



Pressure to Succeed

Truck System Technologies' tire pressure monitoring system was once limited to the RV aftermarket. Its technology was re-engineered in 2017 and has since received approval for OE use on all Forest River and Thor Industries RV brands.

By Matt Masich

Photos by Jeffrey Truitt Photography

Low pressure works great for sales tactics, but in every other aspect of Thomas “Bear” Musgrave’s job low pressure is the ultimate sin.

Musgrave devotes his professional life to ensuring tires are inflated and operating at the correct pressure and temperature. He is the business unit director for Truck System Technologies (TST), a division of Pressure Systems International (PSI).

PSI manufactures automatic tire-inflation systems for the commercial trucking industry. The company supplies major trucking fleets in 46 countries across the globe. In addition to leading TST, Bear Musgrave also serves as a vice president at PSI, under his father, Tim Musgrave, who is president and CEO.

While Bear Musgrave is a longtime expert in tire pressure, he gained his RV industry expertise during the past three years while working with RV OEMs.

Musgrave is a quick study. In March 2019, a little less than two years after taking the helm at TST, the company landed a deal with Forest River’s Palomino Columbus line—making

its tire pressure monitoring system (TPMS) perhaps the first to be installed as standard equipment on a major manufacturer’s towable units. Forest River’s Rockwood and Flagstaff brands soon followed.

TST has now added several other Forest River brands and attracted interest from Thor Industries which is also exploring the benefits of TST’s safety products.

Musgrave said the list of OEMs adopting TPMS as mandatory standard equipment is almost certain to grow because many in the industry expect the feature to become mandatory for RVs before the decade is over.

Potent Potential

Federal law mandated TPMS as a safety measure on automobiles in 2007. TST was founded the same year in Cumming, Georgia. Though the federal TPMS requirement did not apply to most motorized RVs, aftermarket consumer demand has existed since early on and has grown among motorhome owners.

The first tire monitoring system TST developed used sensors that screwed onto tire valves. The sensors used radio

(L to R) PSI Vice President of Business Development Jonathan Gravel; Vice President of Manufacturing Michael McIver, PSI Sales Representative Jim Herzog; Sales Administrator Michelle Edwards; TST National Sales Manager Mike Benson; Vice President of Engineering Steve Miller; Operations Manager Brenna Murphy; Director of Marketing Craig Smith; Vice President of Sales and Marketing Jim Sharkey; and TST Tire Pressure Monitor Unit Director and PSI Vice President Bear Musgrave.

frequency to transmit data to a dash-mounted display in the motorized unit's cab or, when added to a trailer, inside the tow vehicle. The company's present lineup expanded to include internal wheel sensors monitoring both pressure and temperature on up to 115 tires on up to five vehicle/trailer assets. These can include tow vehicles, all types of trailers, towed automobiles and even the toys inside a toy hauler.

Because underinflated tires are the leading cause of blowouts, detecting changes in pressure is crucial to avoiding catastrophic tire failure. The TST monitoring system includes audible and visible alarms incorporated into the dashboard monitor. If tire pressure drops below a safe threshold, or if a tire has a fast leak losing 2 psi or more per minute, an alarm is triggered.

The TST system also monitors tire temperature, which often rises when a problem unrelated to pressure occurs to a tire.

San Antonio, Texas-based PSI began using TST's product to test its automatic tire-inflation systems used on commercial fleets and compare its performance against competing tire-inflation systems. After five years as a TST customer, PSI purchased TST and brought Musgrave on board to lead the new division.

Musgrave said PSI initially planned to use the newly acquired subsidiary's TPMS strictly as an add-on to its semi-trailer tire-inflation product.

"We were going to use the technology to have live, real-time data of vehicles using our inflator systems around the world," he said. "The RV industry was not on our radar."

Mike Benson, who stayed on as TST's national sales manager following the acquisition, alerted Musgrave to the company's strong RV aftermarket



Quality Control Inspector Laura Rodriguez inspects incoming electrical components. The QC team analyzes data to determine battery strength.



Hose cell operator Victoria Ugalde completes a valve core assembly. Ugalde is one of numerous employees participating in the company's education reimbursement program.



TST TPMS: By the numbers

- **115** tire positions can be monitored.
- **4** sensor types: internal; screw-on cap; screw-on flow-through; screw-on sealed for saltwater immersion. Sensor types can be mixed/matched and used together.
- **1 to 218** psi pressure can be monitored.
- **5** assets can be monitored: tow vehicle plus 4 trailers, ATVs, etc.
- **105**-foot signal lock.
- **3**-year warranty, lifetime customer support.



Maintenance Technician John Torres verifies testing criteria of the PSI manifold. Testing is a crucial step in production as all PSI and TST products are safety related.

presence. The TST system sold well at consumer shows and rallies. Benson said he felt an even bigger business opportunity existed in OEM sales.

“You instantly recognize certain people for their skill and acumen,” Musgrave said. “We believe in Mike. His recommendation was enough for us to say, ‘OK, we’ll go down this road.’”

Before TST began pitching its product to RV manufacturers, PSI re-engineered it to further enhance reliability. PSI’s high standards and safety consciousness stem from its experience serving the trucking industry. In commercial trucking, Musgrave said, lives and livelihoods depend on trucks and trailers working perfectly.

“If our product breaks, people could die,” he said. “PSI has a 0.05 percent warranty rate on its products. If we’re going to put our name on it, we’re going to engineer it to our specifications.”

Among the TST upgrades Musgrave outlined, PSI engineers swapped out O-rings for gaskets made from a custom proprietary rubber compound. The

gaskets were less prone to deteriorating in harsh highway conditions. Using proprietary plastics formulas and custom metallurgy to make corrosion-resistant metal parts, engineers also created purpose-built components to replace each off-the-shelf part in the TPMS.

As hard as TST worked to make its product ready for prime time, much more was needed before manufacturers would approve it for RV original equipment use.

Industry First

Benson reached out to his RV industry contacts, including Leo Akins, Forest River’s general manager of corporate PDI, codes and standards, and quality assurance. Akins’ approval is required before a product is approved for incorporation as original equipment on Forest River units.

“What I’m looking for in a system,” Akins said, “is that it’s got to be the best there is. TST is owned by Pressure Systems International. They are the best at what they do. TST was already really good. It wasn’t quite ready for the OEM level, but they worked diligently to get it there.”



Benson (standing) and Bear Musgrave review current sales data and discuss sales projections. Sales of TST's Tire Monitoring System have grown steadily since the company was acquired by PSI in 2016.



Israel Perez performs a 16-point qualification of control boxes following a final test. All assembled products are tested under the control of a team cell leader before they are forwarded to quality control for inspection.

The biggest question facing TST was where to place the sensors on the wheel of the OE version.

Forest River ruled out aftermarket screw-on sensors. The manufacturer did not want to introduce a possible leak point. According to Akins, screw-on sensors presented too many opportunities to be dislodged or otherwise compromised.

TST soon settled on an internal sensor mounted on a stainless-steel band wrapped around the wheel rim. Though installing a sensor in that manner would be prohibitive in the aftermarket, it was simple to install as an OE component before the tire goes on the rim during production. TST began extensive testing, with Forest River providing feedback.

In February 2018, while Forest River's testing was ongoing, Musgrave met with Akins at the National Association of Trailer Manufacturers Expo in Fort Worth, Texas. There, Akins introduced him to David Mihalick, Thor Industries' senior director of vehicle safety and regulatory compliance.

"These are the guys I told you about," Musgrave recalls Akins telling his Thor Industries counterpart. "I've seen all their data. They've provided us with ISO 9001-level testing. We've finally found our air-pressure experts."

If TST's product had been something like a new window shade type, Forest River would have kept the new product's existence confidential and not shared it with competitors. However, Akins said, the opposite is true when safety is involved. The people who oversee safety for major OEMs make a point to share information that may improve safety because it benefits the industry.



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A year after TST first contacted Forest River, Akins approved its Tire Monitoring System product for OE use on any unit from Forest River. Akins said the product is the only TPMS to earn such status. Neither he nor Musgrave are aware of any towable product from a major manufacturer with a TPMS as standard equipment.

In March 2019, Forest River's Palomino Columbus line began including TST's system as standard equipment on fifth wheels. When Musgrave asked Group General Manager Don Gunden and Columbus General Manager Colin Dechant if they wanted a contractual exclusive on the TST product, both Gunden and Dechant declined. They wanted his product for their units but felt it would be wrong to hoard technology tied to safety.

"They could have asked for exclusivity," Musgrave said, "and we would have given it to them."

Since then, Forest River's Rockwood and Flagstaff brands have also adopted the Tire Monitoring System as OE for most fifth wheels and travel trailers. Dynamax RV introduced the TPMS as an option for its motorized

units. Thor Industries also approved TST's system for its companies, with Airstream making it standard on its 2020 Classic model.

Musgrave now splits his time between PSI's San Antonio headquarters, TST's Georgia office and Elkhart, Indiana. He is currently in discussions with other RV manufacturers about installing the Tire Monitoring System on their units, too.

Saving Lives

Musgrave said he anticipates many more manufacturers adopting TPMS in the next few years. TST is not the only TPMS supplier, but Musgrave cites TST's use of radio frequency rather than bluetooth, color display, high number of monitorable assets and tires, and its ability to use a combination of OE and aftermarket screw-on sensors as competitive advantages over other options.

TPMS demand is likely to increase among OEMs, Musgrave said. The biggest reason is a likelihood it will soon become mandatory for all RVs.

He said the requirement could come through an act of Congress or changes to National Highway Traffic Safety Administration (NHTSA) regulations. Another regulatory avenue could be



Work the Line

Truck System Technologies (TST) was founded in 2007 in Cumming, Georgia. In 2017, the tire-pressure monitoring system (TPMS) supplier was purchased by San Antonio, Texas-based Pressure Systems International (PSI).

For more than 25 years, PSI has manufactured automatic tire-inflation systems for the commercial trucking industry. While components come from various sources, all inflation system assembly and testing happens at its headquarters in San Antonio.

PSI has approximately 120 full-time employees, including nine in its TST subsidiary. During the onboarding process, each and every PSI employee spends a day working on the production line.

"No matter whether they are in sales, accounting, HR or shipping and receiving, it's important to us that everybody understands how our products are built so they can be an ambassador for the company," PSI Vice President and TST Business Unit Director Bear Musgrave said. "Our people are able to do that because they have actually made the products with their own hands. It lets everyone know what goes into our systems and how we keep our warranty levels at next to none."

When assembling components, new employees stop at each product line "cell" or workstation. At one cell, they may assemble hoses. At another workstation they might work on the control box or set regulators.

"Every bit of our system," Musgrave said, "is touched during the assembly process in San Antonio."

The production line veterans enjoy teaching novices how to do the work. The process slows down the regular production staff's work, he said, but it provides benefit to them as well.

"The best way to learn something," Musgrave said, "is to teach somebody else how to do it."

changes to the National Fire Protection Association (NFPA) 1192 Standard on Recreational Vehicles, which RVIA OEM members must follow.

As Musgrave said, even if manufacturers are not required to put TPMS on all units, doing so still makes good business sense.

"The median age of RV buyers is getting lower," he said. "A lot of those buyers may not have learned how to check tire pressure. Something as simple as a blowout could do damage that costs as much as \$5,000 and may take seven or eight weeks to get fixed. If a person has that experience right out of the box, do you think they're going to want to buy another RV?"

TPMS is one possible way to address consumer criticism of RV quality, Forest River's Akins said.

"Trailer tires sometimes get a bad rap for not being the quality they should be," Akins said. "We install very high-quality tires on our trailers. When tires fail, oftentimes it's because trailers are overloaded or not loaded properly. If a customer receives a temperature- or air-pressure alert, it's a perfect opportunity for them to prevent an accident."

TPMS' ability to prevent accidents is not merely theoretical. At a recent RV rally, Forest River brought together TST and Lionshead Tire and Wheel to outfit one of its customer's tow vehicle and trailer with new wheels, tires and TPMS. The consumer already had a factory TPMS on his pickup truck, Akins said, but he added TST's aftermarket sensors because the pre-existing system did not also monitor temperature. It proved to be a wise move.

The consumer wrote Akins a note approximately a week later, he said.

"He was 100 miles from the rally on his way home when an alarm went off for his right front wheel," Akins said. "It was the temperature."

The consumer immediately pulled off the highway and called for roadside service. The problem turned out to be a faulty wheel bearing.

"The mechanic said if he hadn't pulled off the road, he could have lost his wheel," Akins said. "TPMS really can save a life."

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