Next Generation Flowmeter Technology for Fuel Transfer Metrological Data Applications

Critical Advancements in Metering Technologies
Understanding Fuel Data Management: Why Improved Reporting is Vital
Positive Displacement Fuel Meters and the Future
Going Wireless: Getting the Best Out of New Technologies
Fuel Management – A Connected Future
Accuracy as predictable as time itself.

Liquid Controls meters have revolutionized the positive displacement, rotary abutment design that delivers accurate fluid metering for the lifetime of the meter.

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- Low pressure differential across the seal for minimal slippage and linearity of +/- 0.1%.
- No metal to metal contact means no wear.
- No wear means no deterioration in accuracy over time!
Foreword

TIME AND time again in these Reports I find myself extolling the big differences that can be gained from small improvements. An area such as fuel flow rate measurement is one. By improving the collection and analysis of data, aviators can achieve substantial savings in one of their core business expenses.

In our opening article, we hear from Liquid Control Systems who provide an excellent overview of how fuel flow monitoring has progressed over the past hundred or so years. They track it from the earliest days through to modern innovations in electrical and wireless registration systems. By doing so, they highlight one of the most important aspects – namely the need to collect and analyze data in the shortest possible time.

We then look more into the commercial backdrop against which all this is happening. Notwithstanding the current volatility in global oil prices, fuel usage remains one of the biggest costs for any airline. In addition, there is mounting pressure from regulators and wireless registration systems. By doing so, they highlight one of the most important aspects – namely the need to collect and analyze data in the shortest possible time.

Fuel has always been – and will remain – one of the most important issues facing the industry. How new technology is adapted and incorporated into existing practices could prove crucially important.

Tom Cropper has produced articles and reports on various aspects of global business over the past 15 years. He has also worked as a copywriter for some of the largest corporations in the world, including ING, KPMG and the World Wildlife Fund.

Critical Advancements in Metering Technologies

Liquid Controls LLC

SINCE THE dawn of commercial trade in fuels and fluids, fluid flowmeters have been the technological backbone that oil and gas industries have leaned on to ensure proper measurement and custody transfer of valuable liquid inventory. It wasn’t until the early 1900s when volumes of custody transfer of petroleum based products reached such significant levels, that oil companies faced the reality that every fraction of inaccuracy resulted in millions of dollars in mis-counted inventory, and lost profits, that focus was placed on improving metering technology to increase measurement accuracy.

In 1932, U.K based Avery-Hardoll introduced a new positive displacement methodology of counting fluid inventory that was accurate at both high and low flow rates. The vision that the company had for a sustainable and scalable design was so revolutionary, that it forever changed the way the world managed trade of the world’s fuels.

The metering capsule design allowed scalability of flow rates by simply adding additional capsules, allowing up to 3875 liters per minute (1000 gallons per minute) flow rates. This concept allowed for a very small package, and it was economically scalable, depending on the application. This design was so revolutionary that it provided metering accuracy 0.1% or better, and the standard for fluid inventory in the industry until the 1990s when both Liquid Controls and Avery-Hardoll introduced electronic meter registration, concurrently. This new method of wired data reporting brought a much higher level of operational efficiency that the industry was previously lacking. It provided an improved user interface, internal algorithms that simplified operational procedures, and a dot matrix printer to provide fueling data that was manually inputted into back office accounting software at the end of the shift. This process eliminated the need for hand written fueling reports by operators, and streamlined operational efficiency by allowing operations to spend more time doing what made their companies money – refueling airplanes. This became the new standard of fluid measurement reporting through the remainder of the 1990s.

On April 13, 2010 while fueling Cathay Pacific flight 780 from Surabaya, Indonesia to Hong Kong, the fueling filtration system experienced a system pressure spike due to the presence of higher than normal levels of water in the underground fuel system, which resulted in catastrophic failure of the internal filter monitor elements on the fuel truck. While the system was equipped with a conventional sensor to detect high pressure differential...
In 1954, USA-based Liquid Controls introduced another unique method of positive displacement flowmeter measurement that soon became the industry standard in North America.

Inside the system, typically due to filters that are overloaded with water or other contamination, in this instance the filter elements broke free, releasing both the back pressure required for the sensor to operate, as well as the spherical filter media that was released into the fuel and into the fuel tanks on the aircraft. While in-flight, the filter media caused the fuel metering valves to seize and caused the engine(s) to remain at greater than 70% thrust before, during, and after landing causing the aircraft to land dangerously at 176 km/hr faster than normal speed.

In this case, the pilots skillfully and heroically landed the plane safely, but this is a condition that could have been prevented with an active onboard differential pressure sensor that reported real-time fueling conditions through an active fuel system monitor. This would not only shut down the fueling process mid-stream, but would have reported back to the control center exactly what was causing the anomaly before the plane ever left the ground.

The use of active dP transducers provides an accurate measurement of pressure anomalies in fuel systems, which is often indicative of contaminated filters. This, combined with active meter register controllers, provides a mechanism to shut down fueling if an unsafe system pressure condition is observed. Water detection devices such as the Faudi AFGUARD™ are recommended for in-situ measurement of particulate matter, like contamination or free water.

These water detection devices can be used also to validate functionality of filter water separators or to measure water absorbing performance of filter monitors.

The Leap to Wireless Reporting
Fortunately, fueling-related incidents are very rare. The vast majority of fueling events are completed in full conformance to specification and result in safe flights. That doesn’t mean that all fueling events go without error. Any time a human being observes, conveys, interprets, reads, or manually records any information, there is a potential for error. While today’s fueling equipment is designed to remove human error during fueling, it’s what happens after the fueling that can have a financially costly impact to fueling operations.

In the 1990s, high volume, data driven organizations craved the benefit of real-time visibility of key performance indicators that provided insights on improvement to safety, operational efficiency, and reporting accuracy. It wasn’t until the onset of widespread use of wireless connectivity that this level of immediate data visibility became possible. This new technology opened up entirely new possibilities to not only automate the fueling process, but also connect other critical safety monitoring devices in fluid conveyance equipment, such as filtration, temperature monitoring, densitometers, fluid quality, system controls, and system pressures.

Automated systems were developed to convey information wirelessly between the back office fueling control center and the fueling equipment on the ramp. These seemingly robust systems eliminated the potential for human communication or interpretation errors between the ramp and the back office. They also provided information in near real-time. Some software providers offered an additional piece of equipment in the form of handheld wireless controllers to allow the operator to both receive dispatch instructions as well as report fueling data. Despite the disadvantages of the additional upfront expense and battery charge issues, as well as ongoing replacement expense due to durability issues in such a physically demanding environment, the handheld wireless concept provided the proof-of-concept bridge between legacy manual reporting processes and fully automated wireless technology that was to come.

Embedded Wireless Connectivity - FlightConnect™ Wireless
In 2011, Liquid Controls developed the first FlightConnect™ Wireless software package that utilizes embedded software in their existing meter register hardware. This eliminates the need for separate handheld devices to communicate transactions between the ramp and the back office. The equipment provides a two-way communication path to allow remote fueling and dispatching instructions to be delivered from a back office computer to the fuel trucks themselves. Then immediately upon completion of the fueling event, it transmits over 20 critical data points of fueling data back to the same computer. This allows back office operations to instantly convey not only custody transfer information to the stakeholders, but also gives instant fuel quality data, system pressures, and any indicators of anomalies that may pose a risk to the upcoming flight.

The Reports generated are in a preferred data format. The software can be pre-configured to automatically import the data into the company’s own back office reporting and accounting software in their preferred data format.

The FlightConnect™ Wireless system consists of embedded dispatch and fueling data management software onboard Liquid Controls portfolio of SMART Registers (LectroCount®, LCR9000 registers, LC’s DMS System, and LC’s Avery-Hardoll MASTERLOAD™ III registry). This logical advancement eliminates all additional hand-held hardware as well as any incremental steps required to operate a handheld device and results in improved efficiency as well as eliminating potential operator reporting error modes.

The FlightConnect™ package includes FlightConnect Office™, which resides on the fueling company’s back office computer and maintains the link between the office and the ramp, as well as providing data conversion that allows fueling data to be imported into an operator’s own ERP or fueling data management system. It is here that all fueling dispatch instructions are assigned and transmitted to the operators on the ground. Then it gathers all final fueling information, which is automatically transmitted back from the fueling equipment upon completion of each fueling. The software can be pre-configured to automatically import the data into the company’s own back office reporting and accounting software in their preferred data format.

Connected Metering Technologies
It has been said that the fuel pump is the heart of the fueling operation, and the metering system is the brain. This analogy is certainly true when it relates to the FlightConnect™ system. The SMART Register (brain) is connected by a system of critical sensing components (nerves) in the
If any established statistical boundary is crossed, the SMART Register will convey commands to the equipment to shut down, then immediately report the non-conformance to the operator. While the industry survived for decades on reporting a single, manually reported data point of total fuel delivered, today’s leading electronic registers are capable of reporting over 20 points of critical data used to monitor safety and improve operational efficiency and profitability including:

- Invoice Number
- Start Date and Time
- End Date Time
- Average fuel density
- Operator Name or ID
- Transaction Type
- Unit ID / (Truck#)
- Fuel Type (Jet A, Avgas…)
- Customer
- Fuel Location
- Flight Number
- Tail Number
- Start Tot/Al (Non-Resetting)
- End Tot/Al (Non-Resetting)
- Aircraft Type (Airline)
- Aircraft Registration
- Fuel on Board
- Total Delivery Volume
- Average Fuel Temperature
- Additive Injection Data
- Total Weight Delivered
- Free Water / Particle counts
- 3 User Defined data points
- +3 User Defined data points

Globally, there are on average over 100,000 flights every day. Airlines, airport authorities, and ground handling operators have realized that reliable automation of flight operations, especially fueling, is critical to ensure safety, accountability, and financial accuracy with every flight. The “2015 Global Fueling Survey” conducted in November, 2015, surveyed over 1000 industry professionals on many fueling related issues, including most needed features that would make the biggest positive impact on the industry relating to fuel measurement and fueling data management. The results were 70-80% of the industry agreed that wireless dispatching and fueling data management with fueling quality data are the most important needs in the industry that can improve overall fueling operations. Reporting Accuracy According to IATA’S “Fuel Volume vs. Weight” Task Force report published in March 2011, aircraft fuel is one of the largest operating expenses for airline companies. It represents “between 20% to 30% of airlines’ annual operating costs.” The intent of the task force was to “identify alternative measurement systems for weight (density or mass) and then field test them against currently used systems” to determine best practices of fuel measurement related to reporting accuracy. Live studies were conducted between 2008 and 2010 at five airports. Results from these five airports demonstrated that electronic data sensors for mass or density were consistently within +/- 1% of the daily manual density readings typically taken only once per day. This finding is a result observed from approximately one thousand (1000) aircraft refuel tests collected during the study.

Aircraft operators require fuel information in weight (kilograms or pounds), but jet fuel is sold and delivered by fuel suppliers and into-plant fueling companies by volume (liters or gallons). Since fuel temperatures can vary significantly between the load rack and the point of fueling, fuel density can also vary greatly which leads to potential significant volume to weight differentials if a constant or manual density reading is used in volume to mass calculations.

**IATA Recommendation 1:** On new hydrant systems and/or hydrant refueling vehicles, install inline Coriolis mass meters that provide both weight and volumetric measurement readings. This new measuring system capability will aid in better fuel management, environmental regulatory reporting, and, cost savings.

**IATA Recommendation 2:** On current hydrant systems and/or hydrant refueling vehicles, install slipstream densitometers as an adjunct to current measurement systems. This will aid in better fuel management, environmental regulatory reporting, and likely enhance cost savings.

Today, governing associations such as IATA, major airlines, and major oil companies are coming into alignment with the direction of control and reporting technologies in relation to safety and accuracy. The future of aviation fueling is in good hands with the key innovators and stakeholders involved, and the flying public is the ultimate beneficiary of this technology through resulting safety measures and operational cost avoidance that these new technologies offer.

**Liquid Controls, LLC** Liquid Controls, LLC, manufactures high-quality positive displacement flow meters, accessories, and flow electronics for accurate liquid measurement in both custody transfer and process control applications under the Liquid Controls and Avery-Hardoll brands. Liquid Controls’ meters have proven track record of reliable performance, sustaining their accuracy and providing a remarkably low cost of ownership in the harshest fluid metering applications. Liquid Controls continues to build on over a half-century of application experience in the commercial, aviation, and military fueling industries by developing innovative, straightforward solutions that provide value to its customers. For more information, visit www.cmeter.com or contact us at lcm-averyhardoll@idexcorp.com. Liquid Controls, LLC is a wholly-owned subsidiary of IDEX Corporation (NYSE:IEX).

**SIPSTREAM DENSITOMETER**

While most airlines do not have tolerance levels for excess fuel, it is also recognized that a zero fuel volume overage is not always operationally practical. If excess fueling was minimized by an average of 63% or minimum overage of 50-250 pounds per flight, this can result in an economic benefit of US$45 - US$25 per flight or US$30,000 - US$168,750 a day based on 50% of 1500 flights a day an airline may have. The overall return on investment on integration of Slipstream densitometers into existing equipment is 66.1, or $66 return on every $1 invested. (see chart)

The IATA report concluded the following recommendations as they pertain to new hydrant systems and current hydrant systems and refueling vehicles that greatly improve fuel accounting accuracy – a pathway to potentially achieve the above fuel savings.

<table>
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<tr>
<th>Benefit</th>
<th>Amount Per Day (USD)</th>
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<tr>
<td>1. Reduction in over-fueling to ave of 250 pounds overage per flight instead of 686 pounds. Assume 225 flights per day (med-sized airport)</td>
<td>$28,853</td>
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<tr>
<td>2. ETSI Measuring Accuracy Benefit of 10 billion tons of fuel per year</td>
<td>$855</td>
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**Calculated Ratio of Cost to Benefit** 1 to 66
Understanding Fuel Data Management: Why Improved Reporting is Vital

Tom Cropper, Editor

The aviation industry faces an uncertain and challenging future. The introduction of advanced data management technologies can help deliver the efficiency changes it needs.

Aviation is a complex beast. The process of ferrying passengers from one part of the world to another takes up a huge amount of resources in terms of energy, man-hours and costs. The operation involves thousands of different processes, each of which has its own impact on the overall performance of the company. With airlines facing a challenging economic environment in which costs are coming increasingly under pressure, every little bit helps. Those which can harvest the maximum amount of accurate usable data on multiple aspects of the aviation process will be at a distinct advantage in this increasingly competitive landscape.

Fuel Usage
One of the most important issues confronting the industry today is the way in which it manages its fuel usage. This has implications from a financial, regulatory and commercial standpoint which is why the aviation industry is taking every possible step to manage it in the most efficient way.

Fuel consumption increased steadily by around 3.6% per year between 1980 and 2000 until it peaked just before the 2001 attacks on the World Trade Centre in the US. Since then figures have been relatively flat. However, while much of this drop off could have been attributed to 9/11 and then the global recession, the last few years have seen the industry return to growth.

In October, 2015 Eurocontrol announced that European air carriers were seeing growth increase by almost 2% on 2014. In some parts of the world, the growth has been quite remarkable. 2016 began with bullish figures from Etihad Airways which said it carried 17.4 million passengers in 2015, an increase of 17% on 2014. IATA’s latest long term passenger forecasts predict traffic to double to 7 billion by 2034. Although the recent slowdown in China is causing some concern, the consensus seems to be that, after some years in the doldrums, air travel is on the move again. This, of course, has a number of implications, not least of which is how aviation companies are going to manage fuel use. In the US fuel costs quadrupled between 2003 and 2014. Fuel is now the single greatest cost for most international airlines. In 2015 US airlines spent a total of $13bn on fuel compared with just $8bn in 2000. Recent years have seen total spending drop from a high of just over $60bn in 2012, partly as a result of lower oil prices, but also through more efficient use of aviation fuel. Even so, as passenger numbers grow, fuel consumption is still increasing. This comes at a time when the industry is undergoing a complicated period. On the one hand, as the research mentioned above indicates, business is good. Passenger demand is growing as is revenue. However, the pressure to continue offering low cost air travel means airlines have been forced to continually reduce ticket prices. Demand might be growing but the amount they can charge for their services is falling. To remain competitive airlines must either increase revenue from other sources such as retail, or find a way to manage costs. That is not necessarily the problem here. Fuel efficiency is coming to the fore with a range of sophisticated fuel management software solutions which help operators monitor multiple data points all in one place. This is streamlining the process of data gathering, improving turnaround times and increasing accuracy. Automated systems, in turn, can reduce human interventions which can eliminate errors and inconsistencies. The result is a series of multiple gains across the process which contributes to a significant overall step forward.

Selling Innovation
These, then, are exciting times for all parties. Developers of fuel data management technologies have a growing and lucrative market. But this comes with plenty of caveats, the most pressing of which is inertia. As with any industry, uptake of new technology varies across the board. Many are suspicious of innovations and reluctant to undertake the systemic change new technologies often demand. Change, often only happens when an existing system demonstrates problems. That is not necessarily the problem here. Fuel has been measured in roughly the same way for several decades. The difference now is that the arrival of wireless technology means it can be done better.

Flow rates have been measured in roughly the same way for several decades. The difference now is that the arrival of wireless technology means it can be done better.
Positive Displacement Fuel Meters and the Future

Jo Roth, Staff Writer

Electronic and wireless data capture are crucial to the development of the next generation of Positive Displacement Fuel Meters.

The aim is simple – to create a product which lasts longer, is more durable and provides a higher level of accuracy for a longer period of time.

In the 1950s fuel flow measurement took a giant leap forward with the introduction of positive displacement flow meters. Since then, the technology has remained more or less intact, despite an aviation landscape which has changed out of all recognition. Now, though, things are changing. A combination of new technology and fresh challenges in the market mean operators are looking again at how fuel is monitored. The result is the first big step forward for decades – one which is opening up a range of new opportunities and challenges.

The Rise of Positive Displacement

Positive displacement meters have survived for so long thanks to their ability to deliver unparalleled levels of accuracy and longevity. Their distinction is in being the only flow measurement technology that measures flow directly passing through the meter. They trap fluid before releasing it in order to measure its flow – a bit like repeatedly filling and emptying a bucket. Flow can be determined by calculating the number of times that ‘bucket’ is filled and emptied. The water is normally drawn in by rotating components that form moving seals preventing the fluid from moving on until it has been measured. It has been the standard measurement technique ever since it was first introduced in the 1900s.

In an industry in which new technologies are coming on line continuously, the remarkable thing about these devices is their capacity to endure. A report from TechNavio, suggests the market for flow meters – including positive displacement meters – would grow by a CAGR of 8.32% for the years between 2013 and 2018. The basic flow meter operation is still based closely on the original design.

In mechanical terms, innovation has always been towards longevity and low cost of ownership. The tri rotor design, featuring no metal to metal contact, has long been a feature of the standard setting models. These avoid wear and tear on mechanical parts and so help the device maintain accuracy for a prolonged period of time. On top of that, construction materials are evolving to help the device function in demanding airport environments. Here they could face all sorts of challenges from bad weather to impact damage and the presence of corrosive chemicals. Even so, the need to offer greater mobile use means materials such as aluminum and stainless steel, which offer a high strength to weight ratio, together with corrosion resistance, are coming to the fore.

Designs are also aiming to minimize the intrusion into the liquid itself, reducing the danger of contamination or problems. As a whole the aim is simple – to create a product which lasts longer, is more durable and provides a higher level of accuracy for a prolonged period of time. In other words, something much more in tune with the requirements of the aviation industry.

What is changing is the way the meters harvest and analyze data.

A Research and Markets report into positive displacement flowmeters found that the greatest changes are in automation and the need to reduce human intervention. The move from electronic registration to wireless is increasing the amount of data that can be harvested. Remote monitoring allows that data to be delivered and analyzed to a remote control center, reducing the risk of accidents and process error. Increased connectivity, meanwhile, increases the flow of information allowing operators to view data in real time and share quickly with other departments.

The use of remote display systems helps with the use of applications over large distances – such as in an airfield – bright LED displays can be physically in position in order to collect valuable data.

An Integrated System

The industry has been looking at ways to improve upon flow measurement practices for some time. A 2011 report from IATA suggested a key weapon could be in the incorporation of new measurement capabilities, such as slipstream densitometers. It found that the addition of these devices on top of the existing mechanical led to greater accuracy and reliability.

IATA’s Fuel Volume Versus weight taskforce carried out field tests at five airports between 2008 and 2011 and identified a number of key improvements from using slipstream density meters and mass meters including:

• Optimizing fuel loading for dispatch: By providing more information on fuel loading, operators can reduce the risk of human error and speed up the overall refueling time.
• More accurate measurement of density loaded into the plane: This can be useful in calculating on CO2 emissions.
• Superior fuel management and inventory control: Improved data gathering allows companies to better control their use of fuel, delivering financial and environmental benefits simultaneously.

Airline operators require fuel information in weight, but jet fuel is sold by volume. By measuring both weight and volume, operators are able to identify discrepancies between the two measurements and thereby significantly improve the accuracy of the entire system.

Increasingly, therefore, complete fuel management kits are coming to the fore which help operators to measure a wider range of parameters and to do so in a more mobile and flexible way.

All this is being fed into new fuel management software solutions which help operators to visualize and share data in a far more efficient manner.

It is, therefore, in many ways, a case of evolution not revolution. The newest generation of PD flowmeters comes with a number of enhancements to their inner workings, but what’s really changed is the combination of different types of data gathering methods. The rise of wireless and web-based technologies creates a new opportunity to speed up the refueling process, minimize down time and improve accuracy. It is a new world of opportunities, which are only now just beginning to be understood by the industry.
Much will also depend on the individual supplier. Developers offer liquid flow rate mechanisms for a number of different industries. What a buyer wants is a manufacturer who has a specific leaning towards the aviation sector.

**FUEL MANAGEMENT** is undergoing a revolution. The arrival of new technology, concerns over emissions and budget constraints mean airlines are looking at new ways to conserve fuel such as pilot training, more fuel efficient aircraft and fuel transfer. All these efforts, though, revolve around metrics, which is why the industry is investing in improved fuel flow meter devices and data management technologies. However, as with anything new, challenges remain particularly in educating the industry about the technology it can offer and the benefits it can bring.

**A New Era**

Key to these new developments has been wireless and web-based technology. Data can be harvested directly from the refueling rig and transferred to a computer. This can track everything from fuel transfer rate, liquid make up, any impurities and density, as well as logging the aircraft type, origin and destination. All this, in turn, can be shared with stakeholders in other departments. It’s designed to offer a huge step forward in manual data collation mechanisms saving time, improving performance and reducing fuel waste.

The most pressing reason for switching is, of course, money. Recent volatility in the global oil price contributed to a 40% drop in the cost of aviation fuel for airlines. Even so, fuel still accounts for between 20% and 30% of an airline’s overall budget. There is also no guarantee that the current low oil price will continue. At the time of writing, the price had rebounded to just above $60 a barrel, having dipped into the twenties. Most analysts expect a recovery of some kind. At the World Economic Forum, BP boss Bob Dudley said that, although a price as low as $10 per barrel was not impossible, it should rebound in the longer term. The market would eventually see prices higher than $80 a barrel. The lesson for the aviation industry and others reliant on oil is to treat the current market as a short term windfall. In the long term they should continue to crunch down on costs.

Here we see the biggest selling point for suppliers of next generation fuel flow meter technology. They point to possible savings across the board including:

- **Time and efficiency savings**: Processes are streamlined and occur more swiftly.
- **Optimal fuel usage**: Accurate data can reduce money wastage through overfuels and also under-fueling.
- **Lower emissions**: Managing environmental liability is a growing imperative for all companies. By monitoring every drop of fuel more effectively, the industry can significantly reduce the amount of energy burned.
- **Reduced errors**: Manual inputs can lead to mistakes. Electrical automated data gathering can reduce the risk of errors in calculation or interpretation.
- **Identifying discrepancies in fuel farm**: Monitoring fuel storage leads to superior inventory management.
- **Analyzing fuel consumption trends**: All the efforts being made towards fuel economy rely on effective analysis. As such operators can assess how fuel is being consumed and develop strategies to improve savings.

**Getting it Right**

Such benefits, however, can only be realized if the technology is adopted in the right way. There is a range of products on the market from different suppliers, all making impressive claims. Buyers need to feel confident the device will work. They will match its claims and integrate harmoniously into existing systems. For this they will need to see quantifiable data – whether through tests or case studies – which can demonstrate performance.

The operational environment will also need to be taken into account. These devices will be operating for prolonged periods of time in all weather conditions. They will be vulnerable to contact damage and corrosion. Devices encased in class 1 div. 1 explosion proof enclosures constructed especially for use in the global aviation industry is imperative.

Additionally, they will need to perform at a high level for a prolonged period of time. Components tend to wear out quickly in the physically abusive fueling environment; damage can lead to downtime, downtime can lead to flight delays, or worse. The more maintenance and downtime a product requires, the higher the overall operational cost. Buyers should look for products which offer long term reliability and low maintenance.

Wireless web based fuel monitoring systems offer the promise of a significant step forward for the aviation industry. What matters is successfully incorporating innovation into existing systems.

Wireless web based fuel monitoring systems offer the promise of a significant step forward for the aviation industry. What matters is successfully incorporating innovation into existing systems.
Fuel Management – A Connected Future

Tom Cropper, Editor

Why big data and automation will be critical for the future of fuel management in the aviation industry.

As the range of information improves, together with the ability to transfer to connected devices, demand for more effective data management systems will grow.

One of the more unsettling truths in any process is that the weakest link is often the individual operator themselves. Human beings are fallible, and low tech apparatus depends largely on the skill, training and reliability of professional crew on the ground. The trouble is that, while you can take all the precautions in the world in terms of training and education, you still can’t necessarily guarantee consistent performance. For this reason, the drive is on to remove – as much as possible – the element of human error. In doing so, the industry has achieved a sizeable step forward through the introduction of wireless data capture, automation and connectivity.

The majority of accidents or safety issues stem from human error rather than mechanical issues. These can be anything from shoddy workmanship to mistakes in communications or data analysis. Older pre-electronic registration fuel management systems relied on a substantial amount of manual recording and analysis. Every point in this process raises the possibility of error or miscommunication. Anything operators can do to accelerate communication and data transfer between the point of collection and the control center will be beneficial.

Addressing this problem has been a two stage process. First, the industry saw the development of electronic registration. This successfully eliminated manual data entry, enabling operators to transfer more information to a printed ticket. While operational procedures are added in attempts to increase productivity and reduce errors, the biggest step forward of late has been the development of wireless reporting connectivity. This means increasing band width of data in fuel reporting and data management, allowing almost unlimited access to large volumes of data that when analyzed at the gate level or across fleets, allows operators to make macro adjustments to their fueling business to achieve cost savings and efficiencies like never before. It all plugs into the expanded ethos of one connected airport, where operators can achieve a much wider visibility of what is happening.

An example of this next generation technology comes in the form of FlightConnectTM – wireless data management system. This can be installed directly onto refueling vehicles where it can be used to control delivery, pull data from the system and turn that data into useful diagnostic and inventory information. This can then be transmitted easily to a control center and uploaded onto fuel management accounting software. The effect is to streamline everything from delivery to data flow and analysis increasing the accuracy of data. It helps to improve the management of the information and also to speed up the overall turnaround.

The strength of the system lies in its power and flexibility. By allowing customers to configure the system to overlay their existing equipment and back office systems, once installed, it essentially becomes invisible while the data streams in. The system records data such as time, fuel type, gallons delivered, airport ID, refueler ID, aircraft type, airport origin, gate and destination, as well as system diagnostics, connected device outputs, and other critical fueling parameters. It includes a rugged DMS 1000 lappad, which is usable in all conditions.

This kind of technology is allowing more connectivity and automation across the data sets. Operators can measure multiple factors all in one place including flow rate, density and make-up of the fuel. They can check quickly for any contamination such as water, which can affect the quality of fuel being delivered.

The FlightConnect™ system is being bolted on to existing and new components. In 2015, Liquid Connect announced their new upstream density measurement system at Inter Airport Europe. It makes use of the FlightConnect™ system to eliminate manual fuel weight and density calculations feeding fuel weight into the overall analysis software. Speaking about the product, Steve Sharp, Liquid Control’s Director of Engineering and Product Development said: “Fuel service providers can now provide airline operators with accurate uplift data in their terms, by weight. The SEMS increases the precision of the density measurement and decreases the time in which it is delivered to the customer.”

Combining Talents

As the range of information improves, together with the ability to transfer to connected devices, demand for more effective data management systems will grow. As such, there is a move towards more flexible integrated fuel management software solutions which can monitor multiple data sets all in the same place. Systems such as Fuel Manager from Varec use the latest mobile computing, internet and wireless technology to provide a paperless ticketing service which the company argues could potentially save airlines millions. The automated technology saves time and money at every point of the process from capturing fueling data, to dispatching aircraft, accounting information and detecting foreign objects in fuel. Rather than having agents manually recording start and finish values, performing complex calculations and collating multiple sources of data, the system does that all automatically. The result is gains throughout the process – time savings, error reduction.

This move away from paper administration and accounting brings in multiple technologies from different players. In making the transition, therefore, developers of products are collaborating by bringing their respective skills together to produce a unified effective system. Varec and Liquid Connect announced a partnership between their two systems in 2015. In a world of increasingly sophisticated interlocking technologies, smaller independent partners are taking the view that it’s better to be in it together.

Looking to the Future

The future, therefore, is in an interesting place. Over the next few years we can expect to see the evolution and development of wireless reporting enabling further increases in accuracy and a greater range of information. As it does so, it opens up multiple gains for airport operators and airlines alike – the opportunity to save money, time and emissions.

Making the most of these advantages relies, as always, on how new technology is integrated into existing systems and practices. Developers are working hard to ensure their products are as compatible as possible with different systems. Operators may face resistance in switching to new ways of working, but once technologies prove themselves, they can overcome most of the barriers placed in their way. Meanwhile the technology continues to evolve and companies are producing ever-more sophisticated devices.
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- Thought Leadership – Advice and guidance from internationally recognised key opinion leaders in the airport industry.
- Peer Input – Contributions from senior airport industry professionals.
- Independent Editorial Content – Expert and authoritative analysis from award winning journalists and leading industry commentators.
- Unbiased Supplier Provided Content.
- Designed to facilitate debate.
- Written to the highest professional standards.