

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HUM INDUSTRIAL TECHNOLOGY, INC.
Petitioner

v.

AMSTED RAIL COMPANY, INC.
Patent Owner

Case IPR2023-00538
Patent No. 9,365,223

PATENT OWNER'S RESPONSE

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Patent Owner Amsted Rail Company, Inc. (“PO”) submits this Patent Owner Response to the Petition for *Inter Partes* Review (“IPR”) filed against U.S. Patent No. 9,365,223 (“the ’223 Patent”). Petitioner has failed to establish by a preponderance of the evidence that any claim of the ’223 Patent is unpatentable.

I. OVERVIEW OF THE ’223 PATENT AND ITS FILE HISTORY

The ’223 Patent was filed on March 15, 2013 as U.S. Patent Application No. 13/842,427 (“the ’427 Application”, Ex. 1002, 8-44). The ’427 Application claims priority to U.S. Provisional Application No. 61/661,661, filed on June 19, 2012 (“the ’661 Provisional”, Ex. 1013). The ’427 Application also claims priority to and incorporates by reference U.S. Application No. 12/861,713 (“the ’713 Application”, Ex. 1014), filed August 23, 2010, now issued as U.S. Patent No. 9,026,281 to Murphy (Ex. 2005). *See* Ex. 1001, 1:6-10. The ’427 Application is a continuation-in-part of the ’713 Application. Ex. 1001, p. 1. The ’713 Application incorporates by reference the entire disclosure of U.S. Patent No. 7,688,218 (“the ’218 Patent”, Ex. 1015), filed December 22, 2006. *See* Ex. 1014, 15; *see also* Ex. 1001, 15:20-24 (incorporating by reference the ’218 Patent). The ’661 Provisional incorporates by reference U.S. Patent Publication No. 2012/0046811, the publication of the ’713 Application. *See* Ex. 1013, ¶109.

A. Technology Overview

The '223 Patent revolutionized mobile train monitoring by teaching a POSA how a single universal sensor device, i.e., a “mote” could be assembled within a housing and mounted on a railcar at a location of interest without requiring the customized bearing adapters and pads of the prior art. *Id.*, 3:60-6:38, FIGs. 1-5A. This advancement required new and complex algorithms and operating software to analyze the collected sensor data because the placement of the sensor was uninhibited by the former constraints in the prior art sensors devices which were typically built directly into specific and expensive adapters. *Id.*; *see also* Ex. 1005 FIG. 4 (showing pad 16 built into the railcar frame). The '223 Patent teaches a sensor device that broke free of the prior placement constraints having advanced heuristics and statistical analysis to form better assessments of operating conditions and better predictions of future operating conditions. Ex. 1001, 1:14-20, 6:60-6:38, 8:10-11:60, 13:63-14:63.

B. Priority Date of the '223 Patent

The '223 Patent is a Pre-AIA first-to-invent patent. Both the '427 Application and the '661 Provisional were filed prior to the effective date of the AIA and thus are subject to the pre-AIA rules. Ex. 1001 at (60), (63); Ex. 1002 at 110, 450, 539. The Challenged Claims have written description support in the '661 Provisional and are thus entitled to its effective filing date, as acknowledged by Petitioner. Petition,

5, 7. As explained in more detail below, the claimed invention of the '223 Patent (except claim 1) was conceived at least by March, 2010 and was, through reasonable diligence, reduced to practice at least by August 2, 2011. §IV.D.1 *infra* (incorporated here).

II. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art is a person with at least a B.S. degree in electrical or computer science or a related field, with at least two years' experience with sensing systems for railcars or similar industrial equipment, including familiarity with wireless networks and heuristics and statistical data analysis for failure prediction. *See* Ex. 2010, ¶13. Less work experience could be compensated for by a higher level of relevant education, and vice versa. *Id.*.

III. CLAIM CONSTRUCTION

In *Inter Partes* Review proceedings, claims are interpreted “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. §42.100(b). Under this standard, the Board construes claims “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *Id.*; *see also Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (en banc). In determining a proper construction, the Board looks primarily to “the intrinsic evidence of record, examining the claim language itself,

the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006).

“Housing”

The Board found that the term “housing” needed no claim interpretation. Paper 15, 15-16. The Board did not explicitly reject PO’s interpretation, i.e., the term housing means “an enclosure.” PO’s construction is consistent with (1) the way a POSA would understand the term based on the plain language of the claims and (2) the usage of the term “housing” in the specification. *See* Ex. 2010, ¶¶14-20; Ex. 1001, 3:60-63, 4:5-14, 4:23-29, 15:19-24 and FIGs. 1, 2, 3 and 3A. PO therefore proceeds for purposes of this Response in accordance with its construction.

IV. ARGUMENT.

A. Ground One: Petitioner has failed to show that Claims 2–10, 18, 20, 21, 23, and 25–32 are unpatentable under 35 U.S.C. § 103(a) over LeFebvre.

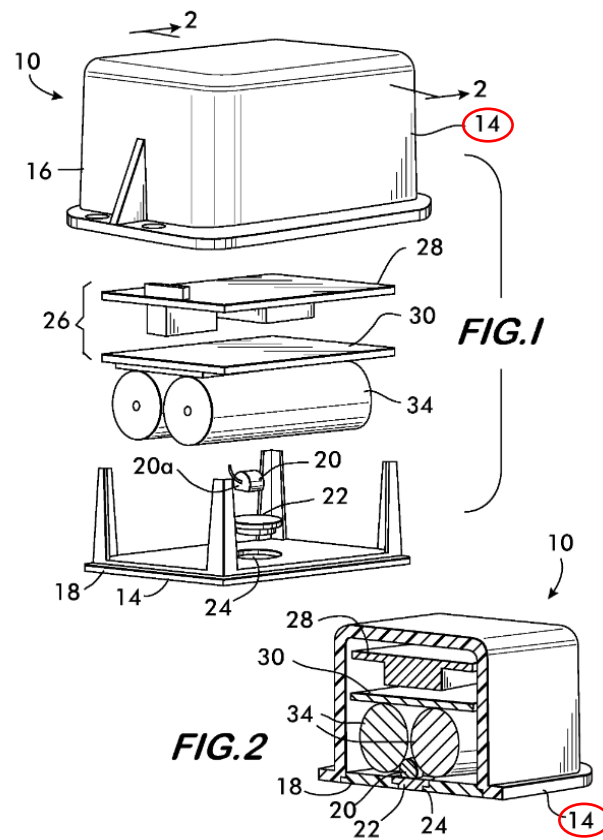
The Board examined the preamble and claim limitations (a), (b) and (d) of Claim 2 in light of Armitage. Paper 15 at 32-33. However, Armitage is not part of Ground 1. As further detailed below, Armitage is not prior art. To the extent the Board intended to refer to LeFebvre, PO also disputes that LeFebvre accounts for certain limitations of Claim 2.

1. **Claims 2-4, and 27-30**

a. **LeFebvre does not disclose a housing**

Petitioner has failed to show that LeFebvre discloses, teaches, or suggests a “at least one temperature sensor device having: *a housing*,” as required by independent claim 2. Ex. 2010, ¶23-32. In the same vein, Petitioner has failed to show that LeFebvre discloses, teaches, or suggests (i) “electrical circuitry,” (ii) a “power source,” and (iii) a “communication device” that are “positioned within said housing” as required by independent claim 2. Ex. 2010, ¶24.

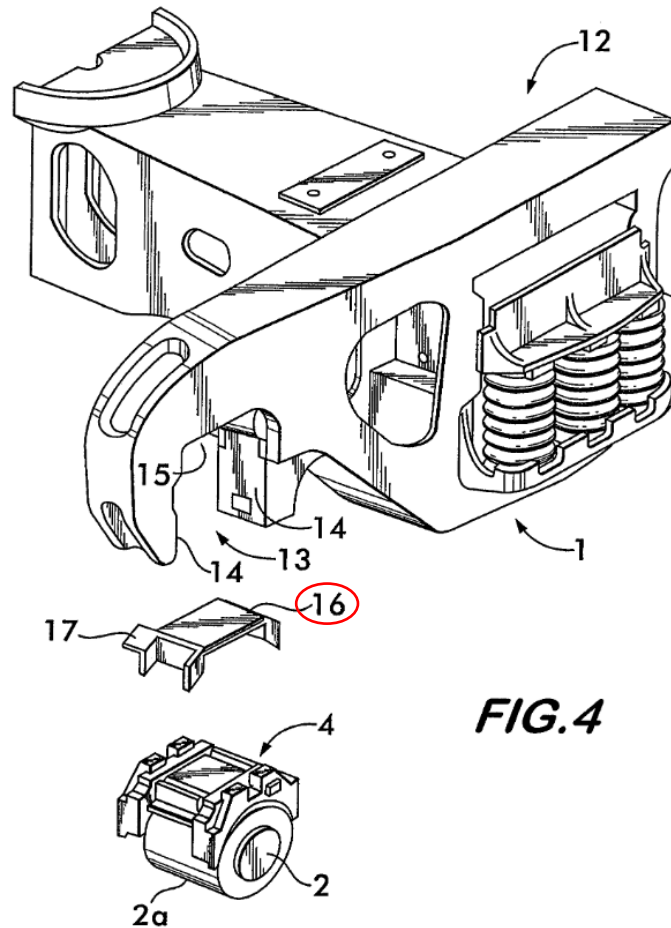
The term “housing” refers to an enclosure that electronic components may be positioned within. See Ex. 1001, FIGs. 1, 2, 3, 3A; Ex. 2010, ¶24; Ex. 2008, ¶11 (confirming a POSA would understand this). Further, the circuitry 26, including main board 28 that has communications circuitry, and power source 34 are depicted as being positioned within a housing 14.



(Ex. 1001, FIGs. 1, 2; Ex. 2010, ¶24.)

The Petition attempts to obfuscate the difference between the phrase “embedded into” found in the LeFebvre reference and the phrase “within said housing” as required by independent claim 2. *See* Petition, 21; Ex. 2010 ¶¶26-27. LeFebvre merely discloses an instrumented pad 16 – which a POSA would understand to be different from the claimed “housing.” Ex. 2010, ¶¶28-32; Ex. 1005, Fig. 3. In granting institution of this proceeding, the Board incorrectly equated the term “pad” to “housing.” Paper, 34-35. However, a POSA would understand from FIG. 4 (reproduced below) that an instrumented pad 16 is not a “housing” as that

term is consistently used in the claims and specification of the '223 patent. Ex. 2010, ¶28; Ex. 2008, ¶12.



Indeed, the '223 patent expressly differentiates the meaning of the terms “housing” and “pad” by distinguishing over the earlier pad embodiments of the LeFebvre reference. Adapter pads were already a common component of railcars at the time of the invention. *See* Ex. 2010, ¶¶22, 29; *see also* Ex. 2003 (describing a bearing adapter and adapter pad). The insight of LeFebvre was to place sensors into

adapter pads that were already in use on many railcars. Ex. 2010, ¶¶22, 29; 2008, ¶¶5-6, 10.

Consistent with this history, the '223 patent explains “[i]n another alternate embodiment of the invention, one or more notes may be housed in alternative housings *or built into the railcar itself*. In one such embodiment, notes can be *built into the form of an adapter pad* similar to the type shown in U.S. Pat. Nos. 7,698,962 and 7,688,218.”¹ Ex. 1001, 15:18-24 (emphasis added); Ex. 2008, ¶¶5-6, 10. Thus, the smart pads disclosed in LeFebvre is an example of the sensor device being “built into the railcar itself” which is expressly distinguished from embodiments having housings. *See* Ex. 1001, 15:18-24; Ex. 2008, ¶¶11-12.

LeFebvre does not suggest its pad is a housing or an enclosure. Ex. 2010, ¶29 (explaining that LeFebvre never refers to the pad as either); *see, generally*, Ex. 1005. Petitioner’s expert tries to sidestep this lack of disclosure by suggesting that a cast or injected molded elastomeric polymer would be considered a “housing.” Ex 1003, ¶81. However, coating something with a polymer does not constitute a “housing,” which implies that the components are both protected and removable. *See* Ex. 2010, ¶29. Thus, Mr. Ricca’s assertion is misguided as LeFebvre does not “disclose a

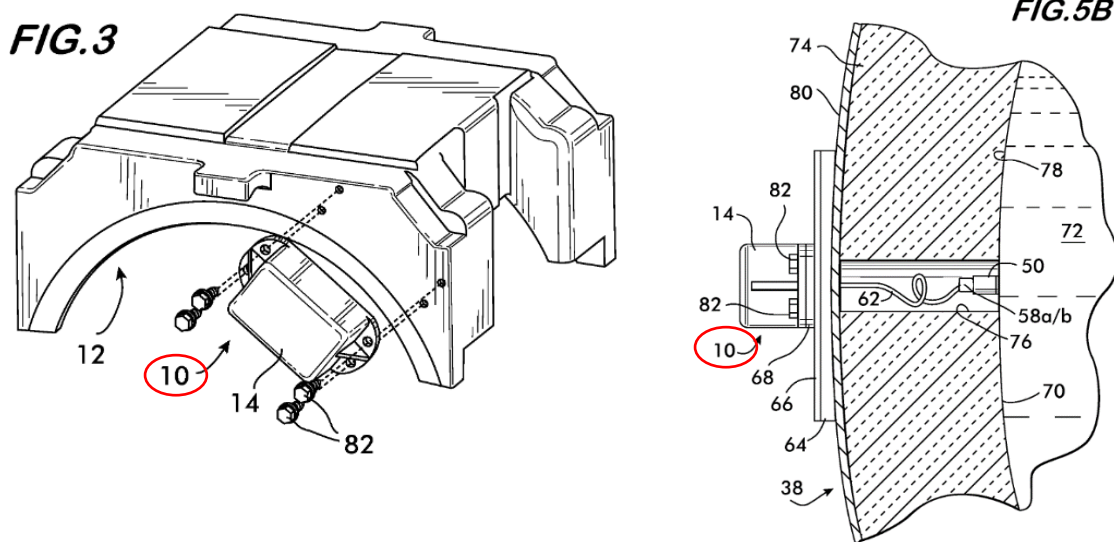
¹ U.S. Pat. No. 7,688,218 (Ex. 1015) is the issued patent corresponding to the LeFebvre reference.

housing formed from a cast or injected molded elastomeric polymer”, but rather merely discloses a *surface* formed by a cast or injected molded elastomeric polymer. Ex 1003, ¶84; Ex. 2010, ¶29.

Instead, LeFebvre refers to Van Auken (Ex. 2006) for additional details on the adapter pads. *See* Ex. 1005, ¶19. Van Auken also does not refer to the various adapter pad embodiments as including a housing or an enclosure. Ex. 2010, ¶29. Van Auken discloses three planar shaped adapter pad embodiments 32, 232, and 332. *See id.*; Ex. 2006, FIGs. 8-12. A POSA would understand that each of the disclosed adapter pad embodiments are planar pads that are installed in a load bearing position in direct contact with a correspondingly shaped surface of a “bearing adapter” and must be placed in a specific orientation on the “bearing adapter” to function. *See* Ex. 2010, ¶29. A POSA would also understand that the term “pad” has a specific meaning as a term of art for a load bearing component of a railcar directly between a bearing adapter and the frame, i.e., in the exact position as shown by LeFebvre. *See* Ex. 2010, ¶29; Ex. 1005, FIG. 4; Ex. 2008, ¶¶5-6, 10.

For at least these reasons, the “pad” of LeFebvre is a demonstrably different from the universally mountable “housing” of the ’223 patent allowing the sensor device to be mounted in virtually any area of interest of a railcar. *See* Ex. 1001, 5:30-46; FIGs. 3, 4, 5; Ex. 2008, ¶¶8-9, 11; Ex. 2010, ¶30. In one embodiment, the sensor device may be mounted on a sidewall of a bearing adapter and not in a load bearing

position. *See* Ex. 1001, FIG. 3 (reproduced below); Ex. 2010, ¶30. In another embodiment, the sensor device, with the claimed housing, may be mounted on a sidewall of a liquid holding tank. *See* Ex. 1001, FIG. 5B (reproduced below); Ex. 2010, ¶30. Neither of these installations are possible with the device disclosed in LeFebvre. *See* Ex. 2010, ¶¶30-31.



Therefore, a POSA would understand that '223 patent's distinguishment over LeFebvre would mean that the "housing" recited in the '223 patent's claim 2 is structurally distinct from—and therefore patentable—over LeFebvre. Ex. 2010, ¶32; Ex. 2008, ¶11. Thus, Petitioner has not shown a reasonable likelihood that independent claim 2 is unpatentable over LeFebvre. Petitioner also cannot show that claims 3, 4 and 26-30, dependent from independent claim 2, are unpatentable over the LeFebvre. Ex. 2010, ¶32; *Mylan Pharms. Inc. v. Research Corp. Techs., Inc.*,

914 F.3d 1366, 1376 (Fed. Cir. 2019) (“Dependent claims, with added limitations, are generally not obvious when their parent claims are not.”).

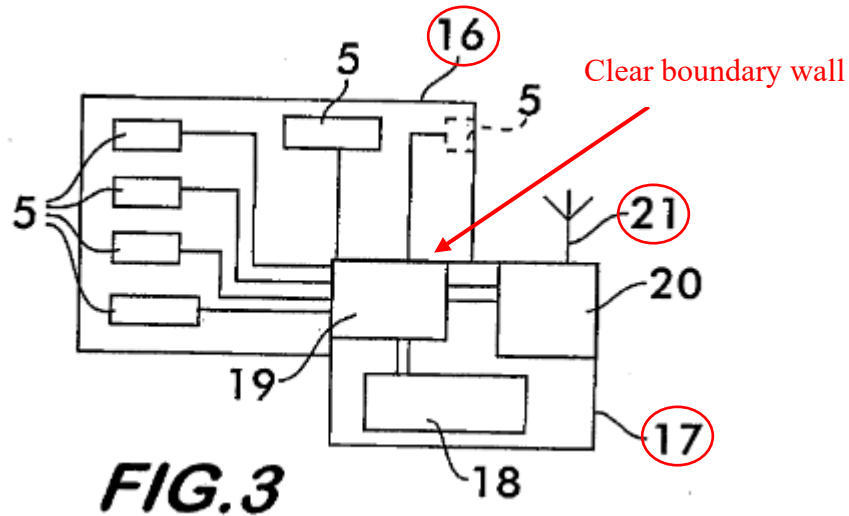
b. LeFebvre does not disclose electrical circuitry within said housing

LeFebvre does not disclose, teach, or suggest “electrical circuitry positioned within said housing,” as required by independent claim 2. Ex. 2010, ¶33. Petitioner incorrectly alleges that “[t]he instrumented pad 16 comprises electrical circuitry, specifically: ‘a power source 18, an analog/signal conditioning means ... and a communications unit 20.’” Petition, 23 (citing LeFebvre, ¶21). LeFebvre discloses that *extended portion 17* — not the pad 16 — contains these components. *See* Ex. 1005, ¶21 (“[t]he extended portion 17 contains a power source 18, an analog/signal conditioning means and analog to digital conversion means and an associated microprocessor unit 19 and a communications unit 20 which is preferably a low power radio transmitter/receiver having an antenna 21.”); Ex. 2010, ¶33. This is a logical conclusion as the pad 16 is not a “housing,” but instead is a “surface.” *See* Ex. 2010, ¶33.

Notably, there is no explanation for how or why the extended portion 17 and adapter 16 do (or even can) form the same “housing.” *See* Ex. 2010, ¶34. Moreover, a POSA would recognize that LeFebvre teaches away from forming or making these structures into a single component. *Id.* LeFebvre discloses that “[i]n preferred form,

the pad 16 has an extended attachment portion 17 *located so as to be relatively isolated* from the forces transmitted through the adapter 16.” Ex. 1005, ¶21, FIG. 3; Ex. 2010, ¶34 (further explaining a POSA would understand that FIG. 3 delineates the boundaries of extended portion 17 and adapter pad 16 as different components).

In view of the above, LeFebvre also does not disclose, teach, or suggest a “power source positioned within said housing” or a “communication device positioned within said housing” as recited in claim 2. *See* Ex. 2010, ¶35. Here again, the Petition waves past the distinction between extended portion 17 and adapter pad 16. *See* Petition, 23-25; Ex. 2010, ¶35. Relying on FIG. 3 of LeFebvre (reproduced below) Petitioner simply ignores that components 16 and 17 are depicted as separated by a boundary and the antenna is depicted as exterior to the boundary of extended portion 17. Ex. 2010, ¶35. A POSA would understand from these disclosures that the power source and communications unit would not be within the same housing. *Id.* Therefore, even under Petitioners flawed interpretation of FIG. 3, LeFebvre simply does not disclose “communication device capable of broadcasting information ... via wireless communication ... positioned *within said housing.*” *See id.*



Therefore, a POSA familiar with the LeFebvre reference would understand that adapter pad 16 and extended portion 17 are separate components that do not collectively form a single housing². *See id.*, ¶36. Accordingly, a POSA would understand that the “power source” and “communication device” as they are disclosed in LeFebvre are not disposed within a housing. For this additional reason, Petitioner has not shown that claim 2 is unpatentable over LeFebvre nor that claims 3, 4 and 26-30 depend from independent claim 2 and are unpatentable. *Id.*; *Mylan*, 914 F.3d at 1376 (“Dependent claims, with added limitations, are generally not obvious when their parent claims are not.”).

² Claim limitations 2(f) and 2(g) require a power source or communication device “positioned within said housing.” For the reasons articulated above, PO disputes that LeFebvre discloses these limitations.

2. **Claims 5-10, 18, 20, 21, 26, 31, and 32**

LeFebvre fails to disclose, teach, or suggest “a communication management unit [that] applies *heuristics* to analyze data collected from said one or more sensor units (a) to determine if an actual failure exists and (b) *to predict* potential or imminent failures *based on a statistical analysis* of said collected data.” Ex. 2010 ¶¶37-49. The claim requires the communication management unit to perform each distinct analysis. *See* Ex. 1001, 16:37-44. First, heuristics are applied “to determine if an actual failure exists,” i.e., whether current failures exist. *Id.* Second, heuristics are applied to prospectively “predict” a failure “based on a statistical analysis” of the data collected by the sensor, i.e., a higher-level statistical analysis for predicting failures not currently detected by the data that may develop at some point in the future. *Id.* A POSA would understand this. Ex. 2010, ¶37.

In order to provide for this forward-looking, predictive analysis that is “based on a statistical analysis,” a statistical model with sufficient data, i.e., previously acquired data, on which to base such predictions would be needed. The ’223 patent explains: “The CMU is capable of wirelessly collecting data from each of the motes and performing higher-level analysis of the data to detect imminent or actual failures. During such data analysis, heuristics may be applied to determine potential failures *based on statistical models* and empirical data.” Ex. 1001, 2:57-62 (emphasis added). That is, the analysis of part (b) necessarily involves a higher-

level analysis than just the mere aggregation of collected sensor data to form an inference as to a condition of a train. *See* Ex. 2010, ¶¶37-40, 43-44 (explaining that heuristics and statistical analysis are distinct).

Petitioner’s reliance on the same disclosures in LeFebvre for both “heuristics” and “statistical analysis” ignores that both of these concepts are claimed and are understood to have different scopes. *See, e.g.*, Petition at 28 (citing LeFebvre, ¶¶58-66 for both claim requirements); Ex. 2010, ¶¶39-40, 43-44. This is improper because Federal Circuit caselaw “instructs that different claim terms are presumed to have different meanings.” *MicroStrategy Inc. v. Bus. Objects Americas*, 238 F. App’x 605, 609 (Fed. Cir. 2007) (explaining “we must presume that the use of these different terms in the claims connotes different meanings.”); *Applied Med. Res. Corp. v. U.S. Surgical Corp.*, 448 F.3d 1324, 1333 n.3 (Fed. Cir. 2006) (“[T]he use of two terms in a claim requires that they connote different meanings”). Petitioner merely relies on disclosure in LeFebvre related to forming an “inference” of a measured condition via an inference engine. Pet., 28; Ex. 2010, ¶¶39-42. This is not the same as performing **both** “heuristics” and “statistical analysis.” Ex. 2010, ¶¶39-40, 44-45. Unsurprisingly, Mr. Ricca also makes the same mistake. *See Id.*, ¶40. Indeed, LeFebvre is silent regarding utilization of “statistical analysis” to form forward looking predictions. *See generally* Ex. 1005; Ex. 2010, ¶¶41-43. Moreover, Petitioner fails to point to anything in LeFebvre that discloses a system performing

statistical analysis to establish forward looking predictions. Petition, 28 (referenced section discussing claim 3, which does not claim heuristics or statistical analysis), 31 (section discussing limitation 5(j) without identifying or explaining what “statistical analysis” is applied in LeFebvre ¶¶58-66 to form forward looking predictions); Ex. 2010, ¶¶40-42. The same deficiency exists for claim 26.

Petitioner’s citation to LeFebvre fails to disclose “statistical analysis” of the collected sensor data, as required by limitation 5(j). *See* Petition, 31-32 (citing Ex. 1005, ¶¶58-66); Ex. 2010, ¶42. In fact, the scope and purpose of this cited passage states:

Examples of performance that the system is capable of monitoring include... [a] temperature sensor in instrumented pad 16 monitors relative changes in temperature against other bearings and provides *an alarm threshold or long term trends to link to bearing condition*. The well-being of a roller bearing can be inferred using either *trends or alarm levels*, avoiding a potential bearing burn off and possible derailment and providing *a direct measurement* that can be used to avoid false alarms from wayside hotbox detectors.

(Ex. 1005, ¶58.) That is, LeFebvre describes identifying certain conditions or types of inferences from direct measurements, not of making any statistical analysis. Ex. 2010, ¶42 (explaining LeFebvre, at most, collects data and infers that a condition

exists). In fact, LeFebvre does not even mention “statistical analysis.” *See* Ex. 2010, ¶41.

The Board reasons that LeFebvre discloses “statistical analysis” because it mentions “long term trends,” but this is incorrect. LeFebvre discloses “A temperature sensor in instrumented pad 16 monitors relative changes in temperature against other bearings and provides an alarm threshold or long-term trends to link to bearing condition.” Ex. 1005, ¶58. LeFebvre does not explain what it means to “provide long term trends.” The next sentence then states “The well-being of a roller bearing can be inferred using either trends or alarm levels, avoiding a potential bearing burn off and possible derailment and providing a direct measurement that can be used to avoid false alarms from wayside hotbox detectors.” *Id.* These sentences taken together do not suggest statistical analysis. *See* Ex. 2010, ¶42. A POSA would also readily understand that this method of using a direct measurement to draw an inference of a condition, e.g., of the roller bearing, is entirely different from performing “statistical analysis.” Ex. 2010, ¶42 (further explaining that while using “long-term trends” may be considered heuristics, it is not statistical analysis).

Petitioner’s reliance on LeFebvre’s disclosure of “frequency spectrum analysis” is also distinguishable from the claimed “statistical analysis.” Ex. 2010, ¶43 (citing and explaining Ex. 1005, ¶59). As Dr. Shamos explains, “[f]requency domain analysis techniques merely transform time waveform data into discrete

frequency components, e.g., by taking a fast Fourier transform (FFT) analysis” and can analyze discrete data such as amplitude, frequency, and phase of sinusoidal signals” but does not perform any statistical analysis on such data. Ex. 2010, ¶43.

In addition, there is no disclosure in LeFebvre relating to how a “potential or imminent failure” may be predicted based on (1) acquiring a measured condition by a sensor as “collected data” and then (2) performing a statistical analysis of the “collected data” to form the prediction. *See generally* Ex. 1005; *see also* Ex. 2010, ¶44 (explaining LeFebvre only discloses measuring actual conditions to form immediate inferences based solely on the measurements taken); Ex. 1005, ¶¶58-66.

Petitioner relies exclusively on LeFebvre’s power-saving features to meet Limitations 5(g) and 8(b), which recite “software performing the functions of collecting data from said sensor at periodic intervals.” *See* Petition, 34 (citing Ex. 1005, ¶¶34-35). This argument also fails. LeFebvre discloses a sensor which “is programmed to switch on briefly” but would normally be “in a low powered state most of the time.” *See* Ex. 1005, ¶¶34-35; *see also* §IV.E.2.a, *infra* (incorporated here). This is not “**collecting data** ... at periodic intervals” as recited in limitations 5(g) and 8(b). *See* Ex. 2010, ¶45. Switching on the radio is not at “periodic intervals,” but instead only when a fault occurs. *See* Ex. 2010, ¶46. In fact, the claims and specification of the ’223 patent expressly distinguish between the power-saving functionality and the periodic collection of data for analysis. *Compare* Ex.

1001, 5:24-29 *with* 13:51-53 (stating that limitation 1(g) is expressly directed toward management of power consumption that “plac[es the] sensor device in a standby state and periodically awakening [the] sensor device ...” while limitation 5(a) recites “software performing the functions of collecting data ... at period intervals”). Thus, a POSA would immediately understand this same distinction and would not confuse a sampling interval with power consumption management. *See* Ex. 2010, ¶45.

To support finding a reasonable likelihood of unpatentability, the Board equated the two systems found in Claim 1 and Claim 5 (i.e., periodic data collecting and power management). *See* Paper 15, 41-42. In Claim 1, the sensor is periodically awakened, transmits, and then goes to sleep again. *See* Ex. 2010, ¶47. This is distinguishable from the system of Claim 5. *See Id.*, ¶48. A sensor can operate constantly, yet only be polled at particular intervals; this does not relate to power management. *Id.* Unlike what the Board suggests, the limitation found in Claim 5 is ***different***, not broader. *See Id.*, ¶48. Therefore, while the same system could infringe both Claims 1 and 5, a system that infringes Claim 5 does not necessarily infringe Claim 1, which requires broadcasting. *See Id.*

Petitioner has not established that independent claim 5 is unpatentable over LeFebvre. *See* Ex. 2010, ¶49. Each of claims 6-10, 18, 20, 21, 31, and 32 depend from independent claim 5 and Petitioner cannot establish they are unpatentable by virtue of their dependance on a patentable independent claim. *Id.*; *Mylan*, 914 F.3d

at 1376 (“Dependent claims, with added limitations, are generally not obvious when their parent claims are not.”).

3. Claims 23 and 25

In addition to LeFebvre not disclosing a housing, *see* §IV.A.1.a, *supra* (incorporated here), Petitioner has not shown that LeFebvre discloses, teaches, or suggests a housing “mountable on a railcar,” as required by limitation 23(a) of independent claim 23. *See* Petition, 38. Ex. 2010, ¶¶50-51. The ’223 patent confirms this distinction when explaining “[i]n one such embodiment, notes can be ***built into*** the form of ***an adapter pad*** similar to the type shown in U.S. Pat. Nos. 7,698,962 and 7,688,218.” Ex. 1001, 15:18-24 (emphasis added); Ex. 2010, ¶22. By contrast, in LeFebvre, the adapter pad 16 is not “mountable on a railcar” because it is merely a planar component that functions as a load bearing and attenuation means. *See* Ex. 1005, ¶19 and FIG. 4. LeFebvre explains “[t]he adapter pad 16 is formed to seat upon the upper surface of adapter 4 which, as indicated above, seats in turn on the bearing.” *Id.*

In the same vein, Petitioner has failed to show that LeFebvre discloses, teaches, or suggests (i) “electrical circuitry,” (ii) a “power source,” and (iii) a “communication device” that are “positioned within said housing,” as required by independent claim 23. Ex. 2010, ¶50.

Petitioner has therefore not established that independent claim 23 is unpatentable over LeFebvre. Dependent claim 25 depends from independent claim 23 and Petitioner cannot establish that it is unpatentable by virtue of depending from a patentable independent claim. *Mylan*, 914 F.3d at 1376.

4. Petitioner provides no evidence that a POSA would have been motivated to modify LeFebvre

Petitioner has failed to explain, much less argue, that a POSA would have been motivated to modify LeFebvre to arrive at the claimed invention. As explained, *supra*, LeFebvre never references a housing and the instrumented pad 16 is not a housing. Ex. 2010, ¶52 (further explaining the instrumented pad 16 does not store components inside of it and therefore serves a different purpose and function from that of a housing). Instead, LeFebvre suggests that pad 16 is a thin planar component, Ex. 1005, FIG. 4, which a POSA would understand to have significant vertical load would bear down it. Ex. 1005, ¶17 (stating “[t]he axle bearings 2a and bearing adapters 4, best shown in FIG. 4, are configured so that each bearing transmits the load which it carries and heat that it may generate through pads 16 and to the truck.”); Ex. 2010, ¶52. Thus, a POSA would not modify it to be a housing. Ex. 2010, ¶52 (explaining that an enclosure would not function well as a load bearing component, especially on an axle designed to support heavy freight).

Petitioner points to no evidence, in the LeFebvre reference or otherwise, which suggests that it would be advantageous to put the pad 16 somewhere else on the railcar. *See generally* Petition. As such, there is no motivation for a POSA to modify the pad 16 to be a housing for enclosing electronic components. Ex. 2010, ¶53.

B. Ground Two: Petitioner has failed to show that Claims 13–17, 22, and 24 are unpatentable under 35 U.S.C. § 103(a) over LeFebvre in view of Barone

1. Claims 13-17, and 22

Petitioner’s reliance on Barone does not cure the above-mentioned deficiencies of LeFebvre. *See* Petition, 41-51; §IV.A.2, *supra* (incorporated here). As an initial matter, Claims 13-17 and 22 all depend from Claim 5, which is independently patentable as described above. Barone does not cure the aforementioned deficiencies in LeFebvre. Indeed, Barone fails to disclose, teach, or suggest “a communication management unit [that] applies *heuristics* to analyze data collected from said one or more sensor units (a) to determine if an actual failure exists and (b) *to predict* potential or imminent failures *based on a statistical analysis* of said collected data,” as required by independent claim 5.

Petitioner has not established that independent claim 5 is unpatentable. Each of Claims 13-17, and 22 depend from independent claim 5 and Petitioner cannot establish that they are unpatentable either. *Mylan*, 914 F.3d at 1376 (“Dependent

claims, with added limitations, are generally not obvious when their parent claims are not.”).

2. **Claim 24**

Petitioner’s arguments regarding Claim 24, which depends from Claim 23, fail for the same reasons discussed above. *See* §IV.A.1.a, *supra* (incorporated here). Petitioner has failed to show that LeFebvre discloses, teaches, or suggests “a housing mountable on a railcar” as required by independent claim 23. *See* §IV.A.3, *supra* (incorporated here). In the same vein, Petitioner has failed to show that LeFebvre discloses, teaches, or suggests (i) “electrical circuitry,” (ii) a “power source,” and (iii) a “communication device” that are “positioned within said housing,” as required by independent claim 23. *Id.* And in fact, Mr. Ricca’s declaration does not even address the phrase “spaced from” or “housing” in his analysis for this claim. *See* Ex. 2010, ¶57. The Petition does not rely on Barone for disclosing the above quoted limitations. *See* Petition, 50-51. Petitioner has not shown that independent claim 23 is unpatentable over LeFebvre and Barone. Claim 24 depends from independent claim 23 and Petitioner cannot shown that it is unpatentable either. *Mylan*, 914 F.3d at 1376 (“Dependent claims, with added limitations, are generally not obvious when their parent claims are not.”).

C. Ground Three: Petitioner has failed to show that Claims 1 and 24 are unpatentable under 35 U.S.C. § 103(a) over LeFebvre in view of Denny and Provasnik

LeFebvre does not disclose a housing. *See* §IV.A.1.a, *supra* (incorporated here). Petitioner has failed to show that LeFebvre discloses, teaches, or suggests “a housing mountable on a railcar” as required by independent claims 1 and 23 (from which claim 24 depends). In the same vein, Petitioner has failed to show that LeFebvre discloses, teaches, or suggests (i) “electrical circuitry,” (ii) a “power source,” and (iii) a “communication device” that are “positioned within said housing” as required by each of independent claims 1 and 23. The Petition does not rely on Denny or Provasnik for disclosing the above quoted limitations. *See* Petition, 38, 53; Ex. 2010, ¶58. And Provasnik does not even relate to trains, but to automotive engines. *See* Ex. 2010, ¶58. Moreover, Denny and Provasnik fail to cure the above explained deficiencies in LeFebvre. *Id.*

Therefore, Petitioner has not established that independent claims 1 and 23 are unpatentable over LeFebvre, Denny, and Provasnik. Claim 24 depends from independent claim 23 and consequently Petitioner cannot show that claim 24 is unpatentable either. *Mylan*, 914 F.3d at 1376.

D. Ground Four: Petitioner has failed to that Claims 2, 3, and 26–28 are unpatentable under 35 U.S.C. § 103(a) over Armitage

Petitioner asserts that Armitage is prior art under “at least 35 U.S.C. §§ 102(a) and 102(e).” Petition, 5. It is neither.

1. Armitage is not prior art to the '223 Patent

The '223 invention (except claim 1) was conceived prior to Armitage's May 10, 2011 filing date, and diligent work on the '223 invention continued until a reduction to practice at least by August of 2011, Armitage is therefore not prior art.³

Although Petitioner notes in a single footnote that Armitage claims priority to a provisional filed on May 10, 2010, it did not enter the Armitage provisional into evidence. Thus, neither party nor the Board have sufficient evidence to make any determination as to Armitage's entitlement to its provisional date for purposes of §102(e). Ex. 2010, ¶¶59-60. Moreover, a "reference patent is only entitled to claim the benefit of the filing date of its provisional application if the disclosure of the provisional application provides support for the claims in the reference patent in compliance with § 112 ¶1." *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1381 (Fed. Cir. 2015); *Amgen Inc. v. Sanofi*, 872 F.3d 1367, 1380 (Fed. Cir. 2017) (applying *Dynamic Drinkware* to application publications). To establish the provisional priority date, a petitioner must first demonstrate that the provisional application's "written description [provides] support for the claims of the [later]

³ Were the Board to conclude that a reduction to practice occurred earlier than May 10, 2011, Armitage is still not prior art and conception and diligence would then not be required.

patent.” *Dynamic Drinkware*, 800 F.3d at 1382. Second, a petitioner must show that the “subject matter relied upon for prior art was effectively filed in the provisional application[.]” *Id.* at 1380-81; 35 U.S.C. (pre-AIA) §119(e)(1) (requiring an invention to be “disclosed in the manner provided by the first paragraph of section 112” to be entitled to a provisional filing date). Here, Petitioner has failed to do either. That exercise is nonetheless irrelevant because the Challenged claims were conceived prior to May 2010, i.e. prior to the Armitage filing. Ex. 2010, ¶66, App. A; Ex. 2013, ¶20.

There are two ways for an inventor to prove prior inventorship: “1) it reduced its invention to practice first, or 2) it was the first party to conceive of the invention and then exercised reasonable diligence in reducing that invention to practice.” *Mycogen Plant Sci. v. Monsanto Co.*, 243 F.3d 1316, 1332 (Fed. Cir. 2001). In IPRs, “Petitioner bears the burden of persuasion that the challenged claims are unpatentable, which includes the burden of establishing that any reference upon which it relies constitutes prior art under 35 U.S.C. § 102.” *Motorola Mobility LLC v. Intellectual Ventures II LLC*, IPR2014-00504, Paper 84, 14-15 (PTAB Mar. 13, 2020). Even if the Board were uncertain about the evidence, Petitioner, the party with the burden, loses. *Dynamic Drinkware*, 800 F.3d at 1378-79.

a. **All Claims of the '223 Patent Were Conceived By At Least March 2010**

“Conception requires proof that the inventor formed in his mind ‘a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.’” *Purdue Pharma L.P. v. Boehringer Ingelheim GMBH*, 237 F.3d 1359, 1365 (Fed. Cir. 2001). While the inventor should have “a specific, settled idea,” the inventor “need not know that his invention will work for conception to be complete [but] need only show that he had the idea...” *Tyco Healthcare Grp. LP v. Ethicon Endo-Surgery, Inc.*, 774 F.3d 968, 975 (Fed. Cir. 2014). There is no particular formula that an inventor must follow in providing corroboration of his testimony of conception. *Kridl v. McCormick*, 105 F.3d 1446, 1450 (Fed. Cir. 1997). Rather, corroboration is determined by a “rule of reason” analysis, in which “[a]n evaluation of all pertinent evidence must be made so that a sound determination of the credibility of the inventor's story may be reached.” *Price v. Symsek*, 988 F.2d 1187, 1195 (Fed. Cir. 1993); *Singh v. Brake*, 222 F.3d 1362, 1367 (Fed. Cir. 2000).

Co-inventors Andrew Martin, William Lefebvre, and Brent Wilson conceived of the invention described and claimed in the '223 patent to overcome problems with previous technologies and began to design a system that would enable bearing temperatures to be continuously (or near continuously) monitored onboard trains. Andrew Martin authored assembly instructions on December 3, 2009 detailing how to assemble the inside of a temperature sensing device (mote), including how to attach the wires onto the pins of a temperature sensor, which in turn contacts a brass

plug for thermal communication and is also connected to an electrical circuit board and soldered to an internal power source (battery) and a printed circuit board that included processing and communication circuitry, thus enabling the device to communicate information regarding the temperature. Ex. 2092; 2013, ¶11. On December 9, 2009, Brent Wilson sent the team photos of the mounting for the temperature sensing devices. Ex. 2136; 2013, ¶12.

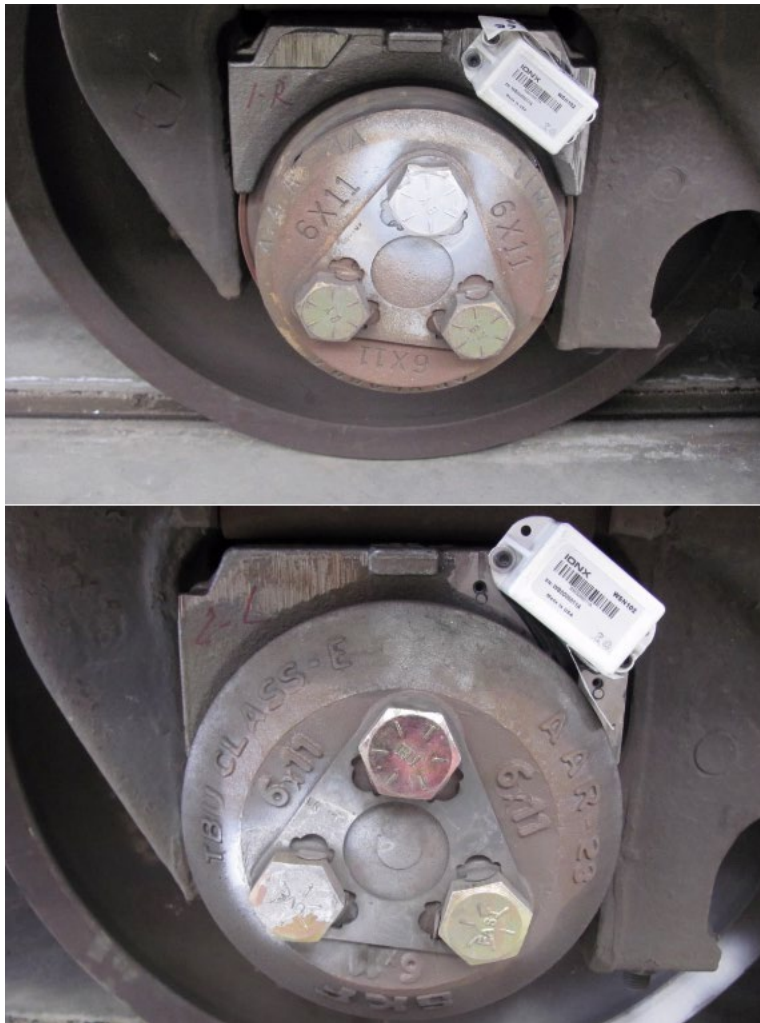
The Amsted inventors met in mid-December to discuss a task-list with status reports. Ex. 2149; 2013, ¶13. The team then worked on finalizing a test plan for the first three months of operation of this field test that included a description of the test equipment, installation/operation instructions and strategy, and output expectations, all of which are indicative of the concepts outlined in the '223 invention. Ex. 2162; 2013, ¶14. This test plan indicates that the inventive system includes a plurality of the temperature sensing devices described above, that are installed on a plurality of railcars, that collect data at periodic intervals and communicate with wireless communication management units (CMU's), wherein the CMU's also receive data from an external (ambient) temperature sensor. *Id.*

The team spent January and February 2010 setting up for the upcoming SCT field trial, as indicated in emails to Andrew Martin and his team discussing the shipment of motes and adapters and how they attach to each other. Exs. 2163; 2167; 2013, ¶15. In mid-January, Matt Lehmer completed an "RF Survey" using an

Amsted box car and “the first SCT system I have been testing.” Exs. 2164; 2013, ¶15-16. His report demonstrates the two way wireless communication capabilities of the network of motes and the CMUs. *Id.* Jay Monaco emailed the team on February 4, 2010 relaying that SCT testing “should commence in March once installations are complete” and that one algorithm for bearing condition assessment “has been incorporated into the IONX software and is currently being bench tested in West Chester,” and then on February 18, 2010 Doug Cummings discussed implementation of a timetable for SCT installations. Exs. 2165; 2014, ¶22; 2166; 2013, ¶17.

Initial tests of mote designs showed promising results, and the data from these tests directly impacted the conception of the heuristics that would eventually be evaluated, validated, and tested by Amsted the SCT trial. Exs. 2015 at 4; 2013, ¶7-9. Simultaneously, comprehensive bearing temperature algorithm validation and testing was also being conducted, at the direction of the Amsted inventors, by a research group at University of Texas-Pan American (“UTPA”) (now University of Texas-Rio Grande Valley). Ex. 2013, ¶9; Ex. 2054. This UTPA testing included validation of the Amsted hardware described above as well as the teardown and analysis of train hardware in which actual or potential faults were detected. Ex. 2013, ¶9; Ex. 2054.

By around March 2010, initial installations were underway for testing with SCT Logistics. Inventor Brent Wilson documented these initial installations for the rest of the team in an email on March 24, 2010, stating that “we did well, finishing 6/10 cars.” Exs. 2016; 2013, ¶18. The pictures attached to the email depict the notes attached to the bearing adapter sidewalls of the train cars:



Ex. 2016, 6; 2041 (stating the field trial “has begun as of March 28th”). An internal IONX presentation dated March 21, 2010 includes slides demonstrating how these

motes formed a remote wireless mesh network of sensors collecting temperature data using a wake/sleep power management, and communicating that data with a CMU and off-railcar locations using satellites. Exs. 2017, 5, 8, 9; 2018 (metadata corroborating date of Ex. 2017); 2047; 2090 (metadata corroborating date of Ex. 2047); 2013, ¶18. In response to conversations with SCT representatives, the inventors realized that “setting locomotive alarm thresholds at values that are sub-critical will lead to too many stoppages and delays” and proposed to “continue to monitor low level (stage 1) alerts to make determinations about repeat temperature offenders and/or trending events.” Exs. 2019; 2013, ¶19. The inventors proposed a “revised alarm notification system” having various alarm stages that limit alerts sent to a locomotive terminal until actionable events of sufficient severity occur (high level alarms) and which vary depending on how severe the events or conditions are. Exs. 2019; 2013, ¶19. The same day, Andrew Martin relayed changes and instructions for the severity levels to be used for triggering alerts. Exs. 2058; 2013, ¶19.

By early April 2010, the Amsted inventors had a definite and permanent idea of the complete invention set forth the '223 Patent as it was intended to be applied in practice, evidenced in a presentation emailed from Andrew Martin to SCT Logistics on April 4. Exs. 2020; 2013, ¶20. This presentation includes an illustration that is nearly identical to Figure 6 of the '223 Patent:

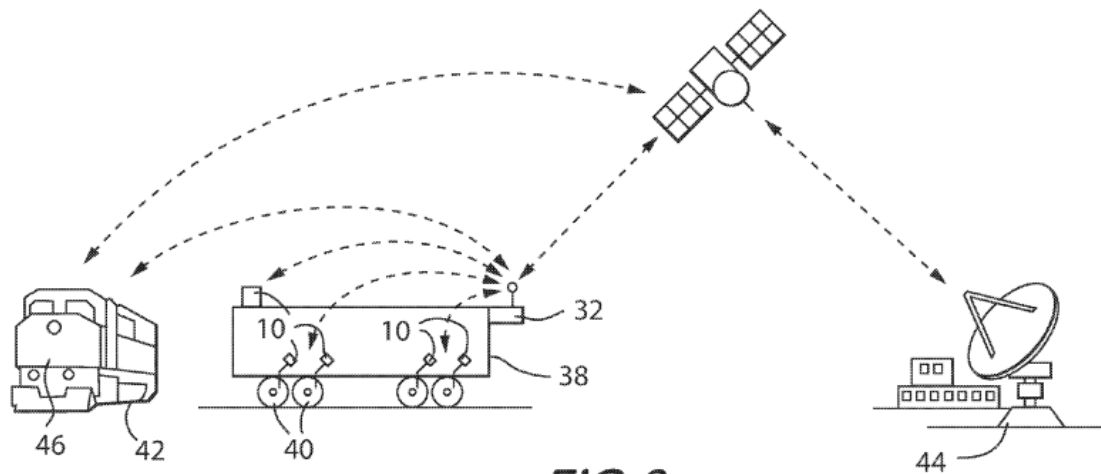
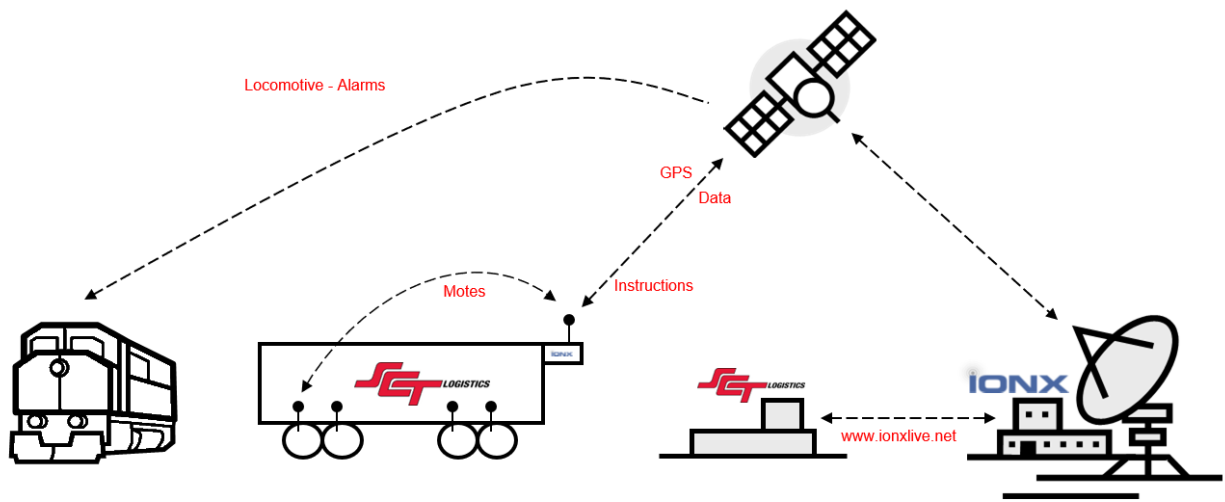
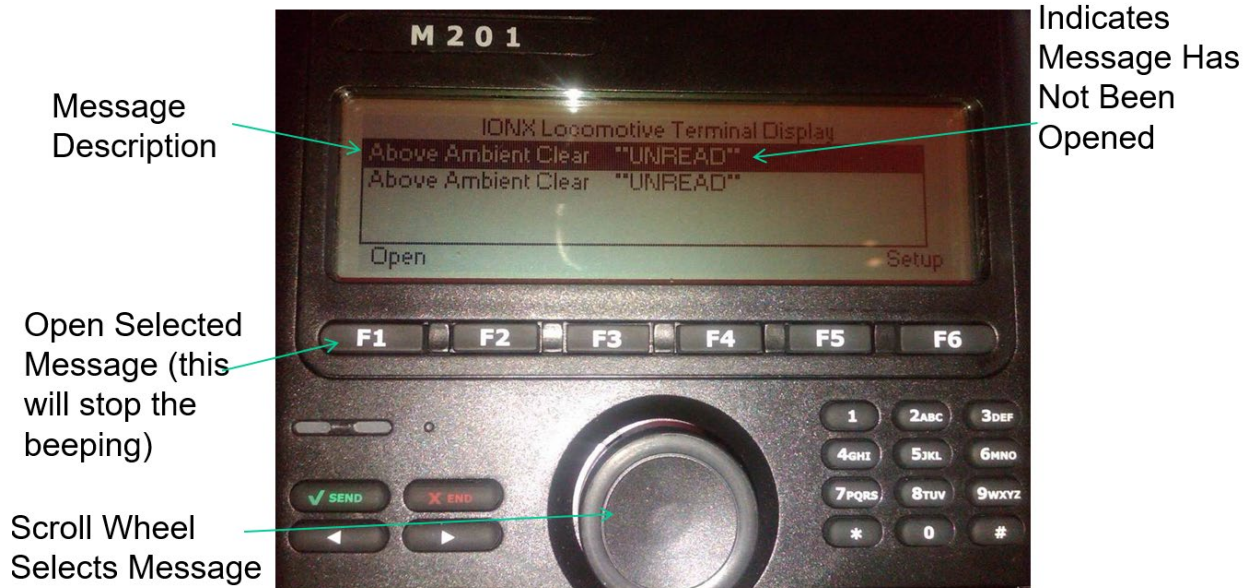
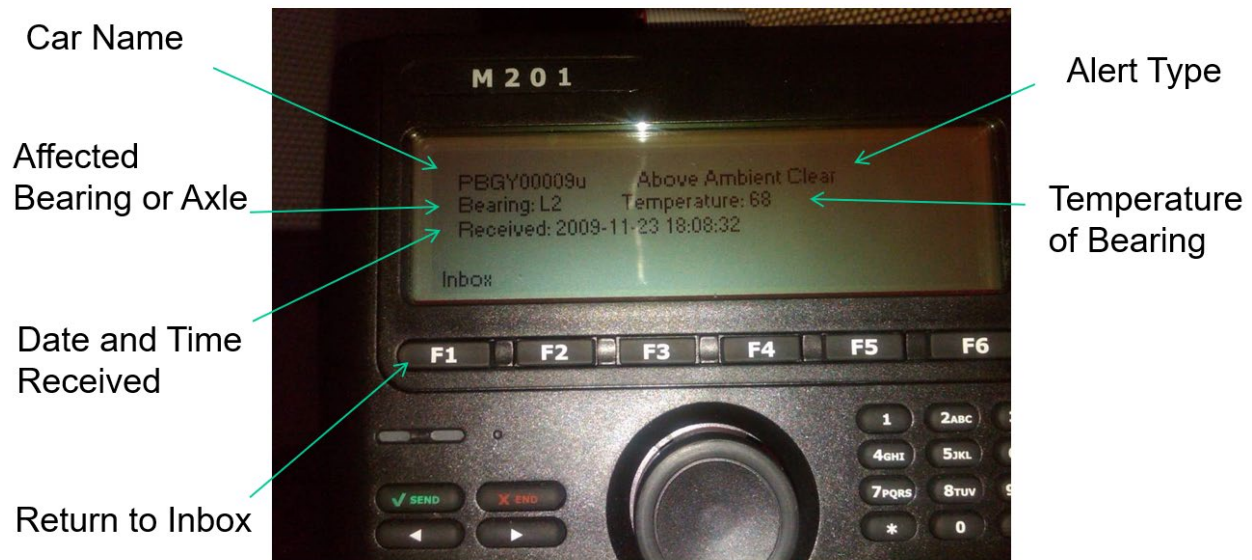


FIG.6

Exs. 2020, 4; 2013, ¶20. The illustration depicts a system of monitoring railcar performance utilizing a variety of sensors, or motes, attached to the railcar and communication circuitry allowing the motes to wirelessly transmit the sensor readings to a receiver. Exs. 2020; 2013, ¶20; Ex. 2040. The presentation includes

photos of the motes attached to the bearing adapter sidewalls of train cars like the March 24 photos from Brent Wilson and an alarm system with multi-tiered severity levels as described by Brent Wilson on March 31. Exs. 2020; 2013, ¶20; Ex. 2040. The presentation also shows a cab display indicating messages determined from applying heuristics to the received data, including the temperature of the bearing, the affected bearing or axle, the alert type, and the car name, demonstrating the ability to communicate alerts in a network with other railcars when the bearing temperature is outside of a certain range:





Exs. 2020; 2013, ¶¶20; 2010, ¶¶35-36.

This presentation (Ex. 2020) provides ample documentary evidence of conception of a specific, settled idea of the invention of the '223 Patent at least by April 4, 2010. Corroboration of conception, although not required for documentary or physical exhibits, is also provided by non-inventor fact witnesses. *See, e.g.*, Ex. 2021 (April 3 email from Ronald Bury asking for photos of the equipment on the cars to “include in instructions to crews and maintainers, i.e. the notes on the adaptor, the ambient note the communication unit on the hand brake end and the loco cab equipment.”); Ex. 2020; *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1169-70 (Fed. Cir. 2006) (finding that corroboration is not required for signed and dated physical exhibits created by the inventors because the “trier of fact can conclude for itself what documents show, aided by testimony as to what the exhibit

would mean to one skilled in the art.”). All of the evidence put forth in support of conception, including any corroborated testimony, must be considered as a whole, not individually. *Price*, 988 F.2d at 1195-96 (evidence is sufficient if it “collectively gives the board an abiding conviction that [patent owner’s] assertion of prior conception is highly probable”) (quotation omitted). Here, conception is also corroborated by the evidence discussed below showing prototyping and testing that resulted in reduction to practice at least by August 2011. When taken as a whole, the evidence set forth by Amsted paints a clear picture that conception prior to the Armitage Patent is at least highly probable. Ex. 2010, ¶66.

b. The Invention Claimed in the ’223 Patent Was Reduced to Practice At Least As Early As August, 2011

“[To] establish an actual reduction to practice, the inventor must prove that: (1) he constructed an embodiment or performed a process that met all the limitations of the [claimed invention]; and (2) he determined that the invention would work for its intended purpose.” *Cooper v. Goldfarb*, 154 F.3d 1321, 1327 (Fed. Cir. 1998). If testing is needed to demonstrate suitability for an invention’s intended purpose, the type and amount of any testing required depends on the nature of the invention, and courts are “guided by a common sense approach when weighing the sufficiency of the testing.” *Scott v. Finney*, 34 F.3d 1058, 1061-62 (Fed. Cir. 1994). Sufficient circumstantial evidence of an independent nature can satisfy the corroboration

requirement. *Knorr v. Pearson*, 671 F.2d 1368, 1373 (C.C.P.A. 1982). Furthermore, an actual reduction to practice does not require corroboration for every factual issue contested by the parties. *Cooper*, 154 F.3d at 1330 (rejecting “the notion that each individual act in the reduction to practice of a count must be proved in detail by an unbroken chain of corroboration”).

Before the inventions described in the '223 Patent, railcar performance was monitored through the use of wayside detectors and fixed locations throughout the railroad network, or through on-board instrumentation. Ex. 1001, 1:49-67. The intended purpose of the invention of the '223 Patent was to improve “(1) the ability to reliably collect and utilize data from multiple sensors on each railcar; (2) the ability to analyze collected data by the application of heuristics to detect and predict operational deficiencies; and (3) the ability to determine the severity of detected conditions to determine if immediate alarms should be raised to facilitate human intervention.” Ex. 1001, 2:10-17; Ex. 2010, ¶64; *Medtronic, Inc. v. Teleflex Innovations S.A.R.L.*, 68 F.4th 1298, 1304 (Fed. Cir. 2023) (“the patents themselves are the most important and... most persuasive evidence of the patents’ intended purpose....”). The Amsted team developed numerous tests, awaited their results, and then applied the results to further improvements and tests. The corroborated evidence here shows that before Armitage was filed, the inventors prototyped and tested a railcar monitoring system and demonstrated that it would work for its

intended purpose, beyond a probability of failure, by at least by August of 2011. Ex. 2010, ¶¶66, App. A, B.

i. Initial Prototypes and Tests

Research, development, and testing on the railroad monitoring system was reasonably continuous between April 2010 and August 2011, through both SCT field trials under actual conditions of use and UTPA lab testing, with nearly all of inventor Andrew Martin’s working time being spent on making improvements to the design and functionality of the system and perfecting the specific heuristics used to analyze the data. Ex. 2013, ¶¶21; *Scott*, 34 F.3d at 1062 (Fed. Cir. 1994) (inventions may be tested “under actual conditions of use” or under “laboratory conditions” which may or may not duplicate each and every condition of actual use). The above documented SCT field trial began and continued to provide useful data throughout the critical period that was analyzed to make the bearing temperature algorithms more robust. Exs. 2030; 2013, ¶¶14-18, 20; 2019; 2020; 2029 at 3; §IV.D.1.a, *supra* (incorporated here).

On April 6, 2010, Brent Wilson noted that Amsted would use the information gained from the SCT trial “to make determinations about the longevity of the bearings that have seen atypically high temperatures” and conservatively utilize “four stage alert levels” in which the “first stage alert will not be broadcast to the locomotive so that it will not cause any undue concern for the drivers.” Exs. 2023

(delineating the temperatures that were set for each alarm level); 2013, ¶¶22-24. Andrew Martin also provided his input on the heuristics on April 6, 2010, in an email response to Brent Wilson, discussing various issues he found with triggering thresholds. Ex. 2024. Back and forth email discussions regarding the algorithm instructions to fix frequent alarm levels continued through April 7, 2010. Exs. 2025; 2013, ¶¶23-24.

Also on April 6, 2010, non-inventor Matthew Lehmer provided all three inventors with photos of the exterior “locomotive install” at the SCT trial, showing the satellite and GPRS installations. Ex. 2026. On April 7, 2010, Brent Wilson and Andrew Martin also provided photos of the alarm display and a mode on the locomotive and the broader installation. Exs. 2027; 2028.

A progress summary of the SCT field trial was detailed in a presentation developed by Brent Wilson and William Lefebvre on April 8, 2010, which was emailed to Bob Cantwell for internal use. Ex. 2022. Slide 3 of the presentation summarizes the challenges the team were facing, including adapting the solution “to support data logging [of over] ½ million temperature readings/day on 10 cars, [d]aily uploads from Australia to West Chester, PA, and [c]ommunicating alarms to locomotive engineer.” *Id.* at 4; Ex. 2013, ¶¶24-25. Slides 5-9 are photos of the components of the system that was ultimately claimed in the ’223 Patent, slide 10 is a chart of the various detected temperatures and associated actions, slides 12-14

provide the data results, and slide 15 outlines the “Next Steps,” including further monitoring of the system and collecting more data. Ex. 2022. In response to the presentation, Bob Cantwell sent a congratulatory email, also on April 8th, remarking on the “successful SCT/IONX/Amsted Rail bearing monitoring installation!” Ex. 2030 (noting that “[t]here have only been a handful of breakthrough developments in the Rail industry over the past 30 years, and this is going to be one of the biggest.”)

Work on temperature analysis as it pertained to the sensors continued throughout the rest of April, and the team began to work on a procedure for the configuration of temperature settings that enabled the updating of thresholds of all nodes of all units to calibrate the sensors. Ex. 2013, ¶¶25-26; Exs. 2031; 2032; 2055; 2056; 2089; 2091. These emails also include the team discussing changing the parameter in the algorithm with the values sent from Brent and Andrew and updating the WSNs in the field. Exs. 2013, ¶18; 2031; 2033.

Testing continued through April and the SCT field trial was “well-received and successful to this point.” Exs. 2035; 2014, ¶12. Andrew Martin visited UTPA to provide the project plan and detailed instructions regarding the analysis and deliverables that Amsted would expect from UTPA. Exs. 2013, ¶¶27-28; 2034; 2057; 2059; 2060. Additional requests were added by email on May 17, 2010 with the expectation that work would begin the week after. Exs. 2013, ¶28; 2061. An email from Andoni Zagouris to Brent Wilson and non-inventor Matthew Lehmer

indicated that the motes were “behaving extremely erratic[ly].” Exs. 2036, 2037, 2038. Work continued throughout the rest of the month to resolve these issues. Exs. 2013, ¶¶28-29; 2062; 2063; 2064; 2065. Work also continued on correcting the issues SCT had reported in April regarding unwanted bearing alerts to the locomotive displays concluding with successful tests at the end of May. Exs. 2039, 2044.

By the beginning of June 2010, the SCT field trial continued “to report successfully and data is being used to refine algorithms.” Exs. 2045; 2048; 2014, ¶14. Testing continued at UTPA, with preliminary results sent on June 1 and with future results promised “weekly.” Ex. 2043. Also, on June 1 a “high temperature profile test” was started to calibrate high sensor temperatures with high bearing temperatures. *Id.* On June 11, UTPA emailed Brent Wilson a preliminary teardown report of the bearing pulled from service during the first week of the trial. Ex. 2046. A new calibration curve was provided a few days later. Ex. 2066. On June 22, UTPA provided a presentation with the results from the IONX bearing health monitoring algorithm, identifying three bearings for further review which was accomplished and presented a few days later. Exs. 2013, ¶¶30-31; 2067; 2068; 2069; 2070; 2071. This presentation provides an overview of the algorithm described in the ’223 Patent that uses a pre-determined percentage of data readings exceeding: allowable peak readings or a determined value (e.g. percent count over 200 F in slide 3), a standard

deviation from readings in the same railcar or from all railcars in the fleet (e.g. temperature skew from railcar or fleet mean in slide 2), and the rate of change of current data readings that exceed a pre-determined threshold (e.g. temperature rise rate in slide 2, 11, 12). Ex. 2067 at 2, 3, 11, 12.

Testing continued through July 2010, as evidenced in an email from Andrew Martin to the team from UTPA on July 2 stating that he had not received “the graphs yet of daily max temp differential with average trend lines” and that “after much pains taking manual effort” was able to get updated data for several cars. Ex. 2042. On July 6 and 13, Andrew Martin emailed UTPA updated sets of instructions for the data analysis we required on the SCT data. Ex. 2072; 2073; 2074; 2013, ¶¶32-34.

On July 19, Brent Wilson emailed the team about “some curious behavior” regarding one of the bearings identified by the IONX algorithm at the end of June (on railcar 130L) and indicating the bearing would be “pulled for inspection.” Exs. 2049; 2067; 2068; 2069; 2070; 2071; 2013, ¶¶31-34. Also on July 19, Andrew Martin sent a report to SCT detailing the first 90 days of the trial. Exs. 2050; 2013, ¶35. This report contains a detailed description of the system previously described in the April 4 presentation, along with photos of the actual components in use. Exs. 2050 at 6-9; 2020 at 5-9. Additionally, “Alarm Improvements” and “Algorithm Advancements” and results of data analysis are described. Ex. 2050 at 13-18. The report ended with a description of “Future Work” including a recommendation that

“the trial be extended to continue for an additional 3 months ... to focus on all the improvements..., including improved alarms on CMU, improved predictive algorithms, and root cause analysis on field anomalies.” *Id.* at 19; 2013, ¶¶35-37. SCT agreed to continue the trial. Ex. 2053 at 3; 2014, ¶16. Field tests continued through the rest of July. On July 29, Andrew Martin and Brent Wilson updated the meeting tasks which included next steps such as gathering a complete list of all algorithms and metrics, and making a list of various temperature data points. Exs. 2075; 2051.

Throughout August 2010, data from the tests was continually analyzed for improvements to be made to the algorithms, particularly to prevent the triggering of false alarms. Ex. 2013, ¶¶38-39. For example, Ronald Bury emailed the inventors on August 1 concerning a triggered alarm, and it was determined that the sensor did not properly update. *Id.*, ¶38; Ex. 2052 at 2-4. Further discussions between the inventors and with UTPA continued throughout the month regarding anomalous bearing temperature readings. Exs. 2076; 2077; 2078; 2079; Ex. 2013, ¶¶38-39. Also in late August, the team decided to have UTPA examine and test the 130L bearing pulled from service in July by running the bearing to failure. Exs. 2081, 2082, 2083; Ex. 2013, ¶39. The inventors reported to Amsted Engineering that “[a] second bearing tripped by our algorithms has been removed from service and is in route to Brenco for analysis.” Ex. 2080 at 3; 2014, ¶17.

In September 2010, Andrew Martin developed new tasks for the UTPA group while the Amsted programming team continued refining the algorithms. Ex. 2013, ¶40. An update from UTPA regarding the analysis of SCT data was received by the inventors on September 20. Exs. 2084; 2013, ¶40. Brent Wilson traveled to Australia between September 11 and September 23 and met with members of SCT Logistics staff and identified units that required battery updates. Ex. 2013, ¶41.

By October 2010, upgraded algorithms were developed for use in the already-installed systems, with the intent of updating those systems with the upgraded algorithms. Ex. 2013, ¶42. On October 6, 2010, Andrew Martin emailed Paul Hubbard to inform him that UTPA would “complete the teardown and report by 10/15/2010” and provided UTPA with maintenance logs for the railcars. Exs. 2085; 2088. Later in October, UTPA transmitted a final report regarding the teardown of the 130L bearing. Ex. 2013, ¶42; 2086. UTPA sent updated results of their analysis of SCT data on October 29, 2010 for a conference call planned for that day. Ex. 2013, ¶42, 2087.

Testing continued in November 2010, as IONX considered “other places to put the WSN for measuring bearing temperature.” Exs. 2093; 2094; 2013, ¶43. Analysis of the bearing test results also continued, and the IONX Update from November 3 emailed from UTPA to Brent Wilson included a detailed analysis of the speed and temperature data for the 130L and 112N railcars. Ex. 2095. There were

several emails indicating productivity at UTPA, including a tear down inspection on some bearings from Australia and a notification of a bearing seizing but that “the results we obtained... clearly show that we are on the right track.” Exs. 2096; 2097; 2098; 2013, ¶43. On November 5, a report that was emailed from Andrew Martin to the team summarized the trial setup, previous and new results, improved predictive algorithms, and next steps, including “data collection [to] aid in development of future algorithms.” Ex. 2099. On November 6, Andrew Martin emailed Tarawneh that “there is a list of 26 bearings that could be considered on our ‘watch list’ and requesting that UTPA “update this ‘top 10’ list every 30 days going forward.” Ex. 2100.

Martin Reed emailed the Amsted team on November 8 about the importance of continuing to run the bearings to failure, since that would signal “that IONX correctly signaled a distressed bearing” that had then proceeded to failure, indicating a successful product. Ex. 2101. By mid-November, Andrew Martin emailed Brent Wilson and Tom Letsch about an inspection of car PBGY130L inspection in Australia. Ex. 2102. On November 26, 2010, Tarawneh send the inventors a report that summarized all of the results for Railcar 130L, with tables summarizing the results of the three alarm levels and temperature history plots, and an observation that there was “some issue” with the rear of the car, and an inspection and teardown was recommended. Exs. 2103; 2013, ¶43. Andrew Martin sent a November 29

meeting invitation for conference calls that “[o]ccur... every Wednesday” regarding “SCT Data Analysis with UTPA” from December 8, 2010 to May 18, 2011. Ex. 2104.

By December 2010, Amsted was continuing “to review the accuracy and completeness of [the bearing condition monitoring] algorithms and check for functions that are portable to a microprocessor.” Exs. 2105; 2013, ¶44. On December 6, Tarawneh noted that several of the bearings on railcar 130L showed high temperatures. Exs. 2106; 2013, ¶44. He also emailed a presentation that updated the November 26 presentation, specifying that 130L Node 6 had a bad ranking, and that the standard deviation was misleading “since there are several bad bearings within the car.” Exs. 2107; 2013, ¶44. Development of alarm thresholds in response to testing results also continued during this time. Exs. 2108 (“we will continue to watch alarm level 3 data very closely in order to get more comfortable with setting up proper alarm thresholds.”); 2013, ¶44. William Lefebvre and Brent Wilson followed up that the alarm levels they were experiencing were not “a negative for monitoring temperature.” Exs. 2109; 2013, ¶44.

In January 2011, the IONX Update from December 15 emailed from UTPA to the inventors indicates extensive testing on the 130L Node, with “Future Work” including generating “10-Day Weekly Reports” and “converting existing scripts to run on last 10 active days of data for the fleet.” Ex. 2110 at 45. On January 6, 2011,

UTPA emailed the “monthly checklists” to the inventors, which included Fleet-Wide Level 3 Report Criteria that reported that they would “re-plot the historical data to see if we can gauge the rate at which “watch list” bearings are degrading.” Ex. 2111. The January 7, 2011 Engineering Status Report verified that data from the tests was still being analyzed and “processed through new advanced algorithms” and “[p]rototype parts have been running in November at UTPA with no sign of trending data.” Ex. 2112. A possible truck issue was detected, with “all bearings running statistically hotter than others” and therefore were “being watched closely.” *Id.* Javier Kypuros sent the inventors another IONX Update on January 13, 2011 with fleet-wide report criteria including observations and analysis. Ex. 2113; 2013, ¶45.

On February 14, 2011, Andrew Martin requested slides from Kypuros on “problematic cars that are reporting erroneous reading for long periods of time.” Exs. 2114; 2013, ¶46. On that same day, he reported to his co-inventors that “[t]he motes are still alive and reporting,” and weekly SCT data analysis conference calls continued with UTPA. Exs. 2115; 2116; 2013, ¶46. On February 16, 2011, Tarawneh sent the inventors two presentations that summarized the SCT 130L and 77H Railcar Performances, including the bearing temperature histories, alarm level summaries for every month from April 2010 through January 2011. Exs. 2117; 2013, ¶46. Emails on February 17 and 18 show further requests from the inventors to UTPA for continued testing and analyses. Exs. 2118; 2119; 2120; 2121; 2013,

¶46. On February 21, Tarawneh emailed the inventors a chart of the Level 2 Alarm violators, noting that UTPA hired someone to look “into the SCT data and prepare presentations and tables of abnormalities.” Exs. 2122; 2013, ¶46. UTPA emailed the slides for the weekly conference call on February 23, which included an IONX Update reporting issues with some of the nodes and node calibration data. Exs. 2123; 2013, ¶46. On February 25, UTPA reported that they “should be starting the low ambient calibration by March 23rd.” Exs. 2124; 2013, ¶46.

Weekly conference calls with the UTPA team continued through March 2011. Exs. 2125; 2013, ¶47. On March 15, Andrew Martin sent an email to his co-inventors that they “should review the slide below on energy reductions in bearings at higher temperatures.” Exs. 2126; 2013, ¶47. On March 30, Andrew Martin emailed the UTPA team that maintenance data on the SCT fleet had been reviewed, and they needed to make sure they were not “comparing old bearings to new bearings.” Exs. 2127; 2013, ¶47. Brent Wilson replied with a request to inspect the 130L truck for anomalies. Exs. 2128; 2013, ¶47. On that same day, William Lefebvre emailed Brent Wilson and Jay Monaco discussing the statistics on a few WSNs and requesting replacement nodes. Ex. 2129.

SCT railcars continued to be monitored into April 2011, with an update for SCT prepared by April 7. Ex. 2130. On April 8, 2011, Brent Wilson emailed slides to the team for a call that included “data I had UTPA generate comparing class K/F

bearings under loaded and unloaded conditions.” Ex. 2131. On April 14, Tarawneh emailed Andrew Martin a calibration plot of new nodes stating that “the calibration curve is good even at low temperatures.” Exs. 2132; 2013, ¶48. He noted that they continued to run temperature data and that “so far, we are very excited about the data.” Exs. 2132. On April 21, 2011, Andrew Martin emailed the Amsted team an update that “[t]he IONX Bearing Condition Monitoring System has been running successfully for twelve months,” and identified a car (130L) that continued to be monitored. Ex. 2133. He gave recommendations and requested a third-party teardown of the flagged 130L assembly. *Id.* The weekly UTPA conference calls to review data analysis continued as well, with updated “IONX Update” slides. Exs. 2134; 2135; 2013, ¶48.

By May 2011, bearing temperatures were continuing to be monitored. Calls with updates from UTPA continued, with the May 4 IONX Update reporting the node temperature calibration graphs, and noting that “there were no Level 2 Violations for the month of April” so Level 3 stats were compiled for analysis. Ex. 2137 at 22. On May 9, Tarawneh emailed UTPA testing would continue through the summer, including “lifetime testing of the scanned components” and “collecting calibration data for IONX.” Ex. 2138. On May 16, Tarawneh emailed the inventors presentations with updated analyses of the performance of 10 of the SCT Railcars, with observations of trends and recommendations. Exs. 2139; 2013, ¶49. On May

18, there was another conference call with UTPA and the inventors to discuss the IONX Updated slides. Exs. 2140; 2013, ¶49.

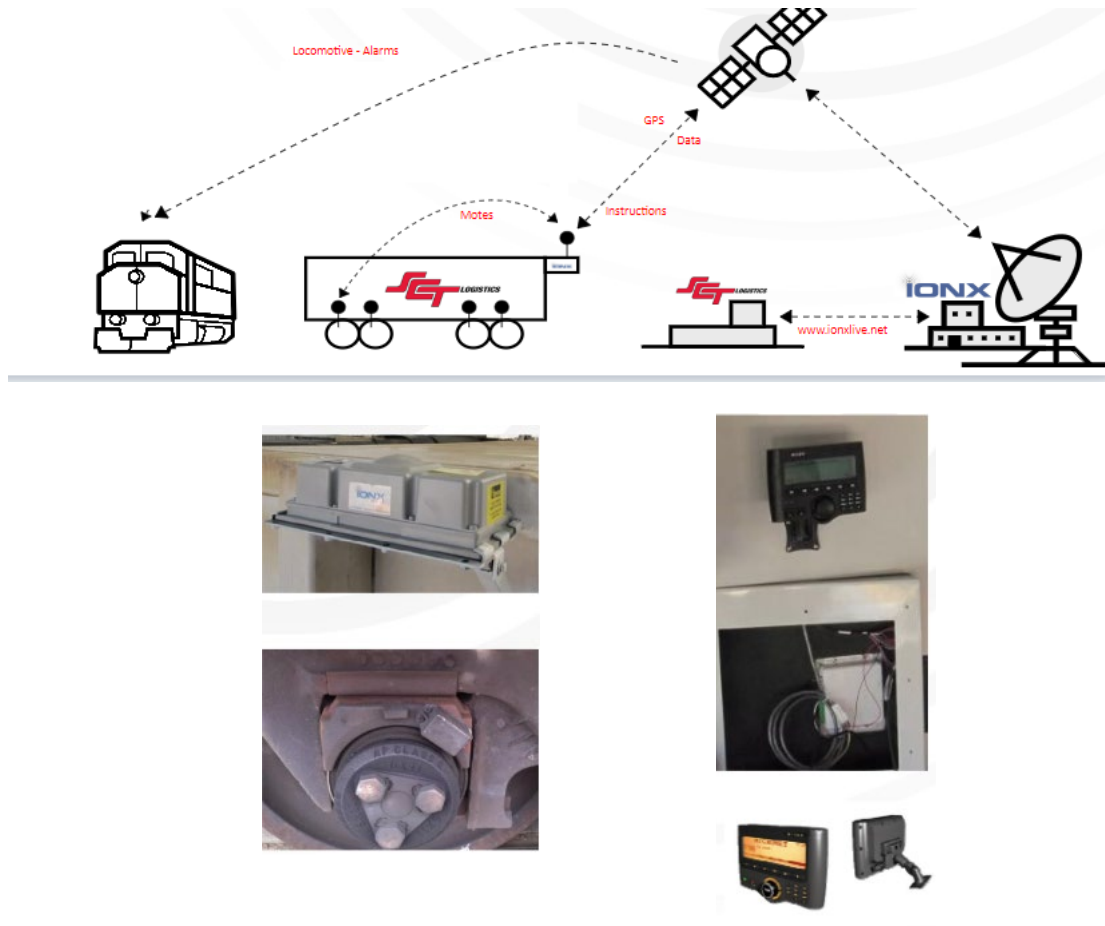
Conference calls with UTPA to discuss the SCT Data Analysis and other testing continued through June 2011, with an IONX Update Presentation reporting on node temperature calibration and a discussion of Criteria 3 and 4 analyses to identify bearings for service that consistently operated above average temperatures. Exs. 2141; 2142; 2013, ¶50. On June 15, Tarawneh emailed the inventors presentations with updated analyses of the performance of 10 of the SCT Railcars, with observations of trends and recommendations. Exs. 2143; 2144; 2145; 2013, ¶50. On June 22, Kypuros provided an IONX update for a conference call scheduled that day. Exs. 2146; 2013, ¶50.

Conference calls with UTPA to discuss the SCT Data Analysis continued in July 2011, with an IONX Update Presentation reporting on node temperature testing and battery life. Exs. 2147; 2013, ¶51. A July 8 email from Andrew Martin to Doug Cummings reports that “[t]he 10 cars on test are still giving us valuable data and the bearing teardowns will help that.” Exs. 2148; 2013, ¶51. This email also discussed the replacement of bearing temperature motes on SCT’s wagons and a request to inspect bearings “that are close to tripping our algorithms.” Exs. 2148; 2013, ¶51. On July 13 and 19, UTPA emailed the inventors more updates with node temperature testing data. Exs. 2150; 2151; 2013, ¶51. A July 20, 2011 email chain among

inventors and non-inventors concludes that the majority of the algorithms can be pushed onto WSNs and two algorithms will need to send data points to the CMU every 6 hours. Exs. 2152; 2013, ¶51. Tarawneh sent a presentation to the inventors on July 27, 2011 that summarized the node temperature testing data. Exs. 2153; 2013, ¶51.

By August 2, 2011, the invention claimed in the '223 Patent was reduced to practice. On this date, Andrew Martin sent an email to the team with a report for SCT that “highlights the successes of the trial and a direction forward.” Exs. 2154, 1; 2013, ¶52. This report demonstrates that the invention worked for its intended purpose, with utility beyond a probability of failure: “The system found two (otherwise undetected) faulty bearings;.... Identified a poorly performing bogie, which has since been serviced eliminating the high bearing temperatures observed; [and] the installation... has withstood a harsh and demanding railroad environment.” Exs. 2154 at 6; 2013, ¶52-53. Additionally, the multi-tiered alarm approach was validated, and algorithms were developed “that indicate bearing ‘condition’”: “[E]xtensive use of predictive algorithms developed during the trial phase have eliminated the high temperature and high risk bearings from the fleet.” Ex. 2154 at 7. In conclusion, the inventors have “developed and proven a bearing condition monitoring system with action instructions for any critical alerts.” *Id.* at 15. The

following pictures from this report demonstrate all components of the '223 invention remained the same throughout the testing period:



Ex. 2013, ¶53.

ii. Reasonable Diligence

Where an inventor conceived of the invention before the filing date of the alleged prior art but reduced it to practice after, the inventor must connect the conception with the reduction to practice by showing that he exercised reasonably continuous diligence. *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1577 (Fed. Cir. 1996). The “point of the diligence analysis... is to assure that, in light of the evidence

as a whole, ‘the invention was not abandoned or unreasonably delayed.’ *Perfect Surgical Techniques, Inc. v. Olympus Am., Inc.*, 841 F.3d 1004, 1009 (Fed. Cir. 2016). Diligence need only be reasonably continuous, not be perfectly continuous; “[p]eriods of inactivity within the critical period do not automatically vanquish a patent owner’s claim of reasonable diligence.” *Arctic Cat Inc. v. GEP Power Prod., Inc.*, 919 F.3d 1320, 1331 (Fed. Cir. 2019). The purpose of the diligence inquiry “is not to scour the patent owner’s corroborating evidence in search of intervals of time where the patent owner has failed to substantiate some sort of activity.” *Id.* The invention described in the ’223 Patent required a long period of testing, collecting and analyzing the results from that testing, and then implementing improvements into new tests. Ex. 2010, ¶71. Since reasonably continuous diligence in this case depended on the nature and timing of this testing, the testing environment, and the collection and analysis of millions of results (including awaiting results from numerous railcar trips and numerous railcars in Australia), the evidence establishes that reasonably diligent work on the invention continued until at least as early as August of 2011. *Id.*, ¶72.

2. Claims 2, 3, and 26–28

Armitage is not prior art to claims 2, 3, and 26–28. *see* §I.B, *supra*; IV.D.1, *supra* (both incorporated here) and Petitioner has not shown that independent claim 2 is unpatentable over Armitage in view of LeFebvre. *See* §IV.A.1 *supra*

(incorporated here). Further, with regard to claim 26, Petitioner simply points to its discussion of claim three which does not claim heuristics or statistical analysis and does not explain how Armitage discloses limitations 26(b)-(c). Ex. 2010, ¶69; *see also* §IV.E.2, *infra* (incorporated here).

E. Ground Five: Petitioner has failed to show that Claims 4-10, 13-18, 20-23, 25, and 29-32 are unpatentable under 35 U.S.C. § 103(a) over Armitage in view of LeFebvre

1. Claims 4, 29, and 30

Armitage is not prior art to claims 4, 29, and 30, *see* §I.B, *supra*; IV.D.1, *supra* (both incorporated here) and Petitioner has not shown that independent claim 2, from which each claim depends, is unpatentable over Armitage in view of LeFebvre. *See* §IV.A.1 *supra* (incorporated here). Accordingly, Petitioner has not shown that claims 4, 29, and 30 are unpatentable. *Mylan*, 914 F.3d at 1376 (“Dependent claims, with added limitations, are generally not obvious when their parent claims are not.”). Further, there is no motivation to combine Armitage and Lefebvre for the reasons provided below in reference to Claim 5. *See* §IV.E.3, *infra* (incorporated here).

2. Claims 5-10, 13-18, and 20-22

a. Claim 5 – There is no motivation to modify Armitage in view of LeFebvre

Petitioner has not and cannot show any motivation to modify Armitage in view of LeFebvre to arrive at claim 5 because doing so would change the basic operating principles of the Armitage invention. Petitioner argues against limitation

5(g) by referring back (through multiple cross references) to limitation 8(b) *See* Petition, 34. Petitioner’s analysis is not only confusing, but fatally flawed.

Initially, Petitioner has not shown that LeFebvre discloses limitation 5(g) because a POSA would not confuse the collection of data at periodic intervals with a power management method. *See* IV.A.2, *supra* (incorporated here). With regard to the combination of LeFebvre and Armitage, Petitioner relies on Armitage, ¶55 (disclosing various components of Armitage’s sensor node), Ex. 1005 ¶¶34-35 (discussing a low power mode), and the Ricca Declaration, ¶¶146, 349. *Id.* It appears that Petitioner’s analysis alleges that Armitage, ¶55 discloses “software” that could be modified in view of LeFebvre’s “power saving scheme.” Petition, 81. Petitioner then argues that a POSA would be motivated to modify Armitage in view of the “power-saving scheme described by LeFebvre because “it saves power” and because it was a “well-known feature.” *Id.* However, Armitage relies on a data analysis technique that requires “continuous monitoring” and there is no indication in Armitage that power saving is a concern. *See* Ex. 1006, ¶44 (“Realtime, continuous monitoring of all critical railway car components can be monitored....”); Ex. 2010, ¶¶71-72. And while, as stated by the Board, “there is no requirement that Armitage expressly teach or suggest that power saving is a concern,” Paper, 58, Armitage at least suggests (if not teaches) *against* it. *See* Ex. 2010, ¶72. Armitage discloses that the sensors operate in the conventional manner by continuously performing sensing

while the railcar is in motion. *See Id.* Specifically, Armitage analyzes sensor data through a comparison of the data from one sensor to a running average of data from a population of sensors and identifies outliers. *See id.* (citing Armitage, ¶¶30, 42). It is also worth noting that when the sensor is asleep, it might miss important indications. *See Ex. 2010, ¶72.* This would therefore not motivate a POSA to combine this feature from LeFebvre into Armitage. *See Ex. 2010, ¶73.*

LeFebvre, in contrast, discloses a sensor which “is programmed to switch on briefly” but would normally be “in a low powered state most of the time.” Ex. 1005, ¶¶34-35. As pointed out by Mr. Ricca, the explicit result of LeFebvre’s low power mode is that “it allows the microprocessor in the sensor node to be in a low powered state most of the time.” Ex. 1003, ¶349 (citing Lefebvre, ¶¶34-35). Such a modification to Armitage would frustrate the ability of Armitage’s sensor to “continuous[ly] monitor[] all critical railway components.” Ex. 1006, ¶44; Ex. 2010, ¶72. While such a modification to Armitage would not render the invention disclosed in Armitage “inoperable,” it is inconsistent with continuous monitoring. *See Ex. 2010, ¶72.*

A POSA would not be able to combine the dynamic continuous monitoring of Armitage and the power management features of LeFebvre to perform periodic collections of sensor data with any probability of success because turning sensors off and on as disclosed in LeFebvre would prevent Armitage’s system from

establishing an accurate running average of the sensor data. Ex. 2010, ¶73; *see also* Ex. 1006, ¶41-44. Thus, LeFebvre’s alleged “power-saving scheme” would not motivate a POSA to modify Armitage in the manner described in the Petition. Ex. 2010, ¶73.

Petitioner has failed to show that independent claim 5 is unpatentable over Armitage and LeFebvre at least because there is no motivation to modify Armitage in view of LeFebvre. *Id.* Claims 6-10, 13-18, and 20-22 depend from independent claim 5 and consequently Petitioner cannot show that they are unpatentable either. *Mylan*, 914 F.3d at 1376.

b. Armitage does not utilize statistical analysis techniques for predictive purposes

Armitage and LeFebvre fail to disclose, teach, or suggest “wherein said communication management unit applies heuristics to analyze data collected from said one or more sensor units (a) to determine if an actual failure exists and (b) to predict potential or imminent failures based on a statistical analysis of said collected data,” as required by independent claim 5. Ex. 2010, ¶74. Petitioner does not apply LeFebvre against any of limitation 5(i), 5(j), 5(k). Petition, 75; Ex. 2010, ¶74. Rather Petitioner relies exclusively on its discussion of claim 3 (which does not recite heuristics nor statistical analysis) only applying Armitage. Ex. 2010, ¶74; Pet., 64-66, 75; *see also* §IV.D.2, *supra* (incorporated here).

The Petition alleges that Armitage's control node 130 corresponds to the claimed "communication management unit" and performs the above quoted application of heuristics by relying on the preceding analysis presented with respect to dependent claim 3. *See* Petition, 64-66, 75. Notably missing from the Petition at these pages is any discussion regarding a "prediction." Ex. 2010, ¶75. Here, all that the Petitioner has done is allege that the "control node collects this data and analyzes it to determine whether a fault condition is present." Petition, 64.

Petitioner's arguments fall short because determining whether a fault condition is present is not the same thing as forming a forward-looking prediction that is "based on a statistical analysis of *said collected data*." Ex. 2010, ¶76. The limitations in 5(i), 5(j) and 5(k) require that heuristics be used in two different ways. *Id.*

First, to determine if a currently detected failure exists, i.e., "determine if an actual failure exists." Ex. 2010, ¶77; Limitation 5(j). Second, to form forward looking predictions based on a statistical analysis of the collected data, i.e., "to predict potential or imminent failures based on a statistical analysis of said collected data." Ex. 2010, ¶77; Limitation 5(k). All that Petitioner has done is argue that the combination discloses a system capable of detecting whether a fault condition event currently exists and whether maintenance is immediately required or may be put off until later. *See* Petition, 58; Ex. 2010, ¶77.

Armitage merely discloses establishing an event ranking for a deviation from normal conditions based on a comparative analysis of sensor data to the population of sensor data. Ex. 2010, ¶79. This type of analysis is not predicated on performing a statistical analysis of the data collected from a specific sensor or even a pool of individual sensor data. *Id.* Rather it is merely a comparative analysis using basic arithmetic. *Id.*

Armitage may only determine a fault condition by scanning for outliers, e.g., by comparing single sensor data against a corresponding pool of sensor data from a plurality of sensors to find outliers. Armitage, ¶42; Ex. 2010, ¶79. That is to say that Armitage may only determine “failure alerts” of a presently detected fault condition by performing a comparative analysis of sensor information from one sensor node against the corresponding sensor information from a plurality of sensor nodes. Ex. 2010, ¶79. For example, “When one or more of the sensor nodes begin to deviate from the others in the population, then a failure condition could be determined.” Armitage, ¶30.

Armitage’s ¶41 refers to FIG. 4, which merely contemplates performing a comparative analysis of sensor 325 against the other sensors 320, 322, 327, 326, etc. Armitage explains that “the population of all of sensor nodes 320-327 is taken into account to determine a dynamic threshold of failure.” *Id.*, ¶41. Next, Armitage explains that a failure condition may be determined by a standard deviation metric,

e.g., “when data from a sensor node deviates by more than three standard deviations, among other examples.” *Id.* Both of these analysis techniques require a pool of sensor data and would not work with a single sensor data. Armitage may determine “failure alerts” of a presently detected fault condition by performing a comparative analysis of sensor information from one sensor node against the corresponding sensor information from a plurality of sensor nodes. Ex. 2010, ¶80.

A POSA would understand that the methodologies contemplated by Armitage are merely comparative in nature and can only establish a fault condition based on how much a single sensor deviates from the other sensors on the railcar. *Id.*, ¶104. Furthermore, the system of Armitage requires a plurality of sensors to determine outliers. *Id.* This is not the same thing as applying a heuristic, i.e., one or more rules, to “predict potential or imminent failures based on a statistical analysis of said collected data,” as required by independent claim 5. Armitage merely performs a comparative analysis that determines a current failure has occurred when a single sensor data is outside of a threshold level (in this case three standard deviations from the average). *Id.* Furthermore, this type of analysis does not “predict potential or imminent failures,” as explained in more detail below. *Id.*

c. Armitage does not “predict” future failures

When addressing limitation 5(k) Petitioner fails to provide any discussion regarding a “prediction.” Ex. 2010, ¶82; Petition, 75 (citing 64-66; Ex. 1003, ¶292).

The cross-reference points to a discussion of claim 3 which does not include any discussion of limitation 5(k). Mr. Ricca at ¶292 does not provide any additional insight into why Armitage discloses limitations 5(k) beyond conclusory statements unsupported by any citation to the record. Specifically, nothing in Petitioner’s analysis addresses the full claim requirements of “*predict[ing]* potential or imminent failures based on a statistical analysis of said collected data.” Ex. 2010, ¶82; *see also* Petition, 64-66, 75. Indeed, the words “predict” are never used by Petitioner. Petitioner has failed to even argue limitation 5(k) is present in the prior art. Therefore, for this reason alone, Petitioner cannot show claim 5 is unpatentable over the Armitage and LeFebvre combination.

Petitioner alleges “Armitage’s system ... distinguishes between potential failures (which warrant maintenance) and actual failures (which require immediate service). Petition, 66. Petitioner cites only to Armitage ¶44 for this assertion. *Id.* However, this passage in Armitage assigns a “yellow” status to the “event” indicating “which indicates that a railway car requires service” and a “red” status which indicates “a serious deviation ... that requires immediate service.” Ex. 1006, ¶44; *see also* Ex. 2010, ¶83. Each of these status indicators refers to a *currently detected failure*, i.e., an “event” in the Armitage nomenclature, and does not in any way disclose *predicting* potential or imminent failures. *Id.*

Petitioner has failed to show that independent claim 5 is unpatentable over Armitage and LeFebvre. Claims 6-10, 13-18, and 20-22 depend from independent claim 5 and consequently Petitioner cannot show that they are unpatentable either. *Mylan*, 914 F.3d at 1376 (“Dependent claims, with added limitations, are generally not obvious when their parent claims are not.”).

3. Claims 23 and 25

Armitage is not prior art to independent claim 23 because Claim 23 is entitled the full benefit of its earliest priority date. *See* §I.B, *supra* ; IV.D.1, *supra* (both incorporated here). Armitage does not disclose, teach, or suggest (i) “electrical circuitry,” (ii) a “power source,” and (iii) a “communication device” that are “positioned within said housing” as required by independent claim 2. *See* §IV.D, *supra* (incorporated here). As explained above, LeFebvre does not disclose, teach, or suggest “a housing” nor does LeFebvre disclose teach or suggest “a housing **mountable on a railcar.**” *See* §IV.A, *supra* (incorporated here). Accordingly, LeFebvre fails to cure the deficiencies of Armitage. Furthermore, this ground of the Petition only relies on LeFebvre for limitation 23(f). *See* Petition, 72.

Petitioner has failed to show that Claim 23 is unpatentable. Claim 25 depends from independent claim 23 and Petitioner cannot show that claim 23 is unpatentable either. Ex. 2010, ¶¶85-87; *Mylan*, 914 F.3d at 1376.

F. Ground Six: Petitioner has failed to show that Claims 1 and 24 are unpatentable under 35 U.S.C. § 103(a) over Armitage in view of LeFebvre, Denny, and Provasnik.

As explained above in reference to limitation 5(g) and 8(b), a POSA would lack a motivation to combine the continuous monitoring and running-average calculations of Armitage with the power-saving features of LeFebvre. *See* §IV.E.2.a, *supra* (incorporated here); Ex. 2010, ¶¶71-73. The same is true regarding limitation 1(g). *Id.*, ¶¶88-90. Petitioner relies entirely on its analysis performed with respect to limitation 8(b) — which relies exclusively on LeFebvre and is fundamentally flawed on its own terms, as explained above — to support its arguments for limitation 1(g). *See* Petition, 86; §IV.B.2, *supra* (incorporated here).

There is no motivation for a POSA to modify Armitage with LeFebvre to reach the subject matter of limitation 1(g) because adding LeFebvre’s power management features would prohibit Armitage’s dynamic continuous monitoring, a critical feature of Armitage’s disclosed system. *See* §IV.E.2.a, *supra*; Ex. 2010, ¶¶88-90.

However, limitation 8(b) requires that “said software performing the functions of collecting data from said sensor at periodic intervals” whereas limitation 1(g) requires “the power consumption of said sensor device is managed by placing said sensor device in a standby state and periodically awakening said sensor device to collect readings from said temperature sensor and to transmit the information

regarding the temperature sensed via said communication circuitry.” Ex. 1001, 15:50-55, 16:58-60. That is, the claims have different scope: using software to collect data at periodic intervals is not the same as placing “said sensor device in a standby state” required by limitation 1(g). Ex. 2010, ¶89. Given the differences between the two features in the specification and claims, a POSA would not confuse them. *See id*; *see also* §IV.B.2, *supra*.

In addition, and contrary to Petitioner’s suggestions, Armitage discloses that the “sensor nodes 121-124 will sense and monitor the equipment while railway car 110 is in motion, such as when rolling.” Ex. 1006, ¶25. That is, the sensors operate by continuously sensing operational parameters while the railcar is in motion. See Ex. 2010, ¶72 (explaining this is confirmed by Armitage’s disclosure in paragraph 44, which discusses realtime, continuous monitoring of all critical components being performed); Ex. 1006, ¶44. Therefore, a POSA would not understand Armitage’s sensors to be placed in a standby state at all, much less periodically awakened to collect and transmit readings as recited by independent claim 1. Ex. 2010, ¶90. Further, any attempt to so modify Armitage using LeFebvre’s power management disclosure would necessarily frustrate the critical function of the realtime, continuous monitoring evidence in Armitage’s disclosed system. *Id*. Therefore, a POSA would have no motivation to seek out a combination of Armitage and LeFebvre. *Id*.

Denny or Provasnik do not remedy these deficiencies. Denny discloses that the electronic circuit 50 is always active. Ex. 1008, 7:14-19; Ex. 2010, ¶91. Thus, its thermal warning device 10 is never placed in a standby state, much less periodically awakened to collect and transmit readings. Ex. 2010, ¶91 In addition, Provasnik has no disclosure relating to a “standby state.” *See generally* Ex. 1009; Ex. 2010, ¶91 (sensor device is always in active state). Furthermore, the Petition does not rely on Denny or Provasnik for disclosing limitation 1(g).

Therefore, Petitioner has not shown that claims 1 and 24 are unpatentable. *Id.*, ¶115.

V. SECONDARY CONSIDERATIONS

Industry praise provides “probative and cogent evidence that one of ordinary skill in the art would not have reasonably expected [the invention would be successful].” *Institut Pasteur v. Focarino*, 738 F.3d 1337, 1347 (Fed. Cir. 2013). The ’223 invention, even before it was reduced to practice, was recognized as an “amazing accomplishment” and “one of the biggest” breakthrough developments in the rail industry over the past 30 years. Ex. 2030.

“Copying may indeed be another form of flattering praise for inventive features, and thus evidence of copying tends to show nonobviousness.” *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1336 (Fed. Cir. 2016). Petitioner’s CTO, Brent Wilson, is a named inventor of the ’223 patent and Petitioner, through Mr. Wilson,

had access to Amsted's technology. IV.C.1, *supra* (incorporated here). Hum
advertises a "proprietary algorithm built on 15 years of research," which Amsted
paid for (*id.*) and touts the very features Amsted patented in the Challenged Claims.
Exs. 2155, 2156.

VI. CONCLUSION

For the reasons described above, the Board should find all claims of the '223
Patent patentable over the grounds cited in the petition.

Respectfully submitted,

Dated: November 3, 2023

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CERTIFICATION

Patent Owner's Response, excluding the caption, Table of Contents, Table of Authorities, Table of Exhibits, and this Certification contains 13,990 words as measured by the word processing software used to prepare the document, in compliance with 37 C.F.R. § 42.24(d).

Respectfully submitted,

Dated: November 3, 2023	By: / Ryan N. Miller / _____ Ryan N. Miller Reg. No. 68,262 Counsel for Patent Owner Amsted Rail Company, Inc.
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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §42.6(e), I certify that on this 3rd day of November, 2023, a copy of PATENT OWNER’S RESPONSE under 37 C.F.R. §42.107 was served by electronic mail on Petitioner’s counsel, lead and back-up, as follows:

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Counsel for Petitioner has consented to service of all documents via electronic email. *See* Petition, Paper 1 at 2.

Dated: November 3, 2023

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