New Technologies & Tools …

A Powerful Effect on Fleet Maintenance

Today (and more so tomorrow) truck maintenance technicians and line management, supported by their employers, are turning to new tools and technologies to meet the challenges presented by modern engines, new power sources and a variety of truck safety and data communication options offered by OEMs and Accessory Manufacturers. The purpose is to be able to respond quickly to in-route issues and to reap rewards and the dividends through predictive maintenance resulting in less vehicle downtime and customer cost associated with that, improved safety and the eventual lowering of operating costs. While in this transformation period, commercial truck owners and operators are also dealing with substantial increases in costs for new equipment and OEMs are actually learning more "on-the-go" from their sensory systems.

Some background … equipment such as Class 8 trucks being produced today are preloaded with a valuable list of electronics and wireless communication capabilities which can be expanded over time. The three digital technologies behind these innovations are vehicle connectivity, artificial intelligence and autonomous operating systems. Experts say these systems will become more powerful and will have the capability to automatically relay data to any designated party at any time. Furthermore, the various systems will become integrated to support safety systems and enhance power-train performance.

Therefore, this growth in the complexity of modern trucks is driving changes at maintenance shops operated by Transervice and for its workers who have to navigate this increasingly digital world. Our maintenance Technicians are becoming more like Diagnosticians. Vehicle electronics are the source of information that allow for real-time access to operating conditions and fault data that can result in swift actionable repair solutions; so for now and well into the next 5-10+ years maintenance shops will continuously evolve with change. In addition, with Transervice each shop is responsible for maintenance and services of different types of vehicle equipment, with different operating parameters and with a different customer … tractors, box trucks, trailers, MHE

and refrigeration or a mix of types all of which adds to shop complexity.

What we have summarized here is Transervice's approach to the new technology by addressing the **10 major challenges associated with this digital transformation.**

1. **Training**

    a. **Technician Training:** Continuous due to advanced remote or onboard information and diagnostic tools as well as software/tools requirements for the shop to utilize. Transervice provides comprehensive online as well as "hands-on" training.

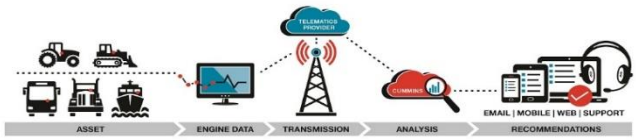
    b. Technician Supervisor Training: Transervice partners with OEM's and Component suppliers along with industry education courses such as the Technology & Maintenance Council (TMC) for input of dedicated end-users thought the US. As this training is on-going, Transervice has a corporate trainer to organize both instructor hands-on level training and on-line training.

2. **Impact on Driver Safety:** When spec'ing equipment close attention is required to understand the new technology that is standard on the equipment that is to be ordered (varies by OEM) and to the additional new technology being added. When the purchase order has been issued, that is the time to start planning who & how the new technology will be introduced to the end users. In addition to critical OEM operating performance sensors, there are several systems offered that focus on-road safety such as collision mitigation, lane departure, predictive cruise control and a number of technologies to influence driver behavior.

3. **Establishing Service Intervals:** The goal in the future of predictive analytics is all about systems that will report back to predetermined shops and supervisors with a timeline for a probable failure. Commercial trucks are becoming increasingly more real time and use based which will have an impact on service intervals; thus, there will be more variability to consider that will result in customized scheduling. This is due to the variances in vehicle specifications, i.e., power trains and fleet operating parameters such as annual mileage, urban or linehaul or combination of the two. This means that, in addition to the current benefit of the prevention of breakdowns, as more

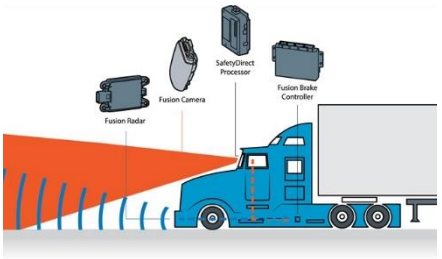
data is captured, Transervice will assign components to its respective service intervals (miles, days, hours) within the regularly scheduled minimum service intervals.

4. **Effect of Remote Diagnostics:** Certain systems now have the ability to alert in advance heading off a potential problem or breakdown. This capability to reduce down-time and towing expense is being further enhanced creating a new category of real-time data management based upon predictive feedback. To deal with this Companies will need to build solutions to accept and manage this data proactively as Transervice has done.



5. **How Key OEM Components Are Affected:** Power trains – engines, transmissions, brakes are designed to perform differently, i.e., safer, due to OEM electronic components. For example, automatically applying brakes at certain wheel positions to prevent rollovers and having the ability to receive input from the collision mitigation system enables faster reaction.

6. **Newest On-board Monitoring Sensors:** Sensors that are being deployed now in new equipment will address current Phase 2 GHG requirements as it relates to after treatment, combustion optimization and waste heat recovery. Overall, there are multiple suppliers that are investing heavily in additional sensing technology including payload based power management, brakes, engine temperature sensing, solar charging and telematics to name a few. Behind all of this is the longer term OEM objective to eventually offer semi-autonomous or possibly fully autonomous trucks.



7. **Equipment Weight – New Components:** Payloads could be potentially effected due to componentry weight, however, battery powered trucks may be a different story so this would be dependent on the weight of the new power batteries versus current weight. However, the greater the weight on the tires the life of the tires could be reduced but tire manufacturers will likely re-engineer their tires to overcome the possibility of reduced the tire life.

8. **Technician Pay:** One industry view is wages would increase due to requirement of technical capabilities, but as AI develops, it would decrease the need for the technological knowledge needed to work on equipment leading to stagnant or lowering wages as AI would be the primary troubleshooting mechanism. However, that may not be the case as in the current scenario companies are absorbing heavy costs due to equipment breakdowns and that, a combination of frequent upgrades from suppliers along with new systems may initiate a demand for pay increases, training and onboarding of new Technicians with the skill set needed. Transervice looks at this as an investment in the future of our technical employees also as an investment in our Company's future. In some shops Transervice has increased its staffing level to bridge the gap between current sensor data-retrieval and interpretation-action plan and the newest technology in the pipeline. Of course, there are still many mechanical parts on the trucks that need Technician attention too: so not all repairs can be made with data feeds and a laptop.

9. **Technician Staffing Levels for Electric Trucks:** The Technician ratio would be the same even though there are less moving parts to wear out. The daily charging of the batteries would be an added task not presently accounted for. If enough quick charge locations are available, there may be less need for Technician hours; however, the deep cycle charges would require a Technician to remove the discharged batteries and install a charged unit for use. We believe that most fleets, at some point in time, would like to participate in running electric powered fleets but cannot take the risk involved with a complete fleet conversion. These companies may be willing to start with one or a small number of electric powered trucks as they need all of their trucks out generating revenue. A partial or full conversion to electric increases shop management complexity and from an operating perspective, feasibility is a real issue. Re-charging station networks are not in place yet, and if you require a range longer than achievable with the electric power provided on one charge, you are in trouble. As far as the mechanic ratio for an electric fleet, we believe it will remain the same as a diesel powered fleet. At this time, urban van or box type delivery trucks serve as a better electric truck opportunity than tractor-trailer operations.

10. **Effect of New Trailer Technology:** Trailer aerodynamics will continue to improve and trailers with refrigeration are migrating to electrification. The use of electric refrigeration and lift-gates

equipped with solar power panels is increasing especially as CARB regulations reach thresholds of electrification. A TMC Study Group, chaired by a Transervice VP, for Trailers, Body & Material Handling is discussing what a Smart Trailer of the future will require. There are existing systems that are monitored but rely on being connected to a tractor to alert the driver or use the truck's telematics to report to shop office personal. One obstacle existing today is the cost of a stand-alone system for a trailer because on average trailers are 2 to 1 with power units, thus ROI would be an issue. However, as electronic monitoring progresses, this will be overcome. In regard to refrigerated trailers, these can now be monitored telemetrically, but many of the systems are proprietary which causes parts of each system to have redundant components. One network that all of the different systems could connect too would improve efficiency. Overall, manufacturers of trailers and ancillary equipment as described above are on a continuous improvement track with these objectives: performance enhancements, weight reduction, improved structural integrity, corrosion resistance, improved braking, automated lubrication, on-board telemetry for security and integrity, cold chain monitoring and fuel levels if applicable. The tracking companies are moving away from the 3G network which is expected to sunset in the next couple of years into 4G with their sights set on 5G.

Final Words

In this Whitepaper, we have tried to explain the effect of enhanced data benefits which will enable us to operate our shops mostly on a proactive maintenance basis. This will allow our customer fleets to complete their mission with greater effectiveness. With sensors, our maintenance managers can detect a problem, determine severity and advise our customer's dispatcher or the Transervice dispatcher what to tell the driver such as to keep driving or whether he/she should bring the truck to the shop at end of route or next day, or immediately.

Thus, as we go through this transformative industrywide change … together, Transervice will manage the entire process for its customers on a collaborative basis for the purpose of making the right equipment selections with the right specifications while we continually improve our shops, technician know-how and staffing structure with the goal of exceeding the required service and maintenance requirements.