

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 IPR2023-00540

Patent No. 10,137,915

PATENT OWNER'S REVISED MOTION TO AMEND

Submitted Electronically via P-TACTS

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Other Authorities

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EXHIBIT INDEX

EX #	Exhibit Description
2001	Expert Declaration of Dr. Michael Shamos
2002	<i>Curriculum Vitae</i> for Dr. Michael Shamos
2003	Joint Claim Construction Chart - Amsted Rail Company, Inc., v. Hum Industrial Technology, Inc., et al., Civil Action No. 4:22-cv-00445-AGF (E.D. Mo. March 31, 2023)
2004	U.S. Pat. Pub. No. 2009/0001226 to Haygood (“Haygood”)
2005	U.S. Pat. No. 7,336,156 to Arita et al. (“Arita”)
2006	Expert Declaration of Dr. Michael Shamos In Support of Patent Owner’s Response
2007	Ricca Declaration - Amsted Rail Company, Inc., v. Hum Industrial Technology, Inc., et al., Civil Action No. 4:22-cv-00445-AGF (E.D. Mo. March 31, 2023)
2008	Expert Declaration of Dr. Michael Shamos In Support of Patent Owner’s Motion to Amend
2009	Expert Declaration of Dr. Michael Shamos In Support of Patent Owner’s Revised Motion to Amend

I. INTRODUCTION

Patent Owner, Amsted Rail Company, Inc. (“PO”), respectfully submits this Revised Motion to Amend (“RMTA”) as authorized by Board in its Scheduling Order, Paper 11 at 4-6, contingent upon a finding of unpatentability with respect to the original challenged claims 1, 22-30, 36 and 37 (the “Challenged Claims”) of U.S. Patent No. 10,137,915 (the “’915 Patent”) (EX1001). The Board issued Preliminary Guidance (“PG”) (Paper 22) on PO’s initial Motion to Amend (“MTA”) (Paper 16) on February 21, 2024. This RMTA is in response to the Board’s PG.

PO attaches the proposed substitute claims as Appendix A. PO proposes to substitute claims 1, 22-26, 30, 36 and 37 with claims 38 through 48, respectively. Substitute claims 38 through 48 include additional limitations not found in the prior art. The substitute claims are presented on a contingent basis in the event the Board finds that the original claims are unpatentable.

As this motion and the Declaration of Michael Shamos in support of Patent Owner’s Revised Motion to Amend (EX2009) ¶¶14-25 demonstrate, the substitute claims meet all of the requirements of 35 U.S.C. §316(d) and 37 C.F.R. §42.121. Each amendment is responsive to a ground of unpatentability raised in this proceeding; none of the amendments seek to enlarge the scope of the claims or to introduce new subject matter; the amendment proposes a reasonable number of substitute claims; and the motion shows the changes that are sought and the support

in the original disclosure of the patent for each substitute claim.

Although the burden of persuasion with regard to the patentability of the substitute claims is on Petitioner, *see Aqua Prods., Inc. v. Matal*, 872 F.3d 1290, 1296 (Fed. Cir. 2017) (*en banc*); *Bosch Auto. Serv. Sols., LLC v. Matal*, 878 F.3d 1027, 1040 (Fed. Cir. 2017), this motion and EX2009 demonstrate that PO has met its burden to produce evidence¹ showing the substitute claims are patentable over the references of record in this trial involving the '915 Patent.

II. STATEMENT OF RELIEF REQUESTED

PO hereby moves to amend the '915 Patent contingent upon whether the Challenged Claims are found unpatentable in the present IPR proceeding. *See* 37 C.F.R. §42.121. If all Challenged Claims are found to be unpatentable, Patent Owner requests the Board order the following:

- Replacement of independent claim 1 with substitute claim 38;
- Replacement of dependent claims 21-26 and 29 with substitute claims 39-45;
- Replacement of independent claim 30 with substitute claim 46;

¹ To the extent Petitioner or Board seek to impose *any* burden of persuasion regarding patentability on PO based on the text of Rule 42.121(d)(1), that assertion conflicts with the unambiguous text of 35 U.S.C. §316(e) and with established Federal Circuit precedent. *See Aqua Prods.*, 872 F.3d at 1340-41.

- Replacement of independent claim 37 with substitute claim 47; and
- Replacement of dependent claims 38 with substitute claim 48.

If any of Challenged Claims is found to be patentable, Patent Owner requests that the Board not substitute any such claim, but order substitution of any claims found to be unpatentable. No other changes are proposed. *See* 37 C.F.R. §42.22(a)(1); 35 U.S.C. §316(d).

III. THE SUBSTITUTE CLAIMS MEET ALL THE REQUIREMENTS OF 37 C.F.R. § 42.121

While PO must establish that the RMTA complies with applicable statutory and regulatory requirements, the burden to persuade the Board that the substitute claims are unpatentable falls only on Petitioner. *See* 35 U.S.C. §316(e); *Aqua Prods.*, 872 F.3d at 1315; *Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 at 4-5 (Feb. 25, 2019) (precedential).

A. Reasonable Number of Substitute Claims

The Board found that the MTA proposed a reasonable number of claims. *See* PG at 3. Petitioner did not challenge the number of claims in its Opposition. This RMTA proposes the same number of claims.

B. The Proposed Claims Are Responsive to the Instituted Grounds

The Board found that the MTA responded to the grounds of unpatentability. *See* PG at 4. Petitioner did not challenge this requirement in its Opposition. This

RMTA responds to the same grounds of unpatentability. *See* §IV, *supra*. (incorporated here).

C. The Proposed Claims Do Not Enlarge the Scope of the Original Claims

The Board found that the MTA did not seek to enlarge claim scope. *See* PG at 4. Petitioner did not challenge this requirement in its Opposition. The amendments presented in this RMTA do not broaden the issued claims and thus do not enlarge claim scope.

IV. THE SUBSTITUTE CLAIMS DO NOT INTRODUCE NEW SUBJECT MATTER

The originally filed disclosure of the '915 Patent supports each proposed substitute claim. *See* 37 C.F.R. §42.121 (b)(1)-(2). The '915 patent issued from U.S. App. No. 15/108,065, filed on June 24, 2016 (EX1002 at 204) (“the '065 Application”), a national phase application of Int’l App. No. PCT/US2014/072380, which in turn claims priority to U.S. Provisional App. No. 61/920,700, filed on December 24, 2013 (“the '700 Prov. Application”) (EX1002 at 113-34). *See* EX1001 at 1.

The Board found that the MTA did not introduce new subject matter. *See* PG at 4. Petitioner did not challenge this requirement in its Opposition. The amendments presented in this RMTA also do not introduce new subject matter as demonstrated below.

A. Claim 38 (Substitute for claim 1, if found unpatentable)

Claim Limitation		Support for Substitute Claim 38
[[1]]38. A system for detecting operational anomalies on a train consist or railcar, comprising:		EX1001 at 1:14-17 (“The present invention relates to the field of railcar and train safety management, and is specifically directed to a system and method for continuously collecting and analyzing operational parameters of railcars and train consists to detect anomalous operating conditions.”), and 1:61-65; EX1002 at 128, 130.
(a) one or more communication management units mounted on one or more railcars;		EX1001 at FIG. 1, 1:66-2:4 (“...each railcar is equipped with multiple wireless sensor nodes...which are arranged in a mesh network controlled by a communication management unit (“CMU”), usually on the same railcar,...”), and 3:22-27; EX1002 at 125, 128-34.
(b) one or more <u>wireless sensor</u> [[s]] <u>nodes</u> located on said one or more railcars <u>and</u>		EX1001 at FIG. 1, FIG. 2, 1:66-67, 4:47-49 (“A wireless sensor node (“WSN”), shown in the drawings as reference number 104 , see, e.g., FIGS. 1 and 2,...”), and 6:56-58 (“FIG. 5 shows an exploded view of a second variety of WSN 104 , which is preferably mounted on the body of railcar 103 .”); EX1002 at 125-26, 128-31, 133-34.
configured to sense an operational parameter of said one or more railcars,	EX1001 at 2:4-7, 4:53-56 (“The WSN 104 is used for sensing a parameter to be monitored (e.g. temperature of bearings or ambient air) or status (e.g., position of a hatch or hand brake).”), and 7:26-35 (“In broad terms, with reference to FIGS. 1 and 2, the present invention provides a novel means for monitoring the performance and operation of a railcar 103 and train consist 109 . This includes a plurality of sensors 104 deployed on the railcars 103 in the consist 109 for sensing various operational parameters of the railcar 103 ...”); EX1002 at 130, 133-34.	
said <u>one or more wireless sensor</u> [[s]] <u>nodes</u> being in communication with said	EX1001 at 1:66-2:4, 3:38-41 (“The CMU 101 supports one or more WSNs 104 (defined below) in a mesh network configuration...”), and 8:7-12 (“If	

one or more communication management units,	an alert or event condition is detected by a WSN 104 ,...a message is forwarded by WSN 104 to CMU 101 for further analysis and action..."); EX1002 at 129-31.
wherein the one or more <u>wireless sensor</u> [[s]] <u>nodes</u> comprise a <u>tri-axis</u> ~~one or more~~ sensor[[s]] configured to measure accelerations of the railcar <u>along a plurality of axes comprising a first axis extending along a length of the railcar, a second axis extending across a width of the railcar, and a third axis extending along a height of the railcar;</u> and	EX1001 at 4:56-58 ("In a preferred embodiment, each WSN 104 is equipped with one or more accelerometers..."), 4:65-67 ("The WSN 104 shown in FIG. 4 is configured and tuned to detect certain kinds of acceleration and temperature events and is typically located on the wheel bearing fitting 111 of railcar 103 ,..."), 5:32-34 ("In a preferred embodiment, each WSN 104 may have one or more accelerometers 404..."), 6:12-20 ("...the configuration of WSNs 104 may vary with respect to the number and types of sensors. Virtually any type of sensor could be used, including, for example,..., an accelerometer 404 ,..."), 13:36-51 ("One possible implementation of the analysis system of FIG. 12 is shown in FIG. 13. Here, accelerometer 404 passes data on to three sensor sections. The first section 1302 selects data from the longitudinal direction down the length of the railcar 103 and uses Longitudinal Section 1304 to extract longitudinal impact data.... The second section 1308 selects data from the lateral direction across the railcar 103 and uses Lateral Section 1310 to extract lateral oscillation data...The third section 1314 selects data from the vertical direction and uses Vertical Section 1316 to extract vertical oscillation data."); EX1002 at 130, 133-34.
(c) <u>a plurality of</u> ~~one or more~~ <u>sensor sections that are provided with the one or more wireless sensor nodes and that comprise</u> (i) <u>a plurality of filters that are each configured to filter at least a portion of the accelerations by receiving an output signal directly from the tri-axis</u>	EX1001 at FIGS. 12-14, 13:11-24 ("With reference to FIGS. 4 and 12, a general implementation model of the analysis system of a WSN 104 is now described. As depicted in the preferred embodiment, the analyzed signal (what is not filtered out by the mechanical filter 410 or potting material), originates with accelerometer hardware 404 and is passed to one or more sensor sections 1202 , 1208 or 1214 . These sensor sections select the data to be analyzed using a digital data filter 1204 , 1210 or 1216 , and passes this data on to a feature detector 1206 , 1212

<u>sensor and selecting ones of the accelerations in the output signal that were measured in a dimension represented by a respective axis of the plurality of axes, and (ii) a plurality of detectors respectively coupled to the plurality of filters, each one of the detectors being configured to detect a respective one of a plurality of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes;</u>	or 1218. Data selection can be based on, for example, direction (e.g. vertical or longitudinal components)”, 13:36-53 (“One possible implementation of the analysis system of FIG. 12 is shown in FIG. 13. Here, accelerometer 404 passes data on to three sensor sections. The first section 1302 selects data from the longitudinal direction down the length of the railcar 103 and uses Longitudinal Section 1304 to extract longitudinal impact data. Longitudinal impacts are detected in Impact Detector 1306 when the peak value of the longitudinal data exceeds a longitudinal impact threshold. The second section 1308 selects data from the lateral direction across the railcar 103 and uses Lateral Section 1310 to extract lateral oscillation data. Lateral oscillations are detected in Vehicle Dynamics Detector 1312 when the RMS value of the oscillations exceeds a lateral oscillation threshold. The third section 1314 selects data from the vertical direction and uses Vertical Section 1316 to extract vertical oscillation data. Vertical oscillations are detected in Vehicle Dynamics Detector 1318 when the RMS value of the oscillations exceeds a vertical oscillation threshold.”); EX1002 at 130.
wherein said communication management units perform the functions of: (i) <u>collecting, from the one or more wireless sensor nodes, data regarding said one or more railcar operational</u>	EX1001 at 2:4-10 (“The wireless sensor nodes collect data regarding various operational parameters of the railcar and are capable of detecting certain anomalies based on the collected data. When anomalous operational data is detected, an alert may be raised and the data may be communicated to the communication management unit located on the railcar.”), 3:41-58 (“Additionally, the CMU 101 is also a member of a train-based mesh network 107,... The CMU 101 thus supports four functions: ... 2) to consolidate data from one or more WSNs 104 in the railcar-based mesh network 105 and to apply logic to the data gathered to generate warning alerts to a host such as a locomotive 108 or remote railroad operations center

parameter[[s]] of said one or more railcars;	120;...”), 4:4-8 (“The CMU 101 is capable of receiving data and/or alarms from one or more WSNs 104...”), 9:3-7 (“The CMU 101 must coordinate the collecting of temperature data from all WSNs 104 in the railcar-based mesh network 105...), 9:8-11 (“Each WSN 104 is able to make a determination of when to report data that may indicate a possible event or alarm condition to CMU 101. CMU 101 is able to collect such notifications from each WSN 104 under its control...”); EX1002 at 131.
(ii) analyzing said collected data to detect a [[for]] trend[[s]] or event[[s]] indicative of an anomalous operational condition of said one or more railcars; and	EX1001 at 3:41-58, 4:4-8, 8:56-62 (“In the illustrated embodiments, the WSNs 104 do not determine if each of the possible conditions actually exists. This determination is preferably made at the next level up of the hierarchy, at CMU 101, which utilizes the readings from multiple WSN 104 to make a determination that an actual event has occurred.”), 9:10-13 (“CMU 101 is able to collect such notifications from each WSN 104 under its control and coordinate the data to make a final determination as to whether or not an event or alarm condition actually exists.”), 9:36-43 (“In the preferred embodiment, the logic in the CMU 101 is capable of analyzing both acceleration and temperature events received from each of the WSNs 104 under its control and determining if an alarm or event condition actually exists. It should be noted that acceleration events are independent of temperature events and the CMU 101 may be configured to either analyze only acceleration events, or to analyze only temperature events.”); EX1002 at 130-31.
(iii) communicating a message to a remote receiver when said trend or event is detected.	EX1001 at 3:41-58 (“Additionally, the CMU 101 is also a member of a train-based mesh network 107,... The CMU 101 thus supports four functions: ... 2) to consolidate data from one or more WSNs 104 in the railcar-based mesh network 105 and to apply logic to the data gathered to generate warning alerts to a host such as a locomotive 108 or remote railroad operations center 120; ... 4) to support bi-directional communication upstream to the host or control point, such as a locomotive 108 and/or an off-train monitoring and remote railroad operations center 120...”),

	4:4-8, 9:49-56 (“It should be noted that when CMU 101 determines that an alarm or event has occurred, a message is sent to the next level in the hierarchy that is either to a PWG 102 located elsewhere on train consist 109 or off train consist 109 to a remote railroad operation center 120 , depending upon the severity of the event and the need to immediately address the event, perhaps by altering the train consist’s 109 operating condition.”); EX1002 at 129-31.
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B. Claim 39 (Substitute for claim 21, if found unpatentable)

Claim Limitation	Support for Substitute Claim 21
[[21]] <u>39</u> . The system of claim <u>38</u> [[1]], wherein at least one of said communication management units includes at least one of said <u>sensor</u> [[s]] <u>configured to measure accelerations of the railcar</u> .	EX1001 at 3:27-27 (“The CMU 101 hardware preferably includes...and, optionally, one or more sensors, including, but not limited to, an accelerometer 404 ,...”), and 3:41-58; EX1002 at 129-31.

C. Claim 40 (Substitute for claim 22, if found unpatentable)

Claim Limitation	Support for Substitute Claim 22
[[22]] <u>40</u> . The system of claim <u>38</u> [[1]], further comprising a powered wireless gateway configured to control a train-based network that includes said powered wireless gateway and a plurality of said communication management units.	EX1001 at 2:13-17 (“The communication management units located on each railcar are also arranged in a mesh network which is controlled by a powered wireless gateway, typically located in the locomotive. This is referred to herein as a train-based mesh network.”), 3:41-45 (“Additionally, the CMU 101 is also a member of a train-based mesh network 107 , which consists of the CMUs 101 from all enabled railcars 103 in the train consist 109 , controlled by a powered wireless gateway 102 , typically located on a locomotive 108 .”), and 4:30-33 (“The PWG 102 controls a train-based mesh network 107 overlaid on a train consist 109 , consisting of

	multiple CMUs 101 from each railcar 103 in a train consist 109. ”); EX1002 at 125, 128-32.
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D. Claim 41 (Substitute for claim 23, if found unpatentable)

Claim Limitation	Support for Substitute Claim 23
[[23]]41. The system of claim 38[[1]], wherein the one or more <u>wireless sensor nodes further filters</u> comprise one or more mechanical filters that include a resilient material configured to filter out undesirable accelerations from the accelerations, wherein the one or more mechanical filters are disposed to remove the undesirable accelerations before the undesirable accelerations reach the <u>tri-axis one or more sensor</u> [[s]] that <u>is</u> [[are]] configured to measure accelerations.	EX1001 at FIG. 4, 5:22-26 (“Additionally, a mechanical filter 410 consisting of upper sections 410 a and lower sections 410 b further serve to mechanically filter high and low frequency types of accelerations that are considered noise and which are preferably removed from the signal of interest. Preferably, these components are composed respectively of silicone of durometer 70 Shore A (the upper filter sections 410 a) and 30 Shore A (the lower filter sections 410 b)...”), and 5:35-40 (“The tuning of WSN 104 is accomplished by...the durometer of upper and lower silicone mechanical filtering elements 410 a and 410 b ,...”); EX1002 at 130.

E. Claim 42 (Substitute for claim 24, if found unpatentable)

Claim Limitation	Support for Substitute Claim 24
[[24]]42. The system of claim 38[[1]], ~~further comprising one or more wireless sensor nodes in communication with at least one of the communication management units, wherein the one or more sensors form part of the one or more wireless sensor nodes, wherein one or more of the wireless sensor nodes~~	EX1001 at 4:56-58 (“In a preferred embodiment, each WSN 104 is equipped with one or more accelerometers...”), and 5:4-19 (“The components of WSN 104 are contained in a housing 400 having an enclosure 400 a and an enclosure base 400 b . Preferably, housing sections 400 a , 400 b are composed of a hard plastic resistant to environmental damage, such as a UV rated polymer, e.g., a polycarbonate/ABS blend, and when fully

comprise a protective housing, wherein the ~~tri-axis~~ ~~one or more~~ sensor[[s]] ~~is~~ [[are]] mounted within the protective housing, wherein the protective housing comprises a potting material configured to tune the wireless sensor nodes by absorbing at least a portion of undesirable accelerations.	assembled is weatherproof. After the various components are installed within the housing as described below, a potting material (not shown) is provided through openings in the housing 400 to isolate, encapsulate and environmentally seal the components within... It has been found that the particular potting material used is also critical in the proper tuning of the WSN 104 to detect various types of accelerations.”); EX1002 at 126, 130, 133-34.
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F. Claim 43 (Substitute for claim 25, if found unpatentable)

Claim Limitation	Support for Substitute Claim 25
[[25]] <u>43.</u> The system of claim <u>38</u> [[1]], ~~further comprising one or more wireless sensor nodes in communication with at least one of the communication management units, wherein the one or more sensors form part of the one or more wireless sensor nodes, wherein one or more of the wireless sensor nodes comprises a microprocessor configured to execute firmware to control operation of the one or more of the wireless sensor nodes, wherein the firmware comprises one or more software filters configured to isolate one or more types of accelerations, and wherein a first one of the plurality of detectors is always~~	EX1001 at FIG. 4, FIG. 12, 5:35-42 (“The tuning of WSN 104 is accomplished by...software filtering performed by software executing on a processor on main PC board 402 a . The software filter used is a digital filter to decrease noise from unwanted acceleration frequencies and increase signals from acceleration frequencies of interest.”), 6:28-36 (“Electrical circuitry is provided for the operation of WSN 104 . The electrical circuitry includes the components and wiring to operate and/or receive and process the signals from the sensors. This can include, but is not limited to, analog and digital circuitry, CPUs, processors, circuit boards, memory, firmware, controllers, and other electrical items, as required to operate the accelerometers and temperature sensors 406 and to process the information as further described below.”), 10:55 – 12:51 (“FIG. 10 is a flow chart showing the conditions under which the wheel damage and vertical impact

<u>enabled when the railcar is moving, and a second one of the plurality of detections is enabled when the railcar is traveling faster than a specific speed and is disabled when the railyard is traveling slower than the specific speed.</u>	events are enabled or disabled. At 1002, the system is initialized and, at 1004, the system is placed in a waiting state wherein the events are disabled, as the critical speed required for event enablement has not yet been reached. . . . If, at 1006, the critical speed has been reached or exceeded, control proceeds to 1008 where both the vertical impact and wheel damage events are enabled. . . Lateral Extreme Vehicle Dynamics—A lateral extreme vehicle dynamics event occurs when an acceleration is detected in the lateral, or cross line, direction of railcar 103, . . . ”); EX1002 at 130, 133-34.
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G. Claim 44 (Substitute for claim 26, if found unpatentable)

Claim Limitation	Support for Substitute Claim 25
[[26]]44. The system of claim 38[[1]], wherein the one or more <u>wireless sensor nodes</u>~~filters~~ <u>further</u> comprise one or more mechanical filters.	EX1001 at FIG. 4, and 5:22-26 (“Additionally, a mechanical filter 410 consisting of upper sections 410 a and lower sections 410 b further serve to mechanically filter high and low frequency types of accelerations that are considered noise and which are preferably removed from the signal of interest.”); EX1002 at 130.

H. Claim 45 (Substitute for claim 29, if found unpatentable)

Claim Limitation	Support for Substitute Claim 25
[[29]]45. The system of claim 38[[1]], wherein said remote receiver is located off-train.	EX1001 at 3:45-58. <i>See</i> §IV.A, specifically, element (c)(iii), <i>supra</i> (incorporated here); EX1002 at 129-31.

I. Claim 46 (Substitute for claim 30, if found unpatentable)

Claim Limitation	Support for Substitute Claim 30
[[30]]46. A method for detecting operational anomalies on a train consist or railcar comprising the steps of:	EX1001 at 1:14-17, 1:61-65. <i>See</i> §VI.A <i>supra</i> (incorporated here).
sensing, by ~~a one or more~~ <u>tri-axis sensor[[s]] of one or more wireless sensor nodes</u> located on one or more railcars, one or more operational parameters of the one or more railcars, wherein the one or more operational parameters comprise one or more accelerations <u>and the tri-axis sensor is configured to measure accelerations of the ~~one or more~~ railcar[[s]] along a plurality of axes comprising a first axis extending along a length of the railcar, a second axis extending across a width of the railcar, and a third axis extending along a height of the railcar;</u>	EX1001 at FIG. 1, FIG. 2, 1:66-67, 2:4-7, 4:53-56, 4:56-58, 4:65-67, 5:32-34, 7:26-35, 13:36-51. <i>See</i> §IV.A <i>supra</i> (incorporated here).
filtering, by <u>each of a plurality of ~~one or more~~ filters of a plurality of sensor sections that are provided with the one or more wireless sensor nodes, at least a portion of the accelerations by receiving an output signal directly from the tri-axis sensor and selecting ones of the accelerations in the output signal that were measured in a dimension represented by a respective axis of the plurality of axes; and</u>	EX1001 at FIGS. 12-14, 13:11-24, 13:36-53. <i>See</i> §IV.A <i>supra</i> (incorporated here).
<u>detecting, by each of a plurality of detectors of the plurality of sensor sections, a respective one of a plurality of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes;</u>	EX1001 at FIGS. 12-14, 13:11-24, 13:36-53. <i>See</i> §IV.A <i>supra</i> (incorporated here).
by one or more communication management units associated with the one or more railcars:	EX1001 at 2:4-10, 3:45-51, 4:4-8, 9:3-7, 9:8-11.

collecting, <u>from the one or more wireless sensor nodes</u> , data regarding said ~~one or more railcar~~ operational parameters <u>of said one or more railcars</u> ;	<i>See §IV.A supra</i> (incorporated here).
analyzing said collected data <u>to detect a</u> [[for]] trend[[s]] or event[[s]] indicative of an anomalous operational condition <u>of said one or more railcars</u> ; and	EX1001 at 3:45-51, 4:4-8, 8:56-62, 9:10-13, 9:36-43. <i>See §IV.A supra</i> (incorporated here).
communicating a message to a remote receiver when said trend or event is detected.	EX1001 at 3:41-58, 4:4-8, 9:49-56. <i>See §IV.A supra</i> (incorporated here).

J. Claim 47 (Substitute for claim 36, if found unpatentable)

Claim Limitation	Support for Substitute Claim 36
[[36]]47. A system for detecting operational anomalies on a railcar that is part of a train consist comprising:	EX1001 at 1:14-17, 1:61-65. <i>See §IV.A, IV.I supra</i> (both incorporated here).
(a) at least one communication management unit (CMU) mounted on the [[a]]railcar in said train consist;	EX1001 at FIG. 1, 1:66-2:4, 3:22-27. <i>See §IV.A supra</i> (incorporated here).
(b) at least two <u>wireless sensor</u> [[s]] <u>nodes</u> located on the [[said]]railcar <u>and</u> [[for]] configured to sense operational parameters of the railcar, said <u>wireless sensor</u> [[s]] <u>nodes</u> being in communication with said communication management unit, wherein the <u>at least two</u> ~~one or more~~ <u>wireless sensor</u> [[s]] <u>nodes</u> <u>comprise a tri-axis</u> ~~one or more~~ <u>sensor</u> [[s]] configured to measure accelerations of the railcar <u>along a plurality of axes comprising a first axis extending along a length of the railcar, a second axis extending across a width of the railcar, and a third axis extending along a height of the railcar</u> ; and	EX1001 at FIG. 1, FIG. 2, 1:66-2:4, 2:4-7, 3:38-41, 4:53-56, 4:56-58, 4:65-67, 5:32-34, 7:26-35, 8:7-12, 13:36-51. <i>See §IV.A, IV.I supra</i> (both incorporated here).

(c) <u>a plurality of ~~one or more~~ sensor sections that are provided with the one or more wireless sensor nodes and that comprise a plurality of filters that are each configured to filter at least a portion of the accelerations by receiving an output signal directly from the tri-axis sensor and selecting ones of the accelerations in the output signal that were measured in a dimension represented by a respective axis of the plurality of axes, and a plurality of detectors respectively coupled to the plurality of filters, each one of the detectors being configured to detect a respective one of a plurality of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes;</u>		EX1001 at FIGS. 12-14, 13:11-24, 13:36-53. <i>See</i> §IV.A, IV.I <i>supra</i> (both incorporated here).
wherein said communication management unit performs the following functions: (i) receiving data from said <u>at least two wireless sensor[[s]] nodes;</u>		EX1001 at 2:4-10, 3:45-51, 4:4-8, 9:3-7, 9:8-11. <i>See</i> §IV.A, IV.I <i>supra</i> (both incorporated here).
(ii) drawing inferences from the data received from at least two <u>wireless ~~of the~~ sensor[[s]] nodes</u> regarding the performance of the railcar; and		EX1001 at 3:45-51, 4:4-8, 8:56-62, 9:10-13, 9:36-43. <i>See</i> §IV.A, IV.I <i>supra</i> (both incorporated here).
(iii) communicating a message to a remote receiver when an anomaly is detected.		EX1001 at 3:41-58, 4:4-8, 9:49-56. <i>See</i> §IV.A, IV.I <i>supra</i> (both incorporated here).

K. Claim 48 (Substitute for claim 37, if found unpatentable)

Claim Limitation		Support for Substitute Claim 37
[[37]]48. The system of claim 47[[36]], wherein said <u>tri-axis sensors</u> comprise accelerometers positioned at different locations of the railcar,		EX1001 at FIG. 1, FIG. 2, 1:66-2:4, 4:56-58, 4:65-67, 5:32-34, 7:26-35. <i>See</i> §IV.A, IV.E, IV.I, IV.J <i>supra</i> (all incorporated here).
wherein said step of drawing	EX1001 at 14:10-19 (“When a derailment occurs, the wheels of one or more axles fall off the rails and run along the track bed.	

inferences comprises the comparison of data from ~~two~~ ~~or more of~~ said accelerometers,	The rough nature of the track bed causes the derailed wheels to experience high-energy vertical accelerations for the duration of the derailment. In a preferred embodiment, a derailment is readily identified by calculating the RMS value of a series of consecutive vertical acceleration measurements and comparing the result with a threshold. If the CMU sees such data from the WSNs on both sides of the same axle, this could indicate a derailment.”); EX1002 at 129-30.
wherein said accelerometers are positioned on the railcar to provide data for carrying out one or more of the following functions: i) compare accelerations from one railcar wheel with that of another railcar wheel on the same axle but opposite side of the railcar,	EX1001 at FIG. 1, FIG. 2, 1:66-2:4, 4:56-58. <i>See</i> §IV.A, IV.E, IV.I, IV.J <i>supra</i> (all incorporated here).
ii) compare accelerations from one railcar wheel with that of at least one other wheel on the same side of said railcar, and	EX1001 at 14:10-19. <i>See</i> §IV.A, IV.E, IV.I, IV.J <i>supra</i> (all incorporated here).
iii) compare accelerations from one railcar wheel with that of at least one other railcar wheel on the same side of said one railcar wheel and which other wheel is on another railcar of the same train consist.	EX1001 at 9:30-35 (“Additionally, CMU 101 may also monitor WSNs 104 installed on other railcars 103 such as in the case where railcar 103 may consist of one or more individual railcars 103 which are permanently connected together.”), 9:36-43, 9:59-66 (“Derailment—A derailment event is regarded as a high priority type of event and is an example of the type of events that can be analyzed by the illustrated embodiment. When a derail message is received from a WSN 104 , the CMU 101 starts a derailment processing timer and also immediately generates a possible derailment message to the PWG 102 . CMU 101 then waits to determine if any other WSNs 104 are generating derailment messages.”), 10:29-37 (“Vertical Impact—A vertical impact message is regarded as a medium priority type of event. When a vertical impact event is received from a WSN 104 , CMU 101 starts a vertical impact processing timer during which CMU 101 waits to see if any other vertical impact events are received from other WSN 104s . Depending on which side of the railcar 103 vertical impact messages are being generated, it can be determined, for

	example, that a broken rail or other track condition may exist.”); EX1002 at 128-30, 133.
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V. SUBSTITUTE CLAIMS 38 THROUGH 48 ARE PATENT-ELIGIBLE

The substitute claims, taken as a whole, are directed to a practical application of using communication management units and wireless sensor nodes to detect of operational anomalies on a train consist or railcar. When viewed as a whole, the eligibility is self-evident. Furthermore, the substitute claims recite sufficient additional elements that they amount to significantly more than any judicial exception.

VI. SUBSTITUTE CLAIMS 23 THROUGH 43 ARE PATENTABLE OVER LEFEBVRE, ARMITAGE, BARONE, WINFREE AND LEITEL, ALONE OR IN COMBINATION

No prior art of record known to Patent Owner anticipates or renders obvious proposed substitute claims 38 through 48.

A. Independent substitute claim 38

Independent substitute claim 38 (corresponding to claim 1 of the Challenged Claims): limits element (b) to wireless sensor node(s) (WSN(s)) located on said railcar(s) and configured to sense an operational parameter of said railcar(s), wherein WSN(s) comprise(s) a tri-axis sensor configured to measure accelerations of the railcar along a plurality of axes comprising a first axis extending along a length of the railcar, a second axis extending across a width of the railcar, and a third axis

extending along a height of the railcar; and limits element (c) to a plurality of sensor sections that are provided with the WSN(s) and that comprise (i) a plurality of filters that are each configured to filter at least a portion of the accelerations by receiving an output signal directly from the tri-axis sensor and selecting ones of the accelerations in the output signal that were measured in a dimension represented by a respective axis of the plurality of axes, and (ii) a plurality of detectors respectively coupled to the plurality of filters, each one of the detectors being configured to detect a respective one of a plurality of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes. Support for these elements, as well as the remainder of the limitations of substitute claim 38 are provided in the portions of EX1001 and EX1002 which are identified above in the table of §IV.A, *supra* (incorporated here). For the reasons discussed below, these limitations are not taught or suggested by Armitage, Barone, Lefebvre, Winfree or Leitel. EX2009, ¶15.

Petitioner does not rely on Winfree for disclosing any feature of claim 1, only relying on Winfree regarding claims dependent 23 and 26. Pet. at 6. Thus, PO asserts that Winfree fails to teach the limitations of claim 38. Petitioner asserts that Armitage discloses: (1) sensor nodes **121-124** located on railway car(s); (2) and accelerometer data is sampled at the CMU level. Pet. at 23-25. However, limitations

(b) and (c) of claim 38 are not disclosed by Armitage. EX2009, ¶¶16-17. While Armitage does state in ¶45 that a 3D accelerometer can be used to monitor axial vibration, Armitage explicitly limits this monitoring along a single axis (e.g., z-axis). EX1006, ¶45. Vibrations along the other two axes (e.g., x-axis (radial) and y-axis (vertical)) are ignored. *Id.* A POSITA would reasonably understand that only the axial vibrations are extracted from the output signal of the 3D accelerometer. EX2009, ¶17. The radial and vertical vibrations are not extracted from the output signal of the 3D accelerometer since they are “ignored”. Thus, Armitage explicitly teaches away from including the sensor system as recited in claim 38 which includes a plurality of filters as defined (e.g., a filter for extracting axial accelerations, a filter for extracting radial accelerations, and a filter for extracting vertical accelerations) and/or a plurality of detectors as defined (e.g., each detector for detecting a respective one of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes). *Id.*

Petitioner asserts that (1) a POSITA would have been motivated in view of Armitage to monitor accelerations along each axis because each axis was known to be associated with one or more **common** problem conditions on a railcar and (2) that doing so would be a mere **duplication** of parts. *See* Paper 19, 10-11. Limitations 38(c) does not recite a mere duplication of parts for detecting a common problem

condition, but rather at least three branches for processing accelerations respectively for the first, second, and third axes to detect different railcar conditions. EX2009, ¶18.

Petitioner asserts that LeFebvre discloses sensors **5** configured to measure accelerations. Pet. at 52. However, LeFebvre is silent with regard to the type of accelerometer used as sensor **5** to measure the acceleration. EX2009, ¶19. Thus, PO asserts LeFebvre does not explicitly nor necessarily teach a WSN comprising a tri-axis sensor as recited in claim 38 and/or the sensor system as recited in claim 38, which includes a plurality of filters as defined (e.g., a filter for extracting axial accelerations, a filter for extracting radial accelerations, and a filter for extracting vertical accelerations) and/or a plurality of detectors as defined (e.g., each detector for detecting a respective one of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes). *Id.* LeFebvre does state in paragraph [0037] that the data control unit **23** may contain a triaxial accelerometer. However, the data control unit **23** does not correspond to the sensor node of claim 1. LeFebvre fails to state that the sensor **5** may also comprise a triaxial accelerometer. Thus, a POSITA would reasonably conclude that the sensor **5** does not comprise a triaxial accelerometer but instead a different type of accelerometer especially since LeFebvre was clearly aware of

triaxial accelerometers and only mentions their use in relation to the data control unit

23. EX2009, ¶19.

Petitioners assert that Barone shows filtering acceleration data. Pet. at 27-29. However, the disclosure of Barone is limited to data selection based on frequency, while Armitage performs data selection based on direction. Petitioner does not address how two fundamentally different data selection schemes could be combined as suggested and why doing so would not involve picking and choosing from the teachings regarding multiple disparate concepts and then selectively combining the teachings regarding disparate concepts so as to form an impermissible hindsight reconstruction of the claimed solution. EX2009, ¶20.

Barone is also limited to accelerometer **171, 470, 279**. EX1007, ¶¶24, 26, 109, 291, 302. The accelerometer **171, 470, 279** is implemented via two single-axis MEMS accelerometer devices – one for the x-axis (i.e., lateral axis or longitudinal axis) and one for the y-axis (i.e., horizontal axis or vertical axis). EX1007, ¶109. Since LeFebvre is silent about the type of accelerometer used as sensor **5**, the LeFebvre/Barone combination would only include Barone’s accelerometer **171, 470, 279** that is implemented via two single-axis MEMS accelerometer devices – one for the x-axis (i.e., lateral axis or longitudinal axis) and one for the y-axis (i.e., horizontal axis or vertical axis). EX2009, ¶21. Thus, the combination of either

Armitage and/or Lefebvre with Barone does not include a WSN comprising a tri-axis sensor, a plurality of filters and a plurality of detectors with the configuration as defined in claim 38, and therefore Barone fails to cure the deficiencies of Armitage and/or LeFebvre. *Id.*

Petitioner asserts that Leitel discloses monitoring acceleration data for detecting wheel damage, wheel derailments and other error conditions. *See* Paper 19, 13. However, such detections are made in Leitel based on x-axis measurements relative to y-axis or z-axis measurements, i.e., based on sensor data associated with two or more axis. (See FIGS. 14-20, [0154]-[0160]). A POSITA would not be motivated to combine Leitel with Armitage since Armitage explicitly teaches ignoring two of the three axes for error condition detection while Leitel explicitly requires use of at least two of the three axes for error condition detection. Leitel does teach in paragraph [0161] that the z-axis can be used to determine axel speed, but axel speed does not constitute an error condition. EX2009, ¶22.

Petitioner asserts that a POSITA would be motivated to use a triaxial accelerometer in LeFebvre and filter acceleration outputs thereof as taught by Armitage, Leitel and Barone. *See* Paper 19, 19. This prior art combination would involve (i) condition detection in which data associated with two of the three axis are ignored as taught in Armitage, (ii) using at least two (rather than one) of the three

axes for error condition detection based on direction as taught by Leitel, and (iii) condition detection based on frequency rather than direction as taught by Barone. Operations (i)-(iii) do not correspond to limitation 38(c). Such a combination would entail the epitome of improper hindsight. EX2009, ¶23.

B. Independent substitute claim 46

Independent substitute claim 46 (corresponding to claim 30 of the Challenged Claims) limits: (1) the sensor to a tri-axis sensor of WSN(s) that is configured to measure accelerations of the railcar along a plurality of axes comprising a first axis extending along a length of the railcar, a second axis extending across a width of the railcar, and a third axis extending along a height of the railcar; (2) the filtering to at least a portion of the accelerations by receiving an output signal directly from the tri-axis sensor and selecting ones of the accelerations in the output signal that were measured in a dimension represented by a respective axis of the plurality of axes, and (3) the detecting, by each of a plurality of detectors of the plurality of sensor sections, a respective one of a plurality of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes. Thus, claim 46 is limited in a manner similar to independent substitute claim 38. Therefore, claim 46 is not taught by Lefebvre, Armitage, Barone, Winfree and/or Leitel for the reasons set forth above in relation to claim 38. EX2009, ¶24.

C. Independent substitute claim 47

Independent substitute claim 47 (corresponding to claim 36 of the Challenged Claims) limits element (b) to at least two WSNs located on the railcar and configured to sense operational parameters of the railcar, said WSNs being in communication with said communication management unit, wherein the at least two WSNs comprise a tri-axis sensor configured to measure accelerations of the railcar along a plurality of axes comprising a first axis extending along a length of the railcar, a second axis extending across a width of the railcar, and a third axis extending along a height of the railcar; and limits element (c) to sensor section(s) that are provided with the WSN(s) and that comprise a plurality of filters that are each configured to filter at least a portion of the accelerations by receiving an output signal directly from the tri-axis sensor and selecting ones of the accelerations in the output signal that were measured in a dimension represented by a respective axis of the plurality of axes, and a plurality of detectors respectively coupled to the plurality of filters, each one of the detectors being configured to detect a respective one of a plurality of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes. Thus, claim 47 is limited in a manner similar to independent substitute claim 38. Therefore, claim 47 is not taught by Lefebvre, Armitage, Barone, Winfree and/or Leitel for the reasons set forth above in relation to claim 38. EX2009, ¶25.

VII. CONCLUSION

PO has satisfied the requirements of 37 C.F.R. §42.121, and thus, the substitute claims should be entered into the record in this matter contingent upon a finding of unpatentability with respect to the Challenged Claims.

Moreover, for the reasons given, should any Challenged Claim be found unpatentable, the respective substitute claim is patentable. Independent substitute claims 38, 46 and 47 – each intended by PO to replace independent Challenged Claims 1, 30 and 36, respectively, should those claims be determined by the Board to be invalid under Ground One of the Petition – include additional limitations not taught by Armitage, LeFebvre, Barone or Winfree. Each substitute claim is therefore patentable over Armitage, LeFebvre, Barone or Winfree, alone or in combination.

Respectfully submitted,

Dated: March 8, 2024

By: / Ryan N. Miller /
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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), the undersigned certifies that on the 8th day of March 2024 a complete and entire copy of “Patent Owner’s Motion to Amend and Request for Preliminary Guidance” was provided via email to the Petitioner by serving the following email addresses:

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Electronic service was used with Petitioner’s consent (*See* Petition, Paper 1 at 2; Patent Owner’s Mandatory Notice, Paper 5 at 5).

Dated: March 8, 2024

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CLAIMS APPENDIX A

Proposed substitute claims are shown in marked-up form below beginning with claim 38. Modifications to the corresponding original claim are shown in the substitute claim by underlining (added material) and strikethrough (deleted material).

Claim 38 (Substitute for claim 1, if found unpatentable)

[[1]]38. A system for detecting operational anomalies on a train consist or railcar, comprising:

(a) one or more communication management units mounted on one or more railcars;

(b) one or more wireless sensor[[s]] nodes located on said one or more railcars and configured to sense an operational parameter of said one or more railcars, said one or more wireless sensor[[s]] nodes being in communication with said one or more communication management units, wherein the one or more wireless sensor[[s]] nodes comprise a tri-axis ~~one or more~~ sensor[[s]] configured to measure accelerations of the railcar along a plurality of axes comprising a first axis extending along a length of the railcar, a second axis extending across a width of the railcar, and a third axis extending along a height of the railcar; and

(c) a plurality of ~~one or more~~ sensor sections that are provided with the one or more wireless sensor nodes and that comprise

(i) a plurality of filters that are each configured to filter at least a portion of the accelerations by receiving an output signal directly from the tri-axis sensor and selecting ones of the accelerations in the output signal that were

measured in a dimension represented by a respective axis of the plurality of axes, and

(ii) a plurality of detectors respectively coupled to the plurality of filters, each one of the detectors being configured to detect a respective one of a plurality of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes; wherein said communication management units perform the functions of:

(i) collecting, from the one or more wireless sensor nodes, data regarding said ~~one or more railcar~~ operational parameter[[s]] of said one or more railcars;

(ii) analyzing said collected data to detect a[[for]] trend[[s]] or event[[s]] indicative of an anomalous operational condition of said one or more railcars; and

(iii) communicating a message to a remote receiver when said trend or event is detected.

Claim 39 (Substitute for claim 21, if found unpatentable)

[[21]]39. The system of claim 38[[1]], wherein at least one of said communication management units includes at least one ~~of said~~ sensor[[s]] configured to measure accelerations of the railcar.

Claim 40 (Substitute for claim 22, if found unpatentable)

[[22]]40. The system of claim 38[[1]], further comprising a powered wireless gateway configured to control a train-based network that includes said powered wireless gateway and a plurality of said communication management units.

Claim 41 (Substitute for claim 23, if found unpatentable)

[[23]]41. The system of claim 38[[1]], wherein the one or more wireless sensor nodes ~~further~~filters comprise one or more mechanical filters that include a resilient material configured to filter out undesirable accelerations from the accelerations, wherein the one or more mechanical filters are disposed to remove the undesirable accelerations before the undesirable accelerations reach the tri-axis~~one or more~~ sensor[[s]] that is[[are]] configured to measure accelerations.

Claim 42 (Substitute for claim 24, if found unpatentable)

[[24]]42. The system of claim 38[[1]], ~~further comprising one or more wireless sensor nodes in communication with at least one of the communication management units, wherein the one or more sensors form part of the one or more wireless sensor nodes,~~ wherein one or more of the wireless sensor nodes comprise a protective housing, wherein the tri-axis~~one or more~~ sensor[[s]] is[[are]] mounted within the protective housing, wherein the protective housing comprises a potting material configured to tune the wireless sensor nodes by absorbing at least a portion of undesirable accelerations.

Claim 43 (Substitute for claim 25, if found unpatentable)

[[25]]43. The system of claim 38[[1]], ~~further comprising one or more wireless sensor nodes in communication with at least one of the communication management units, wherein the one or more sensors form part of the one or more wireless sensor nodes,~~ wherein one or more of the wireless sensor nodes comprises a microprocessor configured to execute firmware to control operation of the one or more of the wireless sensor nodes, wherein the firmware comprises one or more software filters configured to isolate one or more types of accelerations, and wherein a first one of

the plurality of detectors is always enabled when the railcar is moving, and a second one of the plurality of detections is enabled when the railcar is traveling faster than a specific speed and is disabled when the railyard is traveling slower than the specific speed.

Claim 44 (Substitute for claim 26, if found unpatentable)

[[26]]44. The system of claim 38[[1]], wherein the one or more wireless sensor nodes~~filters~~ further comprise one or more mechanical filters.

Claim 45 (Substitute for claim 29, if found unpatentable)

[[29]]45. The system of claim 38[[1]], wherein said remote receiver is located off-train.

Claim 46 (Substitute for claim 30, if found unpatentable)

[[30]]46. A method for detecting operational anomalies on a train consist or railcar comprising the steps of:

sensing, by ~~a one or more~~ tri-axis sensor[[s]] of one or more wireless sensor nodes located on one or more railcars, one or more operational parameters of the one or more railcars, wherein the one or more operational parameters comprise one or more accelerations and the tri-axis sensor is configured to measure accelerations of the ~~one or more~~ railcar[[s]] along a plurality of axes comprising a first axis extending along a length of the railcar, a second axis extending across a width of the railcar, and a third axis extending along a height of the railcar;

filtering, by each of a plurality of ~~one or more~~ filters of a plurality of sensor sections that are provided with the one or more wireless sensor nodes, at least a portion of the accelerations by receiving an output signal directly from the tri-axis

sensor and selecting ones of the accelerations in the output signal that were measured in a dimension represented by a respective axis of the plurality of axes;

detecting, by each of a plurality of detectors of the plurality of sensor sections, a respective one of a plurality of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes;

and

by one or more communication management units associated with the one or more railcars:

collecting, from the one or more wireless sensor nodes, data regarding said
~~one or more railcar~~ operational parameters of said one or more railcars;

analyzing said collected data to detect a~~[[for]]~~ trend~~[[s]]~~ or event~~[[s]]~~
indicative of an anomalous operational condition of said one or more railcars; and

communicating a message to a remote receiver when said trend or event is detected.

Claim 47 (Substitute for claim 36, if found unpatentable)

~~[[36]]~~47. A system for detecting operational anomalies on a railcar that is part of a train consist comprising:

(a) at least one communication management unit (CMU) mounted on the ~~[[a]]~~ railcar in said train consist;

(b) at least two wireless sensor~~[[s]]~~ nodes located on the ~~[[said]]~~ railcar and~~[[for]]~~ configured to sense operational parameters of the railcar, said wireless sensor~~[[s]]~~ nodes being in communication with said communication management unit, wherein the at least two ~~one or more~~ wireless sensor~~[[s]]~~ nodes comprise a tri-axis ~~one or more~~ sensor~~[[s]]~~ configured to measure accelerations of the railcar along a plurality of axes comprising a first axis extending along a length of the railcar, a

second axis extending across a width of the railcar, and a third axis extending along a height of the railcar; and

(c) a plurality of ~~one or more~~ sensor sections that are provided with the one or more wireless sensor nodes and that comprise

a plurality of filters that are each configured to filter at least a portion of the accelerations by receiving an output signal directly from the tri-axis sensor and selecting ones of the accelerations in the output signal that were measured in a dimension represented by a respective axis of the plurality of axes, and

a plurality of detectors respectively coupled to the plurality of filters, each one of the detectors being configured to detect a respective one of a plurality of different railcar conditions based on ones of the accelerations that are associated with only the respective axis of the plurality of axes;

wherein said communication management unit performs the following functions:

- (i) receiving data from said at least two wireless sensor[[s]] nodes;
- (ii) drawing inferences from the data received from at least two wireless ~~of the~~ sensor[[s]] nodes regarding the performance of the railcar; and
- (iii) communicating a message to a remote receiver when an anomaly is detected.

Claim 48 (Substitute for claim 37, if found unpatentable)

[[37]]48. The system of claim 47[[36]],

wherein said tri-axis sensors comprise accelerometers positioned at different locations of the railcar,

wherein said step of drawing inferences comprises the comparison of data from ~~two or more of~~ said accelerometers,

wherein said accelerometers are positioned on the railcar to provide data for carrying out one or more of the following functions:

- i) compare accelerations from one railcar wheel with that of another railcar wheel on the same axle but opposite side of the railcar,
- ii) compare accelerations from one railcar wheel with that of at least one other wheel on the same side of said railcar, and
- iii) compare accelerations from one railcar wheel with that of at least one other railcar wheel on the same side of said one railcar wheel and which other wheel is on another railcar of the same train consist.