

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DJI TECHNOLOGY, INC.,
Petitioner,

v.

REMOTE IMAGING SOLUTIONS, LLC,
Patent Owner.

IPR2020-00345
Patent 8,918,230 B2

Before KEN B. BARRETT, SCOTT A. DANIELS, and
JON M. JURGOVAN, *Administrative Patent Judges*.

JURGOVAN, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. *Background and Summary*

On December 23, 2019, Petitioner, DJI Technology, Inc., filed a Petition requesting *inter partes* review of claims 1–18 of U.S. Patent No. 8,918,230 B2 (Ex. 1001, the “’230 Patent”). Paper 2 (“Petition” or “Pet.”). On April 14, 2020, Patent Owner, Remote Imaging Solutions, LLC, waived filing of a Preliminary Response. Paper 8.

On June 29, 2020, applying the standard set forth in 35 U.S.C. § 314(a), which requires demonstration of a reasonable likelihood that Petitioner would prevail with respect to at least one challenged claim, we instituted an *inter partes* review of claims 1–18 of the ’230 Patent. Paper 9.

On September 21, 2020, Patent Owner filed its Response to the Petition. Paper 11 (“PO Resp.”). On December 14, 2020, Petitioner filed a Reply to Patent Owner’s Response, and on January 25, 2021, Patent Owner filed a Sur-Reply. Paper 12 (“Reply”); Paper 13 (“Sur-Reply”).

Oral Hearing took place on March 30, 2021. The Hearing Transcript is included in the record. Paper 18.

After considering the parties’ arguments and supporting evidence, we determine that Petitioner has proved by a preponderance of the evidence that claims 1–18 of the ’230 Patent are unpatentable. 35 U.S.C. § 316(e) (2018); 37 C.F.R. § 42.1(d) (2019).

B. *Real Parties in Interest*

Petitioner identifies the real parties in interest as itself, SZ DJI Technology Co., Ltd., DJI Europe B.V., iFlight Technology Company Limited, DJI Japan K.K, and DJI Research LLC. Paper 6, 1.

Patent Owner identifies itself as the real party in interest. Patent Owner's Mandatory Notices, Paper 5, 2.

C. Related Matters

Patent Owner has asserted the '230 Patent in the following cases:

Case Name	Case Number	Court	Case Filed
Remote Imaging Solutions LLC v. DJI Technology, Inc.	2:19-cv-02670-JAK-AFM ¹	Central District of California	04/08/2019
Remote Imaging Solutions LLC v. Parrot SA	1:19-cv-00620	District of Delaware	04/02/2019

Patent Owner's Mandatory Notices, Paper 5, 2; Pet. 106.

D. The '230 Patent

1. Summary of Specification

The '230 Patent is titled "Teleoperation of Unmanned Ground Vehicle" and relates to wirelessly controlling one or more unmanned vehicles with a smart phone. Ex. 1001, codes (54), (57). The smart phone receives video streams from an unmanned vehicle and displays controls on a touch-sensitive display screen. *Id.* at code (57), 1:67–2:1. An operator can manipulate the controls to direct the unmanned vehicle. *Id.* at 2:2–3.

Figure 1 of the '230 Patent is reproduced below.

¹ Patent Owner misidentifies the case as 6:19-cv-02670. Patent Owner's Mandatory Notices, Paper 5, 2.

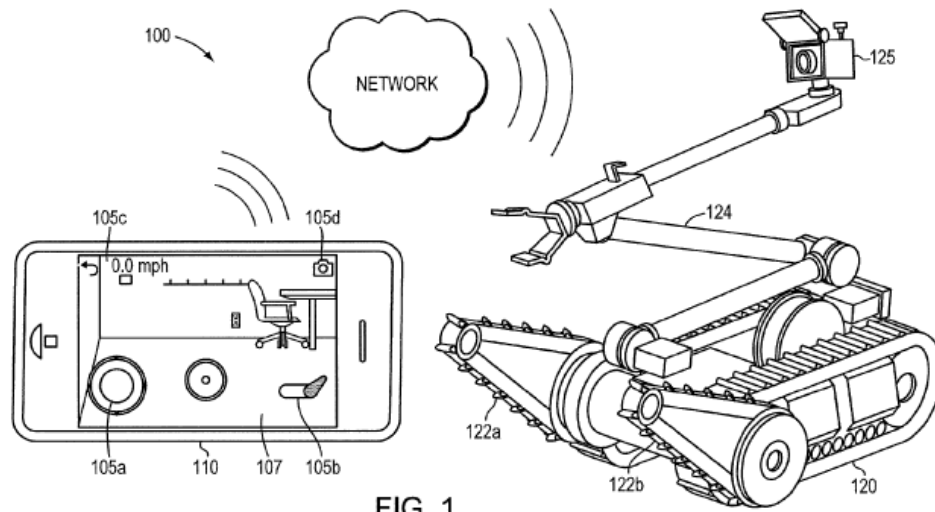


FIG. 1

In Figure 1, unmanned vehicle controller (e.g., smart phone 110) communicates with unmanned vehicle 120 (e.g., a PackBot robot). *Id.* at 4:21–24. Unmanned vehicle 120 includes a camera 125, robotic arm 124, and flippers 122a, 122b. *Id.* at 4:25–26. An operator (not shown) manipulates vehicle controls (e.g., drive control 105a, flipper control 105b, gear control 105c, camera control 105d) that are displayed on touch-screen video display 107 of smart phone 110 to direct unmanned vehicle 120. *Id.* at 4:26–31. Smart phone 110 wirelessly transmits the operators' directions over network 130. *Id.* at 4:32–33. Upon receipt, unmanned vehicle 120 executes the operator's directions. *Id.* at 4:33–35.

Drive control 105a enables the operator to direct the unmanned vehicle to move in any direction. *Id.* at 4:36–37. Flipper control 105b enables the operator to direct flippers 122a, 122b. *Id.* at 4:37–39. Gear control 105c enables the operator to control the maximum speed that the unmanned vehicle can travel. *Id.* at 4:39–41. Camera control 105d enables the operator to control unmanned vehicle camera 125 to take snap shots and video. *Id.* at 4:41–43. Controls may be provided to store a frame of the

video stream as a picture on the smart phone, and to command the unmanned vehicle's camera to zoom in or out. *Id.* at 2:31–34; 4:41–43; 7:26–50. Controls may also be provided to command unmanned vehicle 110 to assume one or more predetermined poses. *Id.* at 2:34–36; 7:26–31.

In addition to the controls, smart phone 110 may display a geographic map and arrows to indicate the heading of unmanned vehicle 120. *Id.* at 2:43–50, 8:28–35. Smart phone 110 may receive and display information on objects within a predetermined distance of the unmanned vehicle. *Id.* at 2:37–42; 8:23–27. A separate joystick may be provided to control movement of the unmanned vehicle. *Id.* at 2:21–23, 6:51.

Smart phone 110 may convert information to direct unmanned vehicle 120 into a protocol recognizable by the unmanned vehicle, or convert information received from the unmanned vehicle into a protocol used by the smart phone. *Id.* at 2:4–9; 3:33–38; 4:63–64. Smart phone 110 may be connected to a separate radio frequency (RF) transmitter via a wire cable to establish communication with the unmanned vehicle. *Id.* at 5:1–7.

2. *Prosecution History*

During prosecution of the '230 Patent, the Examiner issued two office actions. Pet. 7; Ex. 1002, 89–108, 171–189. The first office action rejected the claims as anticipated by US 2012/0072023 to Ota. Ex. 1002, 174. Applicant filed a Rule 131 Affidavit to swear behind Ota, which the Examiner accepted as removing Ota as a reference. Ex. 1002, 95, 113–161.

In the Affidavit, Applicant indicated that “South Florida students built a rudimentary robot controller on the iPhone” with “4 directional arrows for drive forward/back and turn left/right, and a small video display showing the robot's video stream.” Pet. 7; Ex. 1002, 125. Petitioner contends Applicant

identified the University of South Florida (“USF”) work as “prior art” and the work of its “closest competitor” but did not submit any USF documents in an Information Disclosure Statement (“IDS”). Pet. 7–8; Ex. 1002, 125. Applicant also indicated that “3 files in the software are from iRobot’s developer’s documentation” but did not identify or submit any documents from iRobot related to the functionality incorporated into the alleged invention. Pet. 8; Ex. 1002, 125. All the while, Petitioner contends, Applicant continued to pursue claim limitations broad enough to encompass “the rudimentary robot controller” designed by USF students and the functionality of iRobot’s robots. Pet. 7–8, Ex. 1002, 125.

In the second office action, the Examiner rejected certain claims over US2006/0271251 A1 to Hopkins, which uses a Personal Digital Assistant (“PDA”) to control an unmanned vehicle. Pet. 8; Ex. 1002, 89–96. The Examiner determined it would have been obvious to modify Hopkins’s PDA as a smart phone with controls to direct an unmanned vehicle, a statement which Applicant allegedly did not rebut. Pet. 8; Ex. 1002, 93. In response to the second office action, Applicant rewrote the allowable claims into independent form to obtain issuance of the ’230 Patent. Pet. 8; Ex. 1002, 69–77.

E. Challenged Claims

Claims 1, 7–9, 14–15, and 17–18 of the ’230 Patent are independent. Claims 2–6 depend, directly or indirectly, from claim 1. Claims 10–13 depend from claim 9. Claim 16 depends from claim 15. Claim 14 is set forth below with annotated numbering of steps:

14. [preamble] A computerized method for controlling an unmanned vehicle, comprising:

[14A] receiving, by a smart phone, a request to control the unmanned vehicle;
[14B] establishing, by the smart phone, wireless communication between the smart phone and the unmanned vehicle;
[14C] receiving, by the smart phone, a video stream generated by the unmanned vehicle;
[14D] displaying the video stream and vehicle controls on a touch-sensitive display screen within the smart phone;
[14E] manipulating the vehicle controls to direct the unmanned vehicle;
[14F] receiving, by the smart phone, information of objects within a distance of the unmanned vehicle; and
[14G] displaying, on the smart phone, the unmanned vehicle with the objects positioned relative to the unmanned vehicle based the information.

Ex. 1001, 11:17–33.

F. Evidence

Petitioner relies upon the following prior art references²:

Lenser	US 2008/0027591 A1	January 31, 2008	Ex. 1005
iPhone PackBot Operator Control Unit (OCU) ("USF Video")	Video ³	June 19, 2008	Ex. 1006
A Native iPhone Pack Bot OCU ("USF Abstract")	Proceedings to the 2009 HRI Conference	March 26, 2009	Ex. 1007
Phillips	US 2008/0027590 A1	January 31, 2008	Ex. 1008
Jamieson	US 2009/0037024 A1	February 5, 2009	Ex. 1009
Nielsen	US 8,355,818 B2	January 15, 2013	Ex. 1010
Miyazawa ⁴	JP 2004-64418 A	February 26, 2004	Ex. 1011

² Petitioner alleges that all of the prior art references were published before the '230 Patent's earliest alleged priority date of January 21, 2011. Pet. 3–4. Petitioner contends that these references are prior art under 35 U.S.C. § 102(a) and (b) (pre-Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA")). *Id.* Petitioner also alleges that Lenser and Nielsen are prior art under 35 U.S.C. § 102(e). *Id.* Patent Owner does not refute Petitioner's prior art assertions and evidence. On the evidence presented, we determine that the references are prior art to the '230 Patent for the reasons that Petitioner asserts. Accordingly, we will treat these references as prior art in this decision.

³ Petitioner contends the USF Video (Ex. 1006) is prior art because it was: (1) posted on YouTube on June 19, 2008, without privacy restrictions; (2) linked to or embedded by two major online news websites on June 20, 2008; (3) actually viewed on YouTube more than 57,000 times by December 2010; (4) publicly displayed at the March 2009 HRI Conference; and (5) archived online in the proceedings of the same conference by March 26, 2009. Pet. 17–23.

⁴ Petitioner provides a certified English translation of Miyazawa as Exhibit 1012.

Petitioner also supports its challenges with a declaration from Robin Murphy, Ph.D. Ex. 1003. Patent Owner does not rely on any declarant testimony to support its arguments. *See* Sur-Reply 8.

G. Asserted Prior Art and Grounds

Petitioner asserts the following ground of unpatentability:

Challenged Claim(s)	35 U.S.C. §	References/Basis
14, 15, 17, 18	103 ⁵	Lenser, USF References ⁶
16	103	Lenser, USF References, Jamieson
7–10, 12, 13	103	Lenser, USF References, Phillips
11	103	Lenser, USF References, Phillips, Nielsen
1, 3, 4, 6	103	Lenser, USF References, Miyazawa
2	103	Lenser, USF References, Miyazawa, Jamieson
5	103	Lenser, USF References, Miyazawa, Phillips

Pet. 5.

⁵ Because the claims at issue have an effective filing date prior to the effective date of the AIA’s amendments to 35 U.S.C. §§ 102 and 103 (March 16, 2013), we apply the pre-AIA versions of §§ 102 and 103 in this Decision.

⁶ “USF References” refers collectively to the USF Video and USF Abstract.

H. Prior Art Summaries

1. Lenser (Ex. 1005)

Lenser describes a system for controlling multiple remote vehicles using an OCU with a touch-screen interface. Ex. 1005, code (57). The OCU sends commands to remote vehicles to perform autonomous behaviors in a cooperative effort. *Id.* The system generates obstacle detection information from image data received from a time-of-flight sensor or a stereo vision camera sensor. *Id.*

Lenser's Figure 13 is reproduced below.

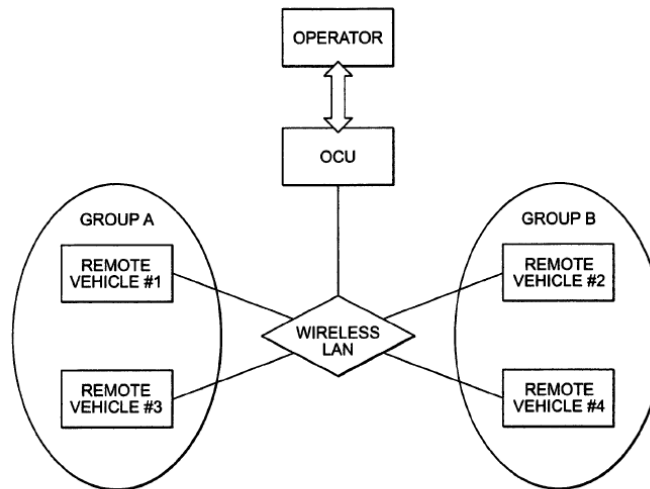
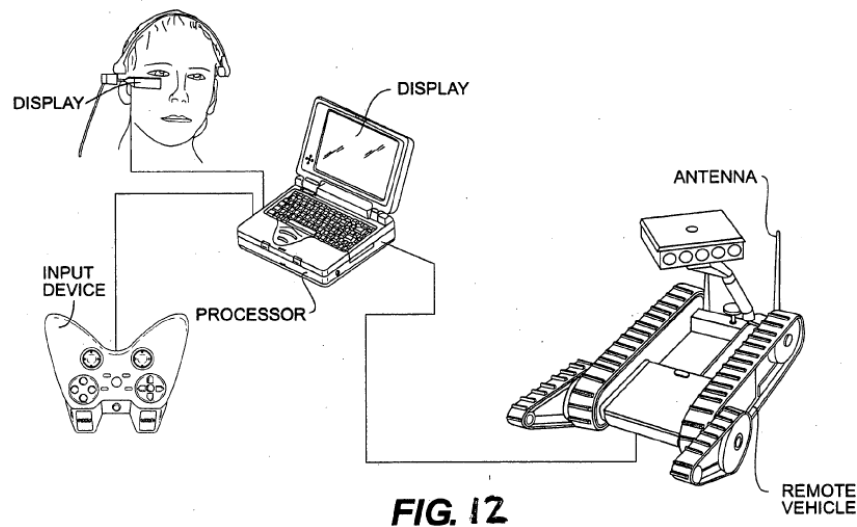


FIG. 13

Lenser's Figure 13 illustrates exemplary interaction among an operator, OCU, and one or more remote vehicles. *Id.* ¶ 32. The operator issues commands to the remote vehicles via the OCU, which sends out data to a processor on each remote vehicle via a wireless LAN. *Id.* ¶¶ 99; 287. The processor of each remote vehicle uses the data from the OCU to control one or more behaviors of that remote vehicle. *Id.* ¶ 99.

Lenser's Figure 12 is reproduced below.



Lenser's Figure 12 illustrates an embodiment of the OCU. *Id.* ¶ 31. The OCU includes a processor, a display, and an input device such as a handheld controller. *Id.* ¶ 92. The processor is described as “any suitably powerful processor, including, for example, a tablet PC” with “802.11 wireless capability and graphics with direct rendering and a touch-screen interface such as a stylus interface.” *Id.* ¶ 94. Lenser describes the OCU can be implemented as a “tablet PC with touch screen input.” *Id.* ¶ 104.

Lenser's Figure 14A is illustrated below.

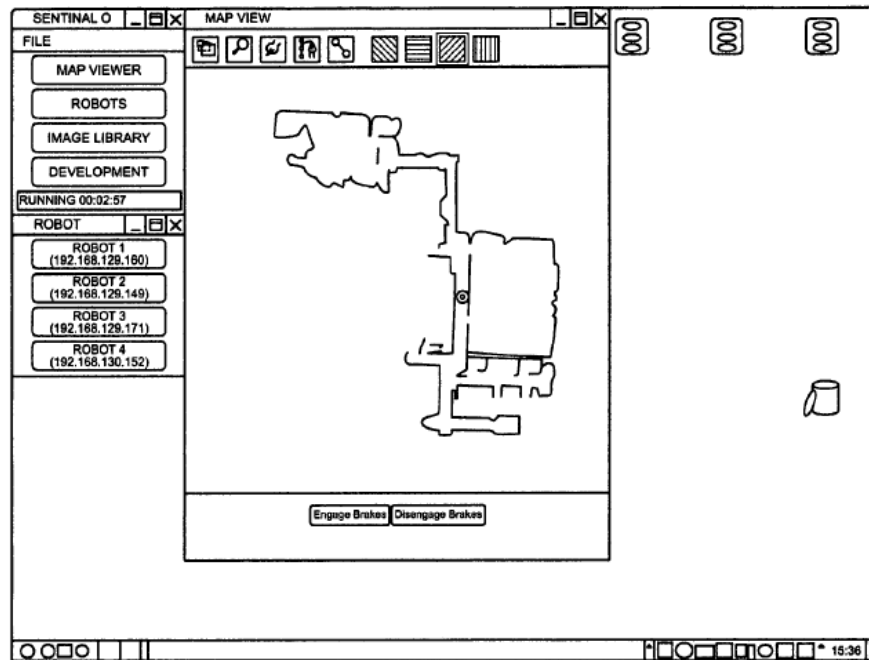


FIG. 14A

Figure 14A shows an initial screen displayed by an OCU. *Id.* ¶ 33. On the left side, Lenser's Figure 14A lists Robots 1 to 4 as unmanned vehicles available for control by the OCU with separate buttons. *Id.* ¶ 105. Selection of one or more buttons results in display of the corresponding status window for the selected robot(s), as shown in Lenser's Figure 16, which is reproduced below. *Id.* ¶¶ 106–107.

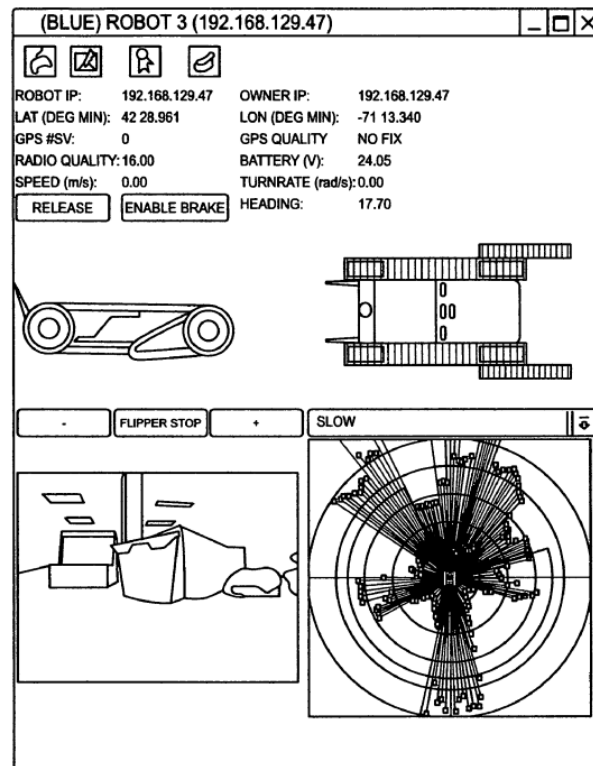


FIG. 16

Figure 16 shows the status window for the selected robot vehicle, which is “Robot 3” in this example. *Id.* ¶¶ 36, 106. Lenser’s OCU displays a live video feed from a camera mounted on the selected remote vehicle, as shown in the bottom left corner of Figure 16. *Id.* ¶ 115. Lenser’s Figure 16 also shows various vehicle controls. *Id.* ¶¶ 111–117. For example, the operator can use the bottom right corner of the touch screen to control movement of the selected unmanned vehicle. *Id.* ¶ 116. The maximum speed of the unmanned vehicle can be controlled at the middle right of Figure 16 (where “Slow” is indicated). *Id.* The display also includes buttons at the right middle to control the remote vehicle’s flippers (where “Flipper Stop” is indicated). *Id.* ¶ 114. Accordingly, Lenser’s OCU display permits selection

of one or multiple remote vehicles, allowing the operator to view their status or control their behavior simultaneously. *Id.* ¶ 107.

2. *USF Video (Ex. 1006)*

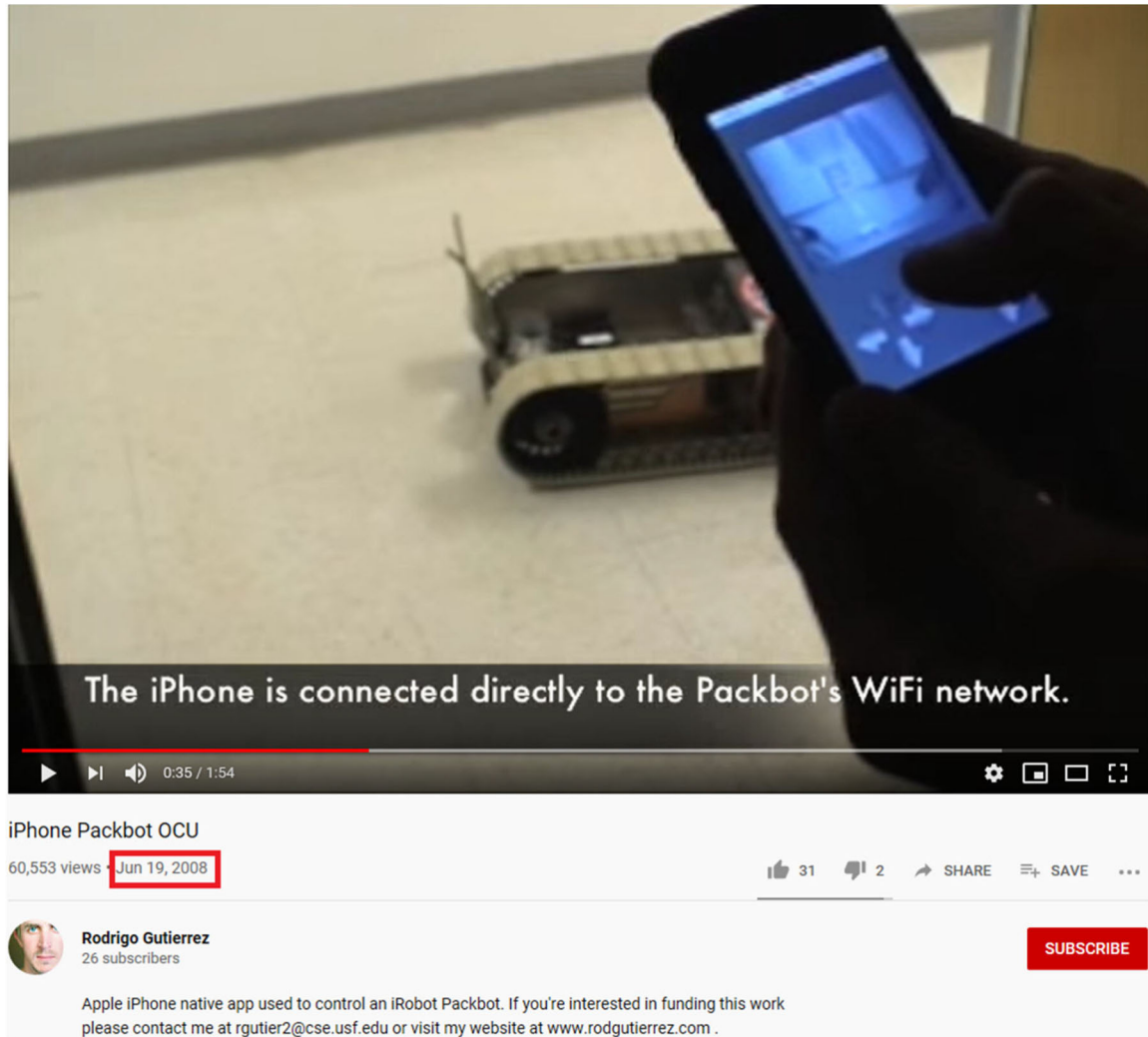
The USF Video allegedly shows an iPhone used as an OCU to control functions of an iRobot PackBot robot vehicle over two years before the January 21, 2011 filing date of the '230 Patent. Pet. 15. Petitioner contends the USF Video was presented in a demonstration at the 2009 ACM/IEEE International Conference on Human/Robot Interaction (HRI) and was posted on YouTube and other websites. Pet. 15–22.

A screenshot of the USF Video, reproduced below, shows streaming video from the robot's camera. Ex. 1006 (at 0:13) (underlined text annotated by Petitioner; plain text in video).



In the screen shot above, arrow buttons on the lower left drive the robot vehicle forward, backwards, left and right. *Id.* (at 0:25–32). Arrow buttons on the right operate the vehicle’s flippers. *Id.* (at 0:18–21).

Another screen shot of the USF Video is shown below, and indicates it was posted on YouTube. Ex. 1006 (at 0:35) (plain text in video).



In the screen shot above, the USF Video shows an operator pressing the forward arrow on the iPhone display to move the PackBot vehicle forward. *Id.* In addition, the captioning indicates the iPhone is connected to the PackBot’s Wi-Fi network. *Id.*

3. *USF Abstract (Ex. 1007)*

The USF Abstract is titled “A Native iPhone Packbot OCU” and discusses details of the implementation of a Packbot operator control unit (OCU) using Apple’s iPhone SDK. Ex. 1007, col. 1. The USF Abstract indicates the USF iPhone OCU connects to the PackBot’s AdHoc Wi-Fi network. *Id.* at col. 2. The USF Abstract indicates when the application starts, it begins listening for multicast video packets from a specified PackBot vehicle and also begins sending drive commands to take control of the vehicle. *Id.* The iPhone interface shows live streaming video from the PackBot vehicle as well as controls to drive the vehicle forward, backwards, left, and right. *Id.*

4. *Jamieson (Ex. 1009)*

Jamieson relates to an architecture and methods for automatically configuring OCUs based on configuration schema and protocol definitions provided from a robot or payload. Ex. 1009 ¶ 2. Jamieson’s Figure 3 is reproduced below.

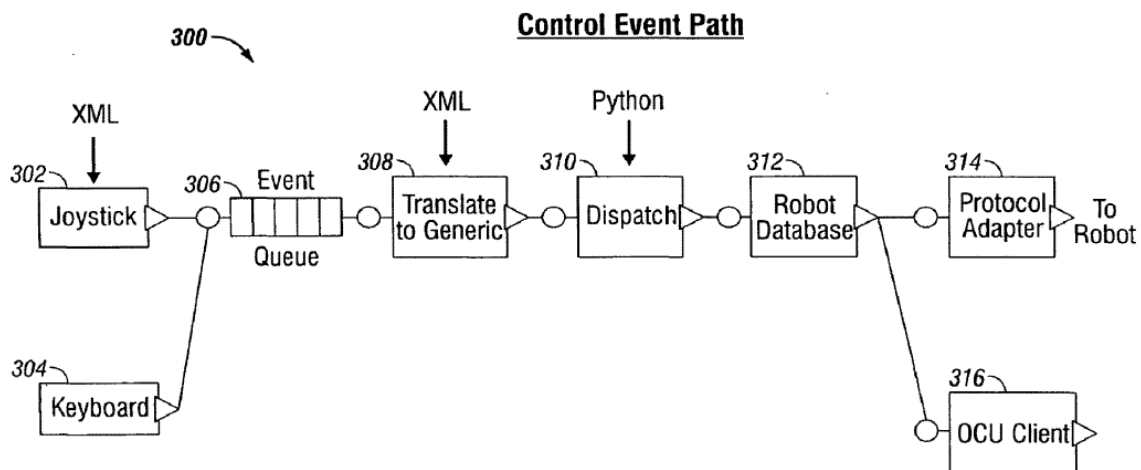


FIG. 3

Jamieson's Figure 3 shows a flow chart of a control event path for control inputs to an OCU. *Id.* ¶ 48. Joystick 302 or keyboard 304 generate control events as XML messages passed to event queue at step 306. *Id.* The control events are mapped to generic functions at step 308. *Id.* ¶ 51. Dispatch step 310 looks up the robot's protocol adapter 314 in robot database 312, and maps the generic function to a network packet. *Id.* Robot protocol adapter 314 then communicates the network packet to the robot, which implements or handles the command. *Id.* ¶ 53.

5. *Phillips (Ex. 1008)*

Phillips discloses a device to control an unmanned ground vehicle (UGV) via a wireless communication link. Ex. 1008 ¶ 74. Phillips device seeks to simplify control of a remote vehicle by switching between tele-operation and autonomous behavior. *Id.* ¶¶ 2, 77. Tele-operation involves use of an operator control console by manipulating an input device such as joystick. *Id.* ¶ 4. Autonomous behavior may be carried out independently by the remote vehicle. *Id.* ¶¶ 5, 125. Autonomous behavior may include having the remote vehicle assume a predefined pose of its body, arms, flippers, neck, and head. *Id.* ¶¶ 228–229.

Phillips's Figure 11 is reproduced below.

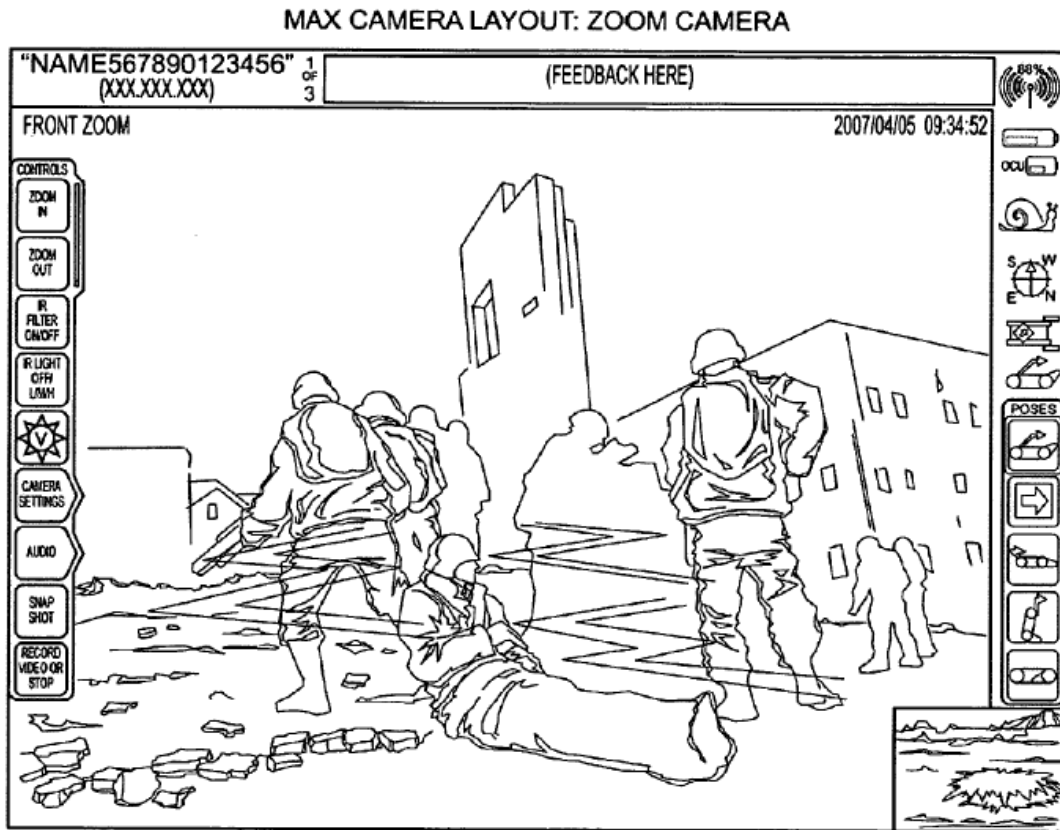


FIG. 11

Phillips's Figure 11 shows a user interface of a control system. *Id.* ¶ 18.

The user interface shows a video feed from the vehicle's camera, and various controls for taking a snapshot of the video feed, zooming in and out, and controlling the vehicle to move into predefined poses. *Id.* ¶¶ 123, 125.

6. *Nielsen (Ex. 1010)*

Nielsen discloses a robot that senses hazards in an environment and communicates them to a remote controller for display on a graphical user interface. Ex. 1010, code (57). Nielsen's Figure 21 is reproduced below.

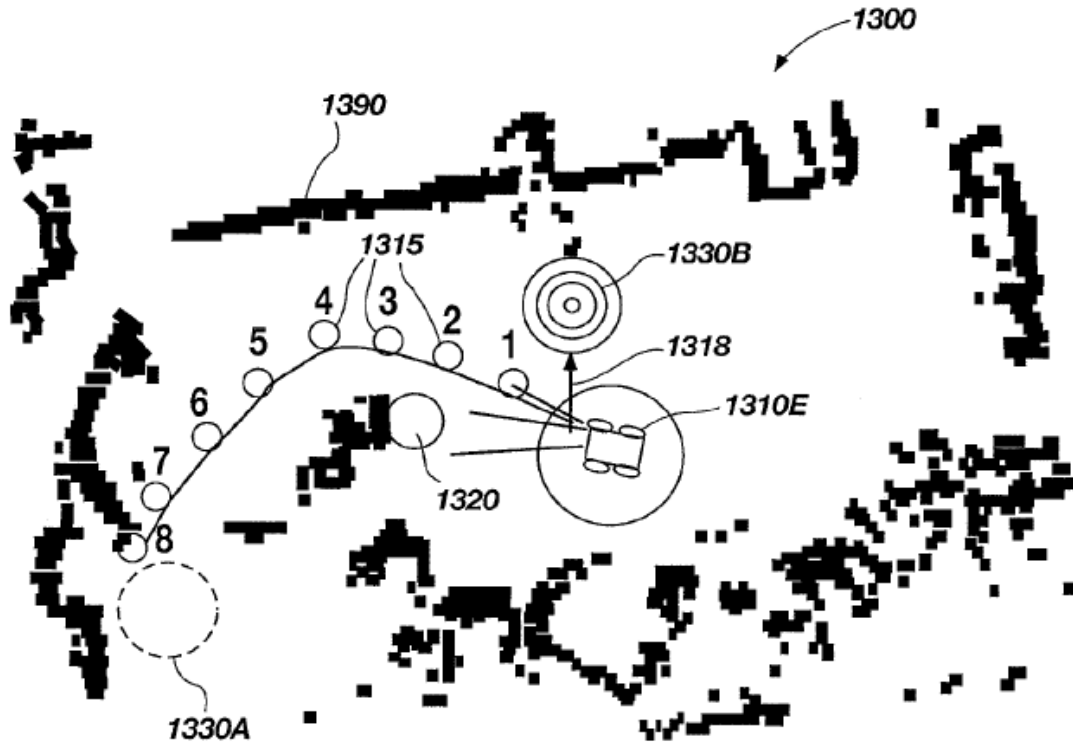


FIG. 21

Nielsen's Figure 21 is a user interface window showing an environment map of the environment proximate to the robot. *Id.* at 5:8–11. In Figure 21, a user intervenes in the robot's behavior by dragging a navigation target from first position 1330A to second position 1330B. *Id.* at 40:18–22. The user interface determines a new vector 1318 indicating the direction from the robot's current position to the new navigation target at 1330B and sends instructions to the robot on how to move to the new navigation target. *Id.* at 40:38–43.

7. *Miyazawa (Ex. 1012)*

Miyazawa relates to remote control of a camera and driving means of a communication apparatus. Ex. 1012, code (57). Miyazawa's Figure 1 is reproduced below.

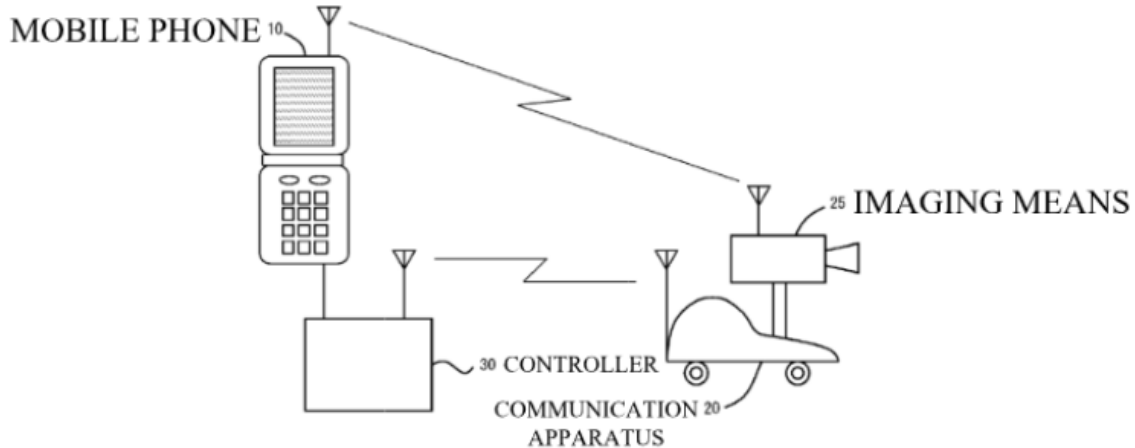


Fig. 1

Miyazawa's Figure 1 shows a wireless communication system with mobile phone 10, communication apparatus 20, imaging means 25, and controller 30. *Id.* ¶ 28. The mobile phone 10 and controller 30 are connected together. *Id.* Wireless communication is performed between mobile phone 10 and imaging means 25 and between communication apparatus 20 and controller 30. Communication apparatus 20 includes driving means such as a wheel or motor and functions as a radio-controlled car. *Id.*

Miyazawa discloses that any communication scheme and bandwidth can be used to support wireless communications. *Id.* ¶ 29. However, Miyazawa prefers to use a relatively large capacity image signal from the imaging means 25 to mobile phone 10. *Id.* Communication of a simple control signal from the controller 30 to the communication apparatus 20 can be done using infrared or short waves that are used for radio-controlled cars, keyless entry, and the like. *Id.*

II. ANALYSIS

A. *Legal Standards*

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *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) where present, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. *Level of Ordinary Skill in the Art*

Petitioner contends “[a] person of ordinary skill in the art (“POSITA”) at the time of the claimed invention would have had a bachelor’s degree in computer science or equivalent training and experience, and at least two years of experience in the field of unmanned vehicles.” Pet. 9; Ex. 1003 ¶¶ 12–15. Petitioner further contends “[a]dditional work or research experience can substitute for less or different education, and vice-versa.” Pet. 9; Ex. 1003 ¶ 14. Patent Owner does not dispute Petitioner’s definition of the level of ordinary skill in the art. *See generally* PO Resp.

To establish the level of ordinary skill in the art, we look to various factors including “the types of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and education level of active workers in the

field.” *In re GPAC*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (citing *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986)). Problems encountered in the art are identified in the background sections of the ’230 Patent as well as in Lenser, USF Abstract, Phillips, Jamieson, Nielsen, and Miyazawa. *See generally* Ex. 1001, 1:21–56; Ex. 1005; Ex. 1007; Ex. 1008, Ex. 1009, Ex. 1010, Ex. 1011. Solutions proposed for these problems are also disclosed in the ’230 Patent and the prior art references. *See generally* Ex. 1001, 1:58–3:55; Ex. 1005; Ex. 1007; Ex. 1008; Ex. 1009; Ex. 1010; Ex. 1011. We observe that innovations were made at a moderate to high rate in this art at the time of the invention, and we find the sophistication of the technology to be moderate to high. *See* Ex. 1003 ¶¶ 22–31; *see generally* Ex. 1001, 1:13–3:55; Ex. 1007; Ex. 1008; Ex. 1009; Ex. 1010; Ex. 1011. On the evidence presented, the education level of active workers in the field aligns with Petitioner’s definition of a POSITA. *See* Pet. 9; Ex. 1003 ¶ 14. Considering these factors, we agree with and adopt Petitioner’s definition of a POSITA, with the exception that we set the level of experience at two years, not “at least two years” as Petitioner contends. Petitioner’s use of the qualifier “at least” introduces ambiguity and encompasses skill levels beyond what was ordinary. We apply this level of ordinary skill in the art in our obviousness analysis.

C. Claim Construction

We construe the challenged claims under the same standard used by a federal court in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2019); *see* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340, 51,341 (Oct. 11, 2018) (now codified at

37 C.F.R. pt. 42 (2019)). 37 C.F.R. § 42.100(b). This standard is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc) and its progeny. Under the *Phillips* standard, we look to intrinsic evidence including the words of a claim, the remainder of the specification, and the prosecution history, as well as extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art. *Phillips*, 415 F.3d at 1314 (citing *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004)).

Only claim terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

We now turn to consider Petitioner's and Patent Owner's contentions concerning claim construction.

1. *Claim 14's "receiving . . . information of objects" and "displaying . . . the unmanned vehicle with the objects positioned relative to the unmanned vehicle based on the information"*

Petitioner contends that none of the terms of the '230 Patent requires explicit construction to resolve the patentability of the challenged claims in view of the prior art in this proceeding. Pet. 9.

Patent Owner disagrees. PO Resp. 26–30. Patent Owner argues that claim 14's "*receiving . . . information of objects*" and "*displaying . . . information*" should be construed as meaning "that the '*information*' *received and displayed* is *descriptive* of the object and is *separate* from the information that is received from the unmanned vehicle's sensors." *Id.* at 30 (emphasis added, alterations in original).

Petitioner replies that Patent Owner's construction improperly imports

three limitations into claim 14: (1) *receiving and displaying the information of objects*; (2) the received and displayed information is *descriptive* of the object; and (3) the received and displayed information is *separate* from the information received from the unmanned vehicle's sensors. Reply 3.

The language of a claim provides “substantial guidance as to the meaning of particular claim terms.” *Phillips*, 415 F.3d at 1315. The relevant language of claim 14 is as follows:

[14F] receiving, by the smart phone, information of objects within a distance of the unmanned vehicle; and

[14G] displaying, on the smart phone, the unmanned vehicle with the objects positioned relative to the unmanned vehicle based [on] the information.

Ex. 1001 at 11:29–33. The claim language is clear that the smart phone receives information of objects and uses it to display the unmanned vehicle with the objects positioned relative thereto.

Claims are read in view of the specification. *Phillips*, 415 F.3d at 1315. In relevant part, the '230 Patent's Specification provides as follows:

FIG. 4F illustrates the objects within the radar view indicator 430 on a map.

...

In various embodiments, the smart phone can receive object information^[7] from radars, command and control centers, text messages, phone messages, email, other unmanned vehicles, or operator input. The object information can include geolocation information, and/or a friendly or non-friendly indicator.

FIG. 4G illustrates a menu that an operator can use to add an object to the radar view indicator 430. FIG. 4H illustrates a

⁷ We determine that the claimed “information of objects” refers to the same thing as the “object information” described in the Specification given the closeness of their wording and meaning, and the lack of anything else comparable in the Specification.

menu that an operator can use to obtain information related to each object within the radar view indicator 430.

Ex. 1001 at 8:23–45. Thus, the Specification describes that the “*object information*” can originate from a variety of sources, and can be of various types, including geolocation and/or friendly/non-friendly information. Geolocation information, of course, is useful in displaying the objects relative to the unmanned vehicle, as recited in claim 14.

The '230 Patent's Figures 4F, 4G, and 4H are reproduced below.

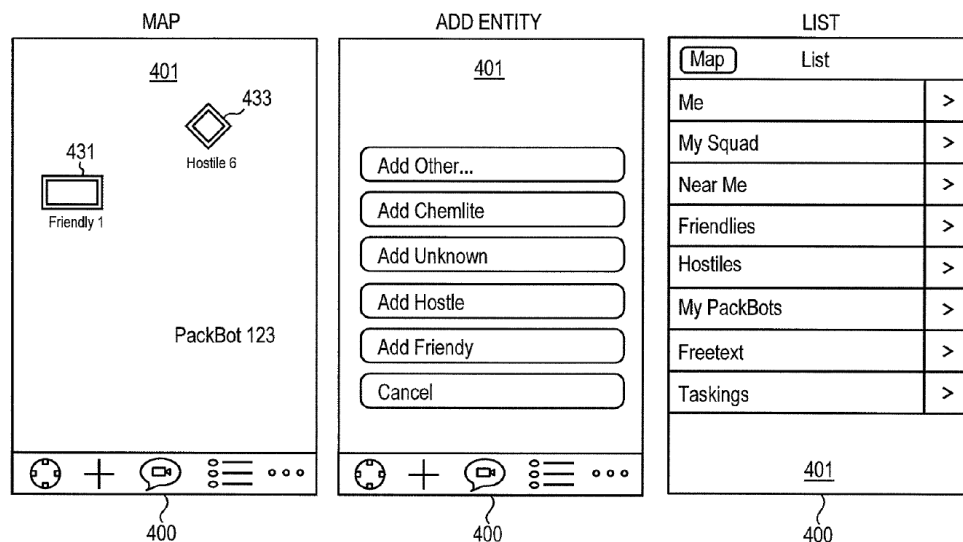


FIG. 4F

FIG. 4G

FIG. 4H

As explained, Figure 4F illustrates objects within the radar view indicator on a map; Figure 4G shows a menu that an operator can use to add an object to the radar view indicator; and Figure 4H illustrates a menu that an operator can use to obtain information about an object, including “Near Me,” “Friendlies,” and “Hostiles” options.

The prosecution history offers little help toward understanding the meaning of the disputed claim limitations. Although the prosecution history

indicated that claim 14⁸ was allowable over the prior art of record,⁹ the Examiner's reasons for allowance were not specific and did not address the particular claim limitations at issue here in any detail. *See* Ex. 1002, 44. Nor did the applicant's remarks offer any insights useful to understanding the disputed claim language. *See generally* Ex. 1002. In sum, the prosecution history contains no discussion of the meaning of disputed claim language, and reveals no disavowal of claim scope touching upon the disputed claim limitations.

Patent Owner does, however, mention that the prosecution history includes an iPhone SUGV Controller Presentation given by the inventors of the '230 Patent. PO Resp. 33–36 (citing Ex. 1002, 127–161). Patent Owner asserts that the presentation shows that information of objects near an unmanned vehicle can be modified by the operator with spot reporting and free text chats. These features are largely redundant, however, to those taught by the '230 Patent in Figures 4F, 4G, and 4H and related description.

Patent Owner also contends an amendment to include the disputed limitations was the reason the examiner allowed claim 14. While this may be so, as noted, the Examiner merely stated “it is found none of the cited prior art of record discloses or suggests [] each and every limitation[] as now required in the independent claims.” Ex. 1002, 44. This sheds little if any light on the meaning of the disputed claim language.

⁸ Claim 14 of the '230 Patent was originally identified as claim 9 in the prosecution history but was renumbered by the Office prior to issuance of the '230 Patent.

⁹ The prior art considered by the examiner did not include the references asserted by Petitioner in this proceeding. *Compare* Section I.F, *with* Ex. 1001, code (56).

Likewise, the extrinsic evidence in the record provides little help in understanding the meaning of the claim terms. Petitioner's expert, Dr. Robin Murphy, does not testify about the meaning of the claim language at issue. *See generally* Ex. 1003. Patent Owner proffers no expert testimony or other extrinsic evidence to support its proposed claim construction. *See generally* PO Resp.; Sur-Reply.

Patent Owner contends that claim 14 requires receiving and displaying the “*information of objects*” which includes information about the object like geolocation information and friendly/non-friendly indicators. PO Resp. 26–27. Patent Owner's contention may be understood in conjunction with the '230 Patent's Figure 4F, *supra*. Figure 4F shows a smart phone display with objects (rectangle and diamond) on a map within a radar view indicator. Ex. 1001, 8:23–24. Object 431 is indicated as “Friendly 1” and object 433 as “Hostile 6.” The location of the unmanned vehicle “PackBot 123” is also shown in Figure 4F.

Claim 14, however, recites *the display of objects* (rectangle and diamond in Figure 4F) positioned relative to the unmanned vehicle, *not the display of information about the objects* (“Friendly 1” and “Hostile 6” indicators in Figure 4F), as Patent Owner contends. PO Resp. 26. Patent Owner appears to read into claim 14 the receiving and displaying of object information, such as geolocation or a friendly/hostile indicator. But the claim language recites “*displaying . . . the unmanned vehicle with the objects positioned relative to the unmanned vehicle based on the information [of objects].*” Ex. 1001, 11:31–33. Thus, claim 14 recites the display of objects, not information about the objects. Accordingly, we agree with Petitioner that Patent Owner improperly reads from the Specification into

claim 14 a limitation of *displaying information about the objects*. Reply 3. We decline to import such limitation into the claim.

Patent Owner also attempts to read into claim 14 the limitation that the received and displayed information is *descriptive* of the object. The plain language of the claim, however, does not require that the information received and displayed describes the object, for example, as friendly or hostile. The Specification describes object information broadly as including the source of the information (radars, command and control centers, text messages, phone messages, email, other unmanned vehicles, or operator input) in addition to information that could be considered descriptive of an object (geolocation and friendly/non-friendly indicator). Ex. 1001, 8:36–41. Thus, the Specification does not limit the object information to only descriptive information, nor is there any language in the claim limiting “*information of objects*” to descriptive information. It would be improper to read a specific embodiment from the specification into the claim when the claim language is broader than the embodiment. *SuperGuide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004). We decline to read this limitation into the claim.

Patent Owner also argues that the received and displayed information in claim 14 is *separate* from the information received from the unmanned vehicle’s sensors. Specifically, Patent Owner argues that “the specification distinctly points out radar data, and describes the information that an operator can review as separate from the radar data.” PO Resp. 30 (citing Ex. 1001, 8:40–45, Figs. 4G, 4H). We find no support in the Specification for the distinction Patent Owner attempts to draw.

Instead, the Specification states that “the smart phone can receive

object information from *radars*, command and control centers, text messages, phone messages, email, other vehicles, or operator input.”

Ex. 1001, 8:36–39. A radar is a type of sensor, and the Specification does not preclude a radar from being onboard an unmanned vehicle and used to determine the position of objects in proximity to it. To the contrary, evidence in the ’230 Patent suggests that some embodiments may include a radar on the unmanned vehicle.

For example, the ’230 Patent’s Figure 4E is reproduced below:

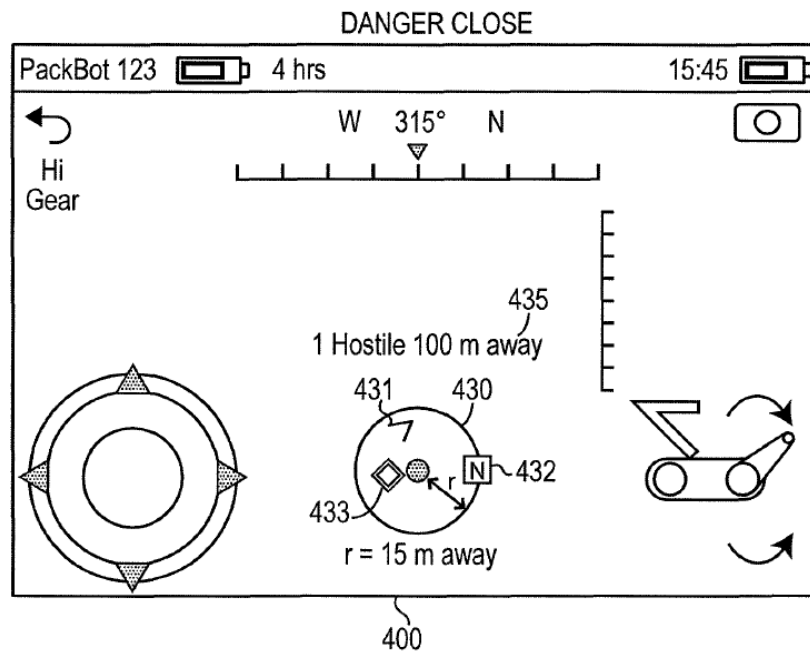


FIG. 4E

Figure 4E shows a radar view indicator 430 with the unmanned vehicle at its center. “Radar view indicator 430 is a top down view showing an object’s location 431 within a radius (r) of the unmanned vehicle.” Ex. 1001, 8:12–14. That the unmanned vehicle is at the center of the radar view indicator in Figure 4E suggests that the radar is onboard the unmanned vehicle since the center commonly denotes the radiation source (the antenna)

on a radar display.¹⁰ Also, Petitioner's expert testifies that use of radar on unmanned vehicles was known in the art. Ex. 1003 ¶¶ 55, 118. Considering this evidence, it is not surprising that the '230 Patent foregoes the details of how to implement a radar on its unmanned vehicle.

Patent Owner's proposed distinction that there are two kinds of object information—one related to radar information, and the other to operator-reviewable information—also fails because the Specification describes operator-reviewable information as relating to the radar view indicator. Ex. 1001, 8:36–45. Thus, the distinction that Patent Owner attempts to draw is not supported by the Specification because the alleged two kinds of information are both described as radar-related and thus are not distinguishable on the basis Patent Owner proposes.

It is also noteworthy that the '230 Patent concludes with the following statement:

One skilled in the art can appreciate the invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. *The foregoing embodiments are therefore to be considered in all respects illustrative rather than limiting of the invention described herein. Scope of the invention is thus indicated by the appended claims, rather than by the foregoing description, and all changes that come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.*

Id. at 9:43–53 (emphasis added). This language from the Specification supports that the applicant intended the claims to be interpreted broadly, without reading limitations from the specification into the claims.

¹⁰ Such a radar display may be referred to as a 'plan position indicator.' See definition at <https://www.merriam-webster.com> (last viewed 6/10/21).

2. Claim 11's "*displaying one or more arrows . . . the one or more arrows indicate a heading for the unmanned vehicle such that the unmanned vehicle can reach a specified location*"

Patent Owner contends that the language of claim 11 requires displaying one or more arrows indicating a specified location to where the unmanned vehicle is to head. PO Resp. 44. As support, Patent Owner points to the specification, stating that "[t]he arrow indicates the direction to direct the unmanned vehicle to move in to reach the object's location." *Id.* (citing Ex. 1001, 8:28–30). Patent Owner contends "[t]here is no claim or specification in the '230 patent disclosing the need for a changed navigation target prior to the displaying of an arrow." *Id.* at 43. Patent Owner seeks interpretation of the claimed heading arrow to distinguish over vector 1318 in Nielsen's Figure 21, which Patent Owner contends appears only when the navigation target *changes*, but which Petitioner contends is shown regardless of whether the navigation target changes. *Id.* at 43–44; Reply 26.

Petitioner argues that the claim does not preclude a change of the navigation target. Reply 25. We agree with Petitioner's argument. We find nothing in the intrinsic evidence, i.e., the claims, Specification, and prosecution history, to support Patent Owner's interpretation. Nor does the extrinsic evidence, including expert testimony, support that the one or more arrows must indicate a heading of the unmanned vehicle such that it can reach a specified location that is *unchanged*. We decline to import such a limitation into claim 11.

Patent Owner also argues that claim 11 requires that the "*one or more arrows*" of claim 11 must be *continuously* displayed. As support for this contention, Patent Owner notes the statement from the Specification that "as the operator directs the unmanned vehicle in the direction of the arrow, the

arrow continually updates to compensate for the change in position of the unmanned vehicle.” PO Resp. 9 (citing Ex. 1001, 8:28–32). However, the immediately preceding sentence states “[i]n some embodiments, the operator can tap the object’s location 431 and *an arrow appears on the screen.*”

Ex. 1001, 8:27–29. Hence, the Specification is clear that the arrow is not continuously displayed. Accordingly, we decline to read into claim 11 that the “one or more arrows” are *continuously* displayed.

3. Conclusion on Claim Construction

We decline to adopt Patent Owner’s proposed constructions which would improperly import limitations into the claims. Instead, we give the claim terms their ordinary and customary meaning, which is “the meaning that the term would have to a person of ordinary skill in the art in question at the time of the inventions.” *Continental Circuits LLC v. Intel Corp.*, 915 F.3d 788, 796 (Fed. Cir. 2019).

Specifically, we read claim 14 to mean “*displaying . . . objects*” not “*displaying . . . information of objects.*” Nor is claim 14 limited to information that is *descriptive* of the object or that originates from a source *separate* from the unmanned vehicle, as Patent Owner proposes.

For claim 11, we read “*displaying one or more arrows*” not to require continuous display, and we interpret “*specified location*” to encompass one that is updated or changed as well as one that is unchanged from the originally specified location.

D. Ground 1: Asserted Obviousness of Claims 14, 15, 17, and 18 Based on Lenser and the USF References

Petitioner contends claims 14, 15, 17, and 18 would have been obvious under 35 U.S.C. § 103(a) based on the combination of Lenser and the USF References (the USF Video and USF Abstract). Pet. 9–60.

1. Motivation to Combine Lenser and USF References

Petitioner contends that a POSITA would have been motivated to combine the teachings of Lenser and the USF References to implement Lenser’s OCU functionality on an iPhone as taught by the USF References. Pet. 23–24; Ex. 1003 ¶¶ 72–81. Petitioner contends Lenser does not limit the devices that can be used for its OCU, and describes preferable characteristics as being lightweight and mobile with a small form factor suitable to carry in a backpack, with an easy-to-use touch-screen interface, and with adequate computer processing power. Pet. 24; Ex. 1005 ¶¶ 93–94. Petitioner contends that Lenser’s teachings would have motivated a POSITA to research other devices with these capabilities, and would have led to the USF References and their demonstration of controlling an iRobot PackBot vehicle with an iPhone. Pet. 24; Ex. 1003 ¶ 73. Petitioner contends that a POSITA would have known that the iPhone had the listed advantages. Pet. 25; Ex. 1003 ¶ 74.

Petitioner also contends that the USF References motivate the combination with Lenser because they taught the advantages for using an iPhone to control a robot, including reduction in size and weight, packability and portability, without requiring a stylus. Pet. 25; Ex. 1007, col. 1. Petitioner contends that a POSITA would recognize these characteristics to be highly advantageous for operating in dangerous conditions and remote

areas. Pet. 25; Ex. 1003 ¶¶ 75–76. Petitioner contends the iPhone’s advantages, as described by USF researchers, match Lenser’s preferred OCU requirements, and would have motivated a POSITA to integrate Lenser’s OCU functionality into the iPhone-based OCU of the USF References. Pet. 25–26; Ex. 1003 ¶¶ 75–76.

Petitioner contends the combination of Lenser and the USF References is the simple substitution of one known element (Lenser’s tablet OCU functionality) for another (USF’s iPhone OCU) to obtain predictable results (controlling an unmanned vehicle from a device with a handheld touchscreen using Wi-Fi). Pet. 26; Ex. 1003 ¶ 77. Petitioner cites U.S. Patent Publication 2010/0084513 A1, filed in 2009, as confirming that substituting a smart phone for a tablet PC was simple, and that smart phones and tablet PCs are near equivalents for controlling unmanned vehicles, and stressing the advantages of using a device with a small form factor, such as a sufficiently capable smartphone or small tablet PC. Pet. 26; Ex. 1043 ¶ 11.

Petitioner further contends that a POSITA would have had a reasonable expectation of success in combining Lenser’s OCU functionality with USF’s iPhone OCU. Pet. 26; Ex. 1003 ¶¶ 78–81. Petitioner contends that the iPhone includes the necessary hardware features of Lenser’s tablet, including a touchscreen, a processor, and a Wi-Fi transceiver. Pet. 26; Ex. 1005 ¶ 94; Ex. 1003 ¶ 78. Petitioner contends that the USF References prove that the concept of controlling a UGV using an iPhone was feasible and ready for further improvements. *Id.* In addition, Petitioner contends that smart phone control of a ground vehicle using an Android phone was disclosed in 2008, and that smart phone control of an unmanned aerial vehicle (UAV) was documented as early as 2006. Pet. 27; Ex. 1037;

Ex. 1024. Petitioner further contends that a 2010 YouTube video demonstrated control of a Parrot AR.Drone with an iPhone. Pet. 27–28; Ex. 1038 (at 0:55 and 3:48); Ex. 1039; Ex. 1003 ¶¶ 79–81. In addition, Petitioner contends that UC Berkeley researchers controlled a UAV using a web page on an iPhone. Pet. 29; Ex. 1007; Ex. 1040; Ex. 1003 ¶ 81. Petitioner contends that these efforts support a POSITA’s reasonable expectation of success and motivate the combination of Lenser and the USF References. Pet. 29.

Patent Owner argues that one would not have been motivated to combine any of the prior art references. PO Resp. 46–47. Patent Owner criticizes Petitioner’s rationale for the combination as “formulaic” and asserts Petitioner provided no evidence that the “information of objects” was a “known technique.” *Id.* at 47. Patent Owner further argues that Lenser merely displays red dots showing the position of detected obstacles, and that “*Lenser* does not disclose other information of the objects near the unmanned vehicle other than simple object detection, much less information of the objects being friendly or non-friendly.” *Id.*

Patent Owner’s arguments hinge critically on its interpretation of the claim as reciting the display of *information of objects*. As discussed at length in Section II.C.1, claim 14 recites the display of objects, not information of objects. Although Patent Owner characterizes Petitioner’s reliance on simple substitution of one known element for another as “formulaic,” we determine that Petitioner properly and adequately applied the simple substitution rationale to the facts of this case. *See KSR* at 417. Consequently, Patent Owner’s argument does not show any deficiency in

Petitioner's stated reasons to combine the prior art references or the reasonable expectation of success.

Reviewing Petitioner's evidence, we agree that Petitioner has made a sufficient showing that a POSITA would have been motivated to combine Lenser and the USF References with a reasonable expectation of success in arriving at the claimed subject matter.

We proceed to examine the combination of teachings or the prior art references with respect to each limitation of claim 14.

2. *Claim 14*

a) *Summary of Petitioner's Contentions Regarding Claim 14*

Petitioner contends that Lenser discloses OCU functionality showing most of claim 14's limitations, except that Lenser implements its OCU on a PDA tablet, not a smart phone. Pet. 23. Petitioner contends that the iPhone described in the USF References is a smart phone that a POSITA would have substituted for Lenser's PDA tablet, thus meeting claim 14's limitations. Pet. 24, 26.

b) *Petitioner's Reading of Claim 14 on the Prior Art Combination*

Petitioner reads the preamble of claim 14¹¹ on the combined references as follows.

¹¹ We need not, and do not, determine whether the preamble of claim 14 is limiting, because Petitioner shows sufficiently that the asserted prior art, specifically, the combination of Lenser and the USF References, teaches the preamble. We reach the same conclusion for the preambles of all other independent claims and thus do not further address those preambles expressly below.

[preamble] 14. *A computerized method for controlling an unmanned vehicle, comprising:*

Petitioner contends that the combination of Lenser and the USF References teaches claim 14's preamble. Pet. 30–32; Ex. 1003 ¶¶ 83–90. Specifically, Petitioner contends Lenser discloses controlling one or more remote vehicles. Pet. 30; Ex. 1005 ¶¶ 11–12. Petitioner further contends that Lenser discloses “*computerized*” because its OCU and vehicles include a processor running software. Pet. 31; Ex. 1005 ¶¶ 71, 89, 92, 94, 97–98, 100; Ex. 1003 ¶¶ 84–87. Petitioner contends that Lenser's vehicles are “*unmanned*” because they are remotely controlled and no human rides in the vehicles. Pet. 31; Ex. 1005, code (57), ¶ 65, Figs. 1–6; Ex. 1003 ¶ 88.

Petitioner further alleges that the USF References teach a “*computerized method for controlling an unmanned vehicle.*” Pet. 31 (emphasis added); Ex. 1003 ¶¶ 89–90. Specifically, Petitioner notes that the USF Abstract discusses implementation of a Packbot OCU using Apple's iPhone SDK. Pet. 31; Ex. 1006 (at 0:03 and 0:06); Ex. 1007, col. 2.¹² Petitioner contends that the USF Video shows an operator interacting with buttons on an iPhone touchscreen interface (“*computerized method*”) to control an iRobot PackBot (“*unmanned vehicle*”). Pet. 31–32; Ex. 1003 ¶¶ 89–90.

Petitioner has made a sufficient showing that claim 14's preamble is taught by the combination of Lenser and the USF References.

Claim 14 further recites:

[14A] *receiving, by a smart phone, a request to control the unmanned vehicle;*

¹² At points in this discussion, Petitioner uses incorrect exhibit numbers. Exhibit 1006 is the USF Video, and Exhibit 1007 is the USF Abstract.

Ex. 1001, 11:19–20 (emphasis added).

Petitioner contends that the combination of Lenser and the USF References discloses the “control request” limitation 14A. Pet. 34–37; Ex. 1003 ¶¶ 91–96, 132–137. Specifically, Petitioner contends Lenser’s OCU includes buttons or icons for launching control applications for respective Robots 1–4 depicted on the left side in Lenser’s Figure 14A (shown above). Pet. 34; Ex. 1005 ¶¶ 17, 105; Ex. 1003 ¶¶ 91, 133. If the operator presses a button to select a remote vehicle, the screen shown in Lenser’s Figure 16 results, which includes various controls for the selected remote vehicle. Pet. 35; Ex. 1005 ¶¶ 106–107, 116; Ex. 1003 ¶¶ 93, 135. Petitioner contends that Lenser’s OCU therefore “*receiv[es] . . . a request to control the unmanned vehicle[s].*” Pet. 36; Ex. 1003 ¶¶ 91–93, 132–136 (alterations in original). Petitioner further contends it would have been obvious to a POSITA to incorporate a button or icon on a touchscreen surface, as taught by Lenser, on USF’s iPhone OCU so that an operator could launch the PackBot application on the iPhone. Pet. 37; Ex. 1003 ¶ 94. Petitioner contends use of buttons or icons to launch applications was well-known and routine prior to the ’230 Patent. Pet. 37; Ex. 1003 ¶ 94.

Petitioner asserts that Lenser’s OCU application running on an iPhone OCU receives an operator’s input to start an application, select one or more vehicles from the initial screen (Lenser’s Figure 14A), and control the vehicles from the detailed vehicle page (Lenser’s Figure 16) to control one or more unmanned vehicles. Pet. 37; Ex. 1003 ¶¶ 91–95, 132–137. According to Petitioner, this constitutes “*receiving, by a smart phone, a request to control the unmanned vehicle[s].*” Pet. 37 (alterations in original).

Reviewing the foregoing evidence, Petitioner has made a sufficient showing that the “*control request*” limitation 14A is taught by the combination of Lenser and the USF References.

Claim 14 further recites:

[14B] *establishing, by the smart phone, wireless communication between the smart phone and the unmanned vehicle;*

Ex. 1001, 11:21–22 (emphasis added).

Petitioner contends that the combination of Lenser and the USF References discloses limitation 14B. Pet. 40–43; Ex. 1003 ¶¶ 97–103. Petitioner contends that Lenser’s OCU includes an antenna/radio for wireless communication. Pet. 37; Ex. 1005 ¶ 92. Petitioner contends that Lenser’s Figure 13 (shown above) depicts an OCU communicating with each of remote vehicles via a wireless LAN, thus teaching “*establishing . . . wireless communication*” with the vehicles. Pet. 37–38; Ex. 1005 ¶ 287; Ex. 1003 ¶¶ 97–99. Petitioner also asserts that the USF Abstract describes that the iPhone connects to the Packbot’s AdHoc Wi-Fi network and corroborates the implicit teaching of Lenser that the OCU must establish wireless communication in order to communicate with the vehicles. Pet. 38; Ex. 1007, col. 2; Ex. 1006 (at 0:37); Ex. 1003 ¶ 100. Petitioner asserts that the combination of Lenser and USF References therefore teaches “*establishing, by the smartphone, wireless communication between the smart phone and the unmanned vehicle[s].*” Pet. 39; Ex. 1003 ¶¶ 97–102.

Reviewing the foregoing evidence, Petitioner has made a sufficient showing that the “establishing” limitation 14B is taught by the combination of Lenser and the USF References.

Claim 14 further recites:

[14C] *receiving, by the smart phone, a video stream generated by the unmanned vehicle;*

Ex. 1001, 11:23–24 (emphasis added).

Petitioner contends that the combination of Lenser and the USF References discloses limitation 14C. Pet. 40–43; Ex. 1003 ¶¶ 103–105. Petitioner contends Lenser’s remote vehicles transmit real-time video streams to the OCU. Pet. 40; Ex. 1005 ¶¶ 64, 84, 91; Ex. 1003 ¶¶ 103, 144. Petitioner further contends the USF Abstract describes that the iPhone PackBot OCU (“*smart phone*”) receives live video streams generated by the PackBot (“*unmanned vehicle*”). Pet. 40–42; Ex. 1006 (at 0:13, 0:49, and 1:31); Ex. 1007, col. 2. Petitioner further contends Lenser contemplates selecting multiple remote vehicles at once so that their associated video feeds are displayed simultaneously. Pet. 42–43; Ex. 1005 ¶¶ 84, 107. Fig. 45; Ex. 1003 ¶ 145.

Reviewing the evidence submitted, Petitioner has made a sufficient showing that the “*video stream*” limitation 14C is taught by the combination of Lenser and the USF References.

Claim 14 further recites:

[14D] *displaying the video stream and vehicle controls on a touch-sensitive display screen within the smart phone;*

Ex. 1001, 11:25–26 (emphasis added).

Petitioner contends that the combination of Lenser and the USF References discloses limitation 14D. Pet. 45–49; Ex. 1003 ¶¶ 106–111. Petitioner contends Lenser’s Figure 16 (shown above) discloses a video display from a selected remote vehicle in the bottom left portion. Pet. 45; Ex. 1003; Ex. 1005 ¶¶ 106, 115. Petitioner further contends that the bottom right portion of Lenser’s Figure 16 can be manipulated by an operator to

control the selected vehicle using a touch-screen. Pet. 45; Ex. 1005 ¶ 116. Petitioner contends Lenser's OCU therefore includes "*a touch-sensitive display screen.*" Pet. 45; Ex. 1003 ¶ 109. Petitioner contends that Lenser discloses a number of controls displayed on the touch screen of Figure 16, including ones for brake release, flipper rotation, and speed control. Pet. 46; Ex. 1005 ¶¶ 112–116. Petitioner contends the USF Abstract explains that the PackBot OCU user interface shows live streaming video as well as buttons to drive the vehicle forward, backwards, left, and right as shown in the USF Video. Pet. 47–49; Ex. 1006 (at 0:13 and 0:18); Ex. 1007, col. 2; Ex. 1003 ¶ 110. Accordingly, Petitioner contends the combination of Lenser's OCU with an iPhone described in the USF References discloses the "displaying" limitation 14D. Pet. 49.

Reviewing the evidence, Petitioner has made a sufficient showing that the combination of Lenser and the USF References teaches the "*displaying*" limitation 14D.

Claim 14 further recites:

[14E] *manipulating the vehicle controls to direct the unmanned vehicle;*

Ex. 1001, 11:27–28 (emphasis added).

Petitioner contends that the combination of Lenser and the USF References discloses limitation 14E. Pet. 49–52; Ex. 1003 ¶¶ 112–115. Petitioner contends that the bottom right portion of Lenser's Figure 16 for the selected remote vehicle can be manipulated to control the vehicle using touch-screen interaction to control its speed and turning. Pet. 49–50; Ex. 1005 ¶¶ 106, 116. Specifically, the y-axis can be manipulated by the operator to control the speed of the robot vehicle, and the x-axis can be manipulated to control the amount of turning relative to translation. Pet. 50;

Ex. 1005 ¶ 116. Therefore, the vehicle controls are manipulated to direct the selected unmanned vehicle. Pet. 50; Ex. 1003 ¶¶ 112–113, 155–156.

Petitioner contends, by manipulation of Lenser’s touchscreen controls, that the operator issues commands for the remote vehicle(s) via an OCU that sends out data wirelessly to a processor on each of the remote vehicles.

Pet. 50; Ex. 1005 ¶ 99.

Petitioner contends that the USF Abstract discloses that the OCU user interface “shows live streaming as well as buttons to drive the vehicle forward, backwards, left, and right.” Pet. 50; Ex. 1007, col. 2. Petitioner contends a screenshot from the USF Video discloses the operator manipulates the arrow controls on the iPhone OCU to drive the PackBot. Pet. 50–51; Ex. 1006 (at 0:34); Ex. 1003 ¶ 114. Petitioner contends that the USF Abstract explains that the OCU “send[s] drive commands to take control of the vehicle.” Pet. 51 (alteration in original); Ex. 1007. Petitioner contends that the combination of Lenser and the USF References discloses “*manipulating the vehicle controls to direct the unmanned vehicle*” as claimed. Pet. 51–52; Ex. 1003 ¶¶ 112–115, 154–157.

Reviewing the evidence, Petitioner has made a sufficient showing that the combination of Lenser and the USF References teaches the “*manipulating*” limitation 14E.

Claim 14 further recites:

[14F] *receiving, by the smart phone, information of objects within a distance of the unmanned vehicle; and*

Ex. 1001, 11:28–29 (emphasis added).

Petitioner contends the combination of Lenser and the USF References discloses limitation 14F. Pet. 52–55; Ex. 1003 ¶¶ 116–120. Petitioner contends that Lenser’s remote vehicle includes “a range-finding

system 121 that can scan the environment surrounding the remote vehicle to detect reflective surfaces of objects such as walls, automobiles, trees, furniture, etc.” Pet. 52; Ex. 1005 ¶ 70. Petitioner contends that Lenser’s vehicle also includes a 3D camera and associated mapping payload that can be a primary sensor for obstacle detection, mapping, and localization. Pet. 52; Ex. 1005 ¶¶ 80–81. Petitioner contends that the range-finding and 3D camera systems gather “information of objects within a distance of the unmanned vehicle.” Pet. 52 (emphasis omitted); Ex. 1003 ¶¶ 116–118.

Petitioner contends that Lenser’s vehicles “transmit data, e.g., video streams and map data, to the OCU during a mission.” Pet. 52; Ex. 1005 ¶ 84. Petitioner contends that the transmitted data includes data collected by the range finder and 3D camera. Pet. 52; Ex. 1005 ¶ 70; Ex. 1003 ¶ 119. Petitioner contends Lenser’s OCU receives this data. Petitioner further contends that a POSITA would have implemented Lenser’s OCU with the iPhone described in the USF References. Pet. 54.

Reviewing the evidence, Petitioner has made a sufficient showing that the “*receiving*” limitation 14F is taught by the combination of Lenser and the USF References.

Claim 14 further recites:

[14G] *displaying, on the smart phone, the unmanned vehicle with the objects positioned relative to the unmanned vehicle based the information.*

Ex. 1001, 11:30–31 (emphasis added).

Petitioner contends that the combination of Lenser and the USF References discloses limitation 14F. Pet. 52–55; Ex. 1003 ¶¶ 121–122. Petitioner contends that Lenser displays “the remote vehicle’s view of its surrounding area as determined, for example, by a range finder (e.g., a

SwissRanger) and 3D camera.” Pet. 53; Ex. 1005 ¶ 115. Petitioner contends that in Lenser’s Figure 16, “[t]he bottom right corner includes the remote vehicle’s view of its surrounding area,” with “the remote vehicle being drawn to scale in the center of the display.” Pet. 53 (alteration in original); Ex. 1005 ¶ 115. Petitioner contends that Lenser’s Figure 16 includes red dots showing the position of detected obstacles. Pet. 53; Ex. 1005 ¶ 115. Petitioner contends that because the vehicle’s view is determined by the range finder and 3D camera mapping functionality, the displayed tangible obstacles corresponds to the “*objects*” of the “*displaying*” limitation 14F. Pet. 53; Ex. 1005 ¶ 115; Ex. 1003 ¶ 119. Petitioner contends that Lenser’s display illustrated in Figure 16 shows a representation of the vehicle (center) and the objects’ locations relative to the vehicle. Pet. 53; Ex. 1003 ¶ 119. Petitioner contends that a POSITA would have been motivated to implement Lenser’s OCU with an iPhone as described in the USF References. Pet. 54. Petitioner thus contends that the combination of the Lenser and USF References discloses the “*displaying*” limitation 14G. Pet. 54–55.

Reviewing the evidence, Petitioner has made a sufficient showing that the combination of Lenser and the USF References teaches the “*displaying*” limitation 14G.

c) Patent Owner Arguments

Patent Owner argues that Lenser’s tablet PC is not a “*smart phone*” as claimed. PO Resp. 31–32. Patent Owner states that Lenser merely uses a tablet PC (an HP TC1100 running SuSe 9.2 Linux operating system) which is large, bulky, and heavy, making it difficult to carry. *Id.*

Patent Owner’s argument attacks Lenser individually and does not consider its combination with the USF References, which teach a smart phone. “Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references.” *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (citing *In re Keller*, 642 F.2d 413, 425 (CCPA 1981)).

Patent Owner also argues that Lenser and the USF References do not disclose receiving “*information of objects*” and “*displaying . . . the objects.*” PO Resp. 32–33, 37–38. Specifically, Patent Owner contends Lenser’s range finder (SwissRanger) merely displays red dots that show the position of detected obstacles or matter, and that the information of objects is more than mere detection of reflective surfaces or production of red dots that show the positions of detected matter, as disclosed in Lenser. *Id.* at 33. Patent Owner does not explain why Lenser’s dots do not indicate objects. Consequently, we do not find this argument persuasive to overcome Petitioner’s evidence.

Patent Owner next argues that Lenser “does not teach receiving or displaying information that is descriptive of the object, or information that is received separately from things like command and control centers, text messages, phone messages, email, other unmanned vehicles, or operator input.” PO Resp. 33, 36–39. As we explained in Section II.C.1, we do not construe claim 14 to require display of information descriptive of the object or that the information is received separately from a source that is not the unmanned vehicle. Instead, claim 14 recites displaying objects positioned relative to the unmanned vehicle. Consequently, Patent Owner’s argument is not supported by language in the claim as properly construed.

d) Conclusion for Claim 14

In light of the foregoing discussion, we determine that Petitioner has shown by a preponderance of the evidence that claim 14 is unpatentable over the combination of Lenser and the USF References. Petitioner makes a sufficient showing that each limitation of claim 14 is taught or suggested by the combination of Lenser and the USF References, and that a person of ordinary skill in the art had reason to combine the references, with a reasonable expectation of success in arriving at method of claim 14.

3. Claim 15

Claim 15 has similarities to claim 14 except that it involves control of a plurality of unmanned vehicles rather than just one. *See* Ex. 1001. The only limitation in claim 15 that we find to differ materially from those of claim 14 is “*selecting, by the smart phone, one of the plurality of unmanned vehicles.*” Pet. 33 (emphasis added). Petitioner’s evidence for claim 14 relies on Lenser’s Figures 14A and 16. Pet. 34–37. Specifically, Petitioner contends (starting from the initial screen in Lenser’s Figure 14A) that “[i]f the operator presses a button to select a detected remote vehicle, a detailed window is displayed (see Fig. 16 . . .)” that allows “the operator to perform low-level control (teleoperation) and/or view telemetry and video data from the selected remote vehicle.” Pet. 55; Ex. 1003 ¶¶ 106, 158–160. As with claim 14, the USF References demonstrate Lenser’s features may be implemented on a smart phone.

4. Claim 17

Claim 17 is materially similar to claim 14 except that it involves a plurality of multiple unmanned vehicles and the last step recites “*toggling between displaying the video stream and controls of each of the plurality of*

unmanned vehicles based on operator input” (limitation 17G using Petitioner’s nomenclature). Petitioner contends this limitation is taught by selection of different robot buttons in Lenser’s Figure 14A to show video stream and controls for the respective selected robots in Figure 16. Pet. 55–56 (citing Ex. 1003 ¶¶ 106–107, 169–171; Ex. 1005 ¶ 94).

5. *Claim 18*

Claim 18 is materially similar to claim 14 except that it further limits the selecting, displaying and manipulating limitations to two vehicles:

“selecting, by the smart phone, two of the plurality of the unmanned vehicles,” “displaying the video stream and controls of the two selected vehicles on a display screen within the smart phone,” and “manipulating controls to direct the two selected unmanned vehicles.” Pet. 33, 57.

Petitioner contends that Lenser’s Figure 14A allows an operator to select two robot vehicles. Pet. 58; Ex. 1005 ¶¶ 107, 280–287; Ex. 1003 ¶¶ 180–181. Petitioner further contends that Lenser’s Figure 45, reproduced below, discloses the *“displaying”* and *“manipulating”* features for two unmanned vehicles. Pet. 58–60; Ex. 1005 ¶ 284; Ex. 1003 ¶¶ 182–186, 112–115, 154–157.

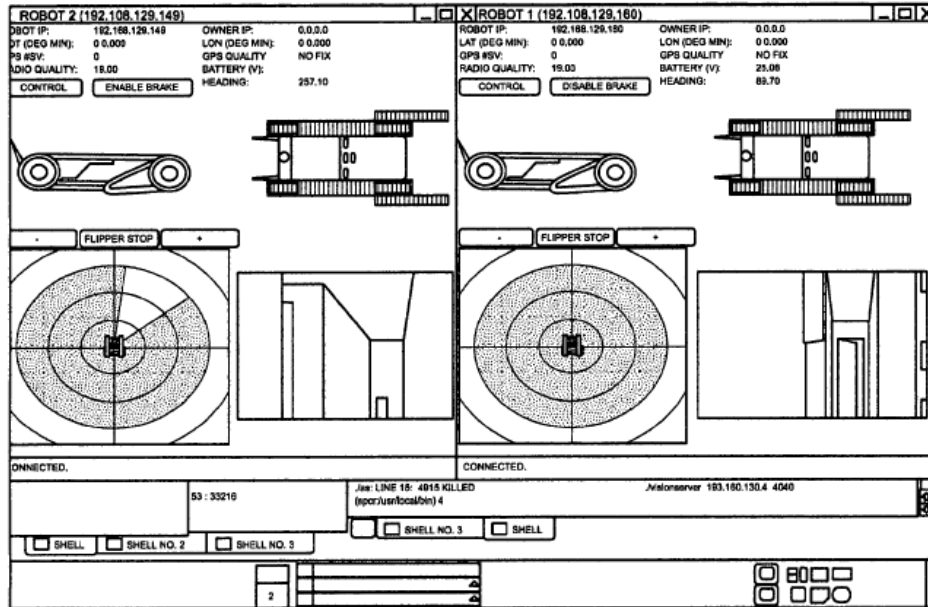


FIG. 45

Lenser describes Figure 45 as “an OCU display allowing an operator to control two teamed remote vehicles.” Ex. 1005 ¶ 62. Petitioner contends that the combination of Lenser and the USF References discloses each limitation of claim 18 of the ’230 Patent. Pet. 60.

6. Conclusion for Ground 1

We have considered Patent Owner’s arguments for patentability of claim 14 but determine that they do not outweigh Petitioner’s evidence of unpatentability. Patent Owner presents no arguments for patentability specific to claims 15, 17, and 18. *See generally* PO Resp.; Sur-Reply.

Petitioner shows by preponderance of the evidence that claims 14, 15, 17, and 18 are unpatentable for the reasons summarized above and stated in the Petition. Petitioner makes a sufficient showing that each limitation of these claims is taught or suggested by the combination of Lenser and the USF References, and that a person of ordinary skill in the art had reason to

combine the references, with a reasonable expectation of success in arriving at the methods recited in these claims.

E. Ground 2: Asserted Obviousness of Claim 16 Based on Lenser, USF References, and Jamieson

Claim 16 depends from claim 15 and further recites “*wherein the establishing of a wireless communication further comprises transmitting, by the smart phone, a signal to each of the plurality of unmanned vehicles, such that the signal changes to a protocol of the particular unmanned vehicle the signal is transmitting to.*” Petitioner notes that Lenser teaches that its OCU “allow[s] the operator to control heterogeneous remote vehicles having different sensors, different capabilities, and different behavior programming.” Pet. 60 (citing Ex. 1005 ¶ 99). Petitioner also points out that while Lenser describes various embodiments with reference to particular standards and protocols, Lenser states that its invention is not limited to those standards and protocols. *Id.* (citing Ex. 1005 ¶ 288). Petitioner contends that Jamieson provides details teaching the claimed limitation. Pet. 60–63.

Petitioner states that Jamieson discloses an architecture for configuring an OCU based on “protocol definitions provided from a robot.” Pet. 61 (quoting Ex. 1009 ¶ 2). Jamieson’s OCU processes user operations from a joystick, for example, along a control event path, and a protocol adapter generates commands to a robot according to its specific protocol. *Id.* at 61–62 (citing Ex. 1009 ¶ 51, Fig. 3; Ex. 1003 ¶¶ 191–192). Petitioner notes that Jamieson determines “the robot’s protocol adapter in the robot database 312.” *Id.* at 62 (citing Ex. 1009 ¶ 51).

As to motivation, Petitioner contends that a POSITA would have incorporated Jamieson's protocol adapter in the iPhone OCU of the Lenser and USF References for a variety of reasons. Pet. 62–65. Specifically, Petitioner contends the following: (1) Lenser describes the goal but not the details of communicating with and controlling heterogeneous remote vehicles, so one would have looked to the prior art like Jamieson for the details (Pet. 62 (citing Ex. 1003 ¶ 93); Pet. 64 (citing Ex. 1009 ¶ 99)); (2) Jamieson is in the same field as Lenser and the USF References (Pet. 62 (citing Ex. 1009 ¶ 59, Fig. 1; Ex. 1005 ¶ 87)); (3) Jamieson describes the limitations of traditional single-protocol OCUs and teaches tools for creating controller configurations for varied robot types to allow dynamic protocol switching (Pet. 63–64 (citing Ex. 1009 ¶¶ 4–5, code (57))); (4) one would have been motivated to expand the number and types of vehicles that can be controlled with a single OCU (Pet. 65 (citing Ex. 1003 ¶ 196; Ex. 1009 ¶ 35)); and (5) the capability of controlling a variety of unmanned vehicles would be beneficial for certain users (e.g., the military) who require a variety of unmanned vehicles with different capabilities on specific missions (Pet. 65 (citing Ex. 1003 ¶ 196)).

Petitioner contends that a POSITA would have had a reasonable expectation of success in combining teachings of Jamieson with those of Lenser and the USF References. Pet. 64 (citing Ex. 1003 ¶ 197). Petitioner contends that (1) Lenser, Jamieson and the USF References all describe an OCU for controlling the iRobot Packbot (*id.*); and (2) “[t]he modification of the iPhone OCU would be a software upgrade and would not require modification of the unmanned vehicles themselves because Jamieson's system allows communication with various types of legacy robots without

‘software upgrades’ to the vehicles” (Pet. 64–65 (citing Ex. 1009 ¶ 41; Ex. 1003 ¶ 197)).

Patent Owner presents no arguments for patentability specific to claim 16. *See generally* PO Resp.; Sur-Reply.

We determine that Petitioner’s evidence shows the unpatentability of claim 16 by a preponderance of the evidence for the reasons summarized above and stated in the Petition. Petitioner shows that each limitation of claim 16 is taught or suggested by the prior art, and that a person of ordinary skill in the art would have had reason to combine the references with a reasonable expectation of success in arriving at the method of claim 16.

F. Ground 3: Asserted Obviousness of Claims 7–10, 12, and 13 Based on Lenser, USF References, and Phillips

1. Claims 7–9

Petitioner contends that independent claims 7–9 each include the same preamble and limitations denoted in claim 14 as 14P and 14A–14E in Petitioner’s nomenclature. Pet. 65. Petitioner contends that each of claims 7–9 recite certain additional limitations including: “*providing a control to store a frame of the video stream as a picture on the smart phone*” [7F]; “*providing a control to command one or more cameras on the unmanned vehicle to zoom in or out*” [8F]; and “*providing one or more controls to command the unmanned vehicle to one or more predetermined poses*” [9F]. *Id.* Petitioner acknowledges that Lenser and the USF References do not explicitly disclose these features, but contends these were well-known features taught by Phillips. Pet. 65–66 (citing Ex. 1003 ¶¶ 74, 123, 125, Fig. 11).

Petitioner contends that a POSITA would have been motivated to integrate Phillips's predetermined poses functionality and camera controls into the iPhone OCU of the Lenser and USF References. Pet. 66. Petitioner contends Lenser discloses an OCU for controlling an unmanned vehicle with some level of autonomy in response to high-level commands from the OCU. *Id.* (citing Ex. 1005 ¶ 11). Petitioner notes that Lenser also discloses that a robot's pose can affect its ability to automatically traverse obstacles. Pet. 67 (citing Ex. 1005 ¶ 146). Petitioner acknowledges, however, that Lenser does not disclose how to change the pose of its vehicle. *Id.*

Petitioner contends that Phillips, filed the same day by iRobot Corporation and claiming priority to the same provisional application as Lenser, emphasizes the need to allow remote vehicles to accomplish certain behaviors autonomously, either continuously or on user command. Pet. 67 (citing Ex. 1008 ¶ 5). Petitioner also notes that Phillips discloses different poses have different advantages and benefits, such as to allow driving on bumpy or flat terrain. *Id.* (citing Ex. 1003 ¶¶ 202–203; Ex. 1008 ¶¶ 228, 235, 236; Figure 39 elements P14 and P20). According to Petitioner, Phillips's autonomous capabilities reduce training requirements and simplify operation of the UGV. Pet. 68–69 (citing Ex. 1008 ¶ 4, 127, 228, Fig. 11; Ex. 1003 ¶¶ 205).

As to motivation, Petitioner contends that a POSITA would have combined “Phillips with Lenser and the USF References to provide additional camera controls including snapshots and zooming.” Pet. 69 (citing Ex. 1003 ¶ 206). Petitioner contends that a POSITA would understand that recording snapshots based on video frames can provide valuable information about the surrounding of a robot that can be viewed at

a later time, a feature useful for reconnaissance and route clearing missions. *Id.* Petitioner further asserts that a POSITA would understand that the zoom functionality is useful in dangerous scenarios encountered by UGVs such as explosive ordinance disposal, and allows the operator to observe the UGV's surroundings without moving closer to a dangerous object or exposing the UGV's presence. *Id.*

Petitioner contends that a POSITA would have had a reasonable expectation of success in combining Phillips with Lenser and the USF References. Pet. 70 (citing Ex. 1003 ¶ 207). Petitioner argues that the combination involves simple modification to the software programs in the OCU, and merely adds a readily available zooming camera or robot arm on the vehicle. *Id.* (citing Ex. 1003 ¶ 208). Petitioner further notes that Lenser and Phillips are patent applications by the same company disclosing structurally similar remote vehicles and OCUs. *Id.* (citing Lenser Fig. 12; Phillips Fig. 1). Petitioner contends iRobot's PackBot incorporated these features before the '230 Patent's critical date. *Id.* (citing Ex. 1019; Ex. 1020 (PackBot specs); Ex. 1003 ¶ 207).

Petitioner also contends "[t]he combination is simply the user of a known technique (Phillips's poses, camera controls, and robot arm controls) to improve similar devices (the robot and OCU of the Lenser/USF References combination) in the same ways that the features improve Phillips' unmanned vehicle system." Pet. 70 (citing Ex. 1003 ¶ 209). In addition, Petitioner notes that Phillips's and Lenser's user interfaces are similar. *Id.* (citing Ex. 1005 ¶¶ 111–117, Fig. 16; Ex. 1008 ¶¶ 123–130, Fig. 12).

Petitioner contends that the preamble P and limitations A–E of claims 7–9 correlate identically to the preamble and limitations of claim 14 and thus are taught by the combination of Lenser and the USF References in the same manner set forth for claim 14. Pet. 71 (citing Ex. 1003 ¶¶ 83–115).

For claim 7, Petitioner contends that Phillips discloses “snap shot recordings” using a robot’s handheld controller by selecting the “SNAP SHOT” icon in Figure 11 to capture a video frame stored locally on the smart phone. Pet. 72 (citing Ex. 1008 ¶¶ 88, 123, 126; Ex. 1003 ¶ 219). Petitioner contends that the combination of Lenser, the USF References, and Phillips discloses “*providing a control to store a frame of the video stream as a picture on the smart phone*” [7F]. *Id.* (citing Ex. 1003 ¶¶ 218–219).

For claim 8, Petitioner notes that Phillips’s user interface provides a control to command a camera to zoom in and out. Pet. 73 (citing Ex. 1008 ¶¶ 107, 110, 123; Fig. 11). Petitioner contends that the combination of Lenser, the USF References, and Phillips discloses “*providing a control to command one or more cameras on the unmanned vehicle to zoom in or out*” [8F]. *Id.* (citing ¶¶ 227–229).

For claim 9, Petitioner notes that Phillips’s OCU interface provides icons that allow the vehicle to perform “a variety of autonomous assist options such as predefined poses” which are stored in memory in advance of their initiation by the operator. Pet. 74 (citing Ex. 1008 ¶ 125, Fig. 11; Ex. 1003 ¶ 238). Operator selection of an icon commands the robot into the pose which it does autonomously without the operator having to manipulate the controls. Pet. 75 (citing Ex. 1008 ¶¶ 227–245; Ex. 1003 ¶ 239, Fig. 14). Petitioner notes that Phillips discloses several examples of poses. Pet. 75–76 (citing Ex. 1008 ¶¶ 143, 227–238, Figs. 14, 39, 40). Petitioner contends that

the combination of Lenser, USF References and Phillips therefore discloses “providing one or more controls to command the unmanned vehicle to one or more predetermined poses” [9F]. Pet. 76 (citing Ex. 1003 ¶¶ 237–241).

2. *Claim 10*

Petitioner asserts that the combination of Lenser, USF References, and Phillips discloses claim 10’s “*displaying the controls and a geographic map on the display screen within the smart phone.*” Pet. 77 (citing Ex. 1003 ¶¶ 242–244). Specifically, Petitioner asserts that Lenser’s initial screen in Figure 14A includes a map view window showing a map of the remote vehicle’s environment, and also shows controls for the vehicle’s brakes. *Id.* (citing Ex. 1005 ¶ 105, Fig. 14A).

3. *Claim 12*

Petitioner asserts that the combination of the Lenser, USF References, and Phillips discloses claim 12’s “*receiving information to rotate the unmanned vehicle.*” Pet. 78 (citing Ex. 1003 ¶ 246). Specifically, Petitioner asserts that the bottom right portion of Lenser’s Figure 16 is a touch screen, and the “x-axis of the screen can be manipulated by the user to control the amount of turning compared to translation.” Pet. 78–79 (quoting Ex. 1005 ¶¶ 115–116) (alteration in original). Petitioner contends that when the operator manipulates the x-axis of the screen, the OCU “*receiv[es] information to rotate the unmanned vehicle.*” Pet. 79 (citing Ex. 1003 ¶ 246) (alteration in original).

4. *Claim 13*

Petitioner contends that while Lenser does not refer to its flippers as robotic arms, Phillips discloses that its UGV has robotic arms whose movement is controlled by commands to the robot. Pet. 79 (citing Ex. 1005,

¶ 257; Ex. 1008 ¶¶ 160, 181, Figs. 20, 29A). Petitioner asserts that Phillips thus discloses “*receiving information to move a robotic arm on the vehicle.*” *Id.* (citing Ex. 1003 ¶¶ 249–252).

5. *Conclusion for Ground 3*

Patent Owner presents no arguments for patentability specific to claims 7–10, 12, and 13. *See generally* PO Resp.; Sur-Reply.

We determine that Petitioner shows by preponderance of the evidence that claims 7–10, 12 and 13 are unpatentable for the reasons summarized above and stated in the Petition. Petitioner makes a sufficient showing that each limitation of claims 7–10, 12, and 13 is taught or suggested by the combination of Lenser, the USF References, and Phillips, and that a person of ordinary skill in the art had reason to combine the references, with a reasonable expectation of success in arriving at methods of claims 7–10, 12, and 13.

G. *Ground 4: Asserted Obviousness of Claim 11 Based on Lenser, the USF References, Phillips, and Nielsen*

1. *Petitioner Contentions*

Claim 11 depends from claim 9 and recites “*displaying one or more arrows, the video stream, and the controls on the display within the smart phone, wherein the one or more arrows indicate a heading for the unmanned vehicle such that the unmanned vehicle can reach a specified location.*” Ex. 1001, 11:6–11 (emphasis added). Petitioner contends that, although Lenser does not disclose one or more arrows indicating a heading such that the unmanned vehicle can reach a specified location, Nielsen does disclose this limitation. Pet. 81.

Specifically, Petitioner contends that Nielsen discloses a graphical user interface that displays a map of the environment proximate the robot. Pet. 81 (citing Ex. 1010, code (57), 5:8–11). Petitioner contends Nielsen’s interface uses a “vector 1318 between the robot and the second position 1330B of the navigation target.” *Id.* (citing Ex. 1010, 40:33–35). Petitioner asserts Nielsen further discloses that as the user drags the second position 1330B around, the vector 1318 updates to instruct “the robot on how to move to achieve the new second position.” *Id.* (citing Ex. 1010, 40:38–43). Petitioner contends Nielsen therefore discloses an arrow (vector 1318) that indicates a heading for the unmanned vehicle such that it can reach a specified location (second position 1330B). *Id.* (citing Ex. 1003 ¶¶ 255–256).

Petitioner contends that a POSITA would have been motivated to combine Nielsen’s Figure 21 to replace the lower left of Lenser’s Figure 16, and that the combined system would display the arrows, live video stream, and controls simultaneously. Pet. 81–82 (citing Ex. 1003 ¶¶ 257–262). Specifically, Petitioner contends that Nielsen is analogous art in the field of remote control of unmanned vehicles. Pet. 82–83. Petitioner contends that a POSITA would have been motivated to enhance Lenser’s interface to assist the operator with setting navigation targets and understanding where and how the robot is moving toward the targets. Pet. 82 (citing Ex. 1005 ¶¶ 116–117, 214–216, 218, Figs. 27–28; Ex. 1003 ¶ 258). Petitioner contends that a POSITA would have been motivated to add this functionality to allow the smart phone OCU operator to adjust the target if the robot took an undesired heading. Pet. 83 (citing Ex. 1003 ¶ 258).

Petitioner also contends that Phillips motivates the combination by disclosing a robot heading arrow on the right side of Figure 11, as well as heading arrows of prior mission movements in Figure 12. Pet. 83–84 (citing Ex. 1008 ¶¶ 125–126; Ex. 1003 ¶¶ 259–260).

Petitioner contends that a POSITA would have had a reasonable expectation of success because Nielsen demonstrates the feasibility of adding a heading arrow to the display, and teaches a similar control mechanism as Lenser’s waypoints behavior. Pet. 85 (citing Ex. 1010, 40:22–43, Fig. 21; Ex. 1003 ¶ 261).

Petitioner further contends that claim 11 recites no more than a combination of prior art elements (Nielsen’s vector arrow and Lenser’s target heading) according to known methods (displaying the arrow relative to the robot as shown in Nielsen) to yield predictable results (a graphical display of the robot’s heading relative to a navigation target). Pet. 86.

2. *Patent Owner Arguments*

Patent Owner argues for patentability of claim 11 on the basis that Lenser does not disclose the use of one or more arrows indicating a heading such that the unmanned vehicle can reach a specified location. PO Resp. 40. Patent Owner’s argument attacks Lenser individually and does not properly consider its combination with the other references, particularly Nielsen. *See Keller*, 642 F.2d at 425. Patent Owner also attacks the USF References individually and does not address what a POSITA would have understood from the combination. PO Resp. 41.

Patent Owner further argues that the ’230 Patent requires continuous display of its heading arrow, whereas Nielsen’s vector is only present upon change of the target location. PO Resp. 43–44 (citing Ex. 1001, 8:31–34).

As discussed in Section II.C.2, we determine this argument is not supported by the '230 Patent, which states that the arrow appears on the screen when the operator taps the object's location. Thus, claim 11 does not require that the arrow is continuously displayed.

In addition, Patent Owner argues that the '230 Patent indicates the heading for a specified location to which the unmanned vehicle is to move in the future, and not merely indicating the direction in which the unmanned vehicle currently happens to be facing or traveling towards. PO Resp. 44. We considered this argument in Section II.C.2 and do not agree with it. Just like the '230 Patent, Nielsen's vector 1310 indicates the direction of travel to the specified location 1330B. Ex. 1010, 40:38–43, Fig. 21. Patent Owner's argument does not expose any deficiency in Petitioner's evidence that the combination teaches claim 11.

Patent Owner criticizes Phillips as disclosing arrows indicating direction of travel or previous mission paths. PO Resp. 44–46. Petitioner acknowledged this difference and combined Nielsen for its teaching of the arrow indicating the direction of travel to a specified location. Consequently, Patent Owner's argument does not show any weakness in Petitioner's evidence that claim 11 is unpatentable.

Patent Owner argues generally that Petitioner has not shown that one would have been motivated to combine the prior art references; that Petitioner's argument is formulaic; that Petitioner's expert testimony adds little to Petitioner's argument; and that Petitioner offers no explanation for why a POSITA would have found claim 11 "as a whole" obvious. PO Resp. 48. However, Patent Owner does not address with sufficient particularity any flaw in Petitioner's stated reasons to combine the prior art references,

which reasons we find persuasive as explained above. Consequently, Patent Owner's arguments do not overcome Petitioner's showing that claim 11 is unpatentable.

3. *Conclusion for Ground 4*

We have considered Patent Owner's arguments for patentability of claim 11 but determine that they do not outweigh Petitioner's evidence of unpatentability.

We determine that Petitioner shows by preponderance of the evidence that claim 11 is unpatentable for the reasons summarized above and stated in the Petition. Petitioner makes a sufficient showing that each limitation of claim 11 is taught or suggested by the combination of the Lenser, the USF References, Phillips, and Nielsen, and that a person of ordinary skill in the art had reason to combine the references, with a reasonable expectation of success in arriving at the method of claim 11.

H. *Ground 5: Asserted Obviousness of Claims 1, 3, 4, and 6 Based on Lenser, USF References, and Miyazawa*

1. *Claim 1*

Petitioner contends that claim 1 includes an identical preamble and common limitations A–E as recited in claim 14 as limitations 14P, 14A–14E respectively. Pet. 86. Petitioner notes that claim 1 further recites the following “RF transmitter” limitations:

[1F] transmitting, by the smart phone, an initiation request via a cable to a rf transmitter;

[1G] transmitting, by the rf transmitter, the initiation request to the unmanned vehicle;

[1H] receiving, by the rf transmitter, a message from the unmanned vehicle; and

[11] transmitting, by the rf transmitter, the message from the unmanned vehicle to the smart phone via the cable to the smart phone.

Id. Petitioner contends the combination of Lenser, USF References, and Miyazawa discloses these “*rf transmitter*” limitations. Pet. 87, 90–91 (citing Ex. 1003 ¶¶ 83–115, 273–278).

Petitioner contends that a POSITA would have been motivated to combine Miyazawa’s RF transmitter with the iPhone OCU of the Lenser and the USF References. Pet. 88 (citing Ex. 1003 ¶¶ 268–272). Petitioner contends that Lenser discloses an OCU simultaneously receiving high-rate video and communicating low-rate control signals to a UGV, and notes that video signals can burden wireless systems by using excessive bandwidth. Pet. 88 (citing Ex. 1005 ¶¶ 111–118; Ex. 1003 ¶ 268). Petitioner contends that a POSITA would have known that using the same wireless communication system for video and control signals is risky, particularly in dangerous missions encountered by Lenser’s UGV, and could force unexpected delays in control signals, making it difficult to remotely control the vehicle. *Id.* Petitioner contends that Lenser’s solution of turning off the video signal “does not address situations where both the video signal and a fast, reliable control signal are necessary to the mission.” Pet. 88–89. Petitioner contends a POSITA therefore would have looked to the prior art for a solution to allow fast, reliable control signaling without having to disable video. Pet. 89.

Petitioner contends that a POSITA would have been motivated to combine Miyazawa with the iPhone OCU because the resulting system separates the wireless communication for the low-rate vehicle control signals from the high-rate video signals, as taught by Miyazawa, such that the video

signal would not affect the reliability or latency of the vehicle control signal. Pet. 89 (citing Ex. 1003 ¶ 269). Petitioner contends a POSITA would have recognized further benefits in the combination because of the varied terrain scenarios contemplated by Lenser, because connecting the OCU to an RF transmitter via a cable expands the available communication options outside of those built-in to the OCU, and because low throughput protocols consume less energy than sending the same control signals over a network capable of handling high-rate video signals. Pet. 89 (citing Ex. 1003 ¶ 269).

Petitioner contends a POSITA would have had a reasonable expectation of success in combining Miyazawa with Lenser and the USF References. Pet. 89 (citing Ex. 1003 ¶ 269). Petitioner contends that Miyazawa, like Lenser, discloses remote control of an unmanned vehicle using a mobile device (Pet. 89–90 (citing Ex. 1012, code (57))); uses wireless communication to control the vehicle and provides a video feed from the vehicle to the mobile device (Pet. 90 (citing Ex. 1005 ¶¶ 89, 95, 111–117, Figs. 13, 16; Ex. 1012 ¶¶ 29, 35, 38, 41, Fig. 1)); and uses preexisting technologies for low-rate wireless communications (Pet. 90 (citing Ex. 1012 ¶ 29; Ex. 1003 ¶ 270)). Petitioner further asserts that a POSITA would have known that cables could be connected to iPhones for communication with other devices (Pet. 90 (citing Ex. 1003 ¶ 270)).

Petitioner further contends that the combination results from application of a known technique (Miyazawa’s separate transmitters/receivers for control signals and video signals) to a known device (the Lenser/USF OCU) ready for improvement to yield the predictable result of a system with a video signal that does not impede the vehicle control signal. Pet. 90 (citing Ex. 1003 ¶ 271).

Turning to the RF transmitter limitations, Petitioner notes that claim 1 recites “*transmitting, by the smart phone, an initiation request via a cable to a rf transmitter*” [1F]. Pet. 91. Petitioner contends Miyazawa’s mobile phone 10 is connected to controller 30 by a cable. Pet. 92 (citing Ex. 1012 ¶ 38). Petitioner contends Miyazawa’s controller 30 is an RF transmitter because it includes transmitting means that transmits short wave signals, signals for a radio controlled car, keyless entry, or the like. *Id.* (citing Ex. 1012 ¶ 29, Fig. 1; Ex. 1003 ¶ 281). Petitioner asserts that Miyazawa’s mobile phone transmits control signals, such as instructions to move the remote vehicle, to the RF transmitter via a cable. *Id.* (citing Ex. 1012 ¶ 41; Ex. 1003 ¶ 282). Petitioner contends that because Miyazawa’s cable connects the phone to the controller via connection I/F 17, this instruction signal is “*transmitted . . . via a cable to an RF transmitter.*” *Id.* (citing Ex. 1012 ¶¶ 37–38; Ex. 1003 ¶ 282) (alterations in original).

Petitioner contends that the initiation request may be part of the establishment of wireless communications, or it may be considered an initiation request because it initiates actions by the UGV. Pet. 91–93 (citing Ex. 1005 ¶ 99; Ex. 1007; Ex. 1003 ¶¶ 279–280, 282–283). As examples of initiating actions, Petitioner notes Miyazawa’s phone transmits a signal to start or stop recording by the imaging means, or to instruct the imaging means to start transmission of a video signal. Pet. 93 (citing Ex. 1012 ¶¶ 35, 42, 44; Ex. 1003 ¶ 283). The ’230 Patent may be read to imply that the initiation request is part of establishing communications, but claim 1 recites that the establishing communication and RF transmitter steps are not the same step. *See* Ex. 1001, 4:59–5:7. Regardless of whether the initiation request is part of or separate from the establishing communication step,

Petitioner contends the combination of Lenser, the USF References, and Miyazawa disclose limitation 1F of claim 1. Pet. 93 (citing Ex. 1003 ¶¶ 279–284).

Petitioner notes that claim 1 further recites “*transmitting, by the rf transmitter, the initiation request to the unmanned vehicle*” [1G]. Pet. 93. As discussed, Petitioner contends that Miyazawa’s controller is an RF transmitter that establishes a wireless communication link and communicates requests to initiate actions by the UGV. Pet. 93–94 (citing Ex. 1012 ¶¶ 41–42; Ex. 1003 ¶¶ 282–283, 285–286).

Petitioner notes that claim 1 further recites “*receiving, by the rf transmitter, a message from the unmanned vehicle*” [1H]. Pet. 94. Petitioner notes that Lenser discloses the receipt of “message[s] from the unmanned vehicle” including “operation complete” and “robot is stuck.” *Id.* (Ex. 1005 ¶ 90; Ex. 1003 ¶ 287). Petitioner contends that “[a] POSITA would have been motivated to communicate these messages from the UGV to the OCU using the low-rate, high-reliability control path between the RF transmitter and the UGV because the messages provide control-related feedback to the OCU and do not require high data rates associated with video signals.” *Id.* (citing Ex. 1003 ¶ 287). Petitioner further contends that a POSITA would have been motivated to implement a two-way link because Miyazawa does not limit the control path to one-way links, and two-way links were common and well-known. *Id.* (citing Ex. 1003 ¶ 288). Petitioner further notes that Miyazawa discloses embodiments that communicate the video signal over the same link as the control signal, which would require a two-way link. *Id.* (citing Ex. 1012 ¶ 69, Fig. 5). Petitioner contends that, when sent from the UGV on the control link of the combined control system,

Lenser's feedback messages would be "*receiv[ed] by the rf transmitter.*" Pet. 94–95 (citing Ex. 1003 ¶ 288). Petitioner contends that the combination of Lenser, the USF References, and Miyazawa thus discloses "*receiving, by the rf transmitter, a message from the unmanned vehicle*" [1H]. Pet. 95 (citing Ex. 1003 ¶¶ 287–289).

Claim 1 further recites "*transmitting, by the rf transmitter, the message from the unmanned vehicle to the smart phone via the cable to the smart phone*" [1I]. Ex. 1001, 10:5–7. Petitioner contends that it established that a POSITA would have been motivated to communicate Lenser's feedback messages from the remote vehicle to an RF transmitter such as Miyazawa's controller 30. Pet. 95 (citing Ex. 1003 ¶¶ 287–289). Petitioner contends that a POSITA similarly would have been motivated to transmit these feedback messages from the RF transmitter to the OCU via the cable to complete communication of the message from the remote vehicle to the OCU. Pet. 95 (citing Ex. 1003 ¶ 290). Petitioner concludes that the combination of Lenser, the USF References, and Miyazawa discloses limitation 1I.

2. Claim 3

Petitioner contends Lenser discloses that the OCU can communicate with the remote vehicle through a wireless LAN. Pet. 96 (citing Ex. 1005 ¶ 287, Fig. 13). Petitioner contends the combination of Lenser, the USF References, and Miyazawa therefore discloses "*establishing communication with the unmanned vehicle via a wireless local area network*" as recited in claim 3. *Id.* (citing Ex. 1003 ¶¶ 292–294).

3. *Claim 4*

Petitioner contends the combination of Lenser, USF References, and Miyazawa discloses “*providing a joystick for governing the acceleration, deceleration, and direction of travel of the unmanned vehicle*” as recited in claim 4. Pet. 96 (citing Ex. 1003 ¶¶ 297–299). Referring to Lenser’s Figure 16, Petitioner contends an operator can manipulate the y-axis on the screen to control the speed of the robot and the x-axis to control the amount of turning relative to translation, and that these actions amount to “*governing the acceleration, deceleration, and direction of travel of the unmanned vehicle.*” Pet. 96–97 (citing Ex. 1004 ¶ 116; Ex. 1003 ¶ 297).

Petitioner further contends Lenser’s touchscreen control in Figure 16 (lower right) is similar to the ’230 Patent’s software joystick in Figure 4A (lower left). Pet. 97 (citing Ex. 1001, 6:51; Ex. 1005 ¶ 116; Ex. 1003 ¶ 297). Petitioner notes that Lenser also discloses a physical joystick (Fig. 9) that could be used with its OCU. *Id.* Petitioner contends that a POSITA would have been motivated to provide a physical joystick as a peripheral with the iPhone OCU to provide more precise control of vehicle movement. *Id.* at 98 (citing Ex. 1003 ¶ 298). Petitioner contends that the combination renders claim 4 obvious. Pet. 99.

4. *Claim 6*

Petitioner contends that the combination of Lenser, USF References, and Miyazawa discloses “*providing a control to set a maximum speed of the unmanned vehicle*” as recited in claim 6. Pet. 99 (citing Ex. 1003 ¶¶ 300–301). Specifically, Petitioner contends that Lenser’s Figure 16 shows a selection box to select a maximum translation speed of the remote vehicle. Pet. 99–100 (citing Ex. 1005 ¶ 116).

5. *Conclusion for Ground 5*

Patent Owner presents no arguments for patentability specific to claims 1, 3, 4, and 6. *See generally* PO Resp.; Sur-Reply.

We determine that Petitioner shows by preponderance of the evidence that claims 1, 3, 4, and 6 are unpatentable for the reasons summarized above and stated in the Petition. Petitioner makes a sufficient showing that each limitation of these claims is taught or suggested by the combination of the Lenser, the USF References, and Miyazawa, and that a person of ordinary skill in the art had reason to combine the references, with a reasonable expectation of success in arriving at methods recited in these claims.

I. *Ground 6: Asserted Obviousness of Claim 2 based on Lenser, USF References, Miyazawa, and Jamieson*

Claim 2 depends from claim 1 and recites “*receiving, by the smart phone, information to direct the unmanned vehicle [2A]; converting, by the smart phone, the information into a protocol recognizable by the unmanned vehicle [2B]; and transmitting, by the smart phone, the converted information to the unmanned vehicle [2C].*” Ex. 1001, 10:8–15 (emphasis added). Petitioner notes that the subject matter of claim 2 is substantially the same as that of claim 16. Pet. 101. Petitioner contends that Lenser’s Figure 16 (bottom right) can be manipulated by the operator to control the speed and turning of the remote vehicle, and that when the operator manipulates the controls, the iPhone OCU of the combination “*receiv[es] . . . information to direct the unmanned vehicle.*” *Id.* (citing Ex. 1003 ¶ 303) (alterations in original).

Petitioner further notes that Jamieson receives a control event generated by user interactivity with a user interface device such as a joystick

constituting “*information to direct the unmanned vehicle*” received by the smart phone OCU in the combined system. Pet. 102 (citing Ex. 1009 ¶ 48; Fig. 3; Ex. 1003 ¶ 304). Petitioner contends the combination therefore discloses “*receiving, by the smart phone, information to direct the unmanned vehicle*” [2A]. Pet. 102–103 (citing Ex. 1003 ¶¶ 303–304).

Petitioner further notes that Jamieson’s control event is converted into a robot-specific network packet and transmitted to the robot. Pet. 103 (citing Ex. 1009 ¶¶ 42, 51–52, Fig. 3; Ex. 1003 ¶¶ 304–307). Petitioner thus contends that the combination discloses “*converting, by the smart phone, the information into a protocol recognizable by the unmanned vehicle*” [2B] and “*transmitting, by the smart phone, the converted information to the unmanned vehicle*” [2C]. Pet. 104 (citing Ex. 1003 ¶¶ 305–307).

Petitioner contends that, as noted in Ground 2 (*see* Section II.E), Lenser’s controlling heterogeneous unmanned vehicles with different capabilities would have motivated a POSITA to look to the prior art for teachings relating to control of various unmanned vehicles within a single OCU. Pet. 104 (citing Ex. 1005 ¶ 99; Ex. 1003 ¶¶ 194–196, 310). Petitioner contends that a POSITA would have combined Jamieson with Lenser, the USF References, and Miyazawa for the same reasons as discussed in Ground 2. Pet. 104 (citing Ex. 1003 ¶¶ 310, 193–197).

Patent Owner presents no arguments for patentability specific to claim 2. *See generally* PO Resp.; Sur-Reply.

We determine that Petitioner shows by preponderance of the evidence that claim 2 is unpatentable for the reasons summarized above and stated in the Petition. Petitioner makes a sufficient showing that each limitation of these claims is taught or suggested by the combination of the Lenser, the

USF References, Miyazawa, and Jamieson, and that a person of ordinary skill in the art had reason to combine the references, with a reasonable expectation of success in arriving at the claimed method.

J. Ground 7: Asserted Obviousness of Claim 5 based on Lenser, USF References, Miyazawa, and Phillips

Petitioner asserts that the combination of Lenser, USF References, Miyazawa, and Phillips discloses “*providing a controller to govern movement of one or more robot arms of the unmanned ground vehicle*” as recited in claim 5. Pet. 104 (citing Ex. 1003 ¶¶ 310–317). Petitioner notes that Phillips discloses a UGV having controllable arms, and that an operator controls the arms by sending drive commands to the mobile robot. *Id.* (citing Ex. 1008 ¶¶ 160, 181). Petitioner contends Phillips’s Figure 20 shows upper and lower robot arms whose movements are governed by a controller. Pet. 105 (citing Ex. 1008 ¶ 160; Ex. 1003 ¶¶ 314–316).

Petitioner contends a POSITA would have been motivated to combine Lenser, USF References, Miyazawa, and Phillips to add a robot arm to the unmanned vehicle and provide control of the robot arm on the OCU. Pet. 105 (Ex. 1003 ¶ 313). Petitioner further contends a POSITA would have been motivated to make this combination to enhance the functionality of Lenser’s robot, allowing it to grasp or manipulate objects in the mobile robot’s environment. Pet. 105–106 (citing Ex. 1008 ¶¶ 159–160, 181–182; Ex. 1003 ¶ 313).

Patent Owner presents no arguments for patentability specific to claim 5. *See generally* PO Resp.; Sur-Reply.

We determine that Petitioner shows by preponderance of the evidence that claim 5 is unpatentable for the reasons summarized above and stated in

the Petition. Petitioner makes a sufficient showing that each limitation of the claim is taught or suggested by the combination of the Lenser, the USF References, Miyazawa, and Phillips, and that a person of ordinary skill in the art had reason to combine the references, with a reasonable expectation of success in arriving at methods recited in this claim.

III. CONCLUSION¹³

For the reasons discussed above, we conclude:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
14, 15, 16, 17	103	Lenser, USF References	14, 15, 16, 17	
16	103	Lenser, USF References, Jamieson	16	
7–10, 12, 13	103	Lenser, USF References, Phillips	7–10, 12, 13	
11	103	Lenser, USF References, Phillips, Nielsen	11	
1, 3, 4, 6	103	Lenser, USF References, Miyazawa	1, 3, 4, 6	

¹³ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

2	103	Lenser, USF References, Miyazawa, Jamieson	2	
5	103	Lenser, USF References, Miyazawa, Phillips	5	
Overall Outcome			1–18	

IV. ORDER

For the foregoing reasons, it is

ORDERED that claims 1–18 of the '230 Patent are unpatentable;

FURTHER ORDERED that, because this is a Final Written Decision, 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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