

Petitioners' Oral Argument Demonstratives

**Siemens Mobility, Inc., Ground Transportation Systems USA, Inc.,
Humatics Corp., and Piper Networks, Inc.,**

Petitioners,

v.

**Metrom Rail, LLC,
Patent Owner.**

**IPR2023-00468
US Patent 9,043,131**

**IPR2023-00470
US Patent 8,812,227**

Summary of the Argument

Grounds 1A₁₃₁ and 1A₂₂₇ (Claims 1, 11 and 14): *Grisham*

- Metrom effectively concedes *prima facie* obviousness
- Metrom's secondary considerations evidence fails

Grounds 1B₁₃₁ and 1B₂₂₇ (Claims 2-4): *Grisham + Douglas*

- Douglas discloses tracking train location
- Challenged claims do not require pinpoint accuracy

Grounds 1C₁₃₁ and 1C₂₂₇ (Claims 5 and 6): *Grisham + Richardson*

- POSITA would have been motivated to combine Grisham and Richardson
- High degree of predictability in art supports reasonable expectation of success for combination

Grounds 1D₁₃₁ and 2D₂₂₇ (Claim 10): *Grisham + McDaniel*

- Grisham and McDaniel disclose determining speed of first and second rail vehicles
- Proposed combination need not eliminate all nuisance alarms to render challenged claims obvious

Summary of the Argument

Grounds 2A₁₃₁ (Claims 7-9, 17 and 19) and 2A₂₂₇ (Claims 7-9, 17-19, 21 and 24-26): *Grisham + Nixon*

- Claims 7-9: POSITA would not have been concerned about interference between UWB and GPS
- Claims 17 and 19: Grisham discloses an antenna that sends/receives separation distance data over air

Ground 2C₁₃₁ (Claim 18): *Grisham + Nixon + Richardson*

- Limitation [18B] is satisfied for same reasons as in Grounds 1C₁₃₁ and 1C₂₂₇
- Richardson discloses calibration information related to vehicle length and mounting location of transceivers

Grounds 3A₁₃₁ (Claims 1, 7-8, 11-14 and 17) and 3A₂₂₇ (Claims 1, 7-8, 11-14, 17-19 and 24-25): *Suzuki or Suzuki + Grisham*

- Claim 17: Suzuki discloses antenna that sends/receives separation distance data over air

Petitioners' Motion to Exclude

- Conti's challenged "expert" opinions on UWB lack proper support

Independent Claims

Differences Between Claim 1 of Each Patent

'131 Patent, Claim 1	'227 Patent, Claim 1
"a first vehicle mounted module" and "a second vehicle mounted module"	"one or more vehicle mounted modules"
"a first transponder sensor module" and "a second transponder sensor module"	"a transponder sensor module"
"a first radio communication unit" and "a second radio communication unit"	"a first ultra wideband unit"
"a first control electronics module" and "a second control electronics module"	"a control electronics module"
"a first user interface module" and "a second user interface module"	"a user interface module"

Compare 468 Ex. 1001 at 30:44-31:12 with 470 Ex. 1001 at 30:40-59

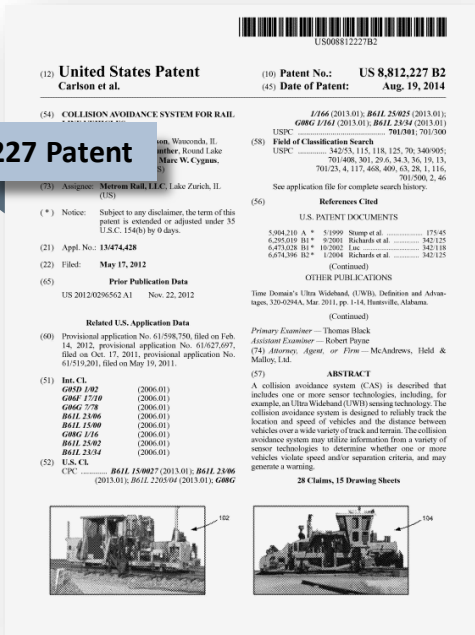
'131 Patent, Claim 1



a first user interface module including a first user interface, the first user interface operable to provide rail vehicle information to a vehicle operator and to receive input from the vehicle operator;

'227 Patent, Claim 1

'227 Patent



1. A collision avoidance system comprising:
 - one or more vehicle mounted modules, each vehicle mounted module mountable on a rail vehicle, each vehicle mounted module comprising:
 - a transponder sensor module operable to send and receive data wirelessly, the transponder module comprising a first ultra wideband unit and a first antenna;
 - a control electronics module comprising a processor in communication with at least the transponder sensor module unit; and
 - a user interface module including a user interface, the user interface being operable to provide rail vehicle information to a vehicle operator and to receive input from the vehicle operator; and wherein each vehicle mounted module is operable to communicate with at least one other vehicle mounted module mounted on at least one other rail vehicle, and wherein each vehicle mounted module is operable to apply a time of flight technique to determine a separation distance between the rail vehicles.

The Board Already (Correctly) Rejected PO's Attempt to Unduly Narrow the Relevant Art

Petitioners: “POSITAs would have had a background in wireless electronics, including at least a bachelor’s degree in electrical engineering or a related field, and would have at least two years of experience with using such electronics for control systems applications such as collision-avoidance systems or positioning systems.”

Paper 5 at 7

Patent Owner: “The hypothetical POSITA would have had a background in wireless electronics, including at least a bachelor’s degree in electrical engineering or a related field, and would have at least two years of experience with using such electronics for control systems applications such as ***railway*** collision-avoidance systems or ***railway*** positioning systems.”

Paper 22 at 4 (emphasis added)

Board: “For purposes of our decision, we adopt Petitioner’s proposed level of skill in the art.”

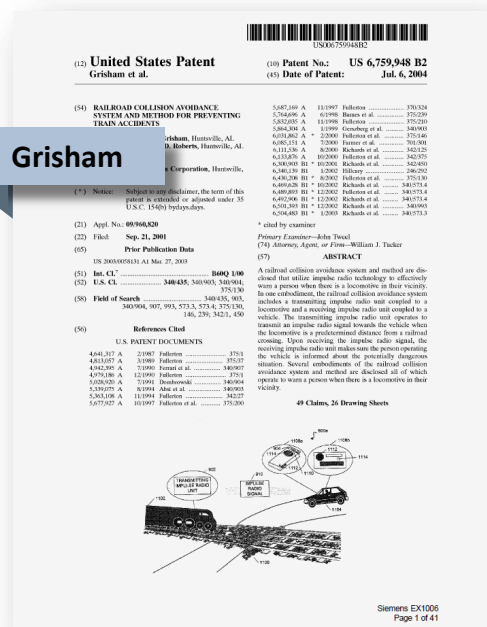
Paper 10 at 11

***Claims 1, 11 and 14 Are Obvious in
View of Grisham***

Metrom effectively concedes *prima facie*
obviousness

Metrom's secondary considerations evidence fails

Grisham Discloses a Collision Avoidance System

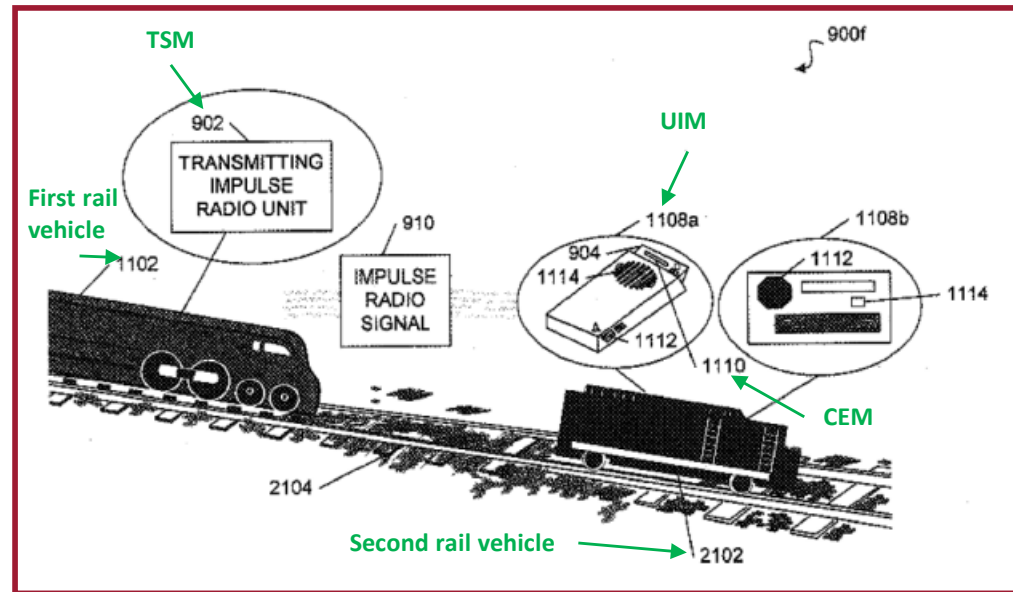


BRIEF DESCRIPTION OF THE INVENTION

The present invention includes a railroad collision avoidance system and method that utilize impulse radio technology to effectively warn a person when there is a locomotive in their vicinity. In one embodiment, the railroad collision avoidance system includes a transmitting impulse radio unit coupled to a locomotive and a receiving impulse radio unit coupled to a vehicle. The transmitting impulse radio unit operates to transmit an impulse radio signal towards the vehicle when the locomotive is a predetermined distance from a railroad crossing. Upon receiving the impulse radio signal, the receiving impulse radio unit makes sure the person operating the vehicle is informed about the potentially dangerous situation. Several different embodiments of the railroad collision avoidance system and method all of which operate to warn a person when there is a locomotive in their vicinity are described below.

Grisham Discloses the Vehicle Mounted Modules (VMMs) Required by the Challenged Claims

Grisham discloses first and second VMMs, comprising first and second transponder sensor modules (TSMs), control electronics modules (CEMs), and user interface modules (UIMs), in communication.



It should be understood that the first locomotive **1102** can contain the same equipment as the second locomotive **2102** (or other objects **908**) and as such could be notified of the presence and speed of an oncoming second locomotive **2102** (or other objects **908**).

Ex. 1006, Fig. 21, 24:25-29, cited in Paper 5 at 11-17 and Ex. 1003, ¶¶105-24; *see also* Ex. 1006, 23:40-49

PO Has Failed to Establish that POSITAs in the Railroad Industry Were Reluctant to Innovate



In re Farrenkopf, 713 F.2d 714, 718 (Fed. Cir. 1983)

“That a given combination would not be made by businessmen for economic reasons does not mean that persons skilled in the art would not make the combination because of some technological incompatibility. Only the latter fact would be relevant.”

Contemporaneous patenting activity contradicts Patent Owner’s disparagement of POSITAs in the railroad industry:

- **100+ U.S. patent applications related to the railroad industry were filed in 2004, when Grisham published**
- **Another 90+ were filed in the year before the priority date of the challenged patents**

PO's Alleged Secondary Considerations Evidence Fails to Overcome Obviousness of the Challenged Claims

- Patent Owner Fails to **Meet Its Burden** of Establishing:
 - Long-Felt, Unresolved Need
 - Skepticism
 - Commercial Success
 - Copying
 - Industry Praise

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PO Fails to Establish a Long-Felt, Unresolved Need

- Metrom argues “that there was a long-felt and unresolved need for a ‘radio-based maintenance of way (MOW) collision avoidance system.’”
 - Grisham already resolved the alleged unresolved need (Paper 5 at 9-10)
 - *Nike, Inc. v. Adidas AG*, 955 F.3d 45, 55 (Fed. Cir. 2020)
 - PO’s theory is NOT commensurate with the claims
 - Claims are NOT limited to MOW vehicles (Ex. 1053, 136:17-137:10)
 - Grisham teaches MOW in any event (Ex. 1006, 22:42-23:32, claim 8, Figs. 19-20; *see also* Ex. 1039, 3)

PO Fails to Establish a Long-Felt, Unresolved Need

- Metrom “also argues that there were failures of every other UWB/RADAR communications systems to go to market and ‘most experts’ thought UWB was ‘dead’ by 2010-2012.”
 - ‘131 claim 1 not limited to UWB (Ex. 1051, 123:22-124:8)
 - Grisham “us[es] UWB technology” (Paper 5 at 9)
 - PO’s declarants were admittedly NOT knowledgeable of the state of the art (Ex. 1053, 150:2-151:19)
 - “UWB **was *not* dead after all.**” (Ex. 2024, 2 (emphasis added))

PO's Alleged Secondary Considerations Evidence Fails to Overcome Obviousness of the Challenged Claims

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 - **Skepticism**
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PO Fails to Establish Industry Skepticism

- PO's declarant does NOT have a sufficient basis to assert skepticism in the industry
 - Non-expert Gunther's opinion is based on his impressions of a single unnamed individual (Ex. 2009, ¶¶37-40; Ex. 1052, 79:16-80:12)
- Metrom's unspecific, hearsay evidence does not establish that industry experts were skeptical "about whether or how a problem could be solved or the workability of the claimed solution." *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1335 (Fed. Cir. 2016)
- PO's theory is NOT commensurate with the scope of the claims

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PO Fails to Establish Commercial Success

- PO misidentifies the relevant market
 - Claims are NOT limited to MOW vehicles (Ex. 1053, 136:17-137:10)
- The alleged features that created the commercial success were known in the prior art
 - *Ormco v. Align*, 463 F.3d 1299, 1312 (Fed. Cir. 2006)
 - Grisham teaches each of the limitations at issue (Ex. 1006, 22:42-23:32, Figs. 19-20, claim 8; see also Ex. 1039, 3)
- No profitability or market share evidence provided

PO Fails to Establish Commercial Success

- PO fails to demonstrate a nexus with AURA
 - Claim chart (Ex. 2023) is insufficient (Ex. 1051, 92:3-19)
 - PO failed to demonstrate “coextensiveness” (Ex. 1051, 117:5-10)
 - Unclaimed and material features (Ex. 2016, 1-6; Ex. 2019, 1-4; Ex. 1054, 125:20-141:7):
 - “operator-defined detection and alarm criteria, with integrated, expandable hardware options”
 - “key machine function monitoring” (e.g., gas consumption)
 - “remote data recording”
 - “customizable user interface”
 - “aluminum and specific molded Radome materials”
 - “adaptive spacing limits” with “three modes” of equipment speed
 - “integrated data recorder”

PO's Alleged Secondary Considerations Evidence Fails to Overcome Obviousness of the Challenged Claims

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PO Fails to Establish Copying

- “[C]opying requires the replication of a specific product.”
Liqwd, Inc. v. L’Oreal USA, Inc., 941 F.3d 1133, 1137 (Fed. Cir. 2019) (Paper 18 at 4)
 - PO and its declarant provide NO evidence that the Helix System is a replication of PO’s AURA system
- Board already found that PO failed to account for the additional features of the Helix system
 - PO “has not shown that the sales of the Helix are commensurate with claim 1 or that the features in claim 1 drive sales of Helix systems.” (Paper 18 at 9)

PO Fails to Establish Copying

- Petitioner Piper filed patent applications concerning UWB/time of flight ranging months prior to Mr. Garcia joining Piper (Ex. 1056)
- Piper demonstrated its UWB technology prior to Mr. Garcia joining Piper (Ex. 1057)
- PO fails to demonstrate access prior to these developments
- PO fails to demonstrate nexus

PO Fails to Establish Copying

- PO presents NO evidence of direct copying
 - PO's declarant admits he can't prove his theory in court:
 - **Q.** "... So simply, do you believe, you, Mr. Gunther, believe that David Garcia took the knowledge he learned from you and wrongly used it in the Piper products?"
 - **A.** "... **I cannot prove it.** I could not prove it in a court of law with what I have physically observed."
 - Ex. 1052, 168:1-15

PO's Alleged Secondary Considerations Evidence Fails to Overcome Obviousness of the Challenged Claims

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PO Fails to Establish Industry Praise

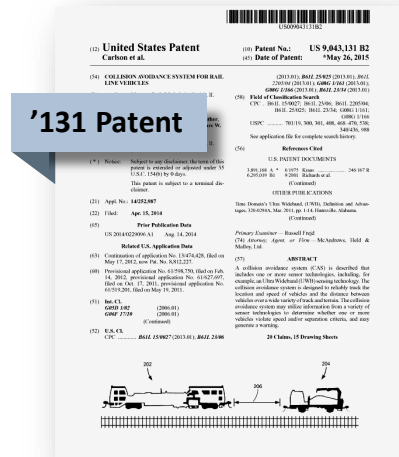
- PO provides NO separate arguments for industry praise

*Claims 2-4 Are Obvious in View of
Grisham and Douglas*

Douglas discloses tracking train location

Challenged claims do not require pinpoint accuracy

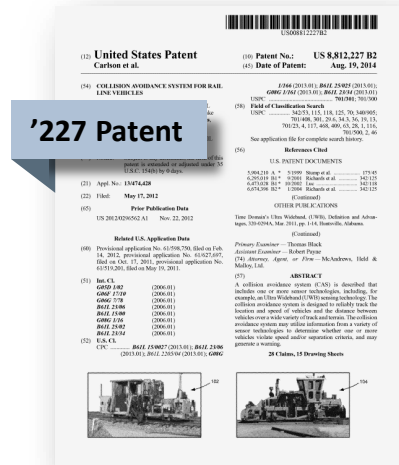
'131 and '227 Patents, Claim 2



2. The collision avoidance system of claim **1**, further comprising:

a central tracking unit in communication with the first vehicle mounted module and the second vehicle mounted module, wherein the central tracking unit is operable to track a location of the first vehicle mounted module and a location of the second vehicle mounted module.

468, Ex. 1001, 31:13-20



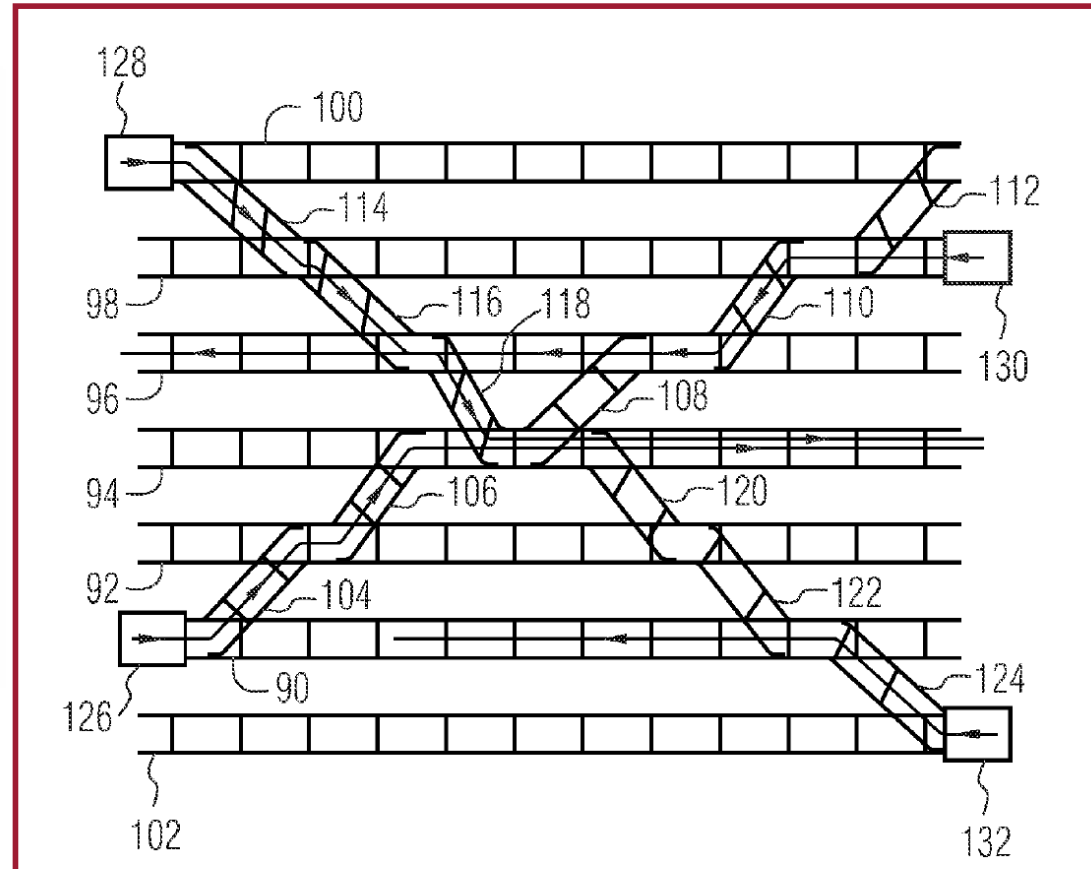
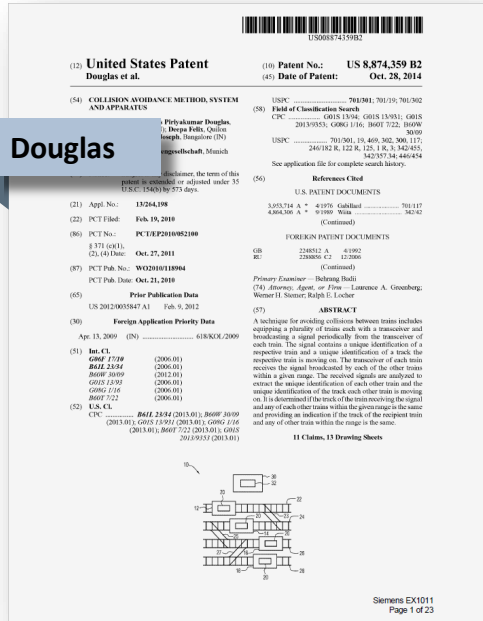
2. The collision avoidance system of claim 1, further comprising a central tracking unit in communication with the first vehicle mounted module and the second vehicle mounted module, wherein the central tracking unit is operable to track the location of at least the first vehicle mounted module and the second vehicle mounted module.

470, Ex. 1001, 30:60-65

Douglas Tracks Train Location to Avoid Collisions, Exactly as Required by the Challenged Claims

Metrom: Douglas “know[s] that the trains are generally in the same zone and the tracks on which the trains are moving.”

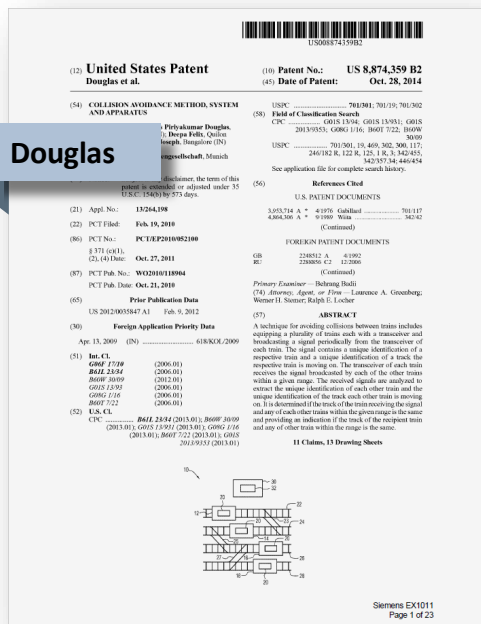
Paper 22 at 17-18



Douglas Tracks Train Location to Avoid Collisions, Exactly as Required by the Challenged Claims

Apparatus 32 “provide[s] each train with a list of rail links and tracks each train will travel, the direction of movement of each train, and other trains located in the zone of station 30”

Paper 10 at 24



Referring again to FIG. 1, each of the trains 12, 14, 16, 18 approaching the station 30 are provided with information of the links 23, 25, 27 and to the tracks 22, 24, 26, 28 the links 23, 25, 27 connect in both the directions and a list including the links 23, 25, 27 to be traversed by the respective train and the direction of motion of the respective train. The links 23, 25, 27 may be identified by assigning a unique identification to each of the links 23, 25, 27. For example, the apparatus 32 located at the station 30 may broadcast the information of links 23, 25, 27 and the list including the links 23, 25, 27 to be traversed by the respective train and the direction of motion of the respective train. The trains 12, 14, 16, 18 may receive the information and the list as the trains 12, 14, 16, 18 are within the zone of the station 30 in the present embodiment. The apparatus 32 typically, comprises a transmitter and a processor such that information may be transmitted by the apparatus 32. The apparatus may also comprise an input means to receive input and an output means to provide output.

PO's Criticism of Douglas Is Misplaced, as the Challenged Claims Do Not Require the Level of Accuracy PO Demands

'131 Patent

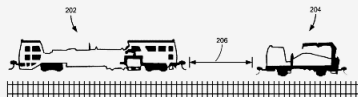
(12) **United States Patent**
Carlson et al.

(10) **Patent No.:** US 9,043,131 B2
(45) **Date of Patent:** *May 26, 2015

(54) **COLLISION AVOIDANCE SYSTEM FOR RAIL LINE VEHICLES**

(57) **Abstract:** Methods and systems for collision avoidance between rail vehicles. A first rail vehicle (100) is equipped with a collision avoidance system (CAS) that receives location information from a second rail vehicle (200) and generates a warning to the operator of the first rail vehicle based on the received location information.

(51) **Int. Cl.** (2006.01)
G08G 1/10 (2006.01)
G08G 1/12 (2006.01)
G08G 1/14 (2006.01)
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a central tracking unit in communication with the first vehicle mounted module and the second vehicle mounted module, wherein the central tracking unit is operable to track a location of the first vehicle mounted module and a location of the second vehicle mounted module.

Ex. 1001, 31:15-20

the CAS recited in claim 1. The patent explains that the CAS is capable of *precisely tracking the location* of vehicles. Ex. 1001 at 21:32-33; see also 29:16-19 (“The

Paper 49 at 27

PO's Criticism of Douglas Is Misplaced, as the Specification Does Not Require the Level of Accuracy PO Demands

'131 Patent

(12) United States Patent
Carlson et al.

(10) Patent No.: US 9,043,131 B2
(45) Date of Patent: *May 26, 2015

(54) COLLISION AVOIDANCE SYSTEM FOR RAIL LINE VEHICLES

(73) Assignee: Metrom Rail, LLC, Lake Zurich, IL

Inventors:
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B. Kurt A. Gauthier,
Carlson, B. (US); Marc W.
Carlson, B. (US)

(73) Assignee: Metrom Rail, LLC, Lake Zurich, IL

(US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: 14/252,987

(22) Filed: Apr. 15, 2014

(65) Prior Publication Data

US 2014/022906 A1 Aug. 14, 2014

Related U.S. Application Data

(63) Continuation of application No. 13/474,428, filed on May 17, 2012, now Pat. No. 8,832,227.

(60) Provisional application No. 61/598,750, filed on Feb. 14, 2012; provisional application No. 61/627,097, filed on Oct. 17, 2011; provisional application No. 61/513,201, filed on May 19, 2011.

(51) Int. Cl. (2006.01)

G08C 1/00

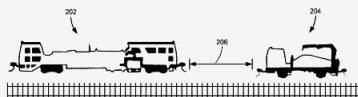
G08C 1/00

(Continued)

(52) U.S. Cl. (2006.01)

CPC: B61L 15/0027 (2013.01); B61L 23/00

20 Claims, 15 Drawing Sheets



Especially if the vehicle **900** is long, a distance sensor (for example a sensor included in TSM **904**) that is placed near the end of a vehicle may more accurately calibrate itself to determine the **exact location** of the end of the vehicle **900**, and thus

Ex. 1001, 12:7-10

the mounting location of the multiple VMMs. The sensors may be designed to adjust for the size of the equipment and **specific location** of the components. The present disclosure

Ex. 1001, 12:45-47

work gang. The vehicle communication devices **612** may be operable to, among other functions, determine the **relative location** of other CAS/VMM-equipped vehicles in relation to the present vehicle. The vehicle communication devices **612**

Ex. 1001, 13:9-12

vehicles on the same track/rail. In some embodiments, the CAS may calculate the locations of vehicles using GPS data (or data from other positioning components) and may determine **vector locations** of such vehicles from which a reasonable calculation of track location can be determined. Other

Ex. 1001, 26:50-54

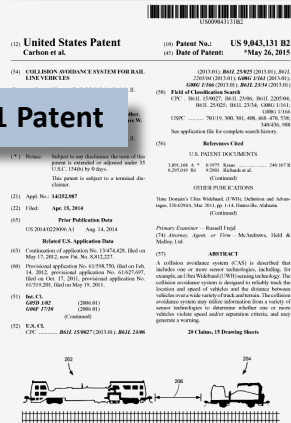
***Claims 5 and 6 Are Obvious in View
of Grisham and Richardson***

POSITA would have been motivated to combine
Grisham and Richardson

High degree of predictability in art supports
reasonable expectation of success for combination

'131 and '227 Patents, Claim 5

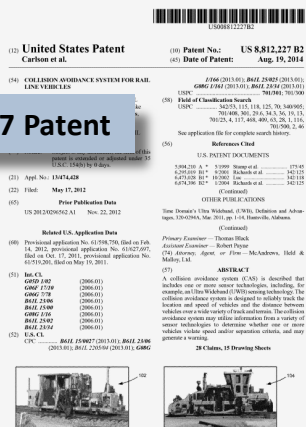
'131 Patent



5. The collision avoidance system of claim 1, wherein the first vehicle mounted module further comprises a first auxiliary transponder sensor module, the first auxiliary transponder sensor module mounted on the first rail vehicle with a first offset with respect to the first transponder sensor module.

468, Ex. 1001, 31:28-32

'227 Patent



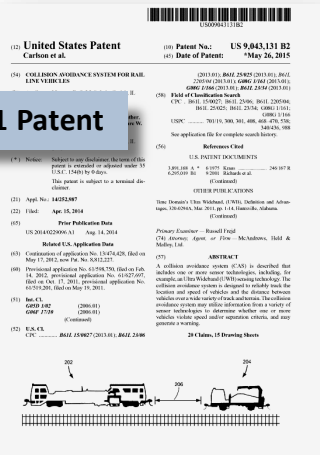
5. The collision avoidance system of claim 1, wherein the first vehicle mounted module further comprises an auxiliary transponder sensor module, the auxiliary transponder sensor module mounted on the first rail vehicle with an offset with respect to the transponder sensor module, and

wherein the user interface is operable to provide calibration information related to the length of the first rail vehicle, the mounting location of the first transponder sensor module, and the mounting location of the auxiliary transponder sensor module.

470, Ex. 1001, 31:6-15

The Specification's Description Highlights the Similarity Between Offset Transponders in Claim 5 and Richardson

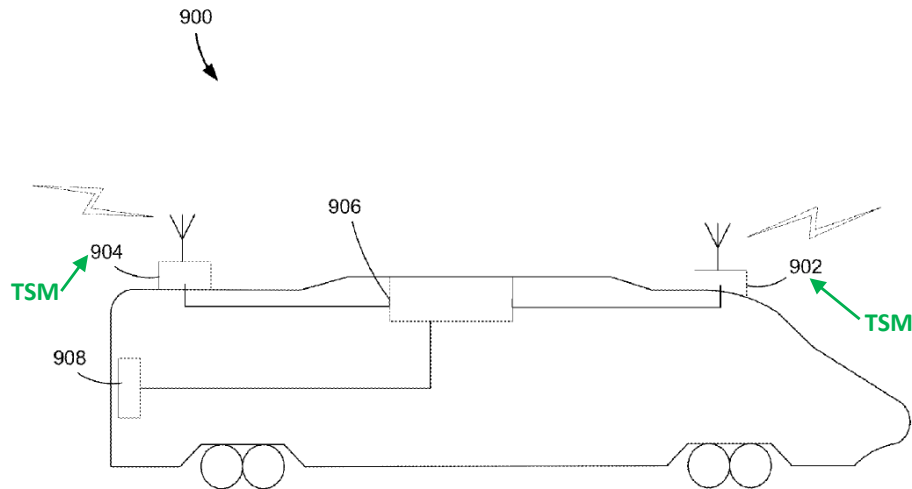
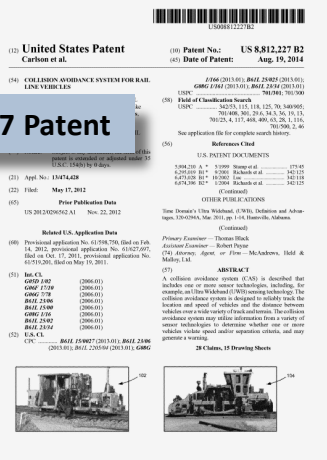
'131 Patent



The '131 patent describes an embodiment in which vehicle 900 uses multiple offset transponder sensor modules (TSMs) 902, 904, and a sensor included in TSM 904 is placed near an end of the vehicle to calibrate itself to determine the location of the vehicle's end and other vehicles. Ex. 1001, 11:64–12:16. A vehicle operator can specify the vehicle's length from the mounted TSMs so the components can compute the distance between their mounting locations and the ends of the vehicle. *Id.* at 11:64–12:57, Fig. 9. This system may calibrate for vehicle length and mounting locations. *Id.* TSMs may be mounted at a vehicle's front and rear ends. *Id.* at 12:40–42.

Paper 10 at 28

'227 Patent



Ex. 1001, Fig. 9

A POSITA Would Have Been Motivated to Improve Grisham's Accuracy Using Offset Transponders as Taught by Richardson

Richardson: Having multiple UWB transceivers offset by a distance r_b causes the location information to be more precise by limiting the dilution of precision (DOP).

Int. J. Ultra Wideband Communications and Systems, Vol. 1, No. 3, 2010

209

An outdoor UWB tracking system to improve safety of semi-autonomous vehicle operations

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Richardson

UWB positioning systems show promise in improving navigational capabilities and operations for semi-autonomous systems that are emerging in applications such as autonomous vehicles. This paper describes an outdoor UWB positioning system that tracks the position of a vehicle in a semi-autonomous track control. The system improves accuracy by providing position data to the vehicle control system with accurate position measurements. A measurement campaign was conducted to collect experimental range errors in open, directed and other channels at distances ranging from 2 m to 60 m. The range errors are characterized and a model for range errors is proposed. Position errors using the proposed model are compared to the experimental data. Performance analysis regarding accuracy and position update delay is provided.

Keywords: ultra wideband; UWB; positioning systems; experimental analysis.

Reference to this paper should be made as follows: Richardson, P., Xiang, W. and Shan, D. (2010) 'An outdoor UWB tracking system to improve safety of semi-autonomous vehicle operations', *Int. J. Ultra Wideband Communications and Systems*, Vol. 1, No. 3, pp.209-221.

Biographical notes: Paul Richardson is the Program Manager for the Vehicle Institute, the Director of Wireless Communications and Control Laboratory and an Associate Professor in the Department of Electrical and Computer Engineering at the University of Michigan-Dearborn. He is a Senior Member of the IEEE and received his MSc in Computer Engineering, his MSc in Computer and Electrical Engineering and his PhD in Systems Engineering, all from Oakland University, Rochester, MI.

Weidong Xiang received his MSEE and his PhD from Tsinghua University, Beijing, China, in 1996 and 1999, respectively. From 1999 to 2004, he was a Postdoctoral Fellow and then a Research Scientist with the Software Radio Laboratory, Georgia Institute of Technology, Atlanta. In September 2004, he joined the Department of Electrical and Computer Engineering, University of Michigan-Dearborn, as an Assistant Professor. His research interests include vehicular networks, software radio and cognitive radio, ultra wideband and wireless networked control systems.

Dan Shan received his BS and MS in Electrical Engineering from Beijing University of Posts and Telecommunications, Beijing, China, in 2004 and 2007, respectively. Since 2007, he has been a Research Associate with the University of Michigan-Dearborn. In 2009, he was admitted to the university's PhD program for information systems engineering. His research interests include UWB communications, tracking systems and vehicular ad hoc networks.

1 Introduction

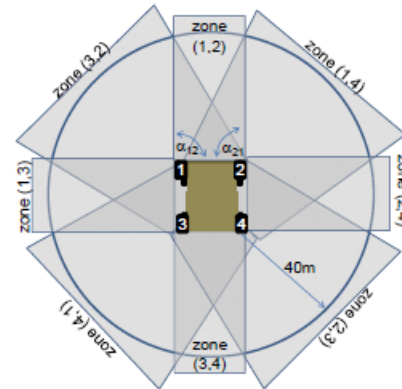
Semi-autonomous vehicles are emerging in defence, construction and agricultural applications with the aim of improving safety and reducing the amount of required personnel resources. These systems have varying levels of autonomy that range from tele-operated systems that are already fielded to experimental systems with fully autonomous navigation. This type of platform can benefit from a highly accurate positioning system to enhance

navigational, especially in GPS denied environments such as deep canyons or heavily forested terrain. Positioning data can improve safety of operations by providing operators and vehicle control systems with the position of nearby objects. This data can also facilitate certain autonomous applications such as 'leader-follower' wherein one vehicle will automatically follow another vehicle.

An ultra wideband impulse radio (UWB-IR) positioning system integrated into the control system of a

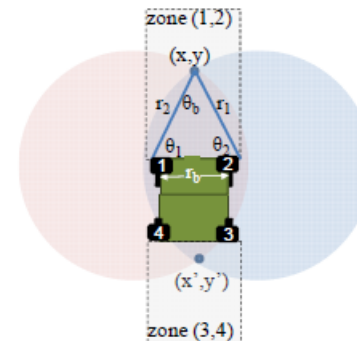
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Figure 6 Eight zone definitions defined by coordinate radio pairs (see online version for colours)



Notes: Ambiguous positions resulting from bilateration will never be in the same zone.

Figure 7 Bilateration for position measurement in a plane (see online version for colours)



Notes: Ambiguous position at (x', y') is eliminated by assigning targets into zones based on last measurement.

Ex. 1008, Figs. 6 and 7, cited at Paper 5 at 25-26

Petitioners' Expert Explained Exactly Why a POSITA Would Have Been Motivated to Combine Grisham and Richardson



Scott Andrews

148. Further, a POSITA would have understood that some trains can be over a mile long. Because of this, a POSITA looking at Grisham would have been motivated to look at other vehicle proximity detection systems to supplement Grisham's UWB-based system with a system that can account for the length of these trains, particularly to detect collisions at both the front and rear of the trains. A

trains, particularly to detect collisions at both the front and rear of the trains. A POSITA would have understood the benefits of providing Richardson's auxiliary transponder sensor module with an offset to the transponder sensor module, including better location measurements and improved collision avoidance due to more precise information relating to length of the vehicle and mounting location of each sensor. Richardson's additional transponders are located offset locations in

each sensor. Richardson's additional transponders are located offset locations in front and rear which provides for significant flexibility in identifying different zones in the vehicle's location. In my opinion, a POSITA would understand that

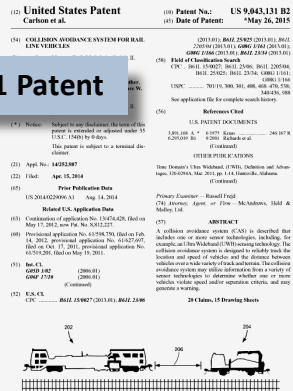
***Claim 10 Is Obvious in View of
Grisham and McDaniel***

Grisham and McDaniel disclose determining speed
of first and second rail vehicles

Proposed combination need not eliminate all
nuisance alarms to render challenged claims
obvious

'131 and '227 Patents, Claim 10

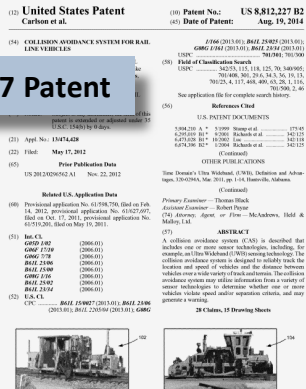
'131 Patent



10. The collision avoidance system of claim 1, wherein the first vehicle mounted module executes an adaptive threshold feature that modifies one or more vehicle separation thresholds based on a speed of the first rail vehicle and a speed of the second rail vehicle.

468, Ex. 1001, 31:66-32:3

'227 Patent



10. The collision avoidance system of claim 9, wherein the first vehicle mounted module executes an adaptive threshold feature that modifies one or more vehicle separation thresholds based on the speed of the first rail vehicle and the speed of the second rail vehicle.

470, Ex. 1001, 31:45-49

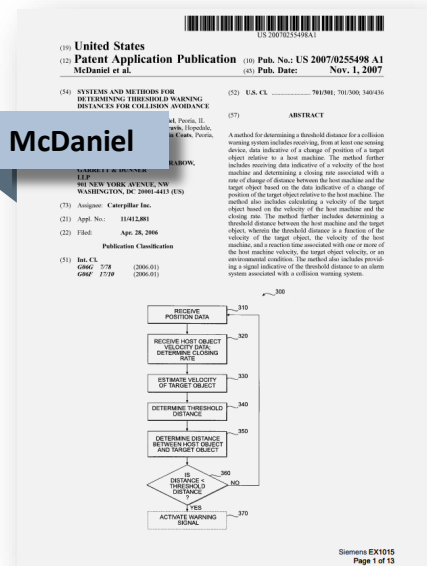
PO's Suggestion that Neither Grisham Nor McDaniel Discloses Determining Vehicle Speed Is Simply Wrong

lated (Step 340). For example, controller 120 may calculate the threshold warning distance based on the respective velocities of host machine 110 and target object 130, as well

Ex. 1015, [0039], cited in Paper 5 at 29

machine 110. For example, velocity monitoring device 114 may include a mechanical or computerized device coupled to a transmission of host machine 110 and configured to determine the velocity of host machine 110 based on the distance traveled over a given time period. Alternatively,

Ex. 1015, [0022], cited in Paper 43 at 18



PO's Argument About the Elimination of Nuisance Alarms Is a Red Herring, Ignoring McDaniel's Disclosure

McDaniel eliminates nuisance alarms in the train yard when two trains on the same track move slowly because McDaniel explains how to change the threshold warning distance based on slow speed

Paper 43 at 19, citing Paper 5 at 29-30; Ex. 1003, ¶¶153-56



In re Fulton, 391 F.3d 1195, 1200 (Fed. Cir. 2004)

“[O]ur case law does not require that a particular combination must be the preferred, or the most desirable, combination described in the prior art in order to provide motivation for the current invention.”

Grounds 2A₁₃₁ and 2A₂₂₇

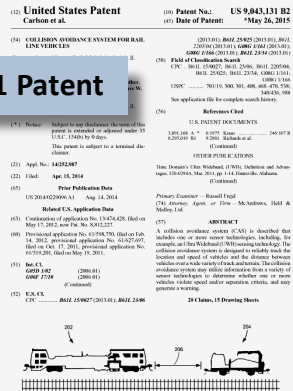
'131 Claims 7-9, 17 & 19, and '227 Claims 7-9, 17-19, 21 & 24-26, Are Obvious in View of Grisham and Nixon

Claims 7-9: POSITA would not have been concerned
about interference between UWB and GPS

'131 Claims 17 and 19: Grisham discloses an
antenna that sends/receives separation distance
data over air

'131 and '227 Patents, Claim 7

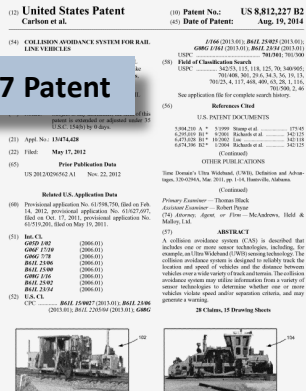
'131 Patent



7. The collision avoidance system of claim 1, wherein: the first vehicle mounted module further comprises a first global positioning system unit, the global positioning system unit operable to receive information from one or more satellites to determine an absolute position of the first rail vehicle; and the first global positioning system unit is in communication with the first control electronics module.

468, Ex. 1001, 31:41-48

'227 Patent



7. The collision avoidance system of claim 1, wherein the first vehicle mounted module further comprises a global positioning system unit, the global positioning system unit operable to receive information from one or more satellites to determine an absolute position of the rail vehicle, wherein the global positioning system unit is in communication with the control electronics module.

470, Ex. 1001, 31:23-29

Petitioners' Expert Explained Why UWB and GPS Provide Redundancy and Diversity, Which PO's Expert Lauds

errors in GPS. So, while GPS would provide a better overall picture of where the train is and where other trains are, UWB allows that picture to be refined to the level of accuracy needed to assure that a collision does not occur. Since the main purpose of Grisham is to avoid collisions at all distances, a POSITA would have been motivated to augment Grisham's UWB based collision avoidance system with the GPS modules of Nixon in order to ensure collisions were effectively avoided. Both



Scott Andrews

Ex. 1003, ¶179, cited in Paper 5 at 35-36

So in any safety system, you need redundancy and diversity to -- to achieve the highest level of safety, so -- so just

Ex. 1053, 41:20-22, cited in Paper 43 at 22



Carl Conti

Petitioners' Expert Explained Why UWB and GPS Provides Redundancy and Diversity, Which PO's Expert Lauds

177. One of the most common positioning systems by the critical date was GPS, and a POSITA would have known that GPS systems pair well with UWB systems in that GPS can make up for the shortfalls of UWB discussed by providing heading and other information useful, such as the path of the train, to train-safety systems. One such GPS system that is used for a railway collision-avoidance system is described in Nixon.

Ex. 1003, ¶177, cited in Paper 5 at 35-36

Q So if you know the GPS location of two different trains, how do you know that they're on two different tracks?

A Well, two different ways. One of them is that many of these applications talk about having a track database, so you know what the track -- where the tracks are. The other way is simply to look at the trajectory of multiple GPS fixes over time and you can see what the path of that train is geographically and you can see what the path of the other one is, and you know that those two paths don't cross.

Ex. 2007, 115:10-20, cited in Paper 43 at 21



Scott Andrews

A POSITA Would Not Have Been Concerned About Interference Between UWB and GPS

Federal Communications Commission		FCC 02-48
Before the Federal Communications Commission Washington, D.C. 20554		
In the matter of	:	
Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems	:	ET Docket 98-153
FIRST REPORT AND ORDER		
Released: April 22, 2002		
Comments by Copps and Martin issuing separate statements.		
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Doreen E. O'Connell Page 1 of 110		

FCC

1. NTIA, DOT and TDC Analyses of Potential Interference to GPS

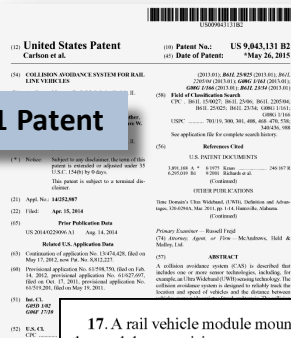
72. NTIA, DOT, TDC, and Qualcomm performed measurements and analyses to determine the UWB emission levels necessary to prevent interference to GPS operation. Qualcomm conducted UWB interference test on a GPS receiver that is intended to provide location information for E-911 services. The information below summarizes various measurement reports on UWB interactions with GPS receivers.

UWB system operating at the general limits in 47 C.F.R. § 15.209. The emission limits being adopted in this proceeding within the GPS frequency bands, ranging from 12 to 34 dB below the Part 15 general limits, were found to be more than sufficient to protect GPS from harmful interference. Further, we note

Ex. 1059 at 28, 67, cited in Paper 43 at 20

'131 Patent, Claim 17

'131 Patent



17. A rail vehicle module mountable on a first rail vehicle, the module comprising:
a transponder sensor module comprising:
a radio communication unit operable to employ time of flight techniques to detect a separation distance between the first rail vehicle and a second vehicle;
a first wireless communications antenna operable to send and receive data representing the separation distance over the air;
a global positioning system unit operable to receive information from one or more satellites to determine an absolute position of the first rail vehicle;
a control electronics module comprising a processor in communication with the transponder sensor module; and
a user interface module including a user interface operable to provide rail vehicle information to a vehicle operator and to receive input from the vehicle operator,
wherein the rail vehicle module communicates with a second rail vehicle module mountable on the second vehicle to detect a separation distance between the first rail vehicle and the second vehicle.

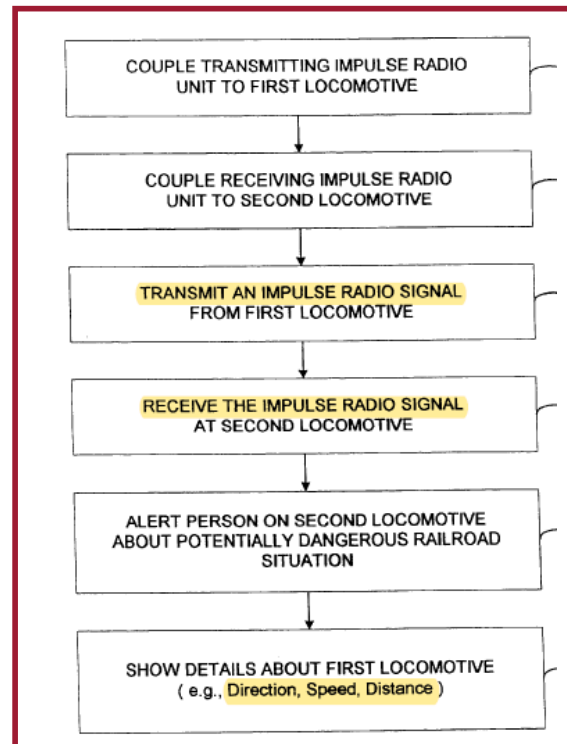
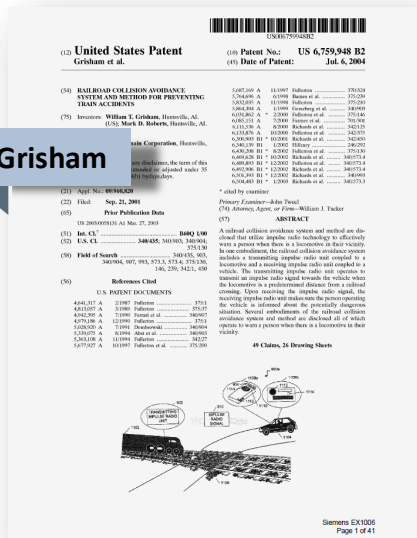
a first wireless communications antenna operable to send and receive data representing the separation distance over the air;

468, Ex. 1001, 32:51-53

Grisham Discloses Sending/Receiving Separation Distance Data as Required by Claim 17 of the '131 Patent

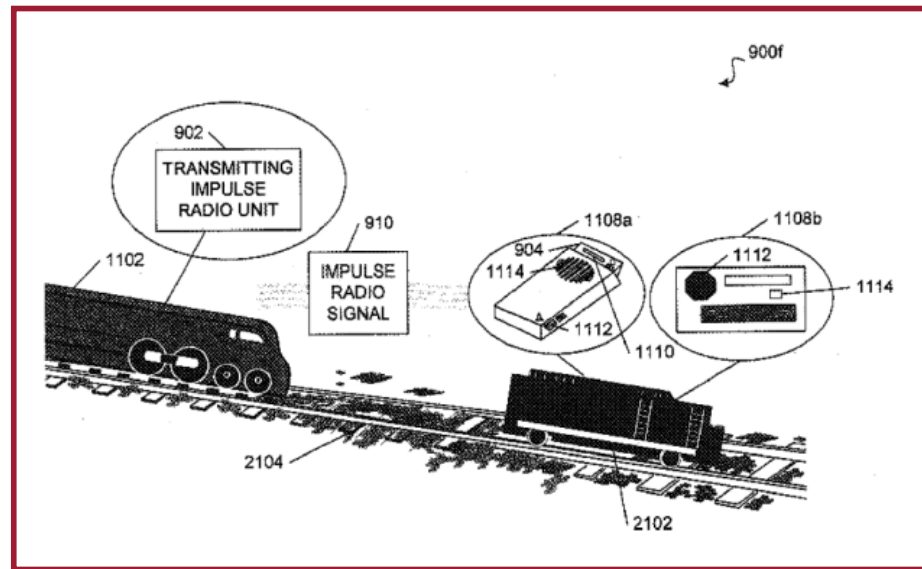
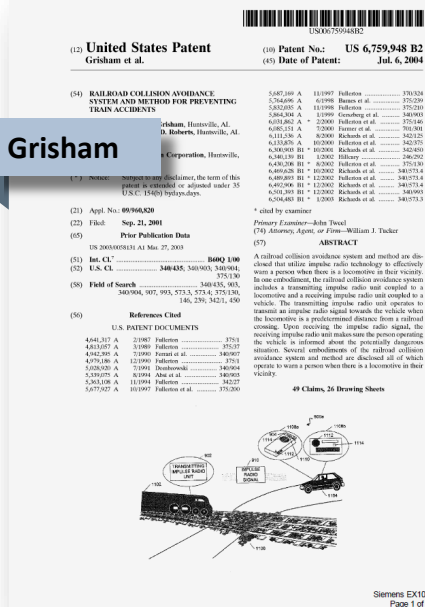
The radio units of Grisham continuously transmit and receive impulse radio signals wirelessly. *See* EX1006, FIG. 22, 23:42-47. The signals provide data such as direction, speed, and distance of each rail vehicle (showing the separation distance between trains). *Id.*, FIG. 22. As shown in FIGS. 6 and 7, Grisham details each

Paper 5 at 40



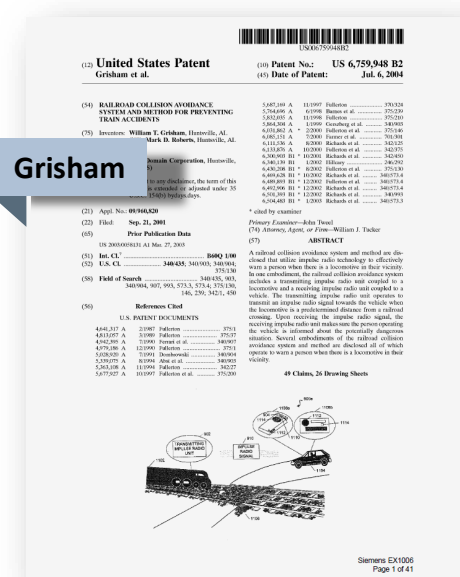
Ex. 1006, Fig. 22, cited in Paper 5 at 40

Grisham Discloses Sending/Receiving Separation Distance Data as Required by Claim 17 of the '131 Patent



the oncoming first locomotive **1102**. To determine the distance that the first locomotive **1102** is from the second locomotive **2102**, a controller **1110** within the receiving impulse unit **904** can use the revolutionary positioning capabilities of impulse radio technology. In particular, the impulse radio signal **910** transmitted between the transmitting impulse radio unit **902** and the receiving impulse radio unit **904** enables the controller **1110** to measure distances to extremely fine resolution because of the absence of ambiguous cycles in the waveform of the impulse radio signal **910**.

Grisham Discloses Sending/Receiving Separation Distance Data as Required by Claim 17 of the '131 Patent



the oncoming first locomotive **1102**. To determine the distance that the first locomotive **1102** is from the second locomotive **2102**, a controller **1110** within the receiving impulse unit **904** can use the revolutionary positioning capabilities of impulse radio technology. In particular, the impulse radio signal **910** transmitted between the transmitting impulse radio unit **902** and the receiving impulse radio unit **904** enables the controller **1110** to measure distances to extremely fine resolution because of the absence of ambiguous cycles in the waveform of the impulse radio signal **910**. In contrast, narrow band systems of traditional communication systems are limited to the modulation envelope and cannot easily distinguish precisely which RF cycle is associated with each data bit because the cycle-to-cycle amplitude differences are so small they are masked by link or system noise. Since the waveform of the impulse radio signal **910** does not have multi-cycle ambiguity, this allows the controller **1110** to positively determine the position of the waveform to less than a wavelength even when the waveform is in or near the noise floor of the system. The time position measurement can be used by the controller **1110** to measure the propagation delay and determine the link distance between the receiving impulse radio unit **904** and the locomotive **1102**. Once, the distance is known and updated then the speed of the first locomotive **1102** can be determined by the controller **1110**.

Claim 18 Is Obvious in View of Grisham, Nixon, and Richardson

Limitation [18B] is satisfied for same reasons as in
Grounds 1C₁₃₁ and 1C₂₂₇

Richardson discloses calibration information
related to vehicle length and mounting location of
transceivers

'131 Patent, Claim 18



the rail vehicle module is operable to receive calibration information related to a length of the rail vehicle, a mounting location of the first wireless communications antenna, and a mounting location of the second wireless communications antenna.

Ex. 1001, 33:1-12

The Petition Properly Cross-References to Claim 5, Which Shows that Richardson Discloses Calibration Information

Claim 18 contains limitations that track the limitations of claims 5 and 6, and its limitations are satisfied for the same reasons as explained above for claims 5-6 in Ground 1C.

Paper 5 at 42

2. Claim 5 – Auxiliary Transponder Sensor Module

Richardson teaches each of its vehicles have four UWB transceivers, numbers 1 and 2 offset by a distance r_b , as shown in Figs. 6 and 7. EX1008, Figs. 6 and 7. A POSITA would have understood the benefits of Richardson's provision of a *first auxiliary transponder sensor module* with a *first offset* to the first transponder sensor module, including better location measurements and improved collision avoidance due to more precise information relating to length of the vehicle and mounting location of each sensor as is described and depicted in Richardson. EX1003, ¶¶145-47.

Petitioners' Expert Explained How Richardson Discloses Calibration Information with Respect to Claim 5 and Claim 18

Richardson

Int. J. Ultra Wideband Communications and Systems, Vol. 1, No. 3, 2010

209

An outdoor UWB tracking system to improve safety of semi-autonomous vehicle operations

Paul Richardson*, Weidong Xiang and Dan Shan

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4901 Evergreen Rd., Dearborn, MI, USA
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UWB positioning systems show promise in improving navigational capabilities and operations for semi-autonomous systems that are emerging in applications such as construction and agricultural vehicles. This paper describes an outdoor UWB positioning system that estimates the position of tracks in a semi-autonomous track conveyer. The system improves safety by providing precise vehicle control system with accurate position measurements. A measurement campaign was conducted to collect experimental range errors in open, forested and urban channels at distance ranging from 2 m to 60 m. The range errors are characterized and a model for range errors is proposed. Position errors using the proposed model are compared to the experimental data. Performance analysis regarding accuracy and position update delay is provided.

Keywords: ultra wideband, UWB, positioning systems, experimental analysis.

Reference to this paper should be made as follows: Richardson, P., Xiang, W. and Shan, D. (2010) 'An outdoor UWB tracking system to improve safety of semi-autonomous vehicle operations', *Int. J. Ultra Wideband Communications and Systems*, Vol. 1, No. 3, pp.209-221.

Biographical notes: Paul Richardson is the Program Manager for the Vehicle Institute, the Director of Wireless Communications and Control Laboratory and an Associate Professor in the Department of Electrical and Computer Engineering at the University of Michigan-Dearborn. He is a Senior Member of the IEEE and received his MSc in Computer Engineering, his MSc in Computer and Electrical Engineering and his PhD in Systems Engineering, all from Oakland University, Rochester, MI.

Weidong Xiang received his MSEE and his PhD from Tsinghua University, Beijing, China, in 1996 and 1999, respectively. From 1999 to 2004, he was a Postdoctoral Fellow and then a Research Scientist with the Software Radio Laboratory, Georgia Institute of Technology, Atlanta. In September 2004, he joined the Department of Electrical and Computer Engineering, University of Michigan-Dearborn, as an Assistant Professor. His research interests include vehicular networks, software radio and cognitive radio, ultra wideband and wireless networked control systems.

Dan Shan received his BS and MS in Electrical Engineering from Beijing University of Posts and Telecommunications, Beijing, China, in 2004 and 2007, respectively. Since 2007, he has been a Research Associate with the University of Michigan-Dearborn. In 2008, he was admitted to the university's PhD program for information systems engineering. His research interests include UWB communications, tracking systems and vehicular ad hoc network.

1 Introduction

Semi-autonomous vehicles are emerging in defence, construction and agricultural applications with the aim of improving safety and reducing the amount of required personnel resources. These systems have varying levels of autonomy that range from tele-operated systems that are already fielded to experimental systems with fully autonomous navigation. This type of platform can benefit from a highly accurate positioning system to enhance

navigation, especially in GPS denied environments such as deep canyons or heavily forested terrain. Positioning data can improve safety of operations by providing operators and vehicle control systems with the position of nearby objects. This data can also facilitate certain autonomous applications such as 'leader-follower' wherein one vehicle will automatically follow another vehicle.

An ultra wideband impulse radio (UWB-IR) positioning system integrated into the control system of a

147. Richardson Figures 6 and 7 illustrate each vehicle having 4 UWB

transceivers, with transceivers 1 to 2 and 3 to 4 offset by a distance r_b . EX1008, Figs.

6 and 7. A POSITA would have been motivated to combine Grisham and Richardson

as a POSITA would have understood the benefits of providing an auxiliary

transponder sensor module with an offset to the transponder sensor module,

including better location measurements and improved collision avoidance due to

more precise information relating to length of the vehicle and mounting location of

each sensor.

in the vehicle's location. In my opinion, a POSITA would understand that Richardson's configuration of transponders would be useful to avoid collisions in

front and in the rear and could provide, among other things, calibration information

based on length of the vehicle, and information about trains moving on adjacent

tracks (i.e. on either side of the train).

Petitioners' Expert Explained How Richardson Discloses Calibration Information with Respect to Claim 5 and Claim 18

Int. J. Ultra Wideband Communications and Systems, Vol. 1, No. 3, 2010

209

An outdoor UWB tracking system to improve safety of semi-autonomous vehicle operations

Paul Richardson*, Weidong Xiang and Dan Shan

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Richardson

UWB positioning systems show promise in improving navigational capabilities and operations for semi-autonomous systems that are emerging in applications such as autonomous vehicles. This paper describes an outdoor UWB positioning system that estimates the position of tracks in a semi-autonomous track control. The system improves safety by providing position data to the vehicle control system with accurate position measurements. A measurement campaign was conducted to collect experimental range errors in open, forested and urban channels at distances ranging from 2 m to 60 m. The range errors are characterized and a model for range errors is proposed. Position errors using the proposed model are compared to the experimental data. Performance analysis regarding accuracy and position update delay is provided.

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1 Introduction

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navigation, especially in GPS denied environments such as deep canyons or heavily forested terrain. Positioning data can improve safety of operations by providing operators and vehicle control systems with the position of nearby objects. This data can also facilitate certain autonomous applications such as 'leader-follower' wherein one vehicle will automatically follow another vehicle.

An ultra wideband impulse radio (UWB-IR) positioning system integrated into the control system of a

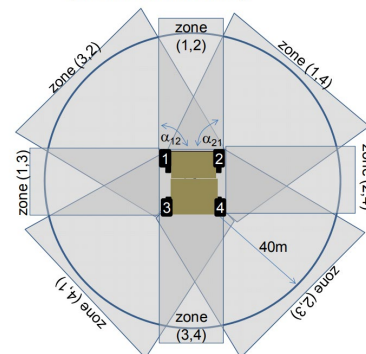
Copyright © 2010 Inderscience Enterprises Ltd.

205. Richardson uses the vehicle length (1 to 3 and 2 to 4) and the mounting

location of the transceivers to define 8 zones to calibrate ranging from vehicle to vehicle. (See, e.g., EX1008, Fig. 6.) While Richardson does not explicitly teach providing this information on a user interface, it would have been obvious to a POSITA to add this information to the user interface of Grisham. Further, it is my opinion that this length information would be necessary in the system described in Richardson because it would facilitate determining the width of all zones other than (1,2) and (3,4). A POSITA would understand that the in order to determine the geography of the other zones would require the length of the vehicle and as such some mechanism of providing that data would be required.

Ex. 1003, ¶1205, cited at Paper 5 at 42-43

Figure 6 Eight zone definitions defined by coordinate radio pairs (see online version for colours)



Notes: Ambiguous positions resulting from bilateration will never be in the same zone.

Ex. 1008, Fig. 6, cited at Paper 5 at 25

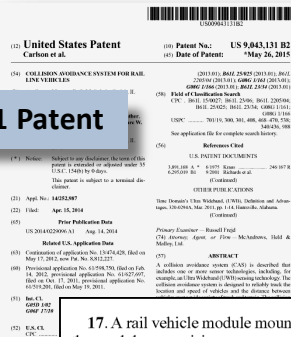
Grounds 3A₁₃₁ and 3A₂₂₇

***'131 Claims 1, 7-8, 11-14 & 17, and '227
Claims 1, 7-8, 11-14, 17-19 & 24-25, Are
Obvious in View of Suzuki, Either Alone or
in Combination with Grisham***

'131 Claim 17: Suzuki discloses antenna that
sends/receives separation distance data over the air

'131 Patent, Claim 17

'131 Patent

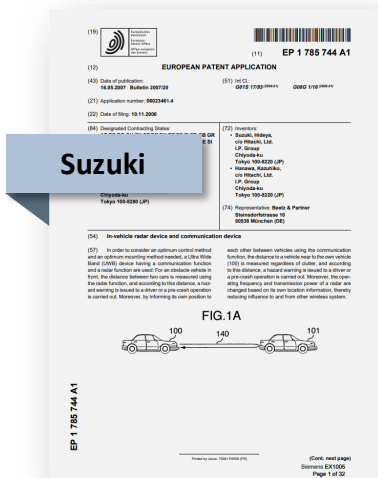


17. A rail vehicle module mountable on a first rail vehicle, the module comprising:
a transponder sensor module comprising:
a radio communication unit operable to employ time of flight techniques to detect a separation distance between the first rail vehicle and a second vehicle;
a first wireless communications antenna operable to send and receive data representing the separation distance over the air;
a global positioning system unit operable to receive information from one or more satellites to determine an absolute position of the first rail vehicle;
a control electronics module comprising a processor in communication with the transponder sensor module; and
a user interface module including a user interface operable to provide rail vehicle information to a vehicle operator and to receive input from the vehicle operator,
wherein the rail vehicle module communicates with a second rail vehicle module mountable on the second vehicle to detect a separation distance between the first rail vehicle and the second vehicle.

a first wireless communications antenna operable to send and receive data representing the separation distance over the air;

468, Ex. 1001, 32:51-53

Suzuki Discloses Sending/Receiving Separation Distance Data



command from the control part 123, and a transmit data including the obtained own location information and the own vehicle ID are prepared, and a radar wave 140 made by adding the transmit data to the pulse of radar wave is transmitted by a transmitter 130 via an antenna 121A.

[0015] A radar wave is received by a radar transceiver 122 via a receiving antenna 121B. As to the mounting position

[0016] Moreover, if it is the received signal of a radar wave transmitted from an in-vehicle radar device mounted in other vehicle, the received signal which has been demodulated in the demodulator 133 is received, and the vehicle ID and the location information of other vehicle are extracted from this received signal and transmitted to the vehicle-to-vehicle distance measurement part 126. The vehicle-to-vehicle distance measurement part 126 calculates the distance B between two cars from the transmitted location information of other vehicle and its own location information obtained from the location information acquisition part 125. In addition, as many distances B between two cars as the number of a plurality of signals received in the receiver 132 of the radar will be obtained because a plurality of other vehicles are assumed to exist around the own vehicle.

[0020] Next, other configuration examples of the in-vehicle radar device are shown in Fig. 2 and Fig. 3. In the in-vehicle radar device of Fig. 2, unlike in Fig. 1B, an example is shown in which an antenna 121C is shared by the transmitter 130 and the receiver 132. Although the antenna 121C is usually connected to the receiver 132 through a selector 136,

Petitioners' Motion to Exclude

Mr. Conti's UWB Opinions Lack Proper Support and Should Be Excluded Under Fed. R. Evid. 602, 702, 703, and 37 C.F.R. § 42.65(a)

- **The Board should exclude Ex. 2012, ¶¶ 41-50, 71-74 (468) and Ex. 2012, ¶¶ 41-50, 69-72 (470)**
 - Mr. Conti's UWB opinions allege the state of railroad collision technology and UWB at the time of the invention, the failure of every other UWB/RADAR communications system to go to market, and interference between UWB and GPS
 - Mr. Conti has no experience with UWB systems
 - Mr. Conti's opinions on UWB at the time of the invention are based on his personal lack of experience
 - Because Mr. Conti did not have personal experience with UWB, he necessarily did not have experience with combining UWB and GPS

Mr. Conti Has No Experience with UWB Systems



Carl Conti

Q. Mr. Conti, do you have any experience in UWB systems?

A. Well, I have experience in rail transit signalling systems, but I've not included UWB in any designs that I've done or considered it.

Q. Have you done any studies about UWB apart from this case?

A. No.

Q. Had you ever worked on any UWB systems in the rail industry or any other industry prior to your work on this case?

A. No.

Ex. 1053, 48:13-24

41. Mr. Andrews uses Grisham alone for his obviousness analysis on these claims, urging that the level of skill in the art fills any gaps in the Grisham reference. I do not agree. The practical reality of the art in 2011-12 was such that it was not at all obvious to implement Metrom's 131 patent invention. I have been asked to opine on the state of railroad collision technology and UWB at the time of the invention. As explained below, there was a long-felt need for a reliable radio based railroad collision avoidance system. There was also a general skepticism and reluctance with using UWB.

Ex. 2012, ¶41

Mr. Conti's Opinions on UWB at the Time of the Invention Are Based Only on His Own Lack of Experience



Carl Conti

42. The railroad industry has long had a need to prevent collisions. For decades, collision prevention has been based on visual rules and block occupancy. These systems use visual signals, track circuits, and in more modern times, narrow band radio to communicate train orders and movement authority. For Maintenance of Way (MOW) equipment specifically, as of 2011 I was not aware of any system for preventing collisions between MOW vehicles other than work rules based on maintaining visual spacing between MOW vehicles and some rudimentary manual radio schemes.

Ex. 2012, ¶42

Q. Are you aware of the use of narrow band radio to communicate train orders and movement authority before 2011?

A. No, not that I'm aware of.

Q. And that's based on your -- your personal awareness? You're not opining, for example, that there was no such use of that technology in the industry?

A. Yeah, that's correct.

Ex. 1053, 114:10-115:5

Q. The next sentence also talks about your awareness of systems -- I'll just paraphrase it here -- related to maintenance of way vehicles.

A. Uh-huh, yes.

Q. Is that sentence also limited to your personal knowledge and you're not opining, for example, that there was no such technology or systems in the industry?

A. That's right, and I believe I did a little bit of research, but did I do exhaustive research to -- to back that sentence? No.

Mr. Conti's Opinions on UWB at the Time of the Invention Are Based Only on His Own Lack of Experience



Carl Conti

50. To summarize these points, by 2012, there had been long felt but unresolved needs in the market relating to improved collision avoidance in the rail industry field generally and for MOW specifically, there had been the failure of every other UWB/RADAR communications system so far to go to market, experts by 2010 had declared UWB dead (Lande, 2022), and the largest practical opportunity to implement a new collision avoidance system in the industry did not use UWB or any other form of terrestrial radio for location/ranging determinations. A POSITA would not have had any motivation to employ UWB technology up to this time, as it had been demonstrated to be not successful and panned by experts.

Ex. 2012, ¶150

Q. Paragraph 50.

A. "There had been the failure of every other UWB/RADAR system --"

Q. That --

A. -- "so far to go to market," yes.

Q. Yes, that sentence.

Can you name any of the UWB radar communication systems to go to market by 2012?

A. I can't name any. I don't know of any.

For radar systems, the increase unlicensed bandwidth provided by UWB regulations solved the fundamental range resolution limitation, but the strict power limitations made radar sensors really challenging to implement. However, NOVELDA started to work out new solutions suited for modern digital technology (CMOS) in joint efforts with Department of Informatics, University of Oslo, Norway. The first reported pulsed UWB radar System-on-Chip (SoC) was successfully created and reported in the MSc-thesis by H. A. Hjortland under supervision of T. S. Lande in 2006. Several new design principles enabled recovery of extremely weak pulses virtually buried in noise. A fully functional, short-range UWB radar system compliant with the "Part 15" power limit was created, so, UWB was not dead after all!

Mr. Conti Did Not Have UWB Experience, so He Could Not Have Experience with UWB in Combination with GPS Either



Carl Conti

71. Since signals from GPS satellites have very low power levels (-130 dBm or -160 dBW) near the surface of the earth, potential interference from UWB to GPS receivers (and corresponding GPS-based systems such as aeronautical safety-critical flight systems) was a serious concern. A POSITA would not be motivated to combine GPS and UWB receivers for a mission-critical task like rail vehicle collision avoidance because of the risk that the UWB signal would interfere with the reception of the GPS signal.

Ex. 2012, ¶171

Q. Did you read Dr. Cooklev's declaration?

A. No.

Q. Do you know the subject matter of Dr. Cooklev's declaration?

A. I do not.

Q. Do you know what opinions Dr. Cooklev provided in this case?

A. No.

Ex. 1053, 189:20-190:3

PO's Motion to Submit Supplemental Information

PO Cannot Satisfy the Supplementation Requirements Because It Has Had Exs. 2032-36 Since 2018



37 C.F.R. § 42.123(b)

“The motion to submit supplemental information must show why the supplemental information reasonably could not have been obtained earlier, and that consideration of the supplemental information would be in the interests-of-justice”

Exhibits 2032-33 are e-mails dated October 12, 2018,

- Exhibit 2034 is a photograph of a speaking panel at the 2018 NextGen Train Control conference, showing David Garcia and PO employee Sara Woitel
- Exhibit 2035 is a photograph of David Garcia speaking at the 2018 NextGen Train Control conference.
- Exhibit 2036 is a certified transcript and still excerpts¹ from a video of David Garcia speaking at the 2018 NextGen Train Control Conference, presenting the

Supplementation of Exs. 2030-31 Would Not Serve the Interests of Justice Because They Are Irrelevant, as the Board Already Found

EX2030-31 “are Piper’s sales collateral.”

Paper 37 at 2

Paper 18

Trials@uspto.gov
571-272-7822

Paper 18
Entered: August 2, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SIEMENS MOBILITY, INC.,
TRANSPORTATION SYSTEMS USA INC.,
ICS CORP., and PIPER NETWORKS, INC.,
Petitioner,

v.

METROM RAIL, LLC,
Patent Owner.

IPR2023-00468 (Patent 9,043,131 B2)
IPR2023-00470 (Patent 8,812,227 B2)¹

Before JAMES P. CALVE, HYUN J. JUNG, and NEIL T. POWELL,
Administrative Patent Judges.

CALVE, *Administrative Patent Judge.*

DECISION
Denying Patent Owner’s Motion for Additional Discovery
37 C.F.R. § 42.51(b)(2)

¹We exercise our discretion to issue one order to be entered in both cases.
The parties are not authorized to use this style heading for subsequent papers
without Board preapproval.

that the Helix comprises more than just vehicle mounted modules and is sold with many components and in many potential configurations.

2–3. This material indicates Helix systems comprise more than the vehicle mounted modules of claim 1. Therefore, any sales data for Helix systems may reflect the commercial success of features other than vehicle mounted modules recited in claim 1 of the ’131 or ’227 patents.

Paper 18 at 7-8

70

PO's Motion to Strike

Consolidated Trial Practice Guide at 73



³ During his deposition, Mr. Andrews suggested use of a “track database.” None of the references suggests using a track database and in my personal experience no such track database existed at the time of the invention.

It should also be noted that knowing the position of at least two points of the train, a more accurate determination of where the train is on the track may be determined by comparison with prestored data bases. This position can be displayed or used with the previously mentioned systems of the prior art.


 US000000782
 (Patent No.) **US 6,480,766 B2**
 (Date of Patent) **Nov. 12, 2002**

(12) **United States Patent**
Hawthorne et al.

Ex. 1060

(73) **INVENTOR**, BY **ROBERTA M. STAN AND**
DAVID M. HAWTHORNE

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(*) **Notes:** Subject to be examined, the subject of this
 U.S. is (US00) 01/010,000 in days.

(21) **App. No.** **09/847,238**
May 3, 2001

(22) **Filed** **May 3, 2001**
Pat. Publication Data

(23) **2000/0000000** in US, 10/01/01

Related U.S. Application Data

(24) **Continuation** of part of application No. 09/454,040, filed on
 Jul. 20, 2000, now the Pat. 6,153,190.

(25) **Int. Cl.** **G01N 33/00** **(2006.11.28)**

(26) **Int. Cl.** **G01N 33/00** **(2006.11.28)**

(27) **Field of search** **2002/01, 123, 145, 156, 170, 203,**
307, 317, 327, 328, 363/000, 370/01, 370/05,
57/06, 57/13

(28) **References Cited**
U.S. PATENT DOCUMENTS

4,638,848 A 1/1987 **Smith et al.** 70/221
 4,627,617 A 1/1988 **Smith et al.** 70/207

4,803,522 A 1/1988 **Bennett et al.** 286/122
 4,759,642 A 1/1988 **Smith et al.** 70/221
 5,159,946 A 1/1994 **Eastwood** 342/014
 5,279,915 A 1/1994 **Smith et al.** 342/013
 5,306,213 A 1/1994 **Smith et al.** 70/227
 5,474,422 A 1/1995 **Bennett** 286/1
 5,579,915 A 1/1995 **Smith et al.** 342/013
 5,706,963 A 1/1998 **Smith et al.** 286/209
 5,795,447 A 1/1998 **Kuhl et al.** 19/275
 5,809,304 A 1/1999 **Kozlov et al.** 3/541
 5,809,448 A 1/1999 **Kozlov et al.** 3/541
 5,810,448 A 1/1999 **Kozlov et al.** 3/541
 5,810,449 A 1/1999 **Kozlov et al.** 3/541
 5,810,450 A 1/1999 **Kozlov et al.** 3/541
 5,810,451 A 1/1999 **Kozlov et al.** 3/541
 5,810,452 A 1/1999 **Kozlov et al.** 3/541
 5,810,453 A 1/1999 **Kozlov et al.** 3/541
 5,810,454 A 1/1999 **Kozlov et al.** 3/541
 5,810,455 A 1/1999 **Kozlov et al.** 3/541
 5,810,456 A 1/1999 **Kozlov et al.** 3/541
 5,810,457 A 1/1999 **Kozlov et al.** 3/541
 5,810,458 A 1/1999 **Kozlov et al.** 3/541
 5,810,459 A 1/1999 **Kozlov et al.** 3/541
 5,810,460 A 1/1999 **Kozlov et al.** 3/541
 5,810,461 A 1/1999 **Kozlov et al.** 3/541
 5,810,462 A 1/1999 **Kozlov et al.** 3/541
 5,810,463 A 1/1999 **Kozlov et al.** 3/541
 5,810,464 A 1/1999 **Kozlov et al.** 3/541
 5,810,465 A 1/1999 **Kozlov et al.** 3/541
 5,810,466 A 1/1999 **Kozlov et al.** 3/541
 5,810,467 A 1/1999 **Kozlov et al.** 3/541
 5,810,468 A 1/1999 **Kozlov et al.** 3/541
 5,810,469 A 1/1999 **Kozlov et al.** 3/541
 5,810,470 A 1/1999 **Kozlov et al.** 3/541
 5,810,471 A 1/1999 **Kozlov et al.** 3/541
 5,810,472 A 1/1999 **Kozlov et al.** 3/541
 5,810,473 A 1/1999 **Kozlov et al.** 3/541
 5,810,474 A 1/1999 **Kozlov et al.** 3/541
 5,810,475 A 1/1999 **Kozlov et al.** 3/541
 5,810,476 A 1/1999 **Kozlov et al.** 3/541
 5,810,477 A 1/1999 **Kozlov et al.** 3/541
 5,810,478 A 1/1999 **Kozlov et al.** 3/541
 5,810,479 A 1/1999 **Kozlov et al.** 3/541
 5,810,480 A 1/1999 **Kozlov et al.** 3/541
 5,810,481 A 1/1999 **Kozlov et al.** 3/541
 5,810,482 A 1/1999 **Kozlov et al.** 3/541
 5,810,483 A 1/1999 **Kozlov et al.** 3/541
 5,810,484 A 1/1999 **Kozlov et al.** 3/541
 5,810,485 A 1/1999 **Kozlov et al.** 3/541
 5,810,486 A 1/1999 **Kozlov et al.** 3/541
 5,810,487 A 1/1999 **Kozlov et al.** 3/541
 5,810,488 A 1/1999 **Kozlov et al.** 3/541
 5,810,489 A 1/1999 **Kozlov et al.** 3/541
 5,810,490 A 1/1999 **Kozlov et al.** 3/541
 5,810,491 A 1/1999 **Kozlov et al.** 3/541
 5,810,492 A 1/1999 **Kozlov et al.** 3/541
 5,810,493 A 1/1999 **Kozlov et al.** 3/541
 5,810,494 A 1/1999 **Kozlov et al.** 3/541
 5,810,495 A 1/1999 **Kozlov et al.** 3/541
 5,810,496 A 1/1999 **Kozlov et al.** 3/541
 5,810,497 A 1/1999 **Kozlov et al.** 3/541
 5,810,498 A 1/1999 **Kozlov et al.** 3/541
 5,810,499 A 1/1999 **Kozlov et al.** 3/541
 5,810,500 A 1/1999 **Kozlov et al.** 3/541
 5,810,501 A 1/1999 **Kozlov et al.** 3/541
 5,810,502 A 1/1999 **Kozlov et al.** 3/541
 5,810,503 A 1/1999 **Kozlov et al.** 3/541
 5,810,504 A 1/1999 **Kozlov et al.** 3/541
 5,810,505 A 1/1999 **Kozlov et al.** 3/541
 5,810,506 A 1/1999 **Kozlov et al.** 3/541
 5,81