

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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PARROT S.A., PARROT DRONES, S.A.S. and PARROT INC.,  
Petitioners,

v.

QFO LABS, INC.,  
Patent Owner.

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Case IPR2016-01550  
Patent 7,931,239 B2

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Before MEREDITH C. PETRAVICK, HYUN J. JUNG, and  
SCOTT C. MOORE, *Administrative Patent Judges*.

JUNG, *Administrative Patent Judge*.

FINAL WRITTEN DECISION  
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

## I. INTRODUCTION

Parrot S.A., Parrot Drones S.A.S., and Parrot Inc. (“Petitioners”) filed a Petition (Paper 2, “Pet.”), requesting institution of an *inter partes* review of claims 1–10 of U.S. Patent No. 7,931,239 B2 (Ex. 1001, “the ’239 patent”). QFO Labs, Inc. (“Patent Owner”) filed a Preliminary Response (Paper 10). Upon considering the Petition and the Preliminary Response, we instituted *inter partes* review of claim 10 of the ’239 patent. Paper 18 (“Dec. on Inst.”).

After institution, Patent Owner filed a Response (Paper 32, “PO Resp.”) and a Contingent Motion to Amend (Paper 31, “Mot.”). Petitioners filed a Reply (Paper 41, “Pet. Reply”) and an Opposition to Patent Owner’s Contingent Motion to Amend (Paper 42), to which Patent Owner filed a Reply to Petitioner Opposition to Contingent Motion to Amend (Paper 43). Because of the then-recently issued *en banc* decision in *Aqua Products, Inc. v. Matal*, 872 F.3d 1290 (Fed. Cir. 2017) (“*Aqua Products*”), the parties requested, and we authorized, additional briefing regarding Patent Owner’s Contingent Motion to Amend. Paper 47. Petitioners thereafter filed a Brief in Opposition to Patent Owner’s Contingent Motion to Amend (Paper 51), and Patent Owner filed a Reply to Petitioner Opposition to Contingent Motion to Amend (Paper 52), to which Petitioners filed a Sur-Reply Brief in Opposition to Patent Owner’s Contingent Motion to Amend (Paper 56).

Petitioners proffered a Declaration of Prof. Girish Chowdhary, Ph.D. in Support of Petition (Ex. 1003, “First Chowdhary Declaration” or “1st Chowdhary Decl.”), a Declaration of Prof. Girish Chowdhary, Ph.D. in Support of Petitioners’ Opposition to Patent Owner’s Contingent Motion to Amend and Its Reply to Patent Owner’s Response (Ex. 1030, “Second

Chowdhary Declaration”), and a Declaration of Prof. Girish Chowdhary, Ph.D. in Support of Petitioners’ Brief in Opposition to Patent Owner’s Contingent Motion to Amend (Ex. 1037, “Third Chowdhary Declaration” or “3d Chowdhary Decl.”). Patent Owner proffered a Declaration of John P. Condon (Ex. 2005, “1st Condon Decl.”) with its Preliminary Response and a Second Declaration of John P. Condon (Ex. 2013, “Second Condon Declaration” or “2d Condon Decl.”) with its Response. A deposition transcript for Mr. Condon (Ex. 1035) was filed, but no deposition transcript was filed for Prof. Chowdhary.

A joint oral hearing in this proceeding and Case IPR2016-01559 was held on November 15, 2017; a transcript of the hearing is included in the record (Paper 59, “Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioners have shown by a preponderance of the evidence that claim 10 of the ’239 patent is unpatentable. Also based on the entirety of the record, we *deny* Patent Owner’s Contingent Motion to Amend.

*A. Ground of Unpatentability at Issue*

We instituted *inter partes* review on the ground that, under 35 U.S.C. § 103, claim 10 is unpatentable over Louvel<sup>1</sup>, Thomas<sup>2</sup>, and Jimenez<sup>3</sup>. Dec. on Inst. 27, 36.

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<sup>1</sup> US 2002/0104921 A1, published Aug. 8, 2002 (Ex. 1004).

<sup>2</sup> US 5,128,671, issued July 7, 1992 (Ex. 1006).

<sup>3</sup> US 2002/0106966 A1, published Aug. 8, 2002 (Ex. 1007).

*B. Related Proceedings*

Patent Owner indicates that the '239 patent, U.S. Patent No. 9,073,532 B2 ("the '532 patent") (Ex. 2002), and U.S. Patent No. 9,645,580 B2 ("the '580 patent") (Ex. 2012) are involved in case 1:16-cv-00682-GM in the U.S. District Court for the District of Delaware. Paper 8, 1–2; Paper 19, 3; PO Resp. 10; Paper 48, 3; Paper 57, 3; *see also* Pet. 75 (indicating intent to file an action in the District of Delaware). The parties indicate that the '532 patent issued from a continuation application of the '239 patent, and the '580 patent issued from a continuation application of the '532 patent. Pet. 75; Paper 8, 1–2; Paper 19, 1–2; Mot. 6; PO Resp. 8; Paper 48, 2; Mot. 5–6; Paper 57, 2.

Patent Owner also indicates that the '239 patent, the '532 patent, and the '580 patent were asserted against Petitioners in case 0:16-cv-03443-JRT-HB (D. Minn.) and in *QFO Labs, Inc. v. Brookstone Stores, Inc.*, case 0:17-cv-01100-JNE-SR (D. Minn.), both of which were dismissed. Paper 19, 3–4; PO Resp. 10; Paper 48, 4; Paper 57, 4; Ex. 1027. Patent Owner further indicates that the '239, '532, and '580 patents have been asserted in *QFO Labs, Inc. v. Amazon.com, Inc.*, case 0:17-cv-05014-DWF-HB (D. Minn.); *QFO Labs, Inc. v. Best Buy Co., Inc.*, case 0:17-cv-5011-JNE-TNL (D. Minn.); and *QFO Labs, Inc. v. Target Corp.*, case 0:17-cv-05012-JRT-DTS (D. Minn.). Paper 57, 5.

The '239 patent is also the subject of Case IPR2017-01089; the '532 patent is the subject of Cases IPR2016-01559 and IPR2017-01090; and the '580 patent is the subject of Case IPR2017-01400. Paper 8, 1–2; Paper 19, 1–2; PO Resp. 10; Paper 48, 2; Paper 57, 2; Ex. 1026; Ex. 2014. We denied institution in IPR2017-01089, IPR2017-01090, and IPR2017-01400.

*C. The '239 Patent (Ex. 1001)*

The '239 patent relates to a “homeostatic flying hovercraft and to a radio controlled flying saucer toy employing the [principles] of a homeostatic flying hovercraft.” Ex. 1001, 1:19–21. Figure 21 of the '239 patent is reproduced below:

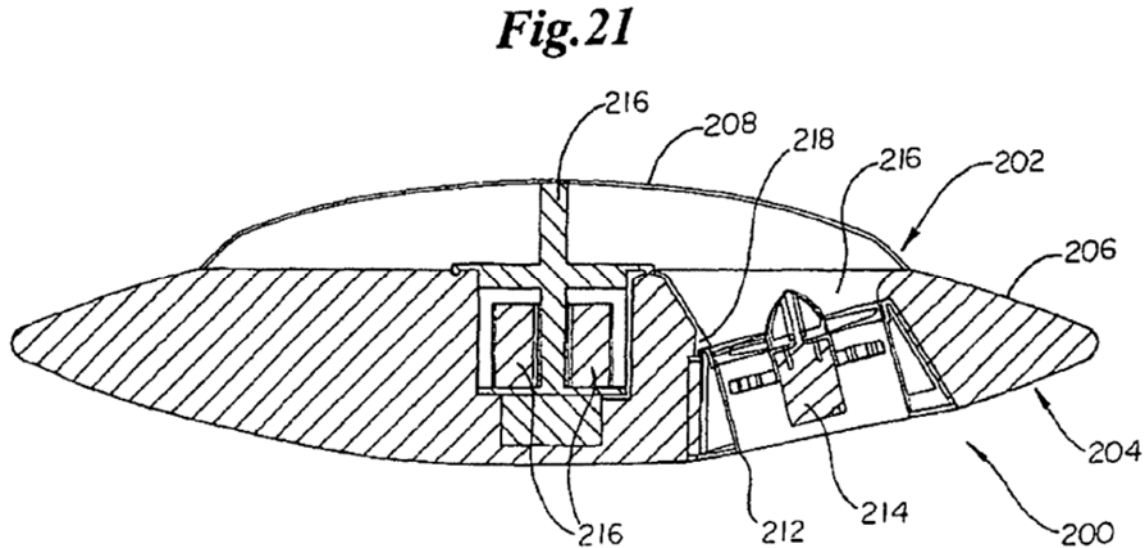


Figure 21 illustrates a “side cutaway view” of a “preferred embodiment of a homeostatic flying hovercraft.” *Id.* at 8:44–46, 8:54–55, 9:14–16. Homeostatic flying craft 200 has upper surface 202, bottom surface 204, four duct openings 212 on bottom surface 204, and battery-powered ducted fan 214 mounted inboard from each duct opening 212. *Id.* at 9:14–29. Each fan 214 is powered from an internal pair of batteries 216. *Id.* at 9:41–42; *see also id.* at 12:27–13:8, 13:34–60 (describing embodiment of Figs. 1–3).

Homeostatic control system 300 is “operably connected to thrusters . . . in order to maintain a desired orientation” and includes “XYZ sensor arrangement 302 and associated control circuitry 304 that dynamically determines an inertial gravitational reference.” *Id.* at 10:64–11:5; *see also*

*id.* at 10:30–37 (also describing a homeostatic control system and XYZ sensor arrangement before stating “[f]inally, the RC aircraft has . . .”). XYZ sensor arrangement 302 “comprises an X-axis sensor system, a Y-[axis] sensor system[,] and a Z-axis sensor system.” *Id.* at 11:14–16. “The X-axis sensor system is positioned in an X plane of the body and includes at least three first sensors that sense acceleration and gravity in the X plane and at least three second sensors that sense acceleration only in the X plane.” Ex. 1001, 11:16–20. The Y-axis and Z-axis sensor systems are similarly configured. *Id.* at 11:20–26. “Preferably, the X-axis sensor system comprises two sets of active accelerometers and two sets of passive accelerometers oriented in the X plane,” and the Y-axis sensor system similarly comprises active and passive accelerometers. *Id.* at 11:27–31. Each set of active accelerometers has a pair of active accelerometers “oriented at 90 degrees with respect to each other in the respective plane,” and each set of passive accelerometers has a pair of passive accelerometers also “oriented at 90 degrees with respect to each other in the respective plane.” *Id.* at 11:32–37. The pairs of active and passive accelerometers are “positioned at 45 degrees offset relative to a horizontal plane through a center of the body.” *Id.* at 11:37–40.

Figure 22a of the '239 patent is reproduced below:

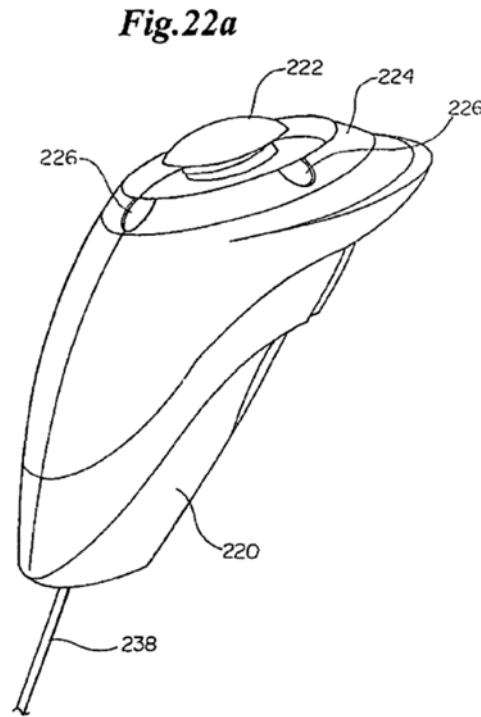


Figure 22a is an isometric view of a hand-held “bee controller.” Ex. 1001, 8:56–57, 9:49–50. A radio-controlled (“RC”) controller 220 “includes a body adapted to be held in one hand” and a “homeostatic control system IS positioned within the body.” *Id.* at 10:13–17. A user selectively positioning an orientation of RC controller 220 provides a “desired orientation.” *Id.* The homeostatic control system “includes an XYZ sensor arrangement and associated control circuitry” to sense the “desired orientation of the RC controller” and “dynamically determines an inertial gravitational reference for use in sensing the desired orientation.” *Id.* at 10:14–21. RC controller 220 also includes a “bidirectional radio frequency (RF) transceiver providing two-way RF communications between the RC aircraft and the hand-held RC controller that communicates the desired orientation to the RC aircraft.” *Id.* at 10:22–25; *see also id.* at 13:18–33, 13:61–14:8 (describing embodiment of Figs. 1–3).

*D. Claim at Issue*

The only claim at issue, claim 10, is reproduced below.

10. A method for operating a radio controlled (RC) homeostatic flying hovercraft having at least four battery powered generally downwardly directed thrusters using an RC controller separate and remote from said flying hovercraft, said method comprising:

providing as part of said RC controller a handheld structure housing a sensor system;

using said sensor system in said RC control<sup>[4]</sup> to sense at least a two dimensional, two-axis sensed orientation of said handheld structure in response to a user remote from said flying structure selectively orienting said handheld structure;

communicating a desired orientation by radio frequency (RF) communication information to said flying hovercraft, said desired orientation including information based on said sensed orientation of said handheld structure;

using a sensor system in said flying hovercraft to dynamically determine an actual orientation of said flying hovercraft, said sensor system including at least a three-dimensional, three-axis sensor;

using control circuitry in said flying hovercraft to automatically and dynamically control a thrust produced by each of said thrusters to achieve and homeostatically maintain said actual orientation of said flying hovercraft in response to said desired orientation communicated to said flying hovercraft and said actual orientation determined by said sensor system in said flying hovercraft without additional control information communicated to said flying hovercraft.

Ex. 1001, 16:35–64.

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<sup>4</sup> In its Contingent Motion to Amend, Patent Owner states that “correction of ‘RC control’ to ‘RC controller’ fixes an obvious typographical error.” Mot. 8.

## II. CLAIM INTERPRETATION

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs. LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (upholding the use of the broadest reasonable interpretation standard).

In the Decision on Institution, we interpreted certain means-plus-function terms in claim 6, for which *inter partes* review was not instituted. Dec. on Inst. 8–11. Also, for the purposes of the Decision on Institution, we determined that express interpretations of “homeostatic,” “orientation,” or any other term was not necessary. *Id.* at 11; *see also* Pet. 15 (stating that “no construction of any non-means plus function claim term is required”).

Patent Owner quotes from the Decision on Institution “[f]or purposes of this Decision, we determine that express interpretations of these terms or any other terms are not necessary” and states that “[f]or purposes of [Patent Owner’s] Response, Patentee accepts this BRI construction.” PO Resp. 14 (quoting Dec. on Inst. 11). Patent Owner also maintains that the “proper construction under the *Markman* standard [(*Markman v. Westview Instruments*, 116 S. Ct. 1384, (1996))] of the term ‘orientation’ as used in the ’239 patent does not encompass either ‘position’ control or ‘motion’ control” and “expressly reserves the right to argue for such a claim construction under the *Markman* standard in any litigation proceedings.” *Id.* n.5.

We understand Patent Owner to be agreeing that, if interpretation of claims terms was required, those terms should be interpreted according to their broadest reasonable construction in light of the specification of the ’239

patent. See Tr. 29:9–31:17, 32:14–25. We also understand Patent Owner to be accepting that express interpretations of “homeostatic” and “orientation” are not necessary for this proceeding.

After reviewing the complete record, we agree with the parties that express interpretation of any claim term is not necessary for determining whether Petitioners have carried their burden of proving claim 10 unpatentable by a preponderance of the evidence. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (construing only those terms in controversy and only to the extent necessary to resolve the controversy); see Pet. 15; PO Resp. 14; Tr. 29:9–31:17, 32:14–25.

### III. CHALLENGE OF CLAIM 10

Petitioners contend that claim 10 would have been obvious in view of Louvel, Thomas, and Jimenez. Pet. 44 (referring to the same reasons asserted against claim 1 for the unpatentability of claim 10); see also *id.* at 33–43 (arguing claim 1 is unpatentable over Louvel, Thomas, and Jimenez). In support of these contentions, Petitioners cite to Louvel, Thomas, Jimenez, and the First and Second Chowdhary Declarations (Exs. 1003, 1030). See Pet. 33–44; Pet. Reply 7–25. Patent Owner disputes the alleged unpatentability of claim 10 supported by citations to the asserted references and the Second Condon Declaration (Ex. 2013). See PO Resp. 14–45.

To prevail in their challenge, under 35 U.S.C. § 103, of claim 10 as unpatentable over Louvel, Thomas, and Jimenez, Petitioners must prove unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented 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. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of 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) objective evidence of nonobviousness. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1996).

As discussed below, the parties’ disputes are related to the scope and content of the prior art, differences between claim 10 and the prior art, and Petitioners’ rationales for combining the asserted references. The parties do not dispute the level of ordinary skill in the art, and the parties have not directed us to any objective evidence of nonobviousness.

After reviewing the complete record, we conclude that Petitioners have shown by a preponderance of the evidence that Louvel, Thomas, and Jimenez teach or suggest each limitation of claim 10, that a person of ordinary skill in the art would have had a reason to combine the teachings of Louvel, Thomas, and Jimenez, and that a person of ordinary skill in the art would have had a reasonable expectation of success in combining the teachings of Louvel, Thomas, and Jimenez.

#### *A. Level of Ordinary Skill*

Petitioners contend that a “person of ordinary skill in the art . . . would have at least a Bachelor of Science degree in Aerospace engineering, or a comparable degree, in combination with at least two years of practical experience in the field.” Pet. 14 (citing 1st Chowdhary Decl. ¶ 51). Patent

Owner states that it “generally agrees with Petitioners that a person of ordinary skill . . . would possess a Bachelor’s of Science degree in aeronautical or electrical engineering with at least two years of practical experience in the design and development of remote control aircraft.” PO Resp. 13 (citing Pet. 14; 2d Condon Decl. ¶ 13).

We adopt the parties’ agreed to level of ordinary skill and find that one of ordinary skill in the art “would have at least a Bachelor of Science degree in Aerospace engineering, or a comparable degree, in combination with at least two years of practical experience in the field” (Pet. 14). We note that any differences in the parties’ asserted level of ordinary skill would not impact our analysis.

*B. Louvel (Ex. 1004)*

Louvel “relates to a light aircraft, like a flying saucer, remotely controlled and remotely powered.” Ex. 1004 ¶ 1. Figures 1 and 2 of Louvel are reproduced below.

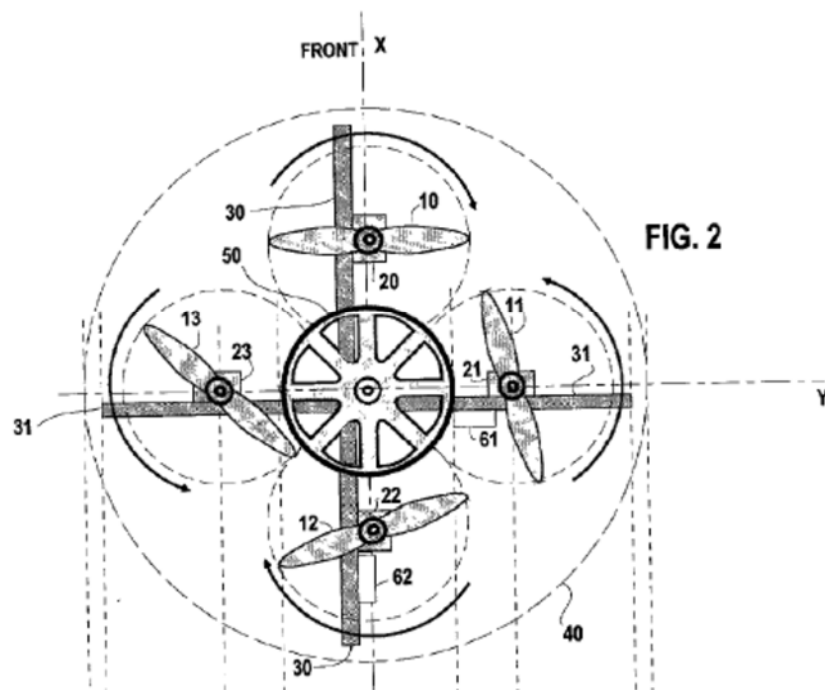
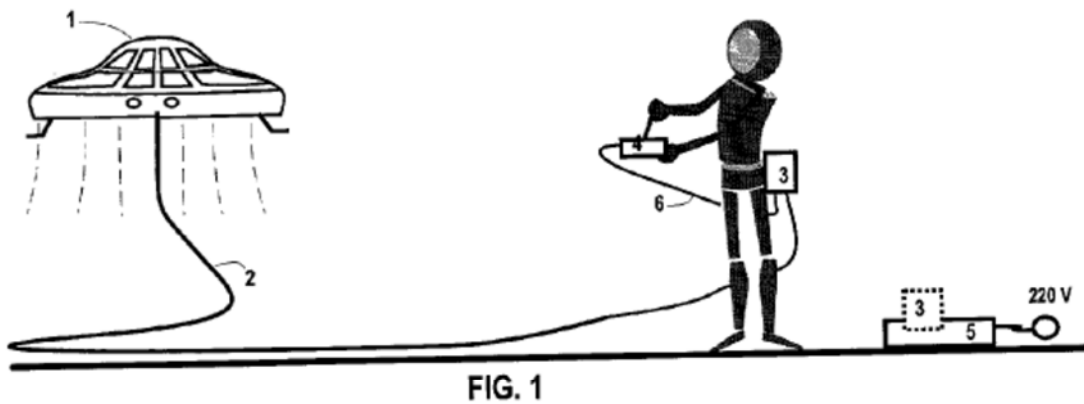


Figure 1 shows the invention of Louvel, including the exterior of aircraft 1; and Figure 2 shows a top view of an interior of aircraft 1. Ex. 1004 ¶¶ 12, 13. Aircraft 1 “has a general shape looking like a flying saucer.” *Id.* ¶ 25. Aircraft 1 has four propellers 10, 11, 12, 13 with vertical axis to provide lift thrust, and each propeller 10–13 is driven independently by electric motor 20, 21, 22, 23. *Id.* ¶¶ 29, 30. Aircraft 1 is “fitted with three attitude sensors whose purpose is to provide information for the closed

loop control,” and the sensors include roll tilt angle sensor 61, pitch tilt angle sensor 62, and yaw sensor 63. *Id.* ¶¶ 42–44, 46.

Aircraft 1 is linked to control unit 3, which is also linked to handling unit 4. *Id.* ¶¶ 25, 26. Control unit 3 includes a rechargeable battery 80 that supplies enough current to the electric motors of aircraft 1 for several minutes. *Id.* ¶ 60.

Figure 5 of Louvel is reproduced below.

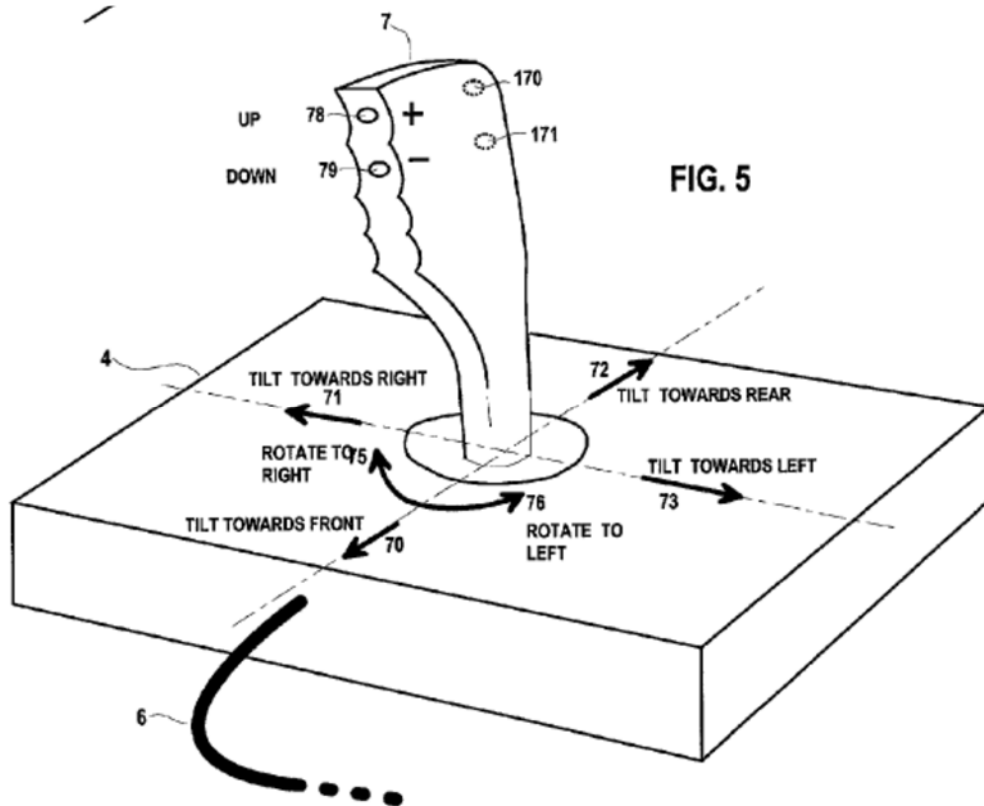


Figure 5 shows handling unit 4. *Id.* ¶¶ 16, 50. Handling unit 4 includes handle 7 and is linked to the control unit. *Id.* ¶ 49. Pushing handle 7 towards direction 70, 72, 71, or 73 causes aircraft 1 to tilt towards the front side, the rear side, the right side, or the left side, respectively, and turning handle 7 in direction 75 or 76 causes aircraft 1 to rotate towards the right or left. *Id.* ¶¶ 51–53.

When there is no action on handle 7, a closed control loop uses data from sensors 60–63 “to converge towards the horizontal normal attitude of the aircraft and to cancel the yaw movement.” *Id.* ¶ 91. When there is action on handle 7, a “microcontroller corrects the present required values driven in each electric current to generate an imbalance in the direction required by the handle position,” and the imbalance is limited in order “to limit the displacement speed of the aircraft” and “to allow a quick stabilization as soon as the action on the handle stops.” *Id.* ¶ 93. For example, if sensor 62 indicates that aircraft 1 is tilting towards the rear, then speed of propeller 12 is increased, speed of propeller 10 is decreased, and speeds of propellers 11, 13 are unchanged. *Id.* ¶ 98.

*C. Thomas (Ex. 1006)*

Thomas relates to a “hand-held control device detecting multiple degrees of freedom of movement.” Ex. 1006, 1:7–9. According to Thomas, “[i]n the past joysticks of various kinds have been used” that “comprise a lever with a handle at one” and the “other end of the lever is attached to . . . potentiometers” so that “[m]ovement of the handle . . . generates electrical signals which stimulate an electrical object.” *Id.* at 1:11–17. Thomas utilizes “accelerometers of various kinds in small packages some of which incorporate electronic signal processing” in a “hand-held joystick able to detect at least six degrees of freedom of movement.” *Id.* at 1:26–31. Figure 1 of Thomas is reproduced below.

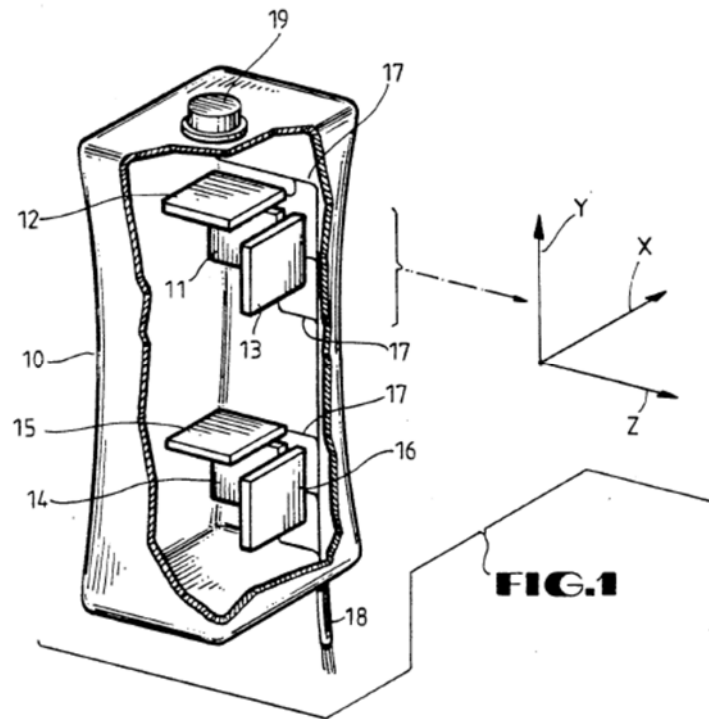


Figure 1 illustrates a “partly broken away” view of a “hand-held joystick using six accelerometers.” Ex. 1006 at 1:59–61. Hand-held enclosure 10 is “not mounted to swivel about some fixed anchor point” and “is held by the user as a pistol-grip type of hand-held device, free from any mechanical connection to a supporting structure.” *Id.* at 2:15–19. It supports two sets of three mutually-perpendicular accelerometers 11, 12, 13, 14, 15, 16. *Id.* at 2:12–14. The geometric configuration of the accelerometers uniquely identifies any combination of translations or linear motions along X, Y, and Z axes and rotations about X, Y, and Z axes. *Id.* at 2:60–3:3.

For example, if housing 10 is moved linearly along the X axis, accelerometers 11, 14 “produce equal signals of the same sign, and all the other accelerometers produce no signal.” *Id.* at 3:3–6. Linear motion along the Y axis causes accelerometers 12, 15 to generate signals, and linear motion along the Z axis causes accelerometers 13, 16 to generate signals.

*Id.* at 3:6–10. The signals from accelerometers 11–16 are sent to conditioning circuitry 26 via cable 18. *Id.* at 2:24–29, 3:43–50.

“Alternatively, the cable 18 may be omitted altogether and a wireless RF transmitter may be employed, transmitting the signals generated by the accelerometers 11–16 to a receiver in the computer 28.” *Id.* at 3:62–65. The hand-held joystick can replace “the joystick, pedals, throttle assembly, trim controls and other input devices on an aircraft such as a helicopter” or “may be used to control robots.” *Id.* at 4:9–13, 26–27.

*D. Jimenez (Ex. 1007)*

Jimenez relates to a “radio controlled toy blimp.” Ex. 1007 ¶ 2. “The blimp includes conventional radio frequency remote control means known to the art for controlling vertical and horizontal flight patterns.” *Id.* ¶ 14.

Figure 3 of Jimenez is reproduced below.

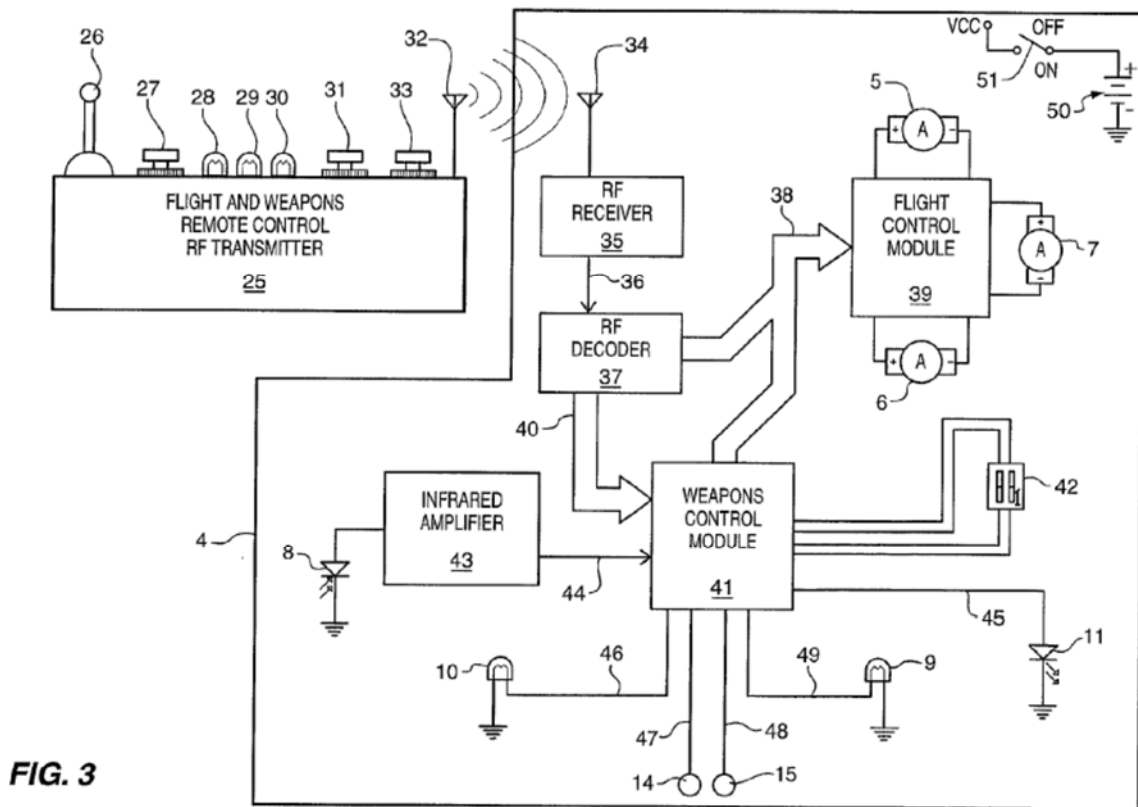


Figure 3 is an electrical block diagram of printed circuit board 4. *Id.* ¶ 25. A gondola is attached to an underside of the blimp, and the gondola includes printed wired circuit board 4. *Id.* ¶¶ 14, 23, 24, 31. It shows “remote control RF transmitter 25 which the pilot employs to transmit flight . . . commands to blimp 1.” *Id.* “The pilot uses joy stick 26 to change the direction and/or elevation of the blimp 1” and “remote control RF transmitter 25 . . . is used . . . to transmit flight . . . commands to the blimp 1.” *Id.* ¶ 35. “The flight . . . commands are transmitted from antenna 32 to antenna 34” and “transformed into a series of binary ones and zeros by RF Receiver 35 and supplied via wire 36 to RF decoder 37 where they are assembled into distinctive binary codes representing flight . . . commands.” *Id.*

*E. Claim 10*

Petitioners contend that the “limitations of claim 10 are expressly disclosed by the prior art for the same reasons discussed above in connection with claim 1.” Pet. 44; *see also id.* at 13–14 (assigning labels to limitations of claim 10).

1. *“A method for operating a radio controlled (RC) homeostatic flying hovercraft having at least four battery powered generally downwardly directed thrusters”*

Petitioners persuade us that Louvel teaches a “method for operating a radio controlled (RC) homeostatic flying hovercraft having at least four battery powered generally downwardly directed thrusters” (Ex. 1001, 16:35–37). Pet. 13 (labeling this portion of claim 10 as “10a”), 33 (citing Ex. 1004 Abstract, ¶¶ 1, 29, 30, 38 for “[l]imitation 1a”), 44 (correlating arguments for “1a” with “10a”). In particular, we find that Louvel teaches a “light aircraft, . . . remotely controlled, propelled by electrical motors” (Ex. 1004

Abstract), “a light aircraft, like a flying saucer, remotely controlled” (*id.* ¶ 1), “a method for the fli[g]ht closed loop control” (*id.* at Abstract), “the aircraft include[ing] four propellers” (*id.* ¶ 29, Figs. 2, 3), “each propeller [] driven independently by an electric motor” (*id.* ¶ 30), and “air flow go[ing] through the aircraft” (*id.* ¶ 38, Figs. 1 (showing air flowing downwardly from aircraft 1), 11, 12). *See also* Ex. 1035, 28:24–25 (Patent Owner’s declarant stating “a hovercraft . . . generates lift using thrusters, downward-facing thrusters”); 153:8–22 (stating “[Louvel] generally describes a . . . type of hovercraft). Thus, we determine that Louvel teaches a method for operating a flying hovercraft having at least four generally downwardly directed thrusters, as required by claim 10. Ex. 1001, 16:35–37.

The “radio controlled” and “homeostatic” recitations are addressed below. As for “battery powered . . . thrusters,” Petitioners cite Louvel for teaching “electric rechargeable battery (80) which allows to supply enough current to the five electric motors of the aircraft.” Pet. 37 (citing Ex. 1004 ¶ 60); *see also* Ex. 1004 ¶ 35 (stating that a “gyroscopic rotor is driven by a fifth electric motor (51)”). The record, thus, provides an adequate factual basis that Louvel teaches battery powered thrusters, as required by claim 10. Ex. 1004 ¶ 60.

2. *“using an RC controller separate and remote from said flying hovercraft”*

Petitioners also persuade us that Louvel teaches “using an RC controller separate and remote from said flying hovercraft” (Ex. 1001, 16:37–39). Pet. 13 (labeling this portion of claim 10 as “10b”), 38–39 (citing Ex. 1004 ¶¶ 25, 26, 49, 51–53, Figs. 1, 5 for “[l]imitation 1f”), 44 (correlating arguments for “1f” with “10b”). We find that Louvel teaches a

“handling unit (4) . . . handled by the user and [] linked to the control unit (3)” (Ex. 1004 ¶ 26, Figs. 1, 5), that “tilting of the aircraft towards the [front, rear, right, or left sides] is achieved by pushing [or pulling] the handle towards [that] direction” (*id.* ¶¶ 51, 52, Fig. 5), and that rotation of the aircraft is achieved by turning the handle in the desired direction (*id.* ¶¶ 52, 53, Fig. 5). *See also id.* at Abstract (stating that the “purpose of the invention is a light aircraft . . . remotely controlled), ¶ 49 (stating that the “handling unit includes a handle”). Thus, we determine that Louvel teaches using a controller separate and remote from a flying hovercraft, as required by claim 10. Ex. 1001, 16:37–39. The radio controlled requirement is discussed below.

3. *“providing as part of said RC controller a handheld structure housing a sensor system” and “using said sensor system in said RC control to sense at least a two dimensional, two-axis sensed orientation of said handheld structure in response to a user remote from said flying structure selectively orienting said handheld structure”*

Petitioners additionally persuade us that Louvel and Thomas teach “providing as part of said RC controller a handheld structure housing a sensor system” and “using said sensor system in said RC control to sense at least a two dimensional, two-axis sensed orientation of said handheld structure in response to a user remote from said flying structure selectively orienting said handheld structure” (Ex. 1001, 16:40–46). Pet. 13 (labeling these portions of claim 10 as “10c”), 40–41 (citing Ex. 1006, Abstract, 1:7–9, 1:29–31, 1:43–45, 2:11–23, 3:3–14, 3:62–65, 4:9–13 for limitation 1g), 44 (correlating arguments for “1g” and “10c”). As discussed above, we find that Louvel teaches handling unit 4 that is remote from Louvel’s aircraft and

causes the aircraft to tilt or rotate. Ex. 1004 Abstract, ¶¶ 26, 51–53, Figs. 1, 5.

We also find that Thomas teaches a “hand-held control device detecting multiple degrees of freedom of movement” (Ex. 1006, 1:7–9), a “hand-held joystick able to detect at least six degrees of freedom of movement” (*id.* at 1:29–31), a “free-standing hand-held enclosure 10” (*id.* at 2:12), “enclosure 10 rigidly support[ing] two sets of three mutually-perpendicular accelerometers” (*id.* at 2:12–14), “[e]ach one of these accelerometers 11–16 [] responsive to acceleration along a single axis” (*id.* at 2:19–20), and each accelerometer “generat[ing] an electrical signal indicating linear acceleration . . . along this particular single axis” (*id.* at 2:21–23). *See also* PO Resp. 16 (stating that Thomas discloses a “hand-held controller with accelerometer sensors used to detect the ‘motion’ of the controller” and “using the accelerometer sensors to detect the motion of the hand-held enclosure (10)”; Ex. 1035, 135:5–15 (Patent Owner’s declarant answering “I would imagine that it was known” in response to “a two-axis accelerometer could be used to sense the orientation of an object, that was known way before the ’239 and ’532 patents, correct?”), 159:3–4 (Patent Owner’s declarant stating “it’s fair to describe [Thomas] as a handheld controller”). The record, thus, supports Petitioners’ position that Thomas teaches providing as part of a controller a handheld structure housing a sensor system and using that sensor system in the controller to sense at least a two dimensional, two-axis sensed orientation of the handheld structure, as required by claim 10.

We further find that Thomas teaches that, if a user moves housing 10 linearly along the x, y, or z axis, two of accelerometers 11–16 produce a

signal and that if it is rotated, pairs of accelerometers generate signals. See Ex. 1006, 2:60–62 (“With this geometric configuration any combination of translations and rotations is uniquely identified.”), 3:3–6 (“If the housing 10 is moved linearly in the X direction by the user, then the accelerometers 11 and 14 produce equal signals of the same sign, and all the other accelerometers produce no signal.”), 3:10–14 (“Rotation about one of the axes . . . causes the pairs of accelerometers to generate unequal signals, and depending upon the center of rotation, the signals may be of opposite sign.”); Ex. 1035, 149:3–6 (Patent Owner’s declarant stating an “instantaneous position of a rotating object is its orientation”), 149:11–14 (Patent Owner’s declarant, in response to “would you agree with me, then, that on at least some level, movement and orientation are related concepts,” answering “[t]hey are derivatives of each other”), 160:7–11 (Patent Owner’s declarant agreeing that Thomas can sense any combination of translations and rotations), 161:13–17 (Patent Owner’s declarant agreeing that Thomas generates signals while moving); 2d Condon Decl. ¶ 29 (“*Thomas* utilizes centrifugal forces to measure rotational velocity, measured in radians per second or degrees per second, as the motion input of the hand-held control device”). The record, thus, supports Petitioners’ position that Thomas teaches using a sensor system in a controller to sense at least a two dimensional, two-axis sensed orientation of the handheld structure “in response to a user remote from said flying structure selectively orienting said handheld structure,” as required by claim 10.

We agree with Petitioners that the “remote controller in Louvel is not ‘radio controlled (RC).’” Pet. 40. However, we find that Thomas teaches that a “wireless RF transmitter may be employed, transmitting the signals

generated by the accelerometers 11–16 to a receiver in the computer 28.” Ex. 1006, 3:63–65; *see also* Ex. 1035, 162:15–17 (Patent Owner’s declarant agreeing that the controller in Thomas can use a wireless transmitter). The record, therefore, provides a factual basis for finding Thomas teaches a RC controller, as required by claim 10. Ex. 1006, 3:63–65. Moreover, in connection with the limitation “communicating a desired orientation by radio frequency (RF) communication . . .” discussed in more detail below, Petitioners assert that Jimenez teaches an RF transmitter and RF receiver in an application involving a remote controlled blimp. Pet. 35–36, 42–43 (citing Ex. 1007 ¶¶ 24, 25, 31, 35, Fig. 3).

Petitioners assert, and we agree, that Louvel and Thomas are combinable because each is from the same field of endeavor and directed to control of a remote device with a handheld controller and an aerial device. Pet. 41 (citing 1st Chowdhary Decl. ¶¶ 117, 119, 120; Ex. 1004 Abstract, ¶ 1; Ex. 1006, 1:7–9, 4:11–14). We credit Prof. Chowdhary’s testimony that Louvel and Thomas are in the “same narrow field of endeavor: control of a remote device with a handheld controller.” 1st Chowdhary Decl. ¶ 117 (citing Ex. 1004 ¶ 1; Ex. 1006, 1:7–9); *see also* PO Resp. 26 (stating the “field of the present invention is admittedly the field of remote control aircraft”); Ex. 1035, 160:7–11 (Patent Owner’s declarant agreeing that Thomas can sense any combination of translations and rotations), 161:13–17 (Patent Owner’s declarant agreeing that Thomas generates signals while moving); 2d Condon Decl. ¶ 29 (“*Thomas* teaches that the signal to the device under control is responsive to the **motion** of the hand-held control device.”). Moreover, Thomas indicates that it takes advantage of “miniature accelerometers in a hand-held joystick” as an alternative to “past joysticks of

various kinds” that “generally comprise a lever with a handle at one end” with its other end “attached to linkages, potentiometers, tensiometers or accelerometers.” Ex. 1006, 1:11–14, 1:29–30, 4:16–18, 4:25–26.

Petitioners further assert that a person of ordinary skill in the art also would have had reason to modify Louvel to include the wireless controller of Thomas. Pet. 41 (citing 1st Chowdhary Decl. ¶¶ 117, 119, 120; Ex. 1004 Abstract, ¶ 1; Ex. 1006 at 4:11–14). Petitioners argue that a person of ordinary skill in the art would have been motivated to “modify Louvel to allow for controlling the aircraft based on the ‘sensed orientation’ of the remote controller, as taught by Thomas” because Louvel teaches sending multi-dimensional orientation information to a flying structure and Thomas allows “specify[ing] such information in a different manner – based on the joystick’s orientation in the user’s hand, rather than a handle.” *Id.* at 41–42 (citing 1st Chowdhary Decl. ¶ 119; Ex. 1004 ¶¶ 50–53, Fig. 5B; Ex. 1006 at 2:11–23). Petitioners assert that “[a]s a matter of common sense,” a person of ordinary skill “would have employed the user-friendly input system disclosed in Thomas . . . in place of the generic handle-based controller disclosed in Louvel” and the proposed combination “would have been a routine design choice.” *Id.* at 42 (citing 1st Chowdhary Decl. ¶ 120). Petitioners also assert that Thomas improves on joysticks like the one of Louvel and there are no unexpected results from its proposed combination because the Louvel controller is used to control an aircraft in the same manner described in Thomas. *Id.* (citing 1st Chowdhary Decl. ¶ 120; Ex. 1004 ¶ 7; Ex. 1006 at 1:11–13).

Record evidence supports Petitioners’ position that modifying Louvel to include the hand-held enclosure of Thomas would have been routine

design choice, that Thomas improves on joysticks like the one of Louvel, and that there are no unexpected results from its proposed combination. Pet. 42. Thomas states that “[i]n the past joysticks of various kinds have been used” that “comprise a lever with a handle at one” and the “other end of the lever is attached to . . . potentiometers” so that “[m]ovement of the handle . . . generates electrical signals which stimulate an electrical object.” Ex. 1006, 1:11–17. Unlike the “past joysticks of various kinds,” Thomas utilizes “accelerometers of various kinds in small packages some of which incorporate electronic signal processing” in a “hand-held joystick able to detect at least six degrees of freedom of movement.” *Id.* at 1:26–31. Thomas also states “[i]n another application the hand-held joystick may be used in place of a . . . joystick” and the “hand-held joystick may be used to control robots.” *Id.* at 4:16–18, 4:25–26.

Similar to the “past joysticks” comprising “potentiometers” described by Thomas, “movements of the handle inside the handling unit” of Louvel “make the analog voltage change according to the handle position.” Ex. 1004 ¶ 82, Fig. 8. Therefore, Thomas itself indicates that its joystick is an alternative to the handling unit of Louvel and that Thomas improves on joysticks like the one of Louvel. See Ex. 1006, 1:11–17, 1:26–31, 4:16–18, 4:25–26. Thomas and Louvel, thus, support Petitioners’ rationales of routine design choice and that Thomas improves on joysticks like Louvel.

We also credit Prof. Chowdhary’s testimony that “[i]mplementing the features of . . . Thomas in the flying saucer described by Louvel would have been within the skillset of a person of ordinary skill in the art.” 1st Chowdhary Decl. ¶ 117 (citing Ex. 1004 ¶ 1; Ex. 1006, 1:7–9). We agree with Petitioners that there would be no unexpected results from combining

Louvel and Thomas because the Louvel controller is used to control an aircraft in a same manner described in Thomas. Pet. 42 (citing Chowdhary Decl. ¶ 120; Ex. 1004 ¶ 7; Ex. 1006, 1:11–13); *see also* Ex. 1006, 4:16–18 (stating “[i]n another application the hand-held joystick may be used in place of a . . . joystick”). Thus, we determine that one of ordinary skill in the art would have had reason to combine Louvel and Thomas to “provid[e] as part of said RC controller a handheld structure housing a sensor system” and to “us[e] said sensor system in said RC control to sense at least a two dimensional, two-axis sensed orientation of said handheld structure in response to a user remote from said flying structure selectively orienting said handheld structure,” as required by claim 10. Ex. 1001, 16:40–46.

4. *“communicating a desired orientation by radio frequency (RF) communication information to said flying hovercraft, said desired orientation including information based on said sensed orientation of said handheld structure”*

For “communicating a desired orientation by radio frequency (RF) communication information to said flying hovercraft, said desired orientation including information based on said sensed orientation of said handheld structure” (Ex. 1001, 16:47–51), Petitioners persuade us that Louvel and Jimenez teach these limitations of claim 10. Pet. 13 (labeling this portion of claim 10 as “10d”), 35–36 (citing Ex. 1007 ¶¶ 24, 25, 31, 35, Fig. 3 for “[l]imitation 1d”), 42–43 (citing Ex. 1007 ¶¶ 24, 25, 31, 35, Fig. 3 for “[l]imitation 1h”), 44 (correlating arguments for “1d and 1h” with “10d”). As discussed above, we find that Louvel teaches handling unit 4 for communicating a desired tilting or rotation of its aircraft that includes information based on its handle position.

Also, as discussed above, we find that Thomas teaches communicating desired orientation based on the sensed orientation of its hand-held enclosure 10 and a wireless RF transmitter that transmits signals generated by accelerometers 11–16 in hand-held enclosure 10. Ex. 1006, 2:60–62, 3:3–6, 3:10–14, 3:63–65. We further find that Jimenez teaches an RF transmitter (Ex. 1007 ¶¶ 24, 25, 31, 35, Figs. 2A, 2B, 3) that “is used by the pilot to transmit flight . . . commands to the blimp 1” by “us[ing] joy stick 26 to change the direction and/or elevation of the blimp 1” (*id.* ¶ 35) and a RF receiver (*id.* ¶ 35, Fig. 3). Jimenez also states that its “blimp includes conventional radio frequency remote control means known to the art for controlling vertical and horizontal flight patterns.” *Id.* ¶ 14.

Petitioners contend, and we agree, that Louvel and Jimenez are combinable because each is from the same field of endeavor and directed to control of a remote device with a handheld controller and an aerial device. Pet. 36 (citing 1st Chowdhary Decl. ¶¶ 103, 117, 118; Ex. 1004, Abstract, ¶ 1; Ex. 1007, Abstract, ¶ 2). We credit Prof. Chowdhary’s testimony that Louvel and Jimenez are in the “same narrow field of endeavor: control of a remote device with a handheld controller” and that “[i]mplementing the features of Jimenez . . . in the flying saucer described by Louvel would have been within the skillset of a person of ordinary skill in the art.” 1st Chowdhary Decl. ¶ 117 (citing Ex. 1004 ¶ 1; Ex. 1006, 1:7–9); *see also* PO Resp. 26 (stating the “field of the present invention is admittedly the field of remote control aircraft”). Furthermore, based on our findings above, Jimenez itself evidences that it was within ordinary skill to implement RF communication in a remotely controlled device. Ex. 1007 ¶ 14 (“For illustration purposes only, a . . . toy blimp is used as an example to describe

the teachings of this invention.”), ¶ 42 (“It is understood that the same principles explained here can be applied to other types of remotely controlled toys, including model airplanes.”).

Petitioners assert that a person of ordinary skill in the art would have had reason to incorporate Jimenez’s RF communication feature into Louvel’s system. Pet. 36 (citing 1st Chowdhary Decl. ¶¶ 103, 117, 118; Ex. 1004 Abstract, ¶ 1; Ex. 1007 Abstract, ¶ 2). Petitioners contend that, because Louvel teaches an RC controller that is connected to the aircraft by flexible cable and Jimenez teaches “an alternative design choice that does not require a physical connection – radio transmission,” the wireless configuration of Jimenez would alleviate Louvel’s increasing cable weight as its aircraft lifts. *Id.* at 37 (citing Ex. 1004 ¶¶ 25, 92; Ex. 1007 ¶ 35). Petitioners also argue that “remote control model aircraft were already popular in the 1990s even before Jimenez.” *Id.* (citing 1st Chowdhary Decl. ¶ 118); *see also* Ex. 1035, 151: 20–23 (Patent Owner’s declarant agreeing that “remote controlled hovercraft were known way before ’239 and ’532 patents”). Petitioners, thus, assert that it would have been obvious to “modify Louvel to use RF communication because doing so would be using a known technique to a known device ready for improvement to yield predictable results” and that the “interchangeability of wired and wireless communications was well known.” Pet. 37 (citing 1st Chowdhary Decl. ¶ 118); *see also id.* at 43 (arguing similarly for the claimed RF transmitter); Ex. 1007 ¶ 14 (“For illustration purposes only, a . . . toy blimp is used as an example to describe the teachings of this invention.”), ¶ 42 (“It is understood that the same principles explained here can be applied to other types of remotely controlled toys, including model airplanes.”). Based on our

findings above regarding Louvel and Jimenez, we determine that Petitioners provide articulated reasoning (Pet. 36–37) having a rational underpinning (Ex. 1004 ¶¶ 25, 92; Ex. 1007 ¶ 35; 1st Chowdhary Decl. ¶ 118) for further modifying the combination of Louvel and Thomas with the teachings of Jimenez.

We, therefore, determine that the combination of Louvel, Thomas, and Jimenez teaches or suggests the recitations of “a radio controlled (RC) . . . flying hovercraft,” “RC controller,” and “communicating a desired orientation by radio frequency (RF) communication information to said flying hovercraft, said desired orientation including information based on said sensed orientation of said handheld structure.” Ex. 1001, 16:47–51.

5. *“using a sensor system in said flying hovercraft to dynamically determine an actual orientation of said flying hovercraft, said sensor system including at least a three-dimensional, three-axis sensor”*

We are persuaded that Louvel teaches “using a sensor system in said flying hovercraft to dynamically determine an actual orientation of said flying hovercraft, said sensor system including at least a three-dimensional, three-axis sensor” (Ex. 1001, 16:52–55). Pet. 13 (labeling this portion of claim 10 as “10e”), 34–35 (citing Ex. 1004 ¶¶ 42–44, 91 for “[I]mitation 1c”), 44 (correlating arguments for “1c” with “10e”). We find that Louvel teaches its “aircraft is fitted with three attitude sensors whose purpose is to provide information for the closed loop control” (Ex. 1004 ¶ 42), the aircraft also has “two tilt sensors” (*id.* ¶ 43), and it further includes “sensor (61)” that “measures the roll tilt angle” and “sensor (62)” that “measures the pitch tilt angle” (*id.* ¶ 44). *See also id.* ¶ 91 (teaching “[w]hen there is no action on the handle, the control loop uses the data coming from the various

sensors (61), (62) and (63) to converge towards the horizontal normal attitude of the aircraft and to cancel the yaw movement.”); *see also* 2d Condon Decl. ¶ 14 (stating “[o]ne skilled in the art would understand the term *orientation* to mean ‘the angular displacement of a body with respect to an inertial gravitational frame of reference’”). We, therefore, determine that Louvel teaches using a sensor system in a flying hovercraft to dynamically determine an actual orientation of the flying hovercraft and the sensor system includes at least a three-dimensional, three-axis sensor, as required by claim 10. Ex. 1001, 16:52–55.

6. *“using control circuitry in said flying hovercraft to automatically and dynamically control a thrust produced by each of said thrusters to achieve and homeostatically maintain said actual orientation of said flying hovercraft in response to said desired orientation communicated to said flying hovercraft and said actual orientation determined by said sensor system in said flying hovercraft without additional control information communicated to said flying hovercraft”*

Petitioners persuade us that Louvel teaches the final recitation of claim 10 (Ex. 1001, 16:56–64). Pet. 13–14 (labeling this portion of claim 10 as “10f”), 34 (citing Ex. 1004 ¶¶ 90, 98 for “[l]imitation 1b”), 44 (correlating arguments for “1b” with “10f”). We find that Louvel teaches performing a calculation to determine the “values of current to be driven through each electric motor” and the “calculation is intended to perform the flight control on a stable attitude for the aircraft.” Ex. 10047 ¶ 90. Thus, Louvel teaches using control circuitry to automatically and dynamically control a thrust produced by each of its thrusters, as required by claim 10. *See also* Ex. 1007 ¶ 31 (stating “gondola 3 accommodates the printed wired circuit board/chassis 4 which integrates all the circuitry required to decode

and execute the flight . . . commands (transmitted by RF transmitter 25)");  
1st Chowdhary Decl. ¶ 118.

We also find that Louvel teaches that “if the information supplied by the sensor (62) indicates that the aircraft is tilting towards the rear, then the correction consists in increasing the speed of the propeller 12, decreasing the speed of the propeller 10” while “speeds of the propellers 11 and 13 remain unchanged.” Ex. 1004 ¶ 98; *see also id.* ¶¶ 97, 101, 104, 105 (describing similar changes for tilts in other directions and rotations). Louvel further teaches that “[w]hen there is no action on the handle, the control loop uses the data coming from the various sensors (61), (62) and (63) to converge towards the horizontal normal attitude of the aircraft and to cancel the yaw movement.” *Id.* ¶ 91; *see also id.* ¶ 118 (stating that “[t]hese calculations, intended to correct the required values, according to the handle position, are performed simultaneously altogether and the calculation limits the unbalance introduced by the information coming from the handle position sensors”). By calculating currents for stable attitude and converging towards a horizontal attitude with no yaw movement when there is no action on the handle, Louvel teaches achieving and homeostatically maintaining the actual orientation of a flying hovercraft without additional control information communicated to the hovercraft. *Id.* ¶¶ 91, 98, 118; *see also* Ex. 1035, 154:15–22 (Patent Owner’s declarant stating that Louvel discloses a “specific instance of a homeostatic point”); 2d Condon Decl. ¶ 18 (stating that the “term *homeostatic* is used . . . consistently referring to how the control system is controlling the craft/hovercraft [to] be stable and stay in a desired orientation”). Therefore, we find that Louvel teaches the final recitation of claim 10. Ex. 1001, 16:56–64.

*F. Patent Owner's Response*

*1. Petitioners' Asserted Rationales*

Patent Owner responds that Petitioners' combination of Louvel, Thomas, and Jimenez would not have been common sense, routine design choice, or result in the joystick of Thomas performing the same function as Louvel. PO Resp. 21 (citing Pet. 42; Dec. on Inst. 27; 1st Chowdhary Decl. ¶ 120). Patent Owner contends that separating acceleration due to gravity from acceleration due to motion precludes a simple substitution. PO Resp. 22 (citing Ex. 2017 ¶ 47). Patent Owner also argues that “the proposed combination of *Thomas* with *Louvel* should use the control scheme of Fig. 3, not Fig. 1” and that the embodiment shown in Figure 3 of Thomas confirms that more than common sense is required because the embodiment of Figure 3 of Thomas is for controlling an aircraft. PO Resp. 22. Patent Owner asserts that “[t]here is no evidence or argument in the Petition supporting why the proposed combination of the embodiment of Fig. 1 of *Thomas* would be the design choice.” *Id.* at 22–23.

As discussed above, Thomas indicates that its joystick is an alternative to the handling unit of Louvel and that Thomas improves on joysticks like the one of Louvel. Ex. 1006, 1:11–17, 1:26–31, 4:16–18, 4:25–26; see also Pet. Reply 8 (stating Petitioners “never argued that the claims are obvious based on a ‘simple substitution’”), 10 (stating that “Petitioners **do not rely** on the embodiment described by Figure 3 in any way”); 2d Chowdhary Decl. ¶ 36 (stating “Figure 3 . . . has not been relied on by [Petitioners] or me”).

We find that Thomas teaches either of its embodiments shown in Figure 1 (asserted by Petitioners) or Figure 3 (asserted by Patent Owner as

the one that should be combined with Louvel) would be an alternative to Louvel's handling unit. Pet. 42; PO Resp. 22. In view of the complete record, Petitioners persuade us that one of ordinary skill would have picked the embodiment shown in Figure 1 for the reasons given above in Section III.E.3.

Patent Owner also responds that Thomas has not been cited in the field of remote control aircraft but has been cited in the field of computer control and video gaming systems. PO Resp. 26 (citing 2d Condon Decl. ¶ 48). Patent Owner, thus, argues that Thomas was not a known substitute or design choice in the field of remote control aircraft and that one of ordinary skill in the art would not have considered Thomas as a substitute or routine design choice "for addressing the complex problems of designing a remote control system for an aircraft." *Id.* at 27.

As discussed above, Thomas indicates that its joystick is an alternative to joysticks like the handling unit of Louvel and that Thomas improves on joysticks like the one of Louvel. *See* Ex. 1006, 1:11–17, 1:26–31, 4:16–18, 4:25–26; *see also* Ex. 1035, 36:16–19 (In response to "you'd agree with me, then, that the video game controllers and drone controllers are relevant to each other," Patent Owner's declarant answering "[t]hey can be in certain circumstances."). The complete record persuades us that one of ordinary skill in the art would have considered Thomas as a known design choice. *See also* Pet. Reply 8 (stating Petitioners "never argued that the claims are obvious based on a 'simple substitution'").

## *2. Figure 3 of Thomas*

Patent Owner further responds that, during prosecution of the application that issued as the '239 patent, the Examiner considered a

reference with a pilot control similar to the one shown in Figure 3 of Thomas. PO Resp. 23–24 (citing Ex. 1001, 3:37–40; Ex. 2004, 166). Patent Owner contends that both that reference and the Figure 3 embodiment of Thomas teach “Pilot Control” which “involve[s] different factors and considerations than references that teach Remote Control (*Louvel* and *Jimenez*)” because of the “addition of a human as part of an onboard control scheme” and thus, Thomas and Louvel would not be “alternative equivalent design choices or simple substitutions.” PO Resp. 25 (citing 2d Condon Decl. ¶ 48). Patent Owner also faults Petitioners for not explaining fully how the embodiment of Figure 3 of Thomas would be combined with Louvel. PO Resp. 25–26.

As discussed above in Section III.E.3, Petitioners rely on the embodiment shown in Figure 1 of Thomas. Pet. 40–41 (citing portions of Thomas related to Figure 1); *see also* PO Resp. 22–23 (arguing “[t]here is no evidence or argument in the Petition supporting why the proposed combination of the embodiment of Fig. 1 of *Thomas* would be the design choice.”); Pet. Reply 10 (stating that “Petitioners ***do not rely*** on the embodiment described by Figure 3 in any way”); 2d Chowdhary Decl. ¶ 36 (stating “Figure 3 . . . has not been relied on by [Petitioners] or me”). In view of our determination that the complete record supports Petitioners’ combination of Louvel, Thomas, and Jimenez, arguments directed to Figure 3 of Thomas do not address directly Petitioners’ combination based on Figure 1 of Thomas (*see* Pet. 41–42) and thus, fail to rebut Petitioners’ position regarding the claim at issue.

Patent Owner also argues that the “‘information’ sent on control cables from the computer to the aircraft in the aircraft controller embodiment

of *Thomas* is the set of ‘net acceleration’ signals.” PO Resp. 34 (citing 2d Condon Decl. ¶ 32). Petitioners, however, cite to the embodiment of Figure 1, not the aircraft controller embodiment. See Pet. 40–41; Pet. Reply 10 (“Petitioners ***do not rely*** on the embodiment described by Figure 3 in any way.”); 2d Chowdhary Decl. ¶ 36.

### 3. *Orientation of the RC Controller*

Patent Owner additionally responds that the combination of Louvel, Thomas, and Jimenez “would not yield a solution in which the orientation of the craft mimics the orientation of the RC controller.” PO Resp. 31. In particular, Patent Owner argues that (1) none of the references include the word “orientation” (*id.* at 31 (citing 2d Condon Decl. ¶¶ 27, 40)), (2) Petitioners do not explain how Louvel and Thomas teach the claimed “orientation” control scheme (*id.*), and (3) Louvel teaches that the “‘information’ sent on the control wires of *Louvel* from the controller to the craft is a set of proportional voltage signals that represent the ‘position’ of the pivotable handle relative its base” (*id.* at 33 (citing 2d Condon Decl. ¶ 20)).

Claim 10 does not require explicitly that the “orientation of the craft mimics the orientation of the RC controller.” Instead, claim 10 requires “communicating a desired orientation . . . including information based on said sensed orientation of said handheld structure” and “using control circuitry . . . to achieve and homeostatically maintain said actual orientation of said flying hovercraft in response to said desired orientation.” Ex. 1001, 16:47–51, 16:56–61.

Also, as discussed above, we find that Louvel teaches a “handling unit (4) . . . handled by the user and [] linked to the control unit (3)” (Ex. 1004 ¶

26, Figs. 1, 5), that “tilting of the aircraft towards the [front, rear, right, or left sides] is achieved by pushing [or pulling] the handle towards [that] direction” (*id.* ¶¶ 51, 52, Fig. 5), and that rotation of the aircraft is achieved by turning the handle in the desired direction (*id.* ¶¶ 52, 53, Fig. 5). We additionally find Thomas teaches that the translations and rotations of hand-held enclosure 10 can be identified uniquely and the resulting generated signals indicate linear movement or rotation. Ex. 1006, 2:60–62, 3:3–6, 3:10–14; Ex. 1035, 154:15–22 (Patent Owner’s declarant stating that Louvel discloses a “specific instance of a homeostatic point”), 160:7–11 (Patent Owner’s declarant agreeing that Thomas can sense any combination of translations and rotations); 2d Condon Decl. ¶ 29.

The complete record persuades us that Petitioners’ proposed combination would result in tilting or rotation of Louvel’s aircraft in response to the sensed translations and rotations of enclosure 10 of Thomas. For example, moving or rotating hand-held enclosure 10 of Thomas would generate a signal based on enclosure 10 moving or rotating to a new position and would be communicated to the aircraft of Louvel that would cause it to tilt or rotate accordingly. Ex. 1006, 2:60–62, 3:3–6, 3:10–14; Ex. 1035, 160:7–11, 161:13–17. Thus, Petitioners’ proposed combination would result in “communicating a desired orientation . . . including information based on said sensed orientation of said handheld structure . . . to achieve . . . said actual orientation of said flying hovercraft in response to said desired orientation,” as required by claim 10. Ex. 1001, 16:47–51, 16:56–61; see *also* Tr. 27:15–19 (Patent Owner’s counsel indicating that the hovercraft of Louvel is “going to move in accordance with the motion” of a handheld controller); Ex. 1035, 149:3–6 (Patent Owner’s declarant stating an

“instantaneous position of a rotating object is its orientation”), 149:11–14 (Patent Owner’s declarant, in response to “would you agree with me, then, that on at least some level, movement and orientation are related concepts,” answering “[t]hey are derivatives of each other”).

Patent Owner also responds that Louvel uses a “position” control scheme (PO Resp. 36–37), that the ’239 patent uses the orientation of its handheld RC controller (*id.* at 37–39 (citing Ex. 1001, Fig. 3; 2d Condon Decl. ¶¶ 23–24)), that Thomas uses a “motion” control scheme (*id.* at 39–41 (citing Ex. 1006, Fig. 1)), and that the combination of Louvel and Thomas does not produce the “orientation” control scheme required by claim 10 (*id.* at 42–44 (citing Ex. 1004 ¶ 91; 2d Condon Decl. ¶ 30)). *See also id.* at 15–19 (describing the control schemes of Louvel, Thomas, and Jimenez) (citing Ex. 1004, Figs. 1, 5; Ex. 1006, 4:9–26, 3:3–25, 4:34–57, Figs. 1, 3; Ex. 1007 ¶¶ 32, 35, Figs. 2, 2A; 2d Condon Decl. ¶¶ 24, 30, 31, 40).

The complete record, however, persuades us that Petitioners’ proposed combination of Louvel, Thomas, and Jimenez would have rendered obvious claim 10. Claim 10 does not require expressly an “orientation” control scheme. As discussed above, claim 10 requires “communicating a desired orientation . . . including information based on said sensed orientation of said handheld structure” and “using control circuitry . . . to achieve . . . said actual orientation of said flying hovercraft in response to said desired orientation.” Ex. 1001, 16:47–51, 16:56–61. Petitioners persuade us that their proposed combination of Louvel, Thomas, and Jimenez would have rendered obvious claim 10.

#### 4. *Gravitational Frame of Reference*

Patent Owner responds that Thomas does not determine any kind of gravitational frame of reference. PO Resp. 34–36 (citing 2d Condon Decl. ¶¶ 34–38). Claim 10, however, does not require expressly determining a gravitational frame of reference. Ex. 1035, 89:24–90:4 (Patent Owner’s declarant answering “no” to “[gravitational reference] doesn’t appear in claim 10”), 91:7–9 (Patent Owner’s declarant stating “orientation does not require a gravitational reference used generally”), 91:20–23 (Patent Owner’s declarant agreeing that “claim 10, orientation can cover a gravitational reference, but it’s not limited to a gravitational reference”). Patent Owner’s argument on this point also focuses on an embodiment in Thomas not cited by Petitioners. See PO Resp. 34–36; Pet. 40–41; Pet. Reply 10.

#### 5. *Prosecution of the Related ’580 Patent*

Patent Owner also argues that a reference cited in the prosecution of the application that issued as the related ’580 patent (U.S. Patent No. 5,453,758, iss. Sept. 26, 1995 (Ex. 2015) (“Sato”)) teaches away from using gravity as an input for a motion control scheme. PO Resp. 28 (citing Ex. 2014, 44, 86; Ex. 2015). Patent Owner argues that Sato describes a hand-held controller similar to Thomas (*id.* at 29 (citing Ex. 1006, 3:24–26, 4:50–53; Ex. 2015, 7:7–15, 7:23–33, Figs. 12(a), 12(b))) with a “floating detecting means” that indicates “gravity is something to be avoided and the tilt or angles of the controller relative to gravity are things to be ignored” (*id.* at 30 (citing Ex. 2015, 2:4–14, 7:1–15)). Patent Owner also argues that “Sato is also evidence against the unsupported allegation that substituting the motion control scheme of *Thomas* for the position control scheme would be a routine design choice.” *Id.* (citing 2d Condon Decl. ¶ 49).

As discussed above, claim 10 does not require expressly determining orientation only with respect to a gravitational reference. Also, Petitioners do not rely on the references to teach anything similar to the “floating detecting means” like Sato. See Pet. 33–43. Even assuming Sato can be said to teach away, according to Patent Owner’s arguments (PO Resp. 28–29), Sato would teach away from using a “floating detecting means,” which is not a part of Petitioners’ proposed combination (see Pet. 33–43). Further, Thomas itself indicates that it improves on joysticks like the one of Louvel. See Ex. 1006, 1:11–17, 1:26–31, 4:16–18, 4:25–26.

Patent Owner further responds that prosecution of the related ’580 patent considered Louvel, Thomas, Jimenez, and the evidence and arguments of this proceeding. PO Resp. 27 (citing Ex. 2011, 6–8). Patent Owner argues that, according to the Examiner, “further modifications to *Louvel* along the lines argued for in the proposed combination would constitute impermissible hindsight.” *Id.*; see also *id.* at 28 (quoting Ex. 2011). Patent Owner also argues that the Reasons for Allowance issued for the ’580 patent confirms that Louvel and Thomas do not yield claim 10. PO Resp. 44–45 (quoting Ex. 2011, 7–8). Patent Owner contends that, because the Examiner considered the embodiment shown in Figure 3 of Thomas, one of ordinary skill in the art also would look to that embodiment. *Id.* at 45.

The record provides insufficient support that the claims of the ’580 patent have the same scope as claim 10. Patent Owner even states that “these Reasons for Allowance were focused on the added claim limitations that are part of the Contingent Motion to Amend” (PO Resp. 44–45), thus indicating that the claims of the ’580 patent are not the same scope as claim 10. See also Pet. Reply 2 (arguing that the “Examiner explicitly premised

allowance on two claim limitations not present in claim 10” and “the alleged distinctions found by the Examiner in the ’580 patent have no relevance to the claim at issue here”); Tr. 38:5–11 (Patent Owner’s counsel indicating that the claims were different).

*G. Conclusion as to Claim 10*

For the reasons given above, we determine that Petitioners have shown by a preponderance of the evidence that claim 10 is unpatentable over Louvel, Thomas, and Jimenez.

IV. CONTINGENT MOTION TO AMEND

Patent Owner filed a Contingent Motion to Amend (Paper 31, “Mot.”). Patent Owner states that “[i]f the Board finds original claim 10 unpatentable, Patentee respectfully requests the Board to grant this Contingent Motion to Amend the ’239 patent.” Mot. 5.

Because the Federal Circuit stated in *Aqua Products*, 872 F.3d at 1327, that the “PTO may not place the burden on the patentee,” the parties requested, and we authorized, new briefing (Paper 47), and a Petitioners’ Brief in Opposition to Patent Owner’s Contingent Motion to Amend (Paper 51, “Pet. Opp.”), Patent Owner Reply to Petitioner Opposition to Contingent Motion to Amend (Paper 52, “PO Reply to Opp.”), and Petitioners’ Sur-Reply Brief in Opposition to Patent Owner’s Contingent Motion to Amend (Paper 56, “Pet. Sur-Reply”) were filed<sup>5</sup>. *See also* “Guidance on Motions to

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<sup>5</sup> Patent Owner requested authorization to file a motion to strike or expunge the Third Chowdhary Declaration (Ex. 1037), but the parties subsequently agreed to keep in the record the Second and Third Chowdhary Declarations (Exs. 1030, 1037) and Papers 42 and 51. Paper 53, 2–3. Therefore, because

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([https://www.uspto.gov/sites/default/files/documents/guidance\\_on\\_motions\\_to\\_amend\\_11\\_2017.pdf](https://www.uspto.gov/sites/default/files/documents/guidance_on_motions_to_amend_11_2017.pdf)) (“[A]ny party may request briefing changes or additional briefing,” and the “Board generally will permit supplemental briefing regarding the patentability of substitute claims proposed in a motion to amend, if requested.”) (“Guidance”).

Also, the record shows that both parties understand that the burden with respect to Patent Owner’s Contingent Motion to Amend is not on Patent Owner. Pet. Opp. 4 (quoting “the PTO may not place that burden on the patentee”); PO Reply to Opp. 4 (quoting “the PTO may not place that burden [of persuasion with respect to the patentability of amended claims] on the patentee”).

Having determined that claim 10 is unpatentable, we turn to Patent Owner’s Contingent Motion to Amend.

*A. Proposed Substitute Claim 11*

Patent Owner proposes substitute claim 11 for claim 10. Mot. 5. Proposed substitute claim 11 recites, with underlined material indicating language added to original claim 10:

Proposed Substitute Claim 11. A method for operating a radio controlled (RC) homeostatic flying hovercraft having at least four battery powered generally downwardly directed thrusters using an RC controller separate and remote from said flying hovercraft, said method comprising:

providing as part of said RC controller a handheld structure housing a sensor system;

using said sensor system in said RC controller to sense at least a two dimensional, two-axis sensed orientation of said

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the parties reached an agreement to keep the Third Chowdhary Declaration in the record, a motion to strike or expunge was not authorized.

handheld structure by dynamically sensing a gravitational reference and a relative tilt of said handheld structure with respect to said gravitational reference in response to a user remote from said flying structure selectively orienting said handheld structure;

communicating a desired orientation by radio frequency (RF) communication information to said flying hovercraft, said desired orientation including information based on said sensed orientation of said handheld structure;

using a sensor system in said flying hovercraft to dynamically determine an actual orientation of said flying hovercraft, said sensor system including at least a three-dimensional, three-axis sensor;

using control circuitry in said flying hovercraft to automatically and dynamically control a thrust produced by each of said thrusters to achieve and homeostatically maintain said actual orientation of said flying hovercraft in response to said desired orientation communicated to said flying hovercraft and said actual orientation determined by said sensor system in said flying hovercraft without additional control information communicated to said flying hovercraft,

whereby on a moment-to-moment basis said actual orientation of said flying hovercraft mimics said sensed orientation of said handheld structure of said RC controller.

Mot. 26–27 (Claims Appendix).

*B. Requirements Under 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121*

“[I]f a patent owner files a motion to amend . . . and that motion meets the requirements of 35 U.S.C. § 316(d) . . . , the Board will proceed to determine whether the substitute claims are unpatentable by a preponderance of the evidence based on the entirety of the record, including any opposition made by the petitioner.” Guidance 2. Also, “patent owner still must meet the requirements for a motion to amend under 37 C.F.R. § 42.121.” *Id.*

During an *inter partes* review, “patent owner may file 1 motion to amend the patent” and “[f]or each challenged claim, propose a reasonable

number of substitute claims.” 35 U.S.C. § 316(d)(1). Patent Owner filed only one motion to amend (Paper 31) that proposes one substitute claim for the single claim at issue. *See* Mot. 8 (“Patentee proposes only one substitute claim” and “therefore fits the ‘presumption . . . that only one substitute claim would be needed to replace each challenged claim.’”). Patent Owner, thus, meets the requirements of 35 U.S.C. § 316(d)(1).

Proposed substitute claims in an *inter partes* review “may not enlarge the scope of the claims of the patent.” 35 U.S.C. § 316(d)(3); *see* 37 C.F.R. § 42.121(a)(2)(ii). In its Contingent Motion to Amend, Patent Owner states, and we agree, that “proposed substitute independent method claim 11 retains all features of the original independent method claim 10, with no claim language deleted” and that the “only claim limitations added are clarifying limitations that, under a broadest reasonable interpretation (BRI) construction, only narrow the claim scope.” Mot. 7–8.

Pursuant to 37 C.F.R. § 42.121(b), a motion to amend in an *inter partes* review must set forth “[t]he support in the original disclosure of the patent for each claim that is added or amended” and the “[t]he support in an earlier-filed disclosure for each claim for which benefit of the filing date of the earlier filed disclosure is sought.” *See also* Guidance 2 (stating a “motion to amend must set forth written description support and support for the benefit of a filing date in relation to each substitute claim, and respond to grounds of unpatentability involved in the trial.”).

In its Motion to Amend, Patent Owner explains where written description support can be found for the subject matter of proposed substitute claim 11 in originally filed Application No. 11/838,040 (Ex. 1002, 414–473) (“the ’040 application”), which issued as the ’239 patent (Ex.

1001, (21)). Mot. 9–11 (citing Ex. 1002, 414–473). Patent Owner also sets forth support in an earlier-filed disclosure (Application No. 10/526,153) for which benefit of the filing date of the earlier disclosure is sought. Mot. 11–14 (citing Ex. 2001). *See also* Ex. 1001 (62) (indicating “Division of application No. 10/526,153”).

After reviewing Patent Owner’s arguments and the disclosures of the ’040 application that issued as the ’239 patent, we conclude that Patent Owner has made a sufficient showing that proposed substitute claim 11, as a whole, has written description support in the disclosure of the application as filed. Mot. 9–11 (citing Ex. 1002); Ex. 1002, 414–473. For example, regarding the added limitation “dynamically sensing a gravitational reference and a relative tilt of said handheld structure with respect to said gravitational reference,” we determine that adequate written support is provided by the disclosure in the ’040 application that the “homeostatic control system includes an XYZ sensor arrangement and associated control circuitry as previously described that dynamically determines an inertial gravitational reference for use in sensing the desired orientation” (Ex. 1002, 431). Also, for the added limitation “whereby on a moment-to-moment basis said actual orientation of said flying hovercraft mimics said sensed orientation of said handheld controller of said RC controller,” we determine that adequate written support is provided by the disclosure that the “one-handed bee controller also includes an XY sensor arrangement and associated control circuitry that allows the craft to mimic the position of the controller in terms of yaw, pitch, roll and lateral flight maneuvers” (*id.* at 425).

Regarding the earlier-filed disclosure, Patent Owner cites to Exhibit 2001. That exhibit, however, is the publication of, and not the originally filed disclosure of, Application No. 10/526,153. *See also* Paper 25, 4 (stating “[c]itation should be made to the original disclosure of the application, as filed”). For purposes of this Decision, we need not make a determination that proposed substitute claim 11 has support in an earlier-filed disclosure because we are satisfied that it has support in the ’040 application and therefore, can proceed to analyzing the patentability of proposed substitute claim 11 based on the entirety of the record. Also, there is no argument that the asserted references would not be prior art because of the filing date of Application No. 10/526,153.

For the foregoing reasons, we determine that Patent Owner’s Contingent Motion to Amend meets the requirements of 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121.

*C. Patentability of Proposed Substitute Claim 11*

Having determined that the Contingent Motion to Amend meets the requirements of 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121, we analyze whether proposed substitute claim 11 is unpatentable by a preponderance of the evidence based on the entirety of the record.

Petitioners argue that proposed substitute claim 11 is unpatentable over the combination of Louvel, Sato, and Jimenez or the combination of Louvel, Nagamitsu, and Jimenez. Pet. Opp. 4–24; *see also* PO Reply to Opp. 2 (stating “these references represent the closest prior art”). In support of their arguments, Petitioners cite to Louvel, Sato, Nagamitsu, Jimenez, and the Third Chowdhary Declaration (Ex. 1037). *See* Pet. Opp. 4–24; Pet. Sur-Reply 4–11. Patent Owner replies with citations to the asserted references

and the Second Condon Declaration (Ex. 2013). *See* PO Reply to Opp. 4–23.

“[I]f a patent owner files a motion to amend . . . and that motion meets the requirements of 35 U.S.C. § 316(d) . . . , the Board will proceed to determine whether the substitute claims are unpatentable by a preponderance of the evidence based on the entirety of the record, including any opposition made by the petitioner.” Guidance 2. “In light of the *Aqua Products* decision, the Board will not place the burden of persuasion on a patent owner with respect to the patentability of substitute claims presented in a motion to amend.” *Id.*

As discussed below, the parties’ disputes are related to the scope and content of the prior art, differences between proposed substitute claim 11 and the prior art, and Petitioners’ rationales for combining the asserted references. The parties do not dispute the level of ordinary skill in the art and do not direct us to any objective evidence of nonobviousness for proposed substitute claim 11.

For the reasons below, we determine that proposed substitute claim 11 is unpatentable by a preponderance of the evidence based on the entirety of the record because the asserted references teach or suggest each limitation of proposed substitute claim 11, a person of ordinary skill in the art would have had a reason to combine the teachings of the asserted references to arrive at the claimed invention, and a person of ordinary skill in the art would have had a reasonable expectation of success in combining the teachings of the asserted references.

### *1. Claim Construction*

Patent Owner states that “[f]or purposes of the proposed substitute claim 11, Patentee does not propose any further constructions of the added claim limitations.” Mot. 15. Patent Owner, however, provides its suggestions for the plain and ordinary meaning of “gravitational reference,” “relative tilt,” “moment-to-moment basis,” and “mimic.” *Id.* at 15–16 (citing 2d Condon Decl. ¶¶ 51–54). In view of the entirety of the record, we determine that express interpretations of any term is not necessary.

### *2. Level of Ordinary Skill*

Patent Owner states that it “generally agrees with Petitioners that a person of ordinary skill . . . would possess a Bachelor’s of Science degree in aeronautical or electrical engineering with at least two years of practical experience in the design and development of remote control aircraft.” Mot. 15 (citing Pet. 14; 1st Condon Decl. ¶ 13). For the same reasons given above in Section III.A, we apply the agreed to level of skill (“person of ordinary skill in the art . . . would have at least a Bachelor of Science degree in Aerospace engineering, or a comparable degree, in combination with at least two years of practical experience in the field”) and note again that any differences in the parties’ asserted level of ordinary skill would not affect our analysis.

### *3. Nagamitsu (Ex. 1028)*

Nagamitsu relates to a simulator. Ex. 1028, 1:8. Figure 4 of Nagamitsu is reproduced below.

FIG. 4

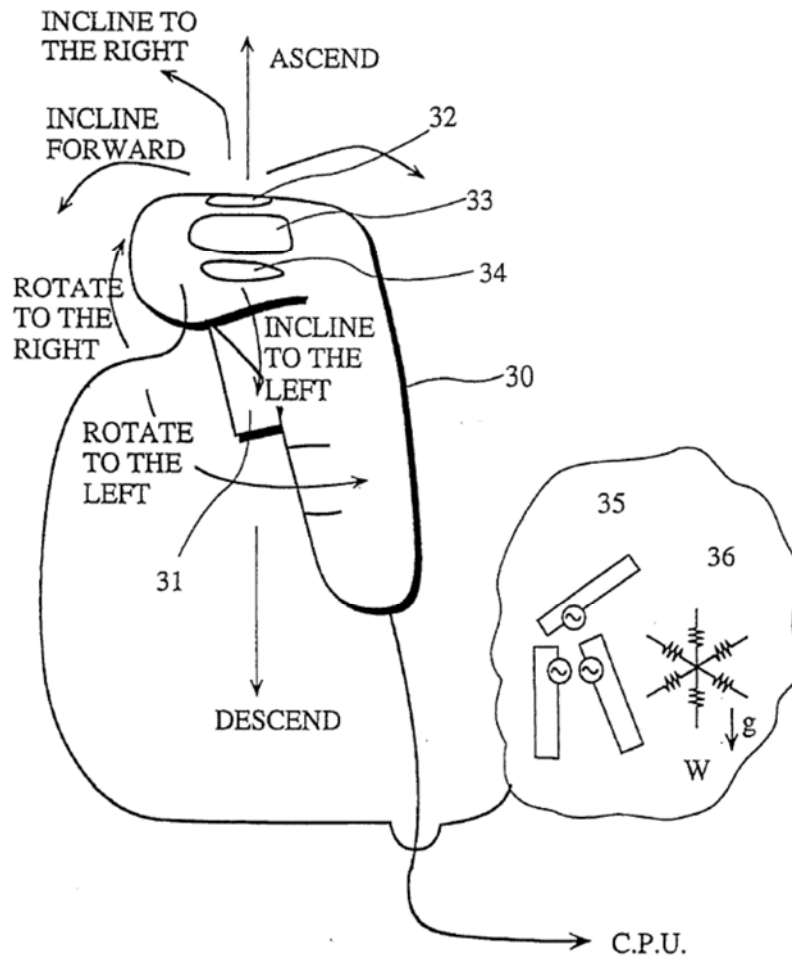


Figure 4 shows a 3-D input unit 30. *Id.* at 10:41–43, 12:10–11. Input unit 30 “is of a configuration similar to a grip of a pistol” and “a magnetism detecting pointer 35 and an accelerometer 36 are installed therein for each direction in 3-D.” *Id.* at 12:12–13, 12:18–19.

By comparing the strengths of the three directions in the magnetic field detected by the magnetism detecting pointer 35 and detecting a[] direction of the gravity and acceleration by the accelerometer 36, the changes of rotational angles, movements, or acceleration of the 3-D input device 30 with respect to the magnetic field indicated by arrows in FIG. 4 can be detected.

*Id.* at 12:20–26.

#### *4. Analysis of Proposed Substitute Claim 11*

Based on our factual findings regarding Louvel, the entirety of the record persuades us that Louvel teaches a “method for operating a . . . homeostatic flying hovercraft having at least four battery powered generally downwardly directed thrusters” for the reasons discussed above in Section III.E.1, “using an RC controller separate and remote from said flying hovercraft” for the reasons discussed above in Section III.E.2, and “using a sensor system in said flying hovercraft to dynamically determine an actual orientation of said flying hovercraft, said sensor system including at least a three-dimensional, three-axis sensor” for the reasons discussed above in Section III.E.5. *See also* Pet. Opp. 5 (citing Ex. 1004 ¶¶ 29, 30, 38), 6 (citing Ex. 1004 ¶¶ 42–44, 90, 91, 98), 21–24 (citing Ex. 1004 Abstract, ¶¶ 1, 4, 29, 30, 38, 42–46, 75–78, 90, 91, 98).

Also, based on our factual findings from Louvel and Jimenez, the entirety of the record persuades us that these references teach a “radio controlled (RC) . . . flying hovercraft” and “communicating a desired orientation by radio frequency (RF) communication information to said flying hovercraft, said desired orientation including information based on said sensed orientation of said handheld structure” for the reasons given above in Section III.E.4 and:

using control circuitry in said flying hovercraft to automatically and dynamically control a thrust produced by each of said thrusters to achieve and homeostatically maintain said actual orientation of said flying hovercraft in response to said desired orientation communicated to said flying hovercraft and said actual orientation determined by said sensor system in said flying hovercraft without additional control information communicated to said flying hovercraft

for the reasons given above in Section III.E.6. *See also* Pet. Opp. 22 (citing Ex. 1007 ¶¶ 24, 25, 31, 35). The entirety of the record also supports that one of ordinary skill in the art would have had reason to combine Louvel and Jimenez with a reasonable expectation of success in combining these references. Pet. 36–37; Ex. 1004 ¶¶ 25, 92; Ex. 1007 ¶ 35; 1st Chowdhary Decl. ¶ 118.

The entirety of the record persuades us that Petitioners’ proposed combination of Louvel, Nagamitsu, and Jimenez teaches “using an RC controller separate and remote from said flying hovercraft,” as required by proposed substitute claim 11. Mot. 26; Pet. Opp. 5 (citing Ex. 1028, 12:4–30, 15:25–46, 16:26–54, Fig. 4), 17 (citing Ex. 1028, 12:4–29, Fig. 4). As discussed above in Section III.E.3, we find that Louvel teaches handling unit 4 that is remote from Louvel’s aircraft and causes the aircraft to tilt or rotate. Ex. 1004 Abstract, ¶¶ 26, 51–53, Figs. 1, 5.

We also find that Nagamitsu teaches input unit 30 that is separate and remote from a device being controlled (Ex. 1028, 12:4–29, Fig. 4; *see also* Pet. Opp. 17 (citing Ex. 1028, 12:4–29, Fig. 4); 3d Chowdhary Decl. ¶ 22). Also, as discussed above in Section III.E.4, we find that Jimenez teaches RF communications. *See, e.g.*, Ex. 1007 ¶ 14 (“For illustration purposes only, a . . . toy blimp is used as an example to describe the teachings of this invention”), ¶ 42 (“It is understood that the same principles explained here can be applied to other types of remotely controlled toys, including model airplanes.”); *see also* Pet. Opp. 18–19 (arguing a person of ordinary skill would have modified Nagamitsu to use the RF communication technique of Jimenez) (citing 3d Chowdhary Decl. ¶¶ 26, 27).

Petitioners assert, and we agree, that Louvel, Nagamitsu, and Jimenez are combinable because each is in the same field of endeavor. Pet. Opp. 18–20 (citing Ex. 1028, Abstract, 15:25–52; 3d Chowdhary Decl. ¶¶ 26, 27); *see also* PO Resp. 26 (stating the “field of the present invention is admittedly the field of remote control aircraft”); 3d Chowdhary Decl. ¶ 41. Petitioners also assert that a person of ordinary skill in the art would have combined Nagamitsu, as modified by Jimenez, with Louvel because the combination would have been (1) a simple, predictable substitution, (2) the use of a known technique to improve a similar device in the same way, and (3) obvious to try. Pet. Opp. 20–21 (citing Ex. 1004 ¶¶ 50–53, Fig. 5B; 3d Chowdhary Decl. ¶¶ 42–44). Petitioners further assert that a person of ordinary skill in the art would have had a reasonable expectation of success when combining Louvel and Nagamitsu as modified by Jimenez. Pet. Opp. 21 (citing 3d Chowdhary Decl. ¶ 45).

The entirety of the record persuades us that Petitioners’ reasons for modifying Louvel to include the input unit of Nagamitsu as modified by Jimenez constitute sufficient articulated reasoning having a rational underpinning. We find that Nagamitsu teaches that its input unit 30 can be used similar to a “joy stick of a TV game or a control stick of a helicopter.” Ex. 1028, 15:25–52; *see also* Ex. 1035, 36:16–19 (In response to “you’d agree with me, then, that the video game controllers and drone controllers are relevant to each other,” Patent Owner’s declarant answering “[t]hey can be in certain circumstances.”). We also credit Prof. Chowdhary’s testimony that the combination of Nagamitsu, as modified by Jimenez with Louvel would have been (1) a simple, predictable substitution, (2) the use of a known technique to improve a similar device in the same way, and (3)

obvious to try because of well-known benefits, such as “more freedom of movement” and “more natural control,” and other advantages, such as “more user-friendly and accurate control.” 3d Chowdhary Decl. ¶¶ 42–44. Thus, we determine that the combination of Louvel, Nagamitsu, and Jimenez would have included “using an RC controller separate and remote from said flying hovercraft,” as recited by proposed substitute claim 11.

The entirety of the record persuades us that the proposed combination of Louvel, Nagamitsu, and Jimenez teaches “providing as part of said RC controller a handheld structure housing a sensor system,” as recited by proposed substitute claim 11. Mot. 26; Pet. Opp. 17–18 (citing Ex. 1028, 12:10–30, 15:25–46, 16:26–54, Fig. 4; 3d Chowdhary Decl. ¶ 22). We find that Nagamitsu teaches input unit 30 “is of a configuration similar to a grip of a pistol” with “a magnetism detecting pointer 35 and an accelerometer 36 . . . installed therein for each direction in 3-D.” Ex. 1028, 12:12–13, 12:18–19; 3d Chowdhary Decl. ¶ 22. Thus, we determine that the combination of Louvel, Nagamitsu, and Jimenez would have included “providing as part of said RC controller a handheld structure housing a sensor system,” as recited by proposed substitute claim 11.

The entirety of the record also persuades us that Petitioners’ proposed combination of Louvel, Nagamitsu, and Jimenez teaches the amended limitation:

using said sensor system in said RC controller to sense at least a two dimensional, two-axis sensed orientation of said handheld structure by dynamically sensing a gravitational reference and a relative tilt of said handheld structure with respect to said gravitational reference in response to a user remote from said flying structure selectively orienting said handheld structure.

Mot. 26. Pet. Opp. 17–18 (citing Ex. 1028, 12:10–30, 15:25–46, 16:26–54, Fig. 4; 3d Chowdhary Decl. ¶ 22). We find that Nagamitsu teaches that its input unit 30 includes accelerometer 36 in each of its 3-D directions and accelerometer 36 detects the direction of gravity and acceleration so that it can detect, at least, changes in acceleration of input unit 30. Ex. 1028, 12:10–30, Fig. 4; 3d Chowdhary Decl. ¶ 22. The entirety of the record persuades us that Nagamitsu teaches using that sensor system in input unit 30 to sense at least a two dimensional, two-axis sensed orientation of the handheld structure, dynamically sense a gravitational reference and a relative tilt of input unit 30 in response to a user selectively orienting input unit 30. *See id.*; Ex. 1035, 149:11–14 (Patent Owner declarant, in response to “would you agree with me, then, that on at least some level, movement and orientation are related concepts,” answering “[t]hey are derivatives of each other”); 2d Condon Decl. ¶ 51 (“‘Gravitational reference’ refers to the use of the gravity vector as a component of a reference frame . . . the term would be understood as the downward direction on Earth.”). Thus, we determine that the proposed combination of Louvel, Nagamitsu, and Jimenez would have included the above-quoted recitation of proposed substitute claim 11.

Petitioners additionally persuade us that the proposed combination of Louvel, Nagamitsu, and Jimenez would have included “communicating a desired orientation by radio frequency (RF) communication information to said flying hovercraft, said desired orientation including information based on said sensed orientation of said handheld structure” in addition to the reasons we determined above in Section III.E.4. Pet. Opp. 5 (citing Ex. 1007, Abstract, ¶¶ 24, 25, 31; Ex. 1028, 8:10–30, 12:10–30, 15:25–46), 18–

19 (citing Ex. 1028, 12:10–30, 15:25–46; 3d Chowdhary Decl. ¶¶ 25–27). We agree with Petitioners that Nagamitsu’s input unit 30 controls movement of a “soft-robot.” Pet. Opp. 18 (citing Ex. 1028, 12:10–30, 15:25–46).

The entirety of the record also persuades us that the proposed combination of Louvel, Nagamitsu, and Jimenez teaches “whereby on a moment-to-moment basis said actual orientation of said flying hovercraft mimics said sensed orientation of said handheld structure of said RC controller.” Mot. 26; Pet. Opp. 5 (citing Ex. 1028, 15:25–52, 16:26–64, Fig. 9), 19 (citing Ex. 1028, 15:25–52, 16:26–64, Fig. 9; 3d Chowdhary Decl. ¶ 30). We agree with Petitioners that Nagamitsu teaches a “soft-robot” that is controlled “on a moment-to-moment basis” and “mimics said sensed orientation of said handheld structure of said RC controller,” and thus, we find that Nagamitsu teaches that its input unit 30 as modified by Jimenez would control the aircraft of Louvel on a moment-to-moment basis and the aircraft of Louvel would mimic the sensed orientation of the handheld structure of input unit 30. *See* Pet. Opp. 19 (citing Ex. 1028, 15:25–52, 16:26–64, Fig. 9; 3d Chowdhary Decl. ¶ 30); 2d Condon Decl. ¶ 52 (“‘Relative tilt’ . . . refers to an orientation of an object relative to gravity or the downward direction.”), ¶ 53 (“‘Moment-to-moment’ refers to a generally dynamic process that is neither completely instantaneous nor completely continuous.”), ¶ 54 (“‘Mimic’ refers to generally corresponding some aspect of the behavior of one thing relative to another.”).

Moreover, we find that Louvel teaches that its “close loop calculus is performed at each moment in real time.” Ex. 1004 ¶ 119. Louvel alone, thus, indicates that the actual orientation of its aircraft corresponds to its control system on a “moment-to-moment basis.” *See also* 2d Condon Decl.

¶ 53 (stating “[m]oment-to-moment’ refers to a generally dynamic process that is neither completely instantaneous nor completely continuous”). Thus, we determine that the proposed combination of Louvel, Nagamitsu, and Jimenez would have included “whereby on a moment-to-moment basis said actual orientation of said flying hovercraft mimics said sensed orientation of said handheld structure of said RC controller,” as required by proposed substitute claim 11.

Additionally, the entirety of the record persuades us that Louvel, Thomas, and Jimenez would have rendered obvious proposed substitute claim 11. Like Nagamitsu, we find that Thomas teaches a hand-held controller that includes accelerometers in each of three perpendicular directions. PO Resp. 16; Ex. 1006, 1:7–9, 1:29–31, 2:12–14, 2:19–23; Ex. 1035, 149:3–6 (Patent Owner’s declarant stating an “instantaneous position of a rotating object is its orientation”); 2d Condon Decl. ¶ 29 (“*Thomas* utilizes centrifugal forces to measure rotational velocity, measured in radians per second or degrees per second, as the motion input of the hand-held control device.”). Nagamitsu evidences that it was known in the art that one of the accelerometers in Thomas can detect a gravitational reference. Thus, the combination of Louvel, Thomas, and Jimenez would have rendered obvious the method of proposed substitute claim 11, including “dynamically sensing a gravitational reference and a relative tilt of said handheld structure with respect to said gravitational reference.”

Also, we find that Louvel teaches a “close loop calculus is performed at each moment in real time” (Ex. 1004 ¶ 119), and thus, teaches “on a moment-to-moment basis said actual orientation of said flying hovercraft mimics said sensed orientation of said handheld structure of said RC

controller,” as required by proposed substitute claim 11. Therefore, based on the findings discussed here and in Section III.E, we also determine that the combination of Louvel, Thomas, and Jimenez would have rendered obvious proposed substitute claim 11.

#### *5. Patent Owner Reply to Petitioners’ Opposition*

Patent Owner replies that Nagamitsu teaches a motion-based controller with a magnetic reference, not a gravitational frame of reference. PO Reply to Opp. 15 (citing Ex. 1028, 13:52–53, 14:44–45). Patent Owner also replies that “the frame of reference used by *Nagamitsu* is a **magnetic field**, not a gravitational reference.” PO Reply to Opp. 15–16 (citing Pet. Opp. 20 with full quote from Ex. 1028, 12:10–30). Patent Owner further replies that Petitioners have misconstrued the teachings of Nagamitsu as to what its accelerometer senses and that Nagamitsu does not teach a gravitational frame of reference. PO Reply to Opp. 16–17 (citing Pet. Opp. 17).

For the reasons discussed above, we find that Nagamitsu teaches accelerometers 36 that detect a direction of gravity, thus teaching the “gravitational reference” of claim 11. Ex. 1028, 12:22–23 (“detecting [a] direction of the gravity and acceleration by the accelerometer 36”). Also, claim 11 recites “gravitational reference,” not “gravitational frame of reference.” Even if claim 11 required a “gravitational frame of reference,” the record persuades us that detecting with respect to a direction of gravity can include detecting with respect to a gravitational frame of reference. Ex. 1028, 12:10–30, Fig. 4; Ex. 1035, 149:11–14 (Patent Owner’s declarant, in response to “would you agree with me, then, that on at least some level, movement and orientation are related concepts,” answering “[t]hey are

derivatives of each other”); 3d Chowdhary Decl. ¶ 22; 2d Condon Decl. ¶ 51 (“‘Gravitational reference’ refers to the use of the gravity vector as a component of a reference frame . . . the term would be understood as the downward direction on Earth.”).

Patent Owner additionally replies that Nagamitsu does not teach controlling an RC craft to mimic the orientation of an RC controller. PO Reply to Opp. 17–18 (citing Pet. Opp. 19; Ex. 1028, 15:25–52, 16:26–51, 28:31–36). The entirety of the record, however, persuades us that Louvel, Nagamitsu, and Jimenez teach “on a moment-to-moment basis said actual orientation of said flying hovercraft mimics said sensed orientation of said handheld structure of said RC controller.” See Ex. 1004 ¶ 119 (“The whole close loop calculus is performed at each moment in real time.”); Ex. 1028, 15:25–52, 16:26–64, Fig. 9; 3d Chowdhary Decl. ¶ 30; 2d Condon Decl. ¶ 54 (“‘Mimic’ refers to generally corresponding some aspect of the behavior of one thing relative to another.”).

Patent Owner also asserts that Petitioners have not set forth a sufficient rationale for combining Nagamitsu with Louvel by citing to its Patent Owner Response. PO Reply to Opp. 19–20 (citing PO Resp. 20–26 (arguments against the rationale for the combination of Louvel, Thomas, and Jimenez)). Our rules, however, do not permit incorporating arguments by reference from one document into another document. 37 C.F.R. § 42.6(a)(3) (“Arguments must not be incorporated by reference from one document into another document.”); *see also* Paper 23, 3 (stating “Patent Owner’s counsel ha[s] read the Board’s requirements regarding electronic filing at 37 C.F.R. §§ 42.6 and 42.63”). Also, Patent Owner’s arguments directed to Louvel, Thomas, and Jimenez are irrelevant because it fails to address Nagamitsu.

Even if those arguments were properly presented and directly addressed the proposed combinations of Louvel, Nagamitsu, and Jimenez, the entirety of the record supports Petitioners' position that one of ordinary skill in the art would have had reason to combine Louvel with Nagamitsu. Pet. Opp. 19–21; Ex. 1028, 15:25–52; Ex. 1035, 36:16–19; 3d Chowdhary Decl. ¶¶ 41–44.

Patent Owner argues combining Louvel with Nagamitsu would be impermissible hindsight and Petitioners' arguments are insufficient to explain why one of ordinary skill in the art would have combined the references. PO Reply to Opp. 20–21. The entirety of the record, however, demonstrates that the asserted references themselves provide a sufficient rationale for why one of ordinary skill would have combined Louvel, Nagamitsu, and Jimenez. Ex. 1004 ¶¶ 25, 92; Ex. 1007 ¶ 35; Ex. 1028, 15:25–52; *see also* Ex. 1035, 36:16–19 (In response to “you’d agree with me, then, that the video game controllers and drone controllers are relevant to each other,” Patent Owner’s declarant answering “[t]hey can be in certain circumstances.”).

Patent Owner further asserts that the proposed combination of Louvel, Nagamitsu, and Jimenez would not arrive at an orientation control scheme, as required by proposed substitute claim 11. PO Reply to Opp. 21–23 (citing PO Resp. 36–38 (arguing Louvel uses a position control scheme, not an orientation control scheme), 41–43 (arguing against the combination of Louvel and Thomas); Ex. 1004 ¶ 91, Figs. 1, 5; 2d Condon Decl. ¶ 30 (discussing the hand-held control device of Thomas)). As discussed above, 37 C.F.R. § 42.6(a)(3) does not permit incorporating arguments by reference from one document into another document. Moreover, these arguments address the combination of Louvel, Thomas, and Jimenez, not the proposed

combination of Louvel, Nagamitsu, and Jimenez. Even if these arguments were applied to the combination of Louvel, Nagamitsu, and Jimenez, proposed substitute claim 11 does not require expressly an orientation control scheme, only “on a moment-to-moment basis said actual orientation of said flying hovercraft mimics said sensed orientation of said handheld structure of said RC controller.” See 2d Condon Decl. ¶ 54 (“‘Mimic’ refers to generally corresponding some aspect of the behavior of one thing relative to another.”).

*D. Conclusion as to Proposed Substitute Claim 11*

In view of the entirety of the evidence, we determine that proposed substitute claim 11 is not patentable over Louvel, Nagamitsu, and Jimenez by a preponderance of the evidence. We also determine by a preponderance of the evidence that proposed substitute claim 11 is not patentable over Louvel, Thomas, and Jimenez. We need not, and do not, reach whether proposed substitute claim 11 is unpatentable over Louvel, Sato, and Jimenez. We, therefore, deny Patent Owner’s Contingent Motion to Amend.

V. CONCLUSION

For the foregoing reasons, based on the full record before us, we determine that Petitioners have demonstrated, by a preponderance of the evidence, that claim 10 of the ’239 patent is unpatentable.

Also, based on the entirety of the record, a preponderance of the evidence demonstrates that proposed substitute claim 11 is unpatentable, and thus, Patent Owner’s Contingent Motion to Amend is denied.

VI. ORDER

Accordingly, it is:

ORDERED that claim 10 of U.S. Patent No. 7,931,239 B2 has been shown, by a preponderance of the evidence, to be unpatentable;

FURTHER ORDERED that, based on the entirety of the record, proposed substitute claim 11 has been shown, by a preponderance of the evidence, to be unpatentable, and therefore, Patent Owner's Contingent Motion to Amend is *denied*; and

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

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