

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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Exotec Product France SAS,  
Exotec North America Inc., and  
Exotec Product USA Inc.,  
Petitioners

v.

Opex Corporation,  
Patent Owner

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Case No. IPR2024-00850  
U.S. Patent No. 11,472,632 B2

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**PETITIONERS' REPLY TO PATENT OWNER RESPONSE**

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Patent Trial and Appeal Board  
US Patent and Trademark Office  
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| <b>Exhibit</b> | <b>Short Name</b>   | <b>Description</b>                                                                                                                                                                                                                                                                                                                                           |
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| Ex. 1001       | '632 Patent         | U.S. Patent No. 11,472,632 B2                                                                                                                                                                                                                                                                                                                                |
| Ex. 1002       | '632 File History   | Prosecution History of U.S. Patent No. 11,472,632 B2                                                                                                                                                                                                                                                                                                         |
| Ex. 1003       | Derby Declaration   | Declaration of Dr. Stephen Derby                                                                                                                                                                                                                                                                                                                             |
| Ex. 1004       | Derby CV            | Curriculum vitae of Dr. Stephen Derby                                                                                                                                                                                                                                                                                                                        |
| Ex. 1005       | Raizer              | U.S. Patent Appl. Publ. No 2017/0158430                                                                                                                                                                                                                                                                                                                      |
| Ex. 1006       | Hangzhou            | English Translation of CN Patent Publication No. CN 109987366A and Certificate of Translation                                                                                                                                                                                                                                                                |
| Ex. 1007       |                     | CN Patent Publication No. CN 109987366A                                                                                                                                                                                                                                                                                                                      |
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| Ex. 1009       | Singhose Deposition | Transcript of Deposition of Dr. Singhose, April 29, 2025                                                                                                                                                                                                                                                                                                     |
| Ex. 1010       |                     | Drawing #1 from Singhose Deposition ("Singhose 01")                                                                                                                                                                                                                                                                                                          |
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| Ex. 1012       |                     | "iRobot Reports Fourth-Quarter and Full-Year 2021 Financial Results,"<br><a href="https://investor.irobot.com/news-releases/news-release-details/irobot-reports-fourth-quarter-and-full-year-2021-financial">https://investor.irobot.com/news-releases/news-release-details/irobot-reports-fourth-quarter-and-full-year-2021-financial</a><br>(Feb. 9, 2022) |

## I. INTRODUCTION

Patent Owner Opex’s (“Opex”) Response (“POR”) does not dispute that the limitations of the challenged claims are taught by *Raizer* and *Hangzhou*. Rather than accept that *Raizer* and *Hangzhou*—two autonomous robot systems that are directed to similar tasks—are readily combinable, Opex attempts to undercut the reasonable expectation of success by contriving complexities that strain reasonableness. Opex mischaracterizes and ignores clear disclosures in the references to advance alleged disadvantages with combining the references that are unsupported and immaterial, as confirmed by Opex’s expert. Opex further attempts to stretch controlling precedent, to no avail.

The Board should reject Opex’s arguments. POR, 1-3.

### A. The Petition demonstrates a motivation to combine.

The Petition goes well beyond Opex’s allegations of “general attributes of warehouse technology” (*see* POR 21-23) and demonstrates several reasons that would have motivated a POSITA to combine *Raizer* and *Hangzhou*. Indeed, the Board recognized “Petitioner contends that there are *various reasons* why a skilled artisan would have sought to combine the teachings of *Raizer* and *Hangzhou*.” Paper 11 (“Decision”), 27; Petition, 6-9. These rationales included at least the following: “it is a known and recognized practice to provide pathways (e.g., auto-guided trolley passage spaces 112) underneath shelving units for movement of automated trolleys

or robots” (Ex. 1006 ¶[0048], Petition 7, Ex. 1003, ¶109); “[i]t was well known to elevate the shelving units above the floor so that robots loaded with containers can travel underneath thereby allowing for more flexible route planning and the elimination of bottlenecks” (Ex. 1003 ¶107; *see also id* at Section VI, ¶¶45–53); running “robots in passage spaces beneath the shelves, would achieve maximum flexibility in maneuvering the robots along the warehouse floor and eliminating bottlenecks” (Petition, 7; Ex. 1003, ¶¶109-110); “the vertical travel flexibility of Raizer’s robots eliminates the need for Hangzhou’s stacking vehicles because Raizer’s robots themselves can pick and place containers on upper shelves, thereby making this combination even more useful” (Petition, 7; Ex. 1003, ¶111).

***i. A POSITA would have combined Raizer and Hangzhou.***

Opex alleges that the Petition fails to describe “why a POSITA would have modified *Raizer* and *Hangzhou* in combination.” POR, 24. However, the Petition sets forth several reasons why a POSITA would have combined *Raizer* and *Hangzhou*. *see InTouch Techs., Inc. v. VGO Commc’ns, Inc.*, 751 F.3d 1327, 1352 (Fed. Cir. 2014).

A POSITA was well aware of the design need for autonomous robot warehouse systems to decrease congestion, avoid autonomous robot collisions, and maximize space utilization. Petition, 6; Ex. 1003, ¶¶105-107. A POSITA would have relied on *Raizer* that focused on improving automated systems for warehouse

management and disclosed autonomous robots configured to travel both horizontally along the floor of the warehouse and along a network of vertical and horizontal rails. Petition, 6-7; Ex. 1003, ¶¶103-104.

A POSITA would have turned to *Hangzhou* and its teaching of routing autonomous robots in passage spaces beneath the shelves to provide added travel pathways. Petition, 7-9; Ex. 1003, ¶¶108-110. These additional travel pathways are needed as more autonomous robots are added to take advantage of taller shelving units due to increased available storage space. Petition, 6-7; Ex. 1003, ¶106. Indeed, elevating shelves for under-shelf robot travel was known. Petition, 6-7; Ex. 1003, ¶107 (“It was well known to elevate the shelving units above the floor so that robots loaded with containers can travel underneath thereby allowing for more flexible route planning and the elimination of bottlenecks.”); *see also* Ex. 1003, ¶49 (“Goren describes ‘further enhanc[ing]’ capabilities of the systems and robots ‘by elevating the shelving units above the floor, for example on legs high enough so that a floor robot loaded with a container can travel beneath the shelves.’”); *see also* Ex. 1006, FIGs., 2, 3, 4 (*Hangzhou*’s under-rack travel without any shelf height adjustment required); Ex. 1005, FIG. 12 (*Raizer* showing lower shelves of sufficient height for under shelf travel); Ex. 1003, ¶¶47-53 (describing Goren (Ex. 1008), including Fig. 1, and shelves sufficient for under-shelf travel); *see also* Ex. 2006, 81:3-6. As the Board understood, a POSITA would have known that “shelving units may be

arranged in numerous configurations and that the prior art of record provides reasons for configurations that allow for the creation of undershelf pathways for robot transit.” Decision, 27-29.

A POSITA would have been motivated to combine these references. Petition, 8-9; Decision, 19-20, 27.

***ii. The Petition demonstrates that the combination is obvious.***

It is well settled that, “if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious.” *KSR Int’l Co. v. Teleflex Inc.*, 550, U.S. 398, 417 (2007); Petition, 8-9.

The Petition demonstrates that the combination is obvious because the combination relies on a known solution—under-rack travel and the turning and routing of *Hangzhou*—that improves a similar system—*Raizer* and *Hangzhou* are similar systems—in the same way the solution would improve other known systems—reducing congestion and preventing traffic jams. Petition, 7-8; Ex. 1003, ¶¶112-114; Decision, 23.

***iii. The Petition demonstrates that the choice of routing is an obvious matter of design choice.***

The ’632 Patent discloses no benefit, unexpected result, or criticality of choice of a particular robot routing. Petition, 9 (*citing In re Kuhle*, 526 F.2d 553, 555

(C.C.P.A. 1975)); Ex. 1003, ¶101 (“...in view of the disclosures of *Raizer* and *Hangzhou* indicating the robots and trolleys can travel throughout a warehouse, the choice of routing (e.g., turning, under racks, in, across, or parallel to aisles) is an obvious matter of design choice.”). Both *Raizer* and *Hangzhou* disclose robots and trolleys traveling throughout a warehouse and in ways that reduce congestion and prevent traffic jams. *Id.* Thus, the choice of robot routing is an obvious matter of design choice within the skill of a POSITA. *Id.*

**B. The Petition demonstrates a reasonable expectation of success in combining *Raizer* and *Hangzhou*.**

Opex argues that the Petition “failed to provide adequate disclosure of [the] proposed modified system,” and “improperly identified only singular elements from each of the references, instead of describing an actual proposed system,” all while shifting between case citations that do not actually support their arguments. POR, 29-31, 45. Opex’s unsupported and contrived complexities cannot help it escape the simple fact that *Raizer* and *Hangzhou* are readily combinable with a clear expectation of success. The proposed and straightforward combination of *Raizer* and *Hangzhou* is amply set forth in the Petition. Petition, 6-9; Ex. 1003, ¶¶110-111.

The straightforward nature of the proposed combination is the epitome of reasonableness—*Raizer*’s robots, which *Raizer* discloses as being able to navigate anywhere along the floor of a warehouse, with *Hangzhou*’s teaching of routing such

robots under the shelves of the warehouse and across aisles. *See* Petition, 6-9; Ex. 1003, ¶¶110-111; *see also* Ex. 2006 87:16-89:25 (Dr. Spenko’s confirmation that the combination involves *Raizer’s* robots and *Hangzhou’s* teaching of robot travel under the shelves and across and parallel to aisles).<sup>1</sup>

The Petition explains that “[a] POSITA would have understood that combining the *Raizer* autonomous robots, which move both horizontally and vertically, with *Hangzhou’s* teaching of running such robots in passage spaces beneath the shelves, would achieve maximum flexibility in maneuvering the robots along the warehouse floor and eliminating bottlenecks.” Petition, 7; Ex. 1003, ¶¶109-111. A “POSITA would have also understood that the vertical travel flexibility of *Raizer’s* robots eliminates the need for *Hangzhou’s* stacking vehicles because *Raizer’s* robots themselves can pick and place containers on upper shelves, thereby making this combination even more useful.” *Id.*

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<sup>1</sup> Opex’s expert confirmed that the floor extends under the racks in the ’632 Patent. *see* Ex. 1009, 36:16-18. This confirmation is notable given *Raizer’s* express teaching that its robots are autonomous and “can be steered by its control system to *any location on the floor* of the warehouse[.]” Ex. 1005, ¶[0104] (emphasis added); *see also* Ex. 2006, 88:9-13; Ex. 1003, ¶¶104-105.

The Petition goes on, “[a] POSITA would have known that implementing the under-rack travel and turning routing of *Hangzhou* with *Raizer*’s autonomous robots having three-dimensional navigation and travel capabilities would have led to a predictable result of reducing congestion and preventing traffic jams as taught by both *Raizer* and *Hangzhou*.” Petition, 8; Ex. 1003, ¶¶110, 114.

Opex cites to *Intelligent Bio-Systems*, alleging that “ambiguities [in the Petition] leave the Board and the Patent Owner to guess as to how Exotec’s proposed combination would operate.” POR, 30 (citing *Intelligent Bio-Systems, Inc. v. Illumina Cambridge, Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016)). However, a “conclusion of obviousness requires a reasonable expectation of success,” and that, “[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, *predictable* solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.” *Id.* (citing *KSR Int’l Co.*, 550, U.S. 398 (2007)) (emphasis in original). “*If this leads to the anticipated success*, it is likely the product not of innovation but of ordinary skill and common sense.” *Id.*

There was a design need or market pressure to solve a problem—reducing congestion, avoiding traffic jams, and more efficiently using space, including in circumstances where storage space is vertically increased by taller shelving units, in automated warehouses employing autonomous robots. Petition, 6-9; Ex. 1003,

¶¶105, 107, 112. There were predictable solutions—increasing available travel ways by running autonomous robots in passage spaces beneath shelves. *Id.*; Ex. 1003, ¶¶106, 108-109. A POSITA had good reason to pursue the known options within his or her technical grasp such that it would lead to anticipated success—reducing congestion, avoiding traffic jams, and more efficiently using space in automated warehouses employing autonomous robots. *Id.*; Ex. 1003, ¶¶111-114. There is no doubt that *Raizer*’s robots could be routed using the teachings of *Hangzhou* given both *Raizer*’s express needs and *Hangzhou*’s explicit teachings of how to address those needs. The Petition demonstrated a reasonable expectation of success in combining *Raizer* and *Hangzhou*.

## **II. OPEX’S CHALLENGES TO THE COMBINATION FAIL.**

Opex’s arguments against the combination collapse under the weight of their many mischaracterizations. Opex misleadingly cherry-picks various features of *Raizer* and *Hangzhou* in a poor assertion that the combination of their teachings is prohibited or undesirable. As the Board has acknowledged, that *Raizer* and *Hangzhou* “may not convey complete symmetry with one another” does not “give rise to a fundamental dichotomy or distinction that prohibits the combination of their teachings.” Decision, 23.

**A. The Combination Does Not Contradict Either References' Teachings or Goals.**

***i. The combination does not undermine Raizer's goals.***

Opex alleges that *Raizer's* invention is designed to satisfy a singular goal while aiming to solve specific shortcomings, including “the requirement of a large capital investment,” “poor modularity,” “reorganization,” and “downtime,” and that modifying *Raizer* with elevated shelves leads to those shortcomings. POR, 10-11, 21-22, 26, 31-32.

Opex provides no explanation as to why modifying *Raizer* with shelving units with elevated lower shelves leads to poor modularity or runs counter to *Raizer's* goals of adaptability. POR, 31-32. To the contrary, elevating the lower shelves would allow more robots to travel vertically to increase warehouse efficiency. Opex also overlooks clear disclosure in *Raizer* that “the system can obviously be installed in new structures” and is not limited to “retrofit existing warehouses.” Ex. 1005, ¶112; *see also* Ex. 2006, 71:8-21. Indeed, Dr. Singhose confirmed that a POSITA would “have a lot of freedom” in setting shelf height and would clearly set a shelf height in a warehouse based on a combined height of a robot and the item that it carries. Ex. 1009, 49:19-52:3; *see also* Ex. 2007, ¶94.

As the Board has already recognized, and left unaddressed by Opex, there is no “record citation that elevating the lower shelves of a warehouse is prohibitive or

constitutes some type of insurmountable pursuit,” and, “Patent Owner’s and Dr. Singhouse’s [sic] assertions that ‘in some cases’ lower shelf elevation is not possible is, on its face, recognition that the corollary is also true that in other cases such lower shelf elevation is possible.” Decision, 27-28; Ex. 1003 ¶107; *see also id.* at Section VI, ¶¶45–53 (describing in detail, with citation to record evidence, that a POSITA understood that shelving units could be elevated above warehouse floors).<sup>2</sup> Opex’s assertions that such a modification would require a large capital investment and require reorganization and downtime are unsupported and without merit. POSITAs would understand that shelf height is a variable that is freely modified. *See* Decision, 21-22; *see also* Ex. 1009, 49:19-52:3 (“They would set the shelf height up to the [height] they would need to easily store the largest box that they anticipate this warehouse needing to store...there’s a whole bunch of freedom basically on the height of the storage areas.”).

Opex also left unaddressed the obvious fact that *Raizer* may be used in a new or retrofit warehouse where the shelving height is initially sufficient to allow robots

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<sup>2</sup> Opex left unaddressed ¶¶45–53 and thus has waived any challenge to the testimony and record evidence cited therein.

with loaded boxes to pass beneath thereby eliminating any need to elevate lower shelves.<sup>3</sup> Opex's meritless assertions evaporate in this obvious circumstance.<sup>4</sup>

***ii. The combination does not undermine Hangzhou's goals.***

Opex's argument that that the proposed combination contradicts *Hangzhou's* teachings because *Hangzhou* allegedly teaches away from a single-type robot system is premised on a selective mischaracterization of *Hangzhou's* background section—as was confirmed by Dr. Singhose. POR, 15, 24-25, 40-41; Ex. 1009, 63:1-22.<sup>5</sup>

Opex makes the misleading assertion that, “[i]n discussing the background of the art, *Hangzhou* specifically teaches away from a single-type, noting that a single-

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<sup>3</sup> Dr. Spenko confirmed *Raizer* does not disclose a particular shelf height. Ex. 2006, 91:1-92:8, 93:22-94:11.

<sup>4</sup> Opex's arguments that the combination would lead to more collisions because of *Hangzhou's* two-robot system or the addition of driving under the shelves are overstated and overlook that the combination has no need for *Hangzhou's* stacking robots. See POR, 32-39; Ex. 1003, ¶¶110-111.

<sup>5</sup> Opex also cherry-picks an in-passing phrase in *Hangzhou's* background to advance a stretch and unsupported allegation that *Hangzhou* teaches away from a robotic arm. POR, 25; Ex. 1006, ¶6.

type robot system is not desirable,” citing to alleged reasons discussed in paragraph 4 of *Hangzhou*. POR, 40-41.

Opex omits that the drawbacks identified by *Hangzhou* in paragraph 4 are specific to two prior art systems – “Amazon’s Kiva robot system” and a solution “owned by Panasonic in Japan.” Ex. 1006, ¶[0004]. That is, *Hangzhou* identifies drawbacks that are specific to two distinct single-type mobile robot systems and does not criticize single-type mobile robot systems as a class.

*Hangzhou* also identifies drawbacks specific to three prior art systems that are multi-type robot collaboration solutions (outnumbering the flawed example single-type systems) in paragraph 5—a fact Opex misleadingly omits. *See* Ex. 1006, ¶[0005]. Indeed, Dr. Singhose confirmed that *Hangzhou*’s background simply discusses drawbacks specific to five example systems named in paragraphs 4 and 5, which are of the single type and multi-type variety and does not criticize single-type robots as a class. Ex. 1009, 63:1-22.

Opex’s mischaracterization of these paragraphs cannot serve the basis for its argument that *Hangzhou* teaches away from single-type robot systems nor that the proposed combination contradicts *Hangzhou*’s teachings.

Opex also ignores that the Petition combines the robots of *Raizer* with the robot travel teachings of *Hangzhou* and nothing in *Hangzhou* suggests that those teachings are inapplicable or undesirable in a single robot system.

***iii. Opex ignores a shared goal of Raizer and Hangzhou.***

The Petition set forth a goal shared by both *Raizer* and *Hangzhou*—creating an efficient automated warehouse system capable of reducing congestion and avoiding traffic jams. *See* Ex. 1005, ¶[0098]; Ex. 1006, ¶[0076]; Petition, 6-8, 20, 47; Ex. 1003, ¶102. The Petition identified and the Board has already recognized that *Raizer* and *Hangzhou* share goals. Decision, 23; Ex. 1005, Abstract; Ex. 1006, Abstract. The combination of *Raizer* and *Hangzhou* does not undermine their shared goal. *See* Ex. 1003, ¶¶103, 108-110. Opex does not dispute that the references share such a goal, nor does Opex argue that the combination undermines the shared goal.

Opex argues that *Raizer* and *Hangzhou* are incompatible because *Raizer* is designed to retrofit an existing warehouse while *Hangzhou* is directed at increasing efficiency with known floorplans. POR, 1, 24-25. Opex provides no evidence to support how or why an existing warehouse materially differs from one having known floorplans of presumably existing shelving units. Indeed, *Hangzhou* discloses that an advantage of its system is that “existing traditional shelves continue to be used,” yet also recognized that warehouses can be “relocated, expanded, and changed in layout at any time.” Ex. 1006, ¶[0009].

**B. Opex’s fabricated complexities fail.**

Opex contrives scattershot alleged complexities that are each unsupported by the record including, most notably, by the disclosure of the ’632 Patent. POR, 42-

55. Opex offers support for its fabricated complexities in the form of case citations and technical publications that not only fail to provide the promised support, but actually undercut and contradict Opex's arguments. *See* Ex. 2007, ¶¶158-159; Ex. 2009.

*i. Opex fails to destroy the reasonable expectation of success.*

Opex cannot escape the simplicity and reasonableness of the combination of *Raizer* and *Hangzhou* set forth in the Petition. The combination is straightforward - *Raizer*'s autonomous robots with their horizontal and vertical travel flexibility, which *Raizer* discloses as being able to navigate any location on the floor of a warehouse, with *Hangzhou*'s teaching of running such autonomous robots under the shelves of the warehouse. *See* Petition, 6-8; *see also* n1 (*supra*).

There was a need to solve a problem—reducing congestion, avoiding traffic jams as robot numbers increase, and more efficiently using space in automated warehouses employing autonomous robots and shelving units that are built taller and taller to take advantage of the full height of the warehouse. Petition, 6-9; Ex. 1003, ¶¶101-115. There were predictable solutions—increasing the number of available travel ways by running autonomous robots in passage spaces beneath shelves and across and parallel to aisles. *Id.* A POSITA had reason to pursue the known options such that it would lead to the anticipated success—reducing congestion, avoiding traffic jams, and more efficiently using space in automated warehouses employing

autonomous robots. *Id.* Thus, a POSITA had a reasonable expectation of success in combining *Raizer* and *Hangzhou*.

Attempts to discredit the reasonable expectation of success fail because any modifications were well within the skill of a POSITA. For example, *Raizer* clearly discloses that “the system can obviously be installed in new structures” and is not limited to “retrofit existing warehouses.” Ex. 1005, ¶112. Dr. Singhose also confirmed that a POSITA would set a shelf height in a warehouse based on a combined height of a robot and any item that it carries. *See* Ex. 1009, 49:19-52:3. And, as mentioned above, Opex leaves unaddressed the obvious scenario where *Raizer’s* system is implemented in a new or retrofit warehouse where the shelving height is initially sufficient to allow robots with loaded boxes to pass beneath thereby eliminating any need to elevate lower shelves. *See also* §II.A.i (*supra*).

***ii. Opex’s “proprietary components” arguments fail.***

Opex’s argument that *Raizer’s* “critical software” is proprietary is of no moment because a POSITA was well prepared to write software for a robot to

perform the basic operations contemplated by the '632 claims.<sup>6 7</sup> POR, 46-49. Indeed, the '632 Patent itself includes no disclosure of specific software algorithms used to achieve the claimed robot movement, further confirming that even the patentee understood that such basic implementation details were well within the knowledge of a POSITA.

Opex's reliance on *N. Telecom, Inc. v. Datapoint Corp.* is flawed. See POR, 46-48. Opex cites to *N. Telecom* after stating that *Raizer's* proprietary components "cannot be combined with technology from a secondary source by a POSITA because a POSITA would not have access to the proprietary components." *Id.* However, in *N. Telecom*, the Federal Circuit's ruling centered on whether documents housed in a restricted military library, and which had notices stating that "[r]eproduction or further dissemination [was] not authorized" as well as "not for public release," qualified as *prior printed publications*. 908 F.2d 931, 936 (Fed. Cir.

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<sup>6</sup> Dr. Singhose testified that programming such basic functionality was well within the skill of a POSITA, even if the POSITA were without access to any proprietary components. See Ex. 1009, 70:6-73:22.

<sup>7</sup> Dr. Spenko confirmed a POSITA would not need access to *Raizer's* software to accomplish the robot operations disclosed in *Raizer*. Ex. 2006, 64:11-66:9.

1990). To be clear, *N. Telecom* has no connection to the argument that Opex is using it to support and there is no dispute that *Raizer* and *Hangzhou* qualify as prior printed publications.

*Raizer* provides no explanation as to what is meant by the term “proprietary,” nor is there record evidence to support that it means anything other than relating to ownership and therefore subject to license. There is no record evidence to support that *Raizer* used the term “proprietary” to indicate “secret.”

To suggest that prior art descriptions of software considered by its owner as proprietary (i.e., subject to license) somehow excludes such descriptions from being combinable with other technology descriptions for obviousness determinations would create a *per se* exception for nearly all prior art software that is contradicted by statute and relevant case precedent. Given that patents confer exclusionary rights, there are few technologies described in patents that patent owners do not consider proprietary. Opex’s assertion that “proprietary technology” is excluded from obviousness determinations is plainly in error.

To the extent that *Raizer*’s use of “proprietary” was deemed to mean “secret,” the Federal Circuit has previously held that prior art with “secret” or “proprietary” aspects can be used in combination with other prior art to obviate a patent. *See Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1570 (Fed. Cir. 1997). There, the Federal Circuit confirmed that “the public need not have access to the ‘inner

workings’ of a device” for it to be prior art. *Id.* Because the system’s features had been known and in use for more than a year before the priority date, the “public was aware” of the capabilities of the system and it could be used in an obviousness combination. *Id.*

***iii. Opex’s multipath effects arguments are a red herring.***

Opex introduces a non-existent distinction between robots operating in “mapping” versus “ordinary obstacle avoidance” roles in a futile attempt to defeat the well-established reasonable expectation of success in combining *Raizer* and *Hangzhou*. POR, 30, 50-52. Not only does Opex invent a robot operating distinction not taught by *Raizer* or any other prior art reference, or disclosed or required of its own patent claims, Opex fails to apply the clear legal standard set forth in its own case citations.

Dr. Singhose explained in his deposition that there is a so-called mapping mode of a robot in which “these survey beams are going out there and they’re trying to find obstacle[s].” Ex. 1009, 87:7-21. And, for some reason left unexplained by Opex and Dr. Singhose, those “survey beams” “have difficulty when they get next to an obstacle,” and the “map just breaks down.” Ex. 1009, 87:17-88:11. Dr. Singhose distinguishes the “mapping part” from the “obstacle detection part,” explaining that “[i]t’s simpler for the obstacle detection part of this.” Ex. 1009, 90:4-11.

Dr. Singhose clarified Opex's position, stating that for the alleged multipath effects "[w]e're talking about initial step where the robot goes out and automatically locates obstacles and paths and intersections and routes that." *Id.* This distinction between allegedly debilitating multipath effects that are present during a mapping mode but somehow vanish during an obstacle detection mode is unsupported in the record and found nowhere in the '632 Patent.

***a. The reasonable expectation of success inquiry does not extend to unclaimed limitations.***

Opex argues that a POSITA would not have had a reasonable expectation of success in combining *Raizer* and *Hangzhou* because *Raizer's* "sensors that perform *Raizer's* 'Survey Mode' mapping would operate drastically different when driving under a shelf than when driving in the open area of a warehouse." POR, 50. Opex does not explain, however, how such alleged effects only exist when robots travel underneath racks, but not when *Raizer's* robots travel in aisles between two racks which would presumably create similar effects in *Raizer's* system even without modification. *Raizer* discloses no such limitations, nor does any other reference. Nonetheless, Opex credits "multipath effects," and claims these "are too complex for a POSITA to work with." *Id.* But even if such effects could impact *Raizer's* mapping operations, Dr. Singhose underscored that Opex's position is specific to multipath effects during mapping, not in obstacle detection mode. Ex. 1009, 91:20-

92:11 (“Q ... after we have the map, when the robot is in operating mode, is the – are multipath effects a problem? A No. The multipath effect I’m talking about is the multipath effect during mapping...I’m done with mapping; is there multipath effects? Not the ones I’m talking about...”). Thus, any such multipath effect would not impact the proposed combination in modes other than “Survey Mode” even under Opex’s contrived theory.

Here, as in *Intelligent Bio-Systems*, the reasonable expectation of success inquiry need not extend to the “Survey Mode” of *Raizer* and any other “mapping” operation because the claims of the ’632 Patent do not require anything resembling a “mapping” mode. *See, e.g.,* Ex. 1001, Cols. 25-28 *see also Intelligent Bio-Systems, Inc.* 821 F.3d 1359, 1367 (Fed. Cir. 2016) (Clarifying that the reasonable expectation of success requirement “refers to the likelihood of success in combining references to meet *the limitations* of the claimed invention.” (emphasis added)). Indeed, Dr. Singhose confirmed that the ’632 Patent, in its entirety, does not “do [a] survey mode to automatically map and set up its navigation system the way *Raizer* does. It just

doesn't do that." Ex. 1009, 140:13-141:8.<sup>8 9</sup> Dr. Singhose suggested that any warehouse map used during operation of the '632 Patent is developed in some other way that is presumably well-known to a POSITA. *Id.*

Opex's arguments that the combination would not operate successfully due to allegedly insurmountable issues resulting from *Raizer's* "Survey mode" used during mapping are thus meritless.

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<sup>8</sup> Opex's discussion of dissimilar systems—iRobot and SharkNinja—are of no moment at least because the claims do not require mapping. Notwithstanding, Petitioner is at a loss to explain how highly successful products somehow evidence an insurmountable inability of a robot to perform mapping functions. *see* Ex. 1012. Dr. Singhose confirmed that programming a robot to perform basic functions was well within the skill of a POSITA. *See* Ex. 1009, 70:6-72:2, *see also* 72:3-73:22.

<sup>9</sup> Opex's attempt to discredit Dr. Spenko is unfounded. *see* POR 55-56. Dr. Singhose agreed that Ex. 2004 is about global navigation satellite systems (GNSS), and that GNSS's are different from Lidar systems. Ex. 1009, 135:6-136-13. Dr. Singhose agreed that a POSITA would not consider using a GNSS in an automated warehouse, so Dr. Spenko's statements regarding unrelated systems are of no moment. Ex. 1009, 138:1-13.

***b. Opex overstates “Survey Mode.”***

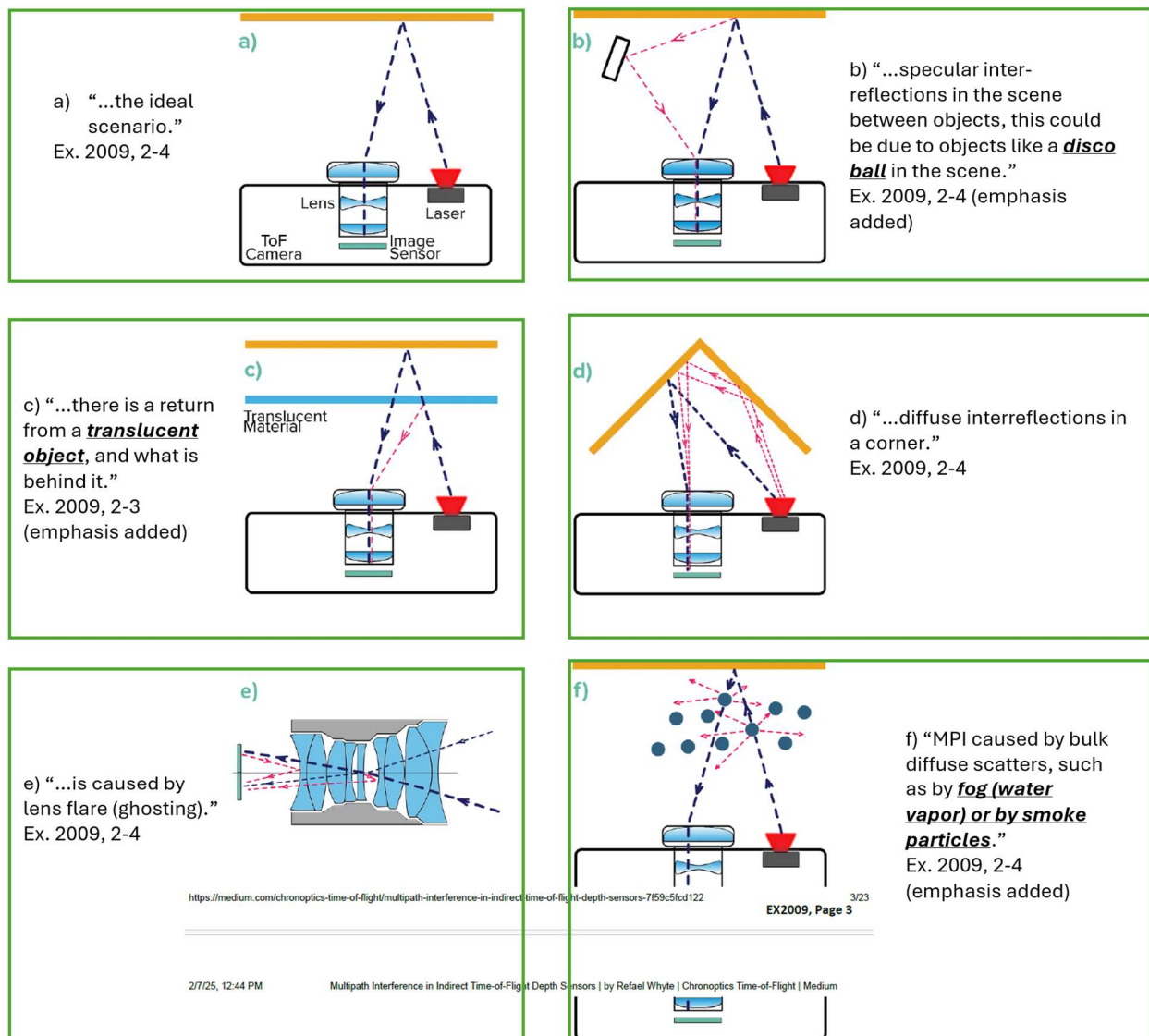
Notwithstanding Opex’s failed legal reasoning, Opex’s arguments are premised on a single sentence in *Raizer* that provides no support for Opex’s multipath fabrications. *See, e.g.*, Ex. 1005, ¶[0084]. *Raizer* merely states that “[t]he robots are pre-loaded with proprietary software which includes the warehouse layout, routes, intersections, and designated areas (this mapping survey is recorded by a ‘Survey Mode’ of the robot’s software).” *Id.* *Raizer* makes no mention of requiring the use of any sensors, let alone sensors at all, for its “Survey Mode.” *Id.* Indeed, *Raizer* states that the software is *loaded* onto the robots. *Id.* The disclosure of *Raizer* does not preclude the use of a pre-generated map that is developed and simply loaded onto a robot without operation of any survey mode. Such a scenario eliminates Opex’s alleged risk of multipath effects entirely because, as Dr. Singhose concedes, the allegedly debilitating multipath effects only occur during survey mode and not during ordinary obstacle avoidance operation. Dr. Spenko also refuted Opex’s allegations, confirming that mapping is not an insurmountable task for a robot. Ex. 2006, 86:16-87:15.

***c. Multipath effects are easily mitigated in warehouses.***

Dr. Singhose testified that “[e]xample diagrams showing multipath problems can be readily found in technical publications, or even with simple Google-based

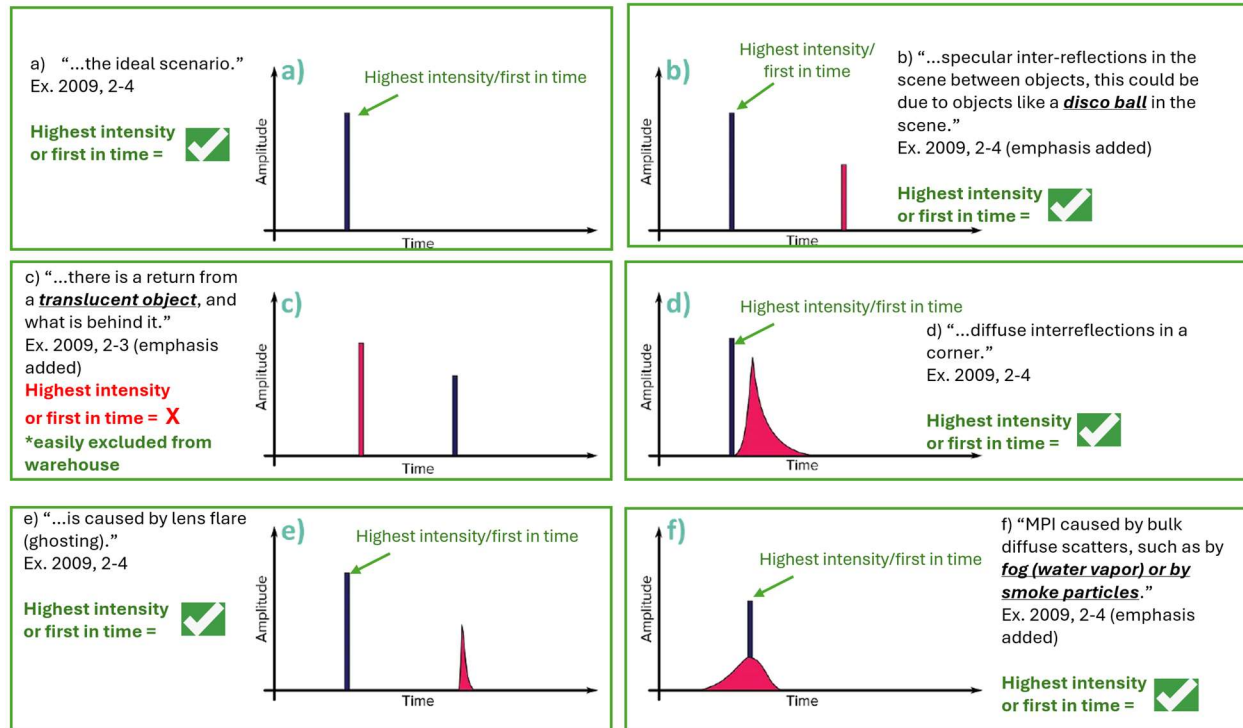
searches.” Ex. 2007, ¶158 (referencing Ex. 2009). However, the technical publication offered in support of the alleged multipath effects problem actually confirms that any multipath effects could be routinely and simply addressed by a POSITA. *See* Ex. 1009, 98:9-115:13.

### Ex. 2009, 3-4 (annotated)



Ex. 2009, reproduced in part above, depicts six example light sensor reflection scenarios (a)-(f) involving multipath interference. Each of the physical circumstances shown in the example scenarios is either (1) ideal such that no multipath interference occurs ((a)), (2) not relevant to a warehouse environment ((b), (c), (e), (f)), or (3) easily excluded from a warehouse environment ((b), (c), (d), (e), (f)) by a POSITA. For example, Ex. 2009 contemplates that multipath interference could be created by a disco ball, translucent materials, or fog. Ex. 2009, 2-3. Dr. Singhose confirmed that such elements are either not common and easily excluded in warehouses, and that a POSITA could simply deploy “less reflective surface[s]” in areas where multipath interference was sought to be avoided such as beneath shelves. Ex. 1009, 100:10-103:14.

**Ex. 2009, 5 (annotated)**



Ex. 2009, reproduced in part above, also confirms that robots equipped with algorithms configured to select return signals of highest intensity or first in time would identify the correct signal. Ex. 2009, 4-5. Ex. 2009 explains that, in the above-depicted scenarios, the blue line represents the direct return (i.e., the correct signal) and the pink represents the multipath interference. *Id.* In each of scenarios (a), (b), (d), (e), and (f), an algorithm that selects the return signal having the highest intensity or the first arrival time would identify the correct (i.e., blue) signal. Dr. Singhose confirmed that such "simple algorithms" would get the correct signal. Ex. 1009, 109:14-19, 110:22-112:1. Dr. Singhose also confirmed that scenario (c) could be

avoided easily by not positioning translucent materials (e.g., glass, etc.) under the shelves. Ex. 1009, 112:14-115:13.

Ex. 2009 underscores that straightforward approaches to dealing with multipath interference are known to the POSITA. Ex. 2009, 8 (“The first method of resolving multipath interference is to setup the scene to minimize the amount of multipath interference being caused.”); *see also* Ex. 1009, 114:2-115:13. Thus, even if additional “multipath effects” were to arise during the Survey Mode of *Raizer* as a result of robot travel under shelves, a POSITA would have no difficulty resolving such issues in a warehouse environment, as demonstrated by Dr. Singhose’s own evidence.<sup>10</sup>

### **III. OPEX’S ARGUMENTS REGARDING THE DEPENDENT CLAIMS FAIL.**

#### **A. Claim 5.**

Regarding 5b, Opex argues that *Raizer*’s drawings do not explicitly indicate a scale, stating that “*Raizer* teaches against a robot where its ‘length is greater than its width.’” POR, 56-57. Opex ignores the disclosure in *Raizer* that the “main components of robot 10 which are shown in [FIGS. 5A-5D] are mounted on a frame

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<sup>10</sup> Dr. Singhose further testified that a POSITA was aware of multiple routine ways to avoid multipath effects, generally. *See* Ex. 1009, 131:18-132:4, 80:21-81:13.

comprised of *two long beams 28 that are rigidly connected together at one end by a shorter beam 12.*” Ex. 1005, ¶[0103] (emphasis added); Petition, 5, 43; Ex. 1003, ¶¶85, 255. *Raizer*’s robot has a first dimension dictated by the shorter beam (e.g., a width) and a second dimension dictated by the long beams (e.g., a length), and given the relative language, the “length is greater than the width.” *Id.*

Opex’s mischaracterizations regarding 5c also fail. Petitioner does not “interject[] *Hangzhou*’s robots when needed,” as Opex alleges. POR, 58. Claim element 5c requires “driving the vehicle *along a path spaced apart from the vertical posts by a distance greater the half the length of the vehicle.*” The Petition explains that, “[a]llowing the robots of *Raizer* to travel *along the various paths* in *Hangzhou* is additionally obvious because such a combination relies on known solutions to improve similar systems and methods in the same way.” Petition, 8. Indeed, the Petition explains, “[s]hould *Raizer* be determined to not disclose driving the vehicle along a path spaced apart from the vertical posts by a distance greater than half the length of the vehicle, a POSITA would have looked to *Hangzhou*,” and goes on to detail the “horizontal gap” disclosed by *Hangzhou* that makes space for the trolleys to travel. Petition, 45. That teaching at minimum renders obvious this limitation, which permits the robot to travel and turn underneath the rack as taught by *Hangzhou*.

**B. Claims 8 and 9.**

Opex suggests that “it is improper for Petitioner to rely on the characteristics of *Hangzhou*’s robots after explicitly pointing to *Raizer*’s robots for their proposed combination.” POR, 59. Again, the Petition does not interject *Hangzhou*’s robots—the Petition explains that the combination involves allowing the robots of *Raizer* to travel along the various *paths* described in *Hangzhou*. Petition, 8, 49-51.

**C. The remaining challenged claims.**

Opex’s other arguments for the remaining challenged claims rise and fall with the arguments addressed above.

**IV. CONCLUSION**

Petitioners request cancellation of the Challenged Claims.

Date: May 14, 2025

By: /John D. Haynes/  
John D. Haynes  
Reg. No. 44,754

**CERTIFICATION UNDER 37 C.F.R. §42.24**

Under the provisions of 37 CFR §42.24, the undersigned hereby certifies that the word count for the foregoing Petition for *inter partes* review totals 5,530 words (Sections I-IV), which is less than the 5,600 allowed under 37 CFR §42.24(c)(1).

Date: May 14, 2024

By: /John D. Haynes/  
John D. Haynes

**CERTIFICATE OF SERVICE**

Pursuant to 37 C.F.R. §42.6(e), the undersigned hereby certifies that true and correct copies of the above-captioned **PETITIONERS' REPLY TO PATENT OWNER RESPONSE and PETITIONERS' EXHIBITS 1009-1012**, were served in their entireties on May 14, 2025 via filing through the Patent Trial and Appeal Case Tracking System (P-TACTS) and electronic mail on the following counsel of record for Patent Owner:

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