint latitude” as “[g]eodetic latitude of waypoint or orbit pattern center.” Ex. 1005 ¶ 188. “Waypoint longitude” is defined as “[g]eodetic longitude of waypoint or orbit pattern center,” and

“[w]aypoint altitude,” is “[e]llipsoidal altitude of waypoint *or* orbit pattern center. *Id.* (emphases added). Table 1 further defines “Waypoint Speed” as “Speed setting at waypoint location.” *Id.* Patent Owner’s interpretation of Table 1, is essentially that “Waypoint Speed” is not defined as “Speed setting at waypoint location *or orbit pattern center*,” and therefore “*Duggan* does not disclose that ‘Waypoint Speed’ applies to any ‘orbit pattern.’” See PO Resp. 24.

Because neither party addressed the claim construction portions of their papers or identified a particular dispute with the meaning of the term “circle velocity,” we consider initially the plain meaning of the claimed “circle velocity” in the ’395 patent, as well as the teachings and disclosure of *Duggan* with respect to “orbit pattern.”

The ’395 patent describes a “fly-to” airspeed and a “circle airspeed,” or “circle velocity.” Ex. 1001, 5:19–30. Also, the ’395 patent describes “a ramping function for changing the airspeed of aircraft 23 from the “fly-to” airspeed to the circle airspeed, if the airspeed values are different.” *Id.* Focusing on “circle velocity,” and using the words of the ’395 patent itself, “circle velocity” is “the commanded airspeed that aircraft 23 is to maintain when flying around the circle (circle airspeed).” *Id.* at 5:24–26. The ’395 patent explains in two examples that aircraft guidance system 35 will “[c]ontinue to command the velocity, altitude, and turn rate to continue flying the commanded circle.” *Id.* at 7:32–33, 8:23–24. In other words, “circle velocity” is the speed, i.e. the airspeed, the aircraft is being told/commanded to fly in the circle pattern.

Turning to *Duggan* and “Waypoint Speed,” in Table 1 of *Duggan*, it defines “waypoint speed” as “[s]peed setting at waypoint location.” Ex. 1005 ¶ 188, Table 1. Considering the ordinary meaning of this

definition, it is reasonable to understand that Duggan discloses a system that tells/commands an aircraft to fly at a desired speed, i.e., velocity, relative to a waypoint. But given Patent Owner's argument that Duggan's speed setting at a waypoint location *does not* correspond to the claimed "circle velocity", we must look closer at Duggan. We again reproduce Duggan's Table 1 below.

TABLE 1

Event Type	Waypoint, figure 8, racetrack, ellipse (circle is racetrack with equal length and width)
Waypoint latitude	Geodetic latitude of waypoint or orbit pattern center
Waypoint longitude	Geodetic longitude of waypoint or orbit pattern center
Waypoint Altitude	Ellipsoidal altitude of waypoint or orbit pattern center
Waypoint Speed	Speed setting at waypoint location
Orbit pattern length	Length of desired orbit pattern
Orbit pattern width	Width of desired orbit pattern
Orbit pattern orientation	Rotation angle of orbit pattern (relative to true North)
Number of orbit laps	Desired number of orbit laps
Time in orbit	Desired time to maintain orbit pattern (overrides orbit laps if greater than minimum threshold)
Orbit pattern center offset	Offset vector of orbit pattern center from known target location

Importantly, Table 1 provides the waypoint location in terms of "[w]aypoint latitude" as "[g]eodetic latitude of waypoint or orbit pattern center."

"Waypoint longitude" is defined as "[g]eodetic longitude of waypoint or orbit pattern center," and "[w]aypoint altitude," is "[e]llipsoidal altitude of waypoint or orbit pattern center. *Id.* (emphases added). It is clear from Table 1 that "[w]aypoint" latitude, longitude and altitude include geolocation of an "orbit pattern center." *Id.* Relative to "orbit pattern center," Table 1 further describes "[o]rbit pattern length," "[o]rbit pattern

width,” and “[o]rbit pattern orientation.” *Id.* “Orbit pattern width, for example, is the “[l]ength of desired orbit pattern.” *Id.*

Immediately following Duggan’s Table 1 is a discussion entitled “Loiter Control.” Ex. 1005 ¶ 189. Here, Duggan explains that an aircraft can be commanded to fly about an “orbit pattern center,” expressly describing that “one embodiment of the present invention pertains to system support for an elliptical orbit pattern. The system illustratively enables the operator to select an oval or a constant radius (circular) loiter pattern.” *Id.* ¶ 191. We acknowledge Patent Owner’s position that Duggan does not expressly state that a command is provided to tell the aircraft to fly at a desired velocity in the “loiter pattern,” which, notably, could include a circular loiter pattern. *See* PO Resp. 26 (Patent Owner arguing that “[t]here is no disclosure in *Duggan* that the ‘speed’ of the ‘RDR’ mode applies to the ‘orbit pattern’ of ‘Go To’ mode—nor would that even be plausible as a ‘constant heading’ will not result in an ‘orbit pattern’ and instead will result in flight in a constant direction.”) (citing Ex. 2016 ¶ 66). But it is not a significant logical leap, and perhaps only a matter of semantics, to understand Duggan’s Table 1 discloses commanding a “[w]aypoint speed” that occurs either at a waypoint or an orbit pattern center. *Id.* ¶ 188, Table 1, *see also In re Bode*, 550 F.2d 656, 660 (CCPA 1977) (“A reference need not teach a limitation *in haec verba*.”). In fact, Duggan expressly describes an exemplary air mission that includes commanding the aircraft to enter a pre-planned orbit pattern at a desired speed. *See id.* ¶ 424 (Duggan describing that “the operator manually steers the vehicle toward a pre-planned orbit pattern. After the vehicle is properly oriented, the operator commands the VACS control system and the vehicle flies autonomously to the orbit

pattern. The vehicles all orbit at an altitude of 1500-ft. MSL (~1000-ft. AGL) and at a speed of approximately 75 kts.”).

We have considered Patent Owner’s argument that Duggan’s Table 1 “clearly differentiates between ‘waypoint[s]’ and ‘orbit pattern[s],’ and uses distinct terminology to refer to each of them.” PO Resp. 24 (citing Ex. 1005 ¶ 188, Table 1). Patent Owner argues that in Table 1 “‘Waypoint Speed’ is disclosed as **only** applying to ‘waypoint,’ and *Duggan* does not disclose that ‘Waypoint Speed’ applies to any ‘orbit pattern.’” *Id.* We disagree with this interpretation because “Waypoint Speed” is defined, not just as speed at a “waypoint,” but specifically as a “[s]peed setting at waypoint *location*.” In other words, Table 1 informs us that a waypoint location is defined by a respective latitude, longitude, and altitude, and that this location defines *either* a “waypoint or orbit pattern center.” Ex. 1005 ¶ 188, Table 1.

Also, with respect to Patent Owner’s argument that Duggan fails to disclose a “commanded value of a circle velocity,” we note that apart from a strained interpretation of Table 1, Patent Owner’s and Dr. Locke’s characterizations of Duggan are not supported by persuasive citation to the record. See PO Resp. 22–25, *see also* Ex. 2016 ¶¶ 59–63. Therefore, given a reasonable reading of Duggan’s specification and Table 1, we are persuaded that a person of ordinary skill in the art would consider “Waypoint Speed” as pertaining to a waypoint as well as a waypoint location that is an orbit pattern center. A reasonable reading of the Duggan’s specification and Table 1 is that Duggan discloses a “Waypoint Speed” applicable to the locations of both a waypoint and an orbit pattern center. Accordingly, we find that a person of ordinary skill in the art would have understood Duggan as disclosing “Waypoint Speed” of an aircraft as

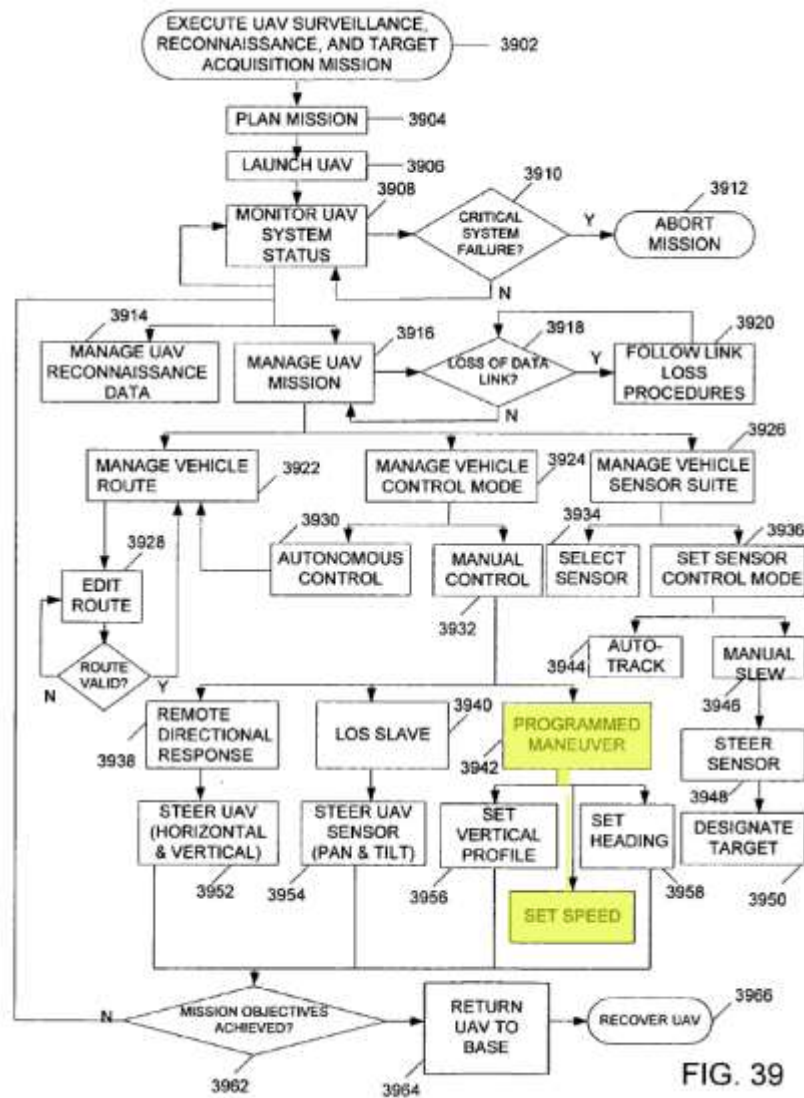
corresponding to *both* the aircraft speed at a waypoint, and the aircraft speed in a loiter, i.e. orbit, pattern about an orbit pattern center.

Patent Owner argues that the testimony regarding “waypoint speed” by “Dr. Singhose is not supported by any underlying facts” and is inconsistent with “the ‘Speed setting at waypoint location,’ which, again, does not refer to any ‘orbit pattern.’” PO Resp. 24 (citing Ex. 1004 ¶¶ 108–111). Dr. Singhose testifies that in Duggan

a radio on the aircraft receives the commands and flight information (the claimed command signals), which are transmitted from the ground station interface. See Section IX.A.1.b, above. The commands and flight information represent various “loiter parameters” set by the operator. Duggan at [0190]. Duggan’s Table 1, reproduced below for convenience, illustrates a sample collection of flight parameters that an operator can enter and edit via a user interface (Duggan at [0187]-[0188]).

Ex. 1004 ¶ 108. Considering Table 1, Dr. Singhose further testifies that “[t]he list includes ‘Waypoint Speed,’ which corresponds to the claimed ‘commanded value of a circle velocity’ because the circular flightpath corresponds to a waypoint.” *Id.* Dr. Singhose does not, in our opinion, come to these conclusions without facts. Dr. Singhose points to additional evidence in Duggan for instance, that the disclosed VACS system performs various autonomous and semi-autonomous functions, and “[e]xamples of such functions include implementation of inertial trajectories, pre-programmed maneuvers such as racetrack loiter patterns.” *Id.* (quoting Ex. 1005 ¶ 64). Dr. Singhose further explains that as shown in Duggan’s annotated Figure 39, reproduced below with highlighting by the Board, the VACS architecture supports a mission control path including within the

“programmed maneuver” at block 3942, sub-functions including “set speed” function. *Id.* ¶ 109.



Duggan’s Figure 39 illustrates “potential control paths through a mission,” including manual programming of a maneuver having set vertical profile, set heading and set speed (highlighted yellow). Ex. 1005, Fig. 39. Dr. Singhose concludes that that Duggan’s disclosure for setting a speed for a loiter pattern, including a circular pattern, thus corresponds to the claimed “commanded value of a circle velocity.” Ex. 1004 ¶ 109. And based on Duggan’s disclosures, Dr. Singhose testifies persuasively that a person of

ordinary skill in the art “would [have understood] that, to perform a pre-programmed maneuver (such as loiter pattern), Duggan’s VACS allows the operator to set a desired speed for the loiter/circle mode.” *Id.*

Overall, considering all the evidence and arguments in the record, we are persuaded that Petitioner has shown, by a preponderance of evidence, that a person of ordinary skill in the art would have understood that Duggan’s “Waypoint Speed” corresponds to the claimed “circle velocity” recited in claims 2 and 17.

ii. Whether Duggan fails to expressly or inherently disclose that “orbit speed” is received as a command signal by the claimed “means for receiving” as recited in claims 1 and 14

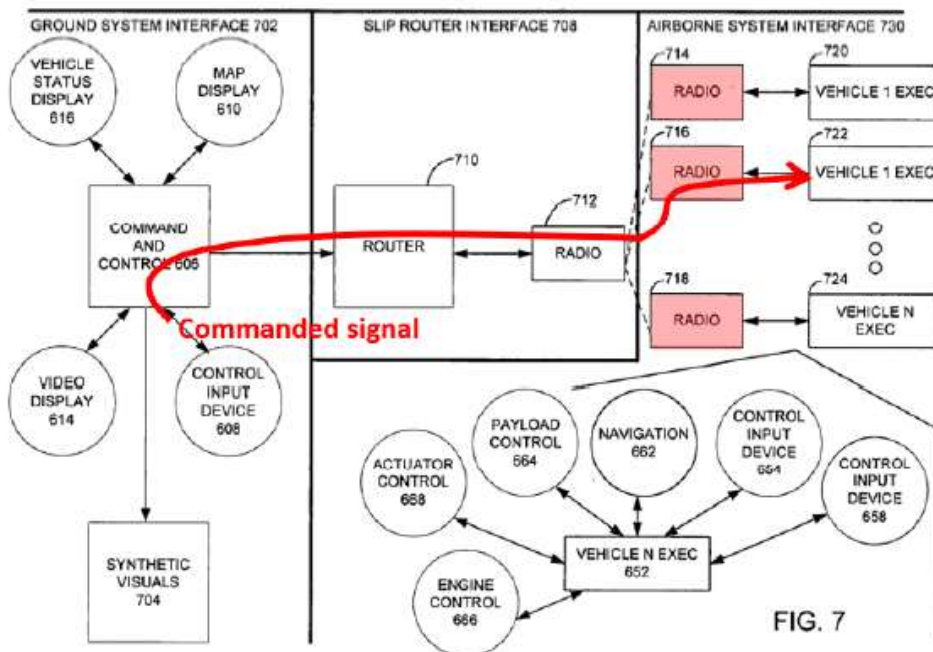
In regards to independent claims 1 and 14, which both recite “means for receiving command signals representing commanded values of a location of a geospatial point,” Patent Owner argues that there is no disclosure in Duggan that the “set speed” block for example in Duggan’s Figure 39, above,

(1) is set via the ‘[r]adios 714-718 of datalink 605’ (the alleged ‘means for receiving command signals’) as opposed to, for example, being ‘set’ from programmed options; (2) is set for a ‘circle velocity’ as claimed in the ’395 Patent; or (3) represents anything different from the “**constant altitude, constant heading, and constant speed flight condition**” discussed above.

PO Resp. 27–28 (citing Ex. 2016 ¶ 67). Patent Owner argues that “both the Petition and Dr. Singhose fail to identify *any* disclosure in *Duggan* that the ‘speed of approximately 75 kts’ is set by the [r]adios 714-718 of datalink 605’ (the alleged ‘means for receiving’) or ‘per’ any ‘operator’s commands.’” *Id.* at 30 (citing Pet. 47; Ex. 2016 ¶ 71).

Patent Owner contends that “[t]here is no disclosure in *Duggan* that the ‘speed’ of the ‘RDR’ mode applies to the ‘orbit pattern’ of ‘Go To’ mode—nor would that even be plausible as a ‘constant heading’ will not result in an ‘orbit pattern’ and instead will result in flight in a constant direction. *Id.* at 26 (citing Ex. 2016 ¶ 66). Patent Owner makes the specific argument that “Dr. Singhose ignores the disclosure from *Duggan* that the “orbit . . . speed” is fixed and that “[t]he vehicles **all orbit** . . . at a speed of approximately 75 kts.” *Id.* at 30.

It may be that *Duggan*, read literally, does not expressly state that the aircraft loiter speed is commanded over radios 714–718. However, *Duggan*’s Figure 7, as reproduced below and as annotated by Petitioner, clearly illustrates that parameters and commands entered at vehicle control input device 608 are transmitted to radios 714–718.



Duggan’s Figure 7 illustrates command and communication mapping including structural components for, and interfacing between, ground system

interface 702 and airborne system interface 730. Ex. 1005 ¶ 110. Dr. Singhose testifies that Duggan expressly discloses “commands and flight information include ‘autonomous flight control functionality with operator inserted path commands such as, but not limited to, waypoint editing, *loiter point editing* or real-time route editing.’” Ex. 1004 ¶ 71 (quoting Ex. 1005 ¶ 73).

This testimony addresses specifically the limitations in claim 1, “means for receiving command signals,” and Dr. Singhose had not at this point, discussed “circle velocity” from claim 2 as one of the command signals. So, we also evaluate Petitioner and Dr. Singhose’s analyses of Duggan’s disclosure in terms of claim 2 and the “command signal” as including a “commanded value of a circle velocity.” Ex. 1001, 9:53–54.

Petitioner argues that “Duggan discloses or renders obvious this limitation” because Duggan’s Table 1 “illustrates a sample collection of flight parameters that an operator can enter and edit via a user interface (*id.*, [0187]-[0188]), which includes ‘Waypoint Speed,’ which corresponds to the claimed ‘commanded value of a circle velocity.’” Pet. 45 (citing Ex. 1004 ¶ 108–111). As discussed above, we are persuaded that a person of ordinary skill in the art would have understood that Duggan’s “Waypoint Speed” corresponds to the claimed “circle velocity” recited in claim 2.

Dr. Singhose testifies that, even if Duggan’s “Waypoint Speed” does not expressly correspond to the claimed “commanded value of a circle velocity,” “Duggan discloses an exemplary use case where ‘the operator commands the VACS control system and the vehicle flies autonomously to the orbit pattern,’ and then ‘orbit at an altitude of 1500-ft. MSL (~1000-ft. AGL) and at a speed of approximately 75 kts.’” Ex. 1004 ¶ 112 (citing Ex. 1005 ¶ 424). A plain reading of Duggan’s example is that “the operator

commands the VACS control system.” Ex. 1005 ¶ 424. The VACS system includes not only the vehicle control input device 608 as shown in Figure 7 above, but also that the operator can command a programmed maneuver including set vertical profile, set heading, and set speed, as expressly shown in Duggan’s Figure 39. See Ex. 1005 ¶ 433 (“Block 3942 represents program maneuver control. Block 3956, 3960 and 3958 represent a setting of parameters for programmed maneuver control.”)

Dr. Singhose explained with respect to Figure 7 that

[t]he commands and flight information include “autonomous flight control functionality with operator inserted path commands such as, but not limited to, waypoint editing, *loiter point editing* or real-time route editing.” Duggan at [0073] (emphasis added). Duggan also states that the VACS “process[es] the operator’s inputs” and enters “an operator specified orbit pattern.” Duggan at [0151].

Ex. 1004 ¶ 71. Based on Dr. Singhose testimony and the clear explanations and examples of speed setting for programmed maneuver and loiter control in Duggan itself, we are persuaded that a person of ordinary skill in the art would have understood Duggan to teach that a commanded “circle velocity,” in terms of an orbit speed about an orbit pattern center, for example 75 kts, would be received by Duggan’s flight control system via radios 714–718. Accordingly, we find that Petitioner has shown by a preponderance of the evidence that independent claims 1 and 14 would have been obvious over Duggan

iii. Why would a person of ordinary skill in the art modify Duggan such that the ‘Waypoint Speed’ parameter would also apply to an ‘orbit pattern’?

Patent Owner argues that “[t]he Petition’s obviousness argument is legally insufficient to establish obviousness because it merely argues that a

[person of ordinary skill in the art] would know that the specific modification to *Duggan* set forth in the Petition **could** be done without showing why a [person of ordinary skill in the art] would have been motivated to make that specific modification.” PO Resp. 37 (citing *Gamber-Johnson LLC v. National Products Inc.*, IPR2021-01159, Paper 7 at 32 (P.T.A.B. Jan. 3, 2022)). We agree that the question as to *why* Duggan would have been modified is important. For the reasons discussed below, we find that Petitioner and Dr. Singhose have explained sufficiently why a person of ordinary skill in the art would have been motivated to apply Duggan’s “Waypoint Speed” also to an “orbit pattern.”

As an initial matter, although we don’t address anticipation directly, we are not necessarily persuaded that Duggan would need to be modified to teach or disclose “a commanded value” for the speed of an aircraft in an orbit pattern about a waypoint or orbit pattern center. See Section II.2.(b)i. (“it is not a significant logical leap, and perhaps no leap at all, to understand that Duggan teaches commanding a “[w]aypoint speed” that occurs either at a waypoint or an orbit pattern center.”). With this understanding, we consider Patent Owner’s specific argument that “[n]either the Petition nor Dr. Singhose provide any basis for **why** a [person of ordinary skill in the art] would modify the disclosure of *Duggan* ‘to use the ‘Waypoint Speed’ parameter . . . in Table 1, to command the aircraft to orbit at a speed of 75 kts.’” PO Resp. 38 (citing Pet. 47–48; Ex. 2016 ¶¶ 81–82).

Dr. Singhose testifies that, even if we accept Patent Owner’s argument that “waypoint speed” is not expressly commensurate with the “commanded value of a circle velocity . . . it would have at least been obvious for a [person of ordinary skill in the art] to use the ‘Waypoint Speed’ parameter to define the speed of the aircraft during the circular flight.” Ex. 1004 ¶ 112.

Dr. Singhose reasons that “[t]he ‘Waypoint Speed’ is already used for controlling the speed of the aircraft, and as Table 1 of Duggan describes, those parameters (including the ‘Waypoint Speed’) are defined for various orbit patterns, including circle, racetrack, and ellipse.” *Id.* Dr. Singhose testifies, persuasively, that for an orbit pattern “commanding the aircraft using the ‘Waypoint Speed’ parameter would have been a simple use or combination of familiar elements according to known methods to yield predictable results.” *Id.* Dr. Singhose bases his testimony also on Duggan’s written description which explains that an operator can “[g]raphically edit the existing route on the mission situation display by adding a waypoint or orbit pattern.” Ex. 1005 ¶ 407. Relying on Duggan’s explanations, Dr. Singhose testifies further that in the VACS system, for either a waypoint or orbit pattern, the operator can “then ‘[p]rogram in a fixed heading, altitude, and **speed** using the control options provided in the route tab of the selection pane [of GUI display].” Ex. 1004 ¶ 108 (quoting Ex. 1005 ¶ 411).

Although it may not be uniquely satisfying when an expert such as Dr. Singhose contends that a prior art modification is predictable, in cases where the modification is not a great leap in technology or logic, predictability based on evidentiary underpinnings as it is here, still answers the question *why*. See *KSR*, 550 U.S. at 417 (“If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability.”), see also *B/E Aerospace, Inc. v. C&D Zodiac, Inc.*, 962 F.3d 1373, 1379 (Fed. Cir. 2020) (The Court affirming the Board where “[t]he prior art yields a predictable result, the ‘second recess,’ because a person of skill in the art would have applied a variation of the first recess and would have seen the benefit of doing so.”).

Overall, when reasonably interpreting Duggan’s Table 1, there are sufficient reasons why a person of ordinary skill in the art would have known to use the commanded “Waypoint Speed” for a waypoint, and also for an aircraft conducting a loiter pattern centered around a waypoint acting as a loiter pattern center. See Ex. 1005, ¶ 188, Table 1. From a purely logical perspective, any in-flight function, autonomous, semi-autonomous, or manual or pre-programmed maneuver, an aircraft would require a “commanded” velocity or speed, otherwise the aircraft would simply not fly or alternatively disastrous consequences would result. Dr. Singhose explains that “[t]he ‘Waypoint Speed’ is already used for controlling the speed of the aircraft, and as Table 1 of Duggan describes, those parameters (including the ‘Waypoint Speed’) are defined for various orbit patterns, including circle, racetrack, and ellipse.” Ex. 1004 ¶ 112. Dr. Singhose testifies persuasively, that “commanding the aircraft using the ‘Waypoint Speed’ parameter would have been a simple use or combination of familiar elements according to known methods to yield predictable results.” *Id.*

Dr. Singhose has provided sufficient reasoning supported by underlying evidence that a person of ordinary skill in the art would have understood Duggan’s “Waypoint Speed” as corresponding to the claimed “commanded value of a circle velocity,” and consequently that Duggan teaches, if not outright discloses, setting a speed, i.e. a velocity for an aircraft along a waypoint leg as well as a racetrack loiter program about an “orbit pattern center.” Ex. 1004 ¶¶ 108–112. Based on Dr. Singhose’s reasoning and the underlying evidence in Duggan on the record before us, Petitioner has shown sufficiently that the limitations of claim 2, and also of claim 17 which contains the same limitations, namely, “a commanded value of a circle velocity,” would have been obvious over Duggan. This is

because we see no reason why Petitioner's asserted modification, such as it is, is anything more than the predictable use of speed setting at a waypoint occurring in the context of an orbit center, and according to the established velocity function for controlling the speed of an aircraft.

(c) *Conclusion for independent claims 1, 2, 14, and 17*

Based on the complete record before us and for the reasons expressed above, we are persuaded that Petitioner has shown a preponderance of evidence that claims 1, 2, 14 and 17 would have been obvious over Duggan.

3. *Claims 3–7, 9–13, 15–16, and 18*

Because Patent Owner argues for claims 10 and 11 expressly, we address those claims separately.

(a) *Claims 3–7, 9, 12–13, 15–16, and 18*

Petitioner argues that the remaining challenged claims 3–7, 9–13, 15–16, and 18, would have been unpatentable over Duggan. Pet. 50–68, 70–72. Petitioner relies upon Duggan alone to teach the limitations of claims 3–7, 9–13, 15–16, and 18. *Id.*

For example, claim 3 depends from claim 2 and recites the limitations “wherein the controller comprises a ramping function for changing a current velocity of the aircraft to the circle velocity based on a distance of the aircraft from the tangent point.” Ex. 1001, 9:59–62. Petitioner argues that Duggan discloses a position error of the aircraft “[b]ased on the position error, the horizontal acceleration command and total local vertical acceleration command are computed as shown in equations 33 and 34 below:”

$$a_{ch} = -k_p \Delta P_x + k_v |\vec{V}_1| \Delta \Psi \quad \text{Eq. 33}$$

$$\vec{a}_c^{LV} = [T_{LV}^E]^T [T_E^B]^T \begin{Bmatrix} a_{ch} \\ 0 \\ k_p \Delta P_z^B - k_v V_{1z} + |g| + k_p k_{FF2.1} V_c \end{Bmatrix} \quad \text{Eq. 34}$$

where

V_c =Airspeed command

$|g|=9.81$

Pet. 50–51. Petitioner argues that “[t]hese computed acceleration commands define control functions that ramp the aircraft’s velocity from the current location to the circle velocity at the tangent point.” *Id.* at 51 (citing Ex. 1004 ¶ 122). Dr. Singhose explains that “[a]s shown in the acceleration commands (equation 34), the acceleration is proportional to the distance of the aircraft from the tangent point. In other words, when the aircraft approaches the desired position, the acceleration (the rate of changing the velocity) would ramp up or down so that the aircraft’s velocity would converge to the desired circle velocity.” Ex. 1004 ¶ 122. From Duggan’s disclosure then, Dr. Singhose testifies, a person of ordinary skill in the art “would[have understood] that the controller is providing the claimed ‘ramping function for changing a current velocity of the aircraft to the circle velocity based on a distance of the aircraft from the tangent point.’” *Id.* (citing Ex. 1005 ¶ 168).

Patent Owner does not substantively dispute that Duggan teaches the additional limitations of claims 3–7, 9, 12–13, 15–16, and 18. *See generally* PO Resp.

As for each of dependent claims 3–7, 9, 12–13, 15–16, and 18, we have considered, and on the complete record before us, accept as our own, Petitioner’s arguments and evidence set forth at pages 50–68 and 70–72 of

the Petition. Accordingly, we determine that Petitioner has shown by a preponderance of the evidence that claims 3–7, 9–13, 15–16, and 18 would have been obvious over Duggan.

(b) Claims 10 and 11

Patent Owner argues that “the Petition relies on the same ‘radios 714-718 of datalink 605’ for the claim element ‘inputting command values into a flight controller’ in Claim 10 as for the claim element “means for receiving command signals” in Claims 1 and 14.” PO Resp. 55. Petitioner responds, asserting that, as set forth in the Petition, “Duggan’s VACS supports a circular loiter pattern and enables an operator to input commands and flight information via a control input device in the ground station, which are then input into the flight controller via radios 714-718 of datalink 605.” Pet. Reply 25 (quoting Pet. 61–62).

Claims 10 and 11 depend from independent claim 9, a method claim including similar limitations as independent claims 1 and 14. Ex. 1001, 10:25–43. Dependent claim 10 is respectively also a method claim, and recites “inputting into the flight controller a command value representing a commanded circle velocity.” *Id.* at 10:45–46. From a claim interpretation standpoint, we have no concerns, nor does Patent Owner articulate any persuasive argument or explanation that “inputting” of a “commanded circle velocity” is substantively different from the limitations in claims 1 and 2 that require “means for receiving command signals,” in claim limitation [1a], and a command signal that is “a commanded value of a circle velocity” as recited in claim 2. In both cases, we find persuasive Petitioner’s mapping of “radios 714–718 of datalink 605,” as both “means for receiving command signals” in claim 1, as well as for the step of “inputting into the flight controller a

command value,” recited in claim 10. Accordingly, we determine that claim 10 would have been obvious over Duggan.

Claim 11, depending from claim 10, is not substantively argued by Patent Owner, and apart from being a method claim is substantially the same as claim 3 discussed above, and for the same reasons would have been obvious in view of Duggan.

E. Ground 1: Claims 1–7 and 9–18 – Anticipation based on Duggan

Because we determine that claims 1–7 and 9–18 would have been obvious over Duggan, we need not determine whether these same claims are also anticipated by Duggan. *Cf. In re Gleave*, 560 F.3d 1331, 1338 (Fed. Cir. 2009) (not reaching other grounds of unpatentability after affirming a ground based on anticipation); *see also Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (explaining that an administrative agency is at liberty to reach a decision based on a dispositive issue because doing so “can not only save the parties, the [agency], and [the reviewing] court unnecessary cost and effort,” but “can greatly ease the burden on [an agency] commonly faced with a . . . proceeding involving numerous complex issues and required by statute to reach its conclusion within rigid time limits”).

F. Ground 3: Claims 2–5, 10–13, and 17, – Obviousness over Duggan and Pate (Ex. 1005)

Because we determine that claims 2–5, 10–13, and 17 would have been obvious over Duggan alone, we need not determine whether these same claims are also obvious over Duggan and Pate. *See Gleave*, 560 F.3d. at 1338.

III. CONCLUSION⁷

For the reasons discussed above, we determine Petitioner meets its burden of establishing, by a preponderance of the evidence, that the challenged claims are unpatentable, as summarized in the following table:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–7, 9–18	102	Duggan ⁸		
1–7, 9–18	103(a)	Duggan	1–7, 9–18	
2–5, 10–13, 17	103(a)	Duggan and Pate ⁹		
Overall Outcome			1–7, 9–18	

IV. ORDER

For the reasons given, it is

⁷ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

⁸ Because Petitioner's contentions regarding the obviousness of claims 1–7 and 9–18 in view of Duggan are dispositive of the challenged claims, we do not reach this asserted ground. See *Gleave*, 560 F.3d. at 1338.

⁹ Because Petitioner's contentions regarding the obviousness of claims 1–7 and 9–18 in view of Duggan are dispositive of the challenged claims, we do not reach this asserted ground. See *Gleave*, 560 F.3d. at 1338.

ORDERED that, based on a preponderance of the evidence, claims 1–7 and 9–18 of the '395 patent have been shown to be unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, any party to the proceeding seeking judicial review of this Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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