



TIRE PRESSURE SYSTEMS

This report is an update of a previously published report on tire pressure systems in order to examine new technology that has emerged in the meantime. [See NACFE's reports here.](#)

The COVID-19 pandemic has illustrated the important role the trucking industry plays in bringing us critical goods. And although fuel costs have dropped due to the virus, they are still a significant part of the expense to operate a tractor-trailer in North America. Fuel costs are now approximately \$0.43 per mile, accounting for 24% of a fleet's total operating costs—the second largest expense for fleets behind only driver wages. The price per gallon for diesel as of April 2020 is around \$2.48 and all indications are that fuel prices will continue to be volatile. Therefore, the industry is in need of solutions that reduce its fuel dependency if it is to stay profitable.

In addition, the United States Environmental Protection Agency (US EPA) and the National Highway Traffic Safety Administration (NHTSA) have enacted greenhouse gas emissions regulations on commercial vehicles extended to 2030 that require manufacturers to develop and sell technologies to improve efficiency. These factors have driven fleets, manufacturers, and others to improve the efficiency of over-the-road tractor-trailers.

Fortunately, myriad technologies that can cost-effectively improve the fuel efficiency of Class 8 trucks are readily available on the market today. Unfortunately, multiple

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barriers have stymied industry adoption of such technologies, including a lack of data about the true performance gains these technologies offer, and a lack of confidence in the payback for investment into these technologies. To overcome those barriers and facilitate the industry's trust in and adoption of the most promising cleaner operating technologies, the North American Council for Freight Efficiency (NACFE) produces a series of Confidence Reports, of which this report on tire pressure systems is the latest. It is an update to the original *Tire Pressure Systems* Confidence Report published in 2013.

Correct tire inflation, within the design limits of load and speed, reduces the risk of unexpected vehicle breakdown and damage, and promotes on-time freight delivery. Maintaining proper tire inflation levels contributes to improved fuel efficiency, reduced tire wear, and longer casing life. On the other hand, tire underinflation causes degradation in tire wear and increased fuel consumption (degradation in fuel economy). Greater fleet productivity and protection of fleet assets can be obtained through effective tire inflation pressure management. The goals of this Confidence Report are to: (a) describe currently available tire pressure systems; (b) communicate ways to ensure successful deployment of the systems on a fleet; and (c) help fleets choose the correct tire pressure systems for their needs.

THE IMPORTANCE OF TIRE PRESSURE SYSTEMS

Maintaining proper tire inflation level reduces the risk of unexpected vehicle breakdown and damage and contributes to improved fuel efficiency, reduced tire wear, and longer casing life. On the other hand, tire underinflation leads to approximately 5%–12% degradation in tire wear for an individual tire which is 10 psi underinflated, and 0.5%–1.0% increase in fuel consumption (degradation in fuel economy) for a vehicle running with all tires underinflated by 10 psi. Greater productivity and protection of assets can be obtained through effective tire inflation pressure management. Historical payback estimates for the implementation of tire pressure systems have ranged from less than one year up to approximately three years, with annual savings projected at \$750 to more than \$1,000 per vehicle per year.

However, studies have shown that:

- About one out of five tractors/trucks is operating with one or more tires underinflated by at least 20 psi.
- About one in five trailers is operating with one or more tires underinflated by at least 20 psi.
- Nearly 3.5% of all tractors/trucks operate with four or more tires underinflated by at least 20 psi.
- 3% of all trailers operate with four or more tires underinflated by at least 20 psi.
- Approximately 3% of all trailers, and more than 3% of all tractors/trucks, are operating with at least one tire underinflated by 50 psi or more.
- Only 46% of all tractor tires and 38% of all trailer tires inspected were within +/- 5 psi of the target pressure.



METHODOLOGIES

NACFE's research for this report included a review of online information sources including industry standards and recommended practices as well as interviewing key people with first-hand knowledge of tire pressure systems at fleets and manufacturers. The full report includes a list of references to assist readers interested in pursuing more detail. These references were researched with the same diligence and thoughtful processes NACFE uses with its other technology Confidence Reports and Guidance Reports.

AVAILABLE TIRE PRESSURE SYSTEMS

The team organized tire pressure system technologies into five categories:

1. Tire Pressure Monitoring Systems (TPMS)—

These systems monitor pressure and, in some cases, temperature, for each individual tire. In most cases the system will transmit the data and display it to the operator and/or the fleet. The TPMS monitors each tire based on a pre-set target pressure, and issues alerts based on the difference between the target pressure and the actual measured pressure in the tire.

2. Dual Tire Pressure Equalizers—In these systems, a single sensor unit is mounted to the vehicle wheel end, monitoring the pressure in both tires of a dual-tire assembly, with a hose connection to each tire valve stem. If pressure levels between the tires do not match, either due to temperature warming of one tire position versus the other, unequal loading, or slow air seepage, the system will attempt to bring the inflation pressure of the two tires to the same level.

3. Automatic Tire Inflation Systems (ATIS)—These systems monitor tire inflation pressure relative to a pre-set target and reinflate tires whenever the detected pressure is below the target level. Two forms exist: one using the compressed air system on the truck and the other pulling in atmospheric air. In general, these systems will alert the driver that reinflation is taking place, but they do not report on the actual pressure in the tire.



“With approximately 70% of new trailers being equipped with Automatic Tire Inflation Systems (ATIS), it is likely the

most specified option on trailers today because of the validated ROI. This is due in no small part to the work that NACFE has done in evaluating the technology and providing an independent resource for fleets considering the investment.”

—Jim Sharkey, vice president of global sales and marketing, Pressure Systems International

4. Central Tire Inflation Systems (CTIS)—The operation of this type of system is similar to ATIS, with the difference that the driver can select the target pressure from an in-cab display, in order to raise or lower the tire inflation level depending on the operating conditions of the vehicle. Most systems of this type are intended for off-road or military truck applications.

5. Passive Pressure Containment Approaches—

Additional methods attempt to retain air in the tire once it has been inflated. These most commonly function by reducing natural air loss through the tire casing, use of tire sealants, or the use an inflation medium such as nitrogen that has a lower permeation rate than oxygen.

Tire pressure monitoring systems and automatic tire inflation systems are recognized efficiency options in the Greenhouse Gas Emissions Model (GEM) of the GHG Phase 2 regulations.

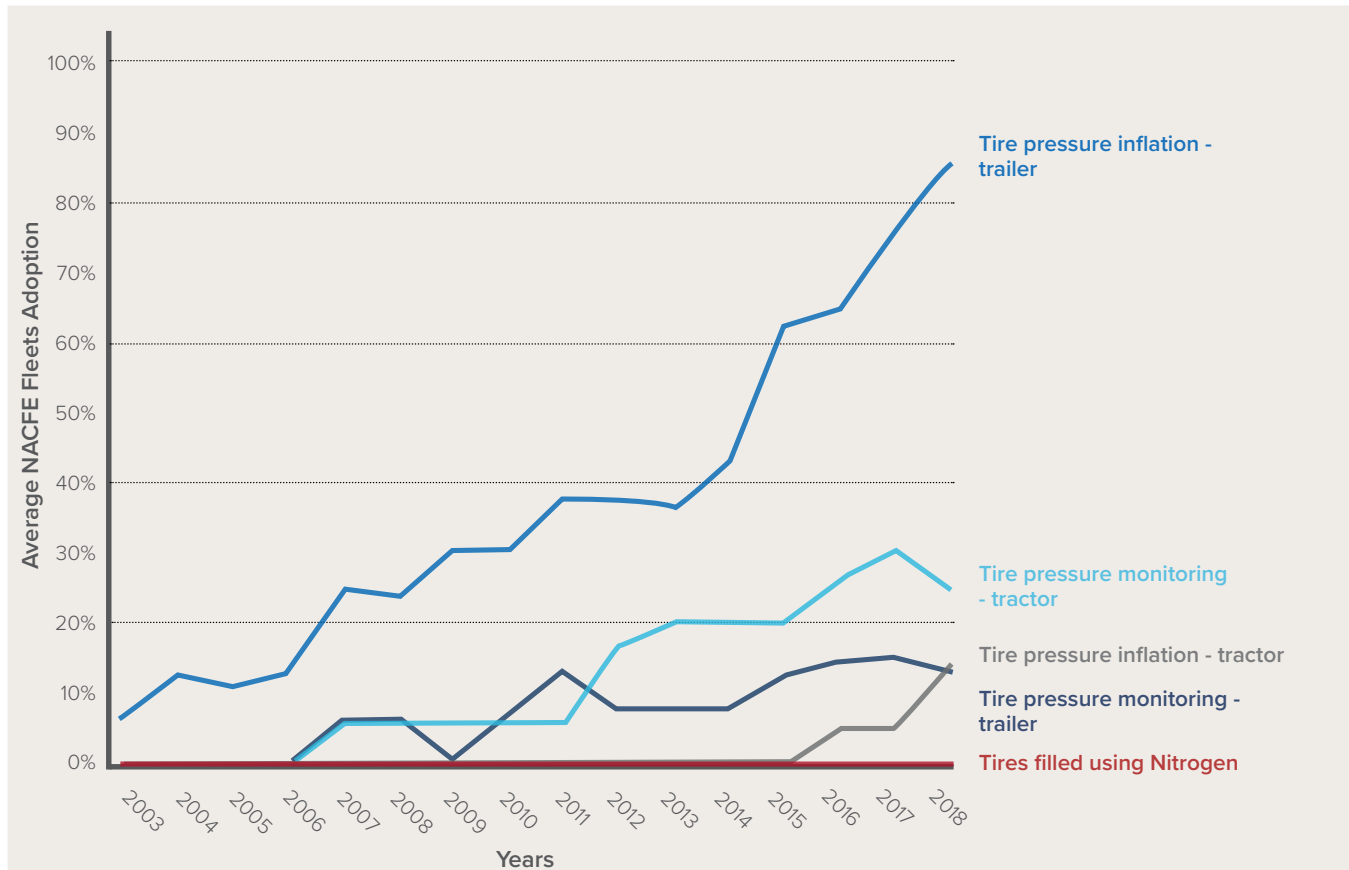
FLEET PERSPECTIVES

The value of appropriate tire pressure is significant and becomes increasingly so with higher fuel and tire prices. As fleets are actively pursuing efforts to lower their operating costs, manufacturers are responding with technologies that ensure good pressure levels in the tires of Class 8 trucks. Fleets are also realizing that their tire pressure maintenance practices, which at present primarily consist of having drivers manually check tire pressure at all wheel ends, are not sufficient to keep the tires at the appropriate pressure.

Most fleets interviewed recognize the benefits of proper tire pressure—improved safety and fewer roadside breakdowns, increased tire life, and higher fuel economy—and are considering the adoption of technologies that can better ensure it. Fleets also shared that tire pressure systems can offer enough value to consider retrofitting them on tractors and/or trailers, where there is enough life left on the equipment to justify doing so. Private fleets generally keep their equipment much longer than their for-hire counterparts, which generally sell equipment after four to six years of long-haul use. Also, trailers are much more often candidates for retrofitting, as all fleets tend to keep trailers for most, if not all of their useful life. Retrofitting also has the cost of taking the equipment out of service in order to add the aftermarket components, requiring a longer and costlier labor process—about twice as much cost as if the device was procured on the original equipment.

FIGURE ES1

SUMMARY OF TIRE PRESSURE SYSTEM ADOPTION RATES FROM NACFE 2019 BENCHMARK STUDY



The team concluded that there are some early adopters of tire pressure systems. They include, but are not limited to:

- Tankers, and in particular, those hauling hazardous materials where the outcome of a vehicle accident can be severe.
- Vehicles with high trailer miles and/or low trailer-to-tractor ratios; for instance, refrigerated units, where the benefits of proper tire inflation are further amplified with the higher miles.
- Duty cycles with diminishing loads, where the diversity of fully loaded and empty trailers where consistent, sufficient tire pressure can help avoid tire wear problems.



“The future of commercial fleet tire management is a comprehensive platform. Tractor ATIS allows fleets to standardize tire inflation pressure across all tire

assets—unlocking the cost savings well-known to trailer ATIS adopters. When coupled with predictive tire analytics it allows fleets to standardize a wholly new tire management operating model that’s predictive, proactive, proportionate, portfolio-wide, and low-overhead. The benefits will be significant—realized as better decisions, time savings, and unlocked capacity from vehicles reallocated to revenue miles and manager time redirected toward higher-value work.”

Judith Monte, vice president of marketing and customer service, Aperia Technologies

CONFIDENCE RATING

The technologies covered in each of NACFE’s Confidence Reports are plotted on a matrix in terms of the expected payback in years compared to the confidence that the study team has in the available data on the technology—that is, not only how quickly fleets can expect payback on their investment but also how certain NACFE is in the assessment of that payback time.

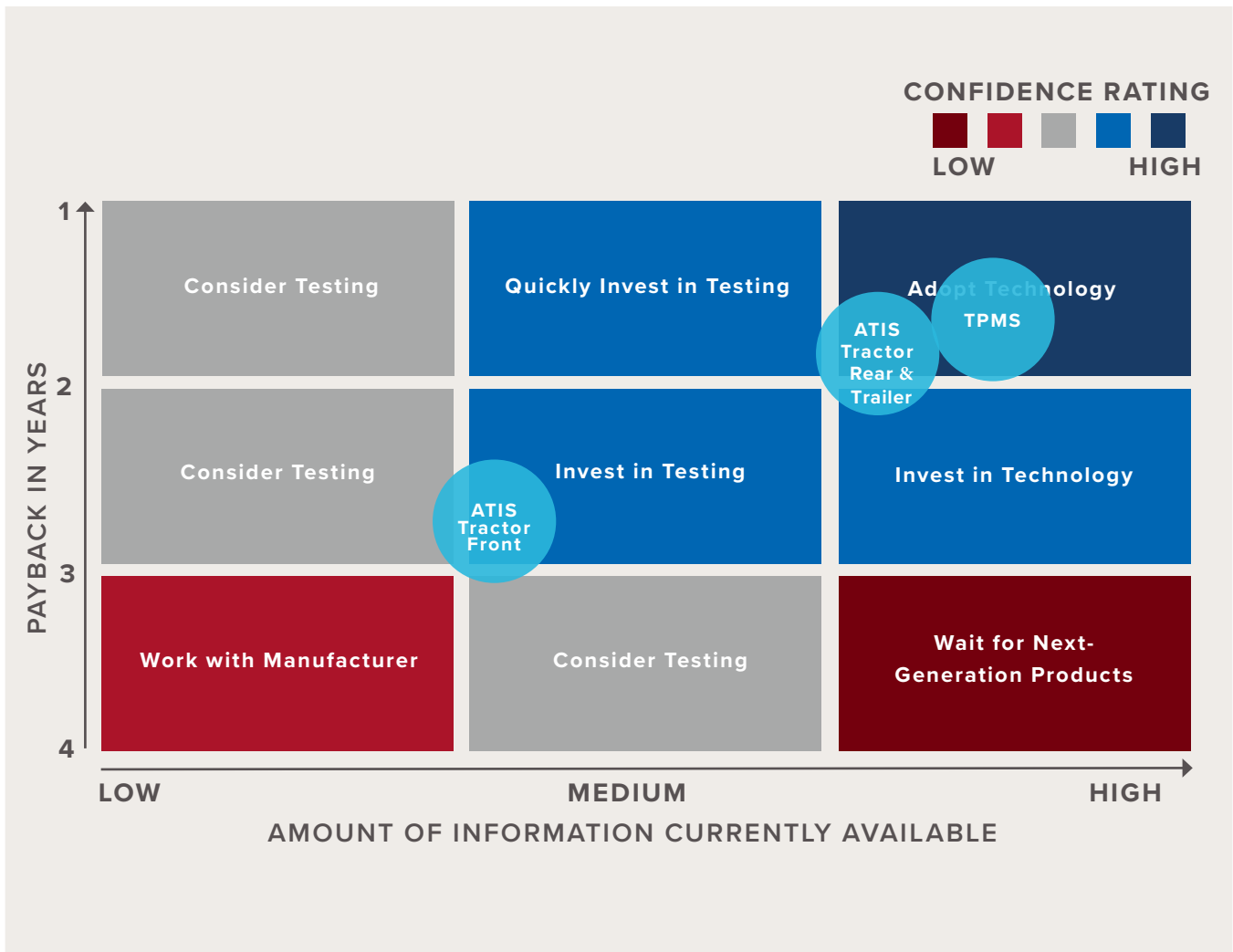
The matrix below indicates how confident the NACFE study team believes trucking fleets should be in the investment case for tire pressure systems. Given these conclusions, NACFE believes that fleets should seriously consider investing in tire pressure systems following the best practices described in this Confidence Report.

CONCLUSIONS AND RECOMMENDATIONS

The currently available commercial vehicle tire pressure systems are reliable and durable. There are strong options for various truck duty cycles and fleet business models, and creative solutions continue to be developed for improved performance, better reliability, and lower overall costs. As the systems become more available from the tractor and trailer manufacturers, the quality of the installation increases and costs decrease. This all leads to increased adoption of these solutions.

The team concludes that the confidence in adopting tire pressure systems should be high given a thorough understanding of each fleet’s needs and investigation and

FIGURE ES2
CONFIDENCE MATRIX



testing of systems to meet those needs. When these steps are completed, a fleet should be confident in selecting the best system for their specific needs.

Factors contributing to satisfactory operation of tire pressure systems include:

- The precondition for fleets to match their needs with the specific capabilities of the various tire pressure systems when making purchasing decisions.
- The importance of user readiness, in terms of personnel training and preparation of internal operating procedures around new tire pressure systems, to ensure successful deployment in the fleet.
- The need for the functionality of tire pressure systems (alerts, warnings, data reporting) to integrate relatively seamlessly into normal, day-to-day fleet operations without requiring significant system oversight or maintenance by the fleet.

The full report contains tools and information to help support the development of a good decision-making process for the purchase of various tire pressure technologies, including a table of potential operational risks associated with the products, a tire pressure technology decision matrix, a payback calculator, case studies, and a product summary table.

As adoption of tire pressure technologies expands in the industry, it is expected that creative solutions will continue to be developed with improved performance, even better reliability, greater functionality, overall lower cost, and probably greater standardization, and will help foster improvements in the efficiency and reliability of North American commercial freight transport.



NACFE

The North American Council for Freight Efficiency (NACFE) is a nonprofit organization dedicated to doubling the freight efficiency of North American goods movement. NACFE operates as a nonprofit in order to provide an independent, unbiased research organization for the transformation of the transportation industry. Data is critical and NACFE is proving to help the industry with real-world information that fleets can use to take action. In 2014, NACFE collaborated with Carbon War Room, founded by Sir Richard Branson and now a part of Rocky Mountain Institute, to deliver tools and reports to improve trucking efficiency. These reports include a series of Confidence Reports that detail the solutions that exist, highlight the benefits and consequences of each, and deliver decision-making tools for fleets, manufacturers, and others. As of May 2020, NACFE and RMI have completed 18 such reports covering nearly all the 85 technologies available.

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Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. RMI has offices in Basalt and Boulder, Colorado; New York City; the San Francisco Bay Area; Washington, D.C.; and Beijing.

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GET INVOLVED

NACFE provides an exciting opportunity for fleets, manufacturers, and other trucking industry stakeholders.

Learn more at: www.nacfe.org

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