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ADVANTECH

Technical White Paper

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On the Road with Fleet Management

Trends in Marketing, Technology, and Solutions

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Abstract:

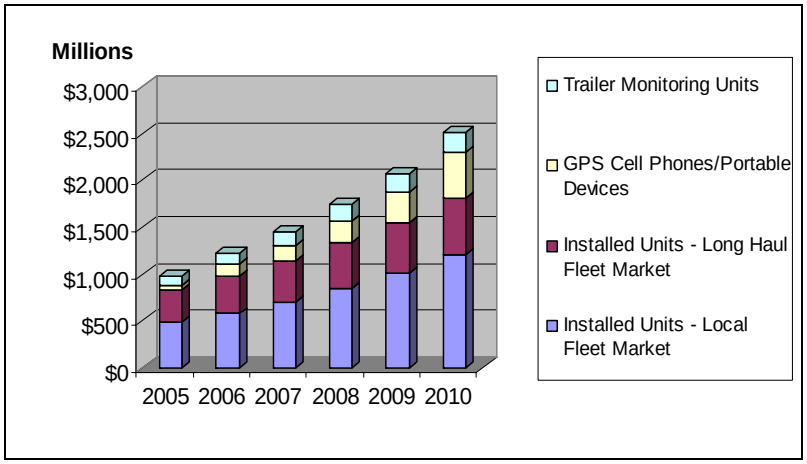
Today's vehicle fleet operators must continually look for ways to improve labor, inventory handling, and fleet efficiency in order to maintain competitive advantage. Vehicle fleets are increasingly expensive to run and operate, in terms of oil prices, maintenance, and running costs. The roads that businesses rely on to deliver goods and services are getting more and more congested—and dangerous. Changing regulatory and safety considerations spell potential liabilities for fleet managers. There are, however, fleet management solutions that aid in many operational aspects of the business, including: routing, navigation, vehicle diagnostics, on-time delivery, and many others. This whitepaper examines the trends, technologies, and motivations behind implementing a fleet management solution which assists fleet operators in the operation, management, and administration of a fleet of vehicles and equipment.

Marketing Trends

Examining the Market

Fleet management is a complicated business: operational costs are constantly on the increase, there is tremendous competitive pressure, new regulations are appearing regarding driver safety and owner liability, fleets are mixed, vehicle breakdowns affect performance—the list goes on and on. Fleet managers must contend with three major cost drivers: labor, inventory, and fleet. The first two have typically received the focus, and the last has historically been neglected. Why? In part, there is a lack of knowledge about what system integrators and manufacturers can provide, and there is the question of who will manage the system. These factors, combined with upfront costs, have made it difficult for fleet operators to justify the systems. But adoption is growing; the first problem operators usually try to solve is the need for vehicle tracking, followed by driver accountability, on-time delivery, monitoring vehicle usage, number of stops, etc. And high fuel costs, the largest business expense outside of the fleet managers' control, can be offset by automated vehicle location tracking and by reporting and analyzing vehicle data. Think about it: trucks left idling for long periods waste approximately 3.6 billion liters of diesel fuel each year in the United States alone!

The worldwide market for fleet management systems is projected to grow from $24 billion in 2004 to an estimated $270 billion by 2010. Continuing deployments in the supply chain, retail, utilities, and security sectors are the primary contributors to a forecast 49 percent annual growth rate. The MRM[1] market in the US has enjoyed consistent 25% a year growth with annual revenue expected to approach $2.5B by 2010.[2]



In the U.S. market today, there are some 3.2 million MRM units in service managing fleet vehicles, mobile workers, trailers, heavy equipment and other assets, representing $1.5B. Clearly, the rising costs, the need to maintain competitive focus, and the growth of the market, mark opportunities for system integrators and fleet managers alike.

1. Please see the "Glossary of Terms" for definitions to all abbreviations at the end of the document.
2. Source: CJ Driscoll & Associates, July 2008

Efficiency/Cost Savings for Fleet Management Solutions

The US Department of Transportation, Federal Highway Administration studied advancements in information technologies pertaining to freight transportation. They looked specifically at efficiency, reliability and security related to the increasing numbers of fleets equipped with intelligent freight technology. The DOT has calculated a detailed breakdown of savings for various fleet management applications as shown in the following table:

Source	Dollar Range	Unit of Measure
Asset tracking, mobile communications	$7,866 to $15,222	Annual savings per tractor
Asset tracking, chassis tracking	$210.35	Annual savings per chassis
Asset tracking, containers with RFID	$400	Benefits to shippers per container load
Freight status information, ESCM and biometric ID	$16.20	Time and labor savings per air freight shipment
Gateway facilitation among ports, highways, and border crossings	$12.8 to $24.8 million	Annual savings
Network status information, FIRST-like capabilities	$21.36 to $247.57	Savings per terminal trip

http://ops.fhwa.dot.gov/freight/intermodal/freight_tech_story/sectionfour.htm

Technical Development

Fleet management systems are comprised of in-vehicle devices capable of wireless communication, typically via GPRS, connected to vehicle diagnostic systems, using GPS satellite positioning for tracking and navigation, and finally connected to back office file and application servers. For a device to be suitable for use in a vehicle interior, it must be ruggedly constructed and able to withstand dust, vibration and shock, temperature extremes, and even driver abuse or neglect. Several fleet management device form factors exist: blackbox, terminal, portables, and dashboard mount. Display modes may range from monochrome to full color, and input methods may include touchscreen, stylus or full keyboard. Systems may run on standard software platforms such as Windows or Linux, or may be designed for use on microcontrollers performing a narrower set of functions.

The market is served by low, medium and high price points (from around $100 ~ $2000 USD). Devices in the low-end typically consist of microcontroller units (typically 6-bit, 80 Hz). They are limited in function, and not expandable by system integrators or end-users. Mid-range devices are usually RISC-based, with compact CPUs and some I/O ports for expansion and connectivity. At the high end are x86-based systems with more expandability and a broader base of applications. Both mid- to high-end systems, basically those with operating systems, are more easily customized by system integrators, and better suited to commercial fleet environments. These commercial products are ruggedized, vibration and shock tested, and sealed against dust. Such a device should operate in a range of temperatures of at least -40~+85 °C. Certifications

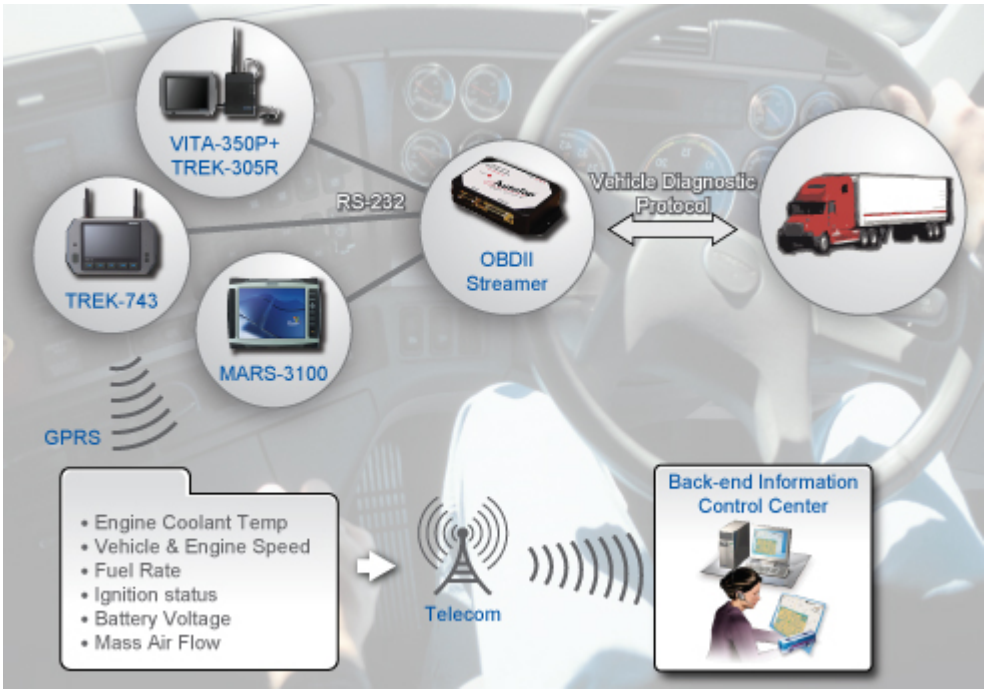
are also important; a good determiner of durability will be devices carrying ISO-7637, eMark, and IP43/54 certifications.

Key Applications

There are many fleet management solutions available, both off-the-shelf applications and through customized development. The strength and commitment of a system integrator and equipment manufacturer come into play in tailoring specific solutions to specific customers. Typical fleet management system applications fall into four broad categories: vehicle/system maintenance, driver/inventory monitoring, routing/navigation, and compliance.

Vehicle / System Maintenance

Vehicle diagnostic information is made available to fleet management systems by way of a standard OBD-II connector. The OBD-II standard calls for a uniform connector link to one of four interfaces ISO 9141-2, KWP 2000, SAE J1850 or ISO 15765. A protocol converter reads and translates a data feed of some 300 readings between a manufacturer's proprietary vehicle diagnostic system and a fleet management system. Some systems can access data from a vehicle CAN-bus system.



A vehicle so equipped can display things such as sensor operations, ignition voltage, cylinder misfires, brake conditions, temperatures, vehicle speed and other key metrics.

This allows for preventative maintenance, diagnosis and repair of a vehicle, keeping it in service longer and making for more economical operation.

System maintenance applications help operators manage in-vehicle devices remotely using over-the-air (OTA) file transfers via GPRS/CDMA, secure logins, and job schedulers. They eliminate physical visits to update devices one-by-one with a cable and laptop in hand. A typical solution may utilize triple-DES for authentication, FTP with a file manager for file transfer and management, GPRS for transport, and static IP addressing for registration and logging purposes. These tools allow system integrators to automate application distribution in highly mobile fleets.

Driver / Inventory Monitoring

Driver behavior and inventory management are two other applications fleet management solutions can help with. For example, a driver who is constantly changing pressure on the gas pedal to accelerate and decelerate a vehicle will use more fuel than one who maintains consistent pressure. This is easily identifiable with a vehicle monitoring system. Another concern that fleet operators face is the unauthorized use, loading and unloading of cargo, or unscheduled stops on a route. GPS locator systems and cargo door sensors

can alleviate this problem. Temperature monitors can also report cargo status and improve the transport of volatile or perishable goods. This is good for the company, good for the customer, and good for the environment. An added bonus is that some insurance carriers offer lower premiums for vehicles equipped with fleet management systems.

Routing / Navigation

Routing systems can help find optimal routes, reducing mileage and vehicle wear and tear. Real-time inventory tracking and efficient routing reduce lead times for customers, and boost the fleet owner's competitive edge. Inventory loss can be minimized and risk of theft mitigated. In some scenarios, portable in-vehicle devices equipped with RFID and barcode scanners can record pick up and delivery, and trigger order replenishment systems.

Compliance

There is an increase of regulations regarding fleet movement, driver safety and other issues, violation of which can put a fleet operator in jeopardy. In the EU, for example, the use of digital tachographs has become mandatory to monitor the speed and length of time a vehicle has been moving or stationary. Drivers are issued RFID-readable cards which log driving time and provide positive identification. These technologies help prevent accidents and reduce the incidence of fatigued drivers behind the wheel, as well as ensuring accurate data for wage calculations. Another compliance issue is the monitoring of transport of hazardous materials, which is easily done with the use of fleet management systems. Still another issue is that of negligent entrustment, which arises when the owner of a vehicle entrusts it to someone known to be incapable of using it properly and a third party is injured. A fleet owner may be held liable for an accident caused by a driver who had a history of reckless driving. Fleet management systems can help protect against accident and legal liability risks by making adequate provision for regular driving record background checks.

Comparison of Solutions

Consumer and Non-consumer Products

There are many systems available on the market today. An important distinction must be made between consumer and commercial class products. A consumer-grade GPS navigation system may offer many features: navigation, tracking and speed, yet it has limited or no connectivity to OBD systems, and limited customization capacity. It will

certainly be smaller, less-durable and lower in cost. A commercial system, by contrast, will be ruggedized, with a larger screen, have fuller features and more storage. Commercial systems are built to withstand vibration and shock and resist dust and water penetration. Connection to OBD-II gives them the capability to monitor key driver and vehicle metrics, some of which are outlined below:

- Vehicle speed – to monitor aggressive driving
- Engine speed – to monitor idle time and engine abuse
- Engine coolant temperature
- Odometer/Distance traveled – to monitor trip distance and HOS
- Instantaneous fuel rate /total fuel – to monitor MPG & protect against theft
- Ignition status
- Battery voltage
- PTO status – to automatically calculate fuel tax savings
- Brake switch status
- Diagnostic trouble codes
- MIL status
- Emissions readiness monitors – to check remotely whether or not vehicles are ready for emissions certification

It is easily seen that commercial systems make data available which was previously difficult to obtain regarding driver behavior and vehicle performance. A key distinction between consumer and commercial systems is that the commercial systems are customizable by system integrators to meet specific user requirements. And of course, the system integrator is more capable of providing support, service, installation and training services than is a consumer based vendor.

OS and Non-OS

By now it should be apparent that the limitations of a micro-controller based, hardwired system makes it unattractive for serious fleet management use. A system with a full-featured operating system can be tailored by system integrator and customer alike, making it more flexible. From the SI point-of-view, this means a quicker time to market, better integration with other vehicle systems, more computing power, and expandability. From a fleet manager point of view, a robust operating system translates to better functionality, which increases management efficiency. More robust systems include better developed communication channels that promote real-time communication between dispatch and the fleet. And using OTA technology, application updates, and configuration changes can be propagated to a vehicle fleet over-the-air, using the GPRS

protocol. Some researchers estimate the electronic components of vehicles approach 30% of the total value of the vehicle. Systems with a full-featured operating system are better equipped to adapt to the demands placed on them, bringing a higher return on investment dollars.

Conclusion

Fleet management system integration and development is a growing and attractive market for integrators and is becoming a necessity for operators. Selection of a full-featured, industrial-grade system is critical to success, as is selection of a partner that can help customize and support the system after the sale. Factoring long-term total cost of ownership will help in ROI calculation and make apparent the choice to invest in quality, reliable hardware, with a strong vendor that can provide advice and support. With spiraling fuel costs, health and safety risks, and costly vehicle maintenance, fleet management offers the only sensible route to control and monitor all the complex parts that make up fleet operations.

About Advantech

Founded in 1983, Advantech has a solid reputation for leadership and innovation in delivering excellent products and services, and has become the leading global ePlatform services provider. This excellent reputation, along with industrial-grade systems know-how and vast customization experience, assure Advantech can deliver and is committed to serving system integrators, telematics service providers and fleet operators.

Design and Manufacture Capability

Advantech manufactures and designs its own products, has global logistics centers, and worldwide field offices to assist in deployment and support of critical fleet management system solutions.

Advantech Product Highlights

VITA-350P provides in-vehicle data processing and GPS automatic vehicle location solutions over GSM/GPRS networks. VITA-350P provides a

Figure 1 - VITA-350P

50-channel GPS module, an RS-232 port and 10 programmable GPIO ports to allow vehicle location tracking, wireless data transmission and remote sensing and alarm notification. Utility software provides the tools needed to integrate VITA-350P with other OBD systems, and the OTA SDK makes updates seamless.

Figure 2 – TREK-743

TREK-743 is a rugged compact vehicle mounted computer for logistics and fleet management featuring compact in-vehicle mounts for comprehensive data processing in forklifts, trucks, trailers, tractors, and cranes and industrial vehicles. The front and back panels resist dust and water penetration, and wireless 802.11b/g, GPS, GSM/GPRS modules can be integrated for real-time data exchange, navigation, and communications.

MARS-3100 is a 10.4" Industrial Tablet PC for applications such as field service, transportation and emergency services. The rugged design resists shock and vibration and the chassis is fully sealed to IP54 ratings to prevent water and dust damage in outdoor applications. In addition, the optional built-in WLAN, Bluetooth and GSM/GPRS/EDGE modules facilitate data transfer and communication with other devices.

Figure 3 – MARS-3100

Glossary of Terms

CAN-Bus – controller area network bus, mandatory in all vehicles

COTS – commercial off-the-shelf software

eMark – mandatory mark established in the EU for vehicle safety systems and components

FTP – file transfer protocol

GPRS – general packet radio service

HOS – hours of service

IP43/45 – ratings against dust and/or water penetration

ISO 15765 – specifies requirements for the emissions-related systems of legislated OBD-compliant controller area networks.

ISO 9141-2 – protocol with 10.4 kbaud data rate used primarily in Chrysler, European, and Asian vehicles.

ISO-7637 – Electrical disturbances from conduction and coupling

KWP 2000 – diagnostic protocol on a K-line Physical medium with ST7 or ST9 microcontroller

MIL – malfunction indicator lamp

MPG – miles per gallon

MRM – mobile resource management

OBD-II – on-board diagnostics

OTA – over the air

RFID – radio frequency identification

ROI – return on investment

SAE J1850 – fixed rigid barrier collision test

SDK – system developer kit

SI – system integrator

Triple-DES triple – data encryption standard block cipher