



Zebra Enterprise Solutions

# Equipment Fleet Management for Aviation



# Optimize Your Fleet Operations and Lower Your Capital and Operational Expenditures

The typical airport operates hundreds, if not thousands, of pieces Ground Support Equipment (GSE). However, fleet managers are often blind to the utilization of that equipment, as they don't have visibility into its location, use and status. The absence of real-time data on these specialized, high-value assets often becomes a major logistical challenge in the aviation industry, particularly for Fleet Managers.

Zebra Enterprise Solutions addresses these challenges through an electronic visualization system, Equipment Fleet Management (EFM). By instrumenting ground equipment with telemetry systems, the Equipment Fleet Management solution is able to provide real-time asset management capabilities that not only track hardware utilization, but also monitor equipment functionality, determine vehicle operator qualifications and enhance the overall safety of the personnel operating in and around the equipment. The EFM solution captures real-time data directly from the equipment, thus providing the basis to optimize the ground operations' activities on-site and beyond. The collected equipment positions and equipment status derived from real-time telemetry is displayed on a digital map as it happens. The status of the GSEs is easily identified through color-coding. For instance, the map shows where the equipment is and whether the equipment is working or available. As a result, the Zebra solution reduces costs, mitigates risks and improves fleet efficiency. At the same time, EFM helps with equipment optimization, and safety, while lowering the impact on the environment.



## EQUIPMENT FLEET MANAGEMENT BENEFITS:

### Optimize the Fleet Operations

- Improve equipment response times and fact-based decision making
- Increase availability and productivity
- Improve return on your assets
- Secure extra revenue by billing correctly and preventing under billing

### Optimize the Use, Size & Maintenance of Your Fleet

- Reduce capital expenditures
- Reduce costs for maintenance, repair and operations
- Lower total cost of ownership
- Extend asset life cycles and warranties
- Prove adherence to your agreed Service Level Agreements

### Increase Safety & Security

- Provide access control to the fleet
- Detect safety violations
- Reconstruct incidents and audit safety practices
- Enforce flexible no-go zones (Geofencing)

## Our Fleet Asset Management Solutions

The modular approach of Zebra's solutions allows for utmost flexibility and fastest time to value to address the following departmental business requirements:

- Maintenance Management
- Operations
- Safety & Security

### Industry Expertise in Aviation

As experts in the aviation industry, Zebra Enterprise Solutions focuses specifically on the airport ground operations market. With full understanding of customer needs always being of highest importance, we always keep a close eye on the market to quickly incorporate new requirements and market trends.

### A Technology for every Purpose

Zebra Enterprise Solutions applies the vast spectrum of technologies available within the Zebra family. A deep knowledge of both the aviation industry as well as information technology, complemented by Zebra's full wireless location and communication solutions portfolio distinguishes Zebra Enterprise Solutions from all its competitors. However large or small the airport operation, however simple or sophisticated the requirements, the Zebra family's joint portfolio from a single source is unique in our market space worldwide.

### Hardware

With access to the entire range of hardware available within the Zebra family we can tailor our solutions individually. Depending on the requirements we can also apply multiple technologies to complement each other, e.g. RFID transponders on non-motorized assets and the Infoman on motorized ones.

The Infoman is a sophisticated, flexible and powerful hardware computing device for electronic data capture on all kinds of fleet assets. Even the standard version fulfils many of the demanding requirements usually associated with innovative telematics systems, not to mention a toolbox of accessories enhancing the Infoman's benefits further.



# Operations

## A PICTURE SPEAKS MORE THAN A THOUSAND WORDS ...

...AN ANCIENT SAYING BUT STILL AS VALID TODAY AS IT WAS HUNDREDS OF YEARS AGO. EVEN MORE SO IN A MODERN AVIATION HUB ENVIRONMENT WHERE HUGE GEOGRAPHICAL AREAS AND DISTANCES POSE PARTICULAR CHALLENGES TO BOTH THE AIRPORT OPERATOR AS WELL AS ANY ORGANISATION OFFERING ITS SERVICES ON THE GROUND. AIR TRAFFIC INCREASING STEADILY, SAFETY AND SECURITY CONCERNS ON THE RISE, PROGRESSING MARKET LIBERALISATION AND GROWING PRESSURE ON PROFIT MARGINS OFTEN DEMAND DRAMATIC CHANGES IN BUSINESS PROCESSES. VISIBILITY AND TRANSPARENCY COME TO MIND, TWO BUZZ WORDS SYNONYMOUS WITH ANY MODERN BUSINESS ENVIRONMENT.

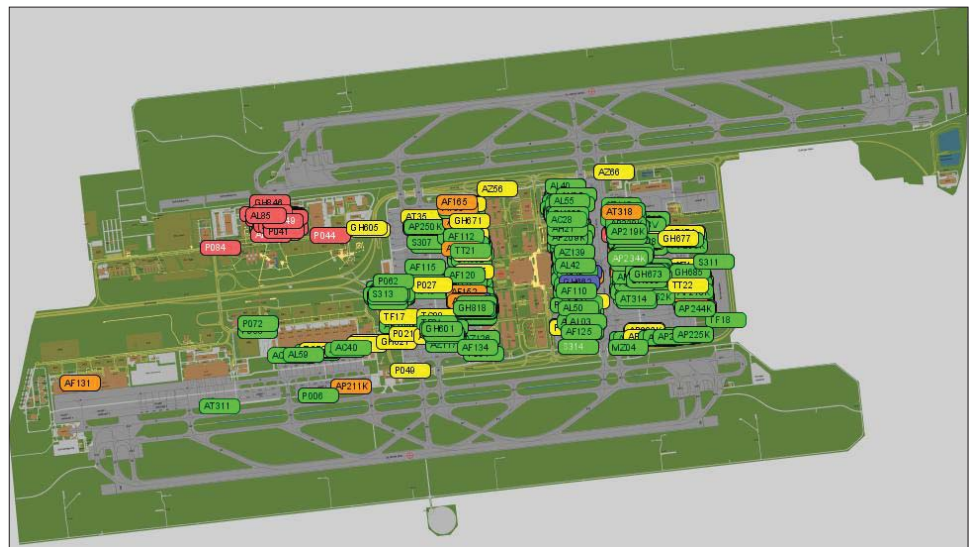
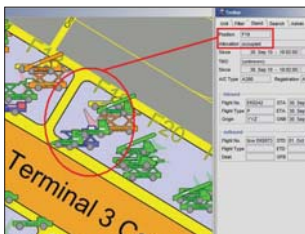
Why introduce change to the ground handlers' business practice, after all it has been proven over the years? Because, a change in customer expectations and dramatic increases in traffic also demands a change in business processes on the apron, not only to sustain the existing business, but especially to keep pace with the rapid changes aviation is facing these days. With more and more smaller airports turning into regional gateways the pressure is on, existing hubs have to defend their competitive edge.

### Airport Map

The airport map is an electronic map of the airport apron in SVG (Scalable Vector Graphics) format. It allows the use of a single screen overview of the complete apron area and infrastructure showing all fleet assets and their respective location and statuses. Visualization of all processes on the airport map offers the benefit of graphic representation, either in real-time or replay mode in case of historical events, optionally also with a "snail trail" showing the equipment's route taken. The airport map provides for a consolidated bird's eye view of what happens on the apron allowing management and operations personnel to take the right decision ad-hoc and based on facts rather than verbal communication, or worse even speculation. All data generated through the Infoman can be displayed, filtered and searched for on the airport map.

### Asset Viewer

The asset viewer enables the system user to view all motorized or towed GSE, any other vehicle or self-propelled equipment such as catering trucks, fire engines, service or security cars etc., on the Airport map. Additional options cater for the visualization of relevant flight data related to each aircraft stand as well as passenger bridges.



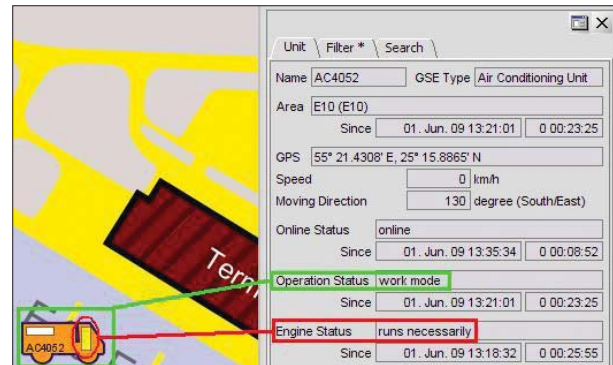
## Time Management

RAMP SERVICES, MARSHALLING, PUSHING/TOWING AIRCRAFT, FUELING, GROUND POWER SUPPLY, DE-ICING, COOLING/HEATING, CATERING OR LOADING – THESE ARE ONLY SOME OF MANY PROCESSES OCCURRING BY THE THOUSANDS OVER AND OVER AGAIN AT MAJOR AIRPORTS AROUND THE GLOBE. DESIGNATED AS EITHER TERMINAL OR AIRSIDE OPERATIONS, ZEBRA'S SOLUTIONS FOCUS ON THE AIRSIDE ONES AS THE COMPLEXITY OF TASKS AND THE DIVERSITY OF REQUIRED EQUIPMENT ARE FAR MORE EXTENSIVE AND SOPHISTICATED.

Obviously, ground handling management has to deal with these very diverse tasks. Airlines pay for the most part for the delays that their aircraft experience and therefore strongly emphasize the time-efficiency of ground operations provided either by themselves, or the airport authority or independent service providers. It makes the task even tougher for ground handlers whose efficiency does not rely on technology-advanced GSE and information support systems.

### Status and Location Monitoring

Status and location monitoring enables the dispatcher to select a unit based on real-time data not only by knowing the current location but also the unit's operation status (working/available/out of service/stand-by/ driving) as well as its engine status (off/running necessarily/idling). These statuses are determined by individually defined parameters as per the ground handler's business processes and are composed electronically by the Infoman hardware device without human intervention. A distinct differentiation between the different engine statuses further allows for the identification and subsequent reduction of engine idling hours (e.g. due to air conditioning in the driver's cabin) leading to substantial savings on fuel and maintenance costs whilst typically extending hour-based warranty periods. A reduction in carbon emissions is a positive side effect contributing towards the achievement of your environmental targets.

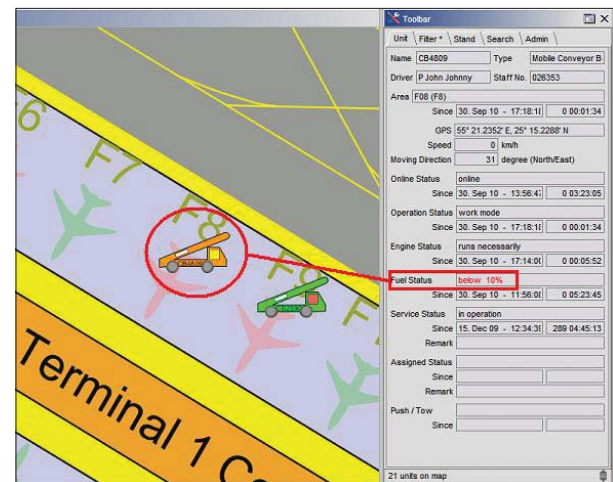


### Fluid Monitoring

Fluid Monitoring optimizes the processes related to fluids and liquids of all kinds in your fleet's tanks. Whether fuel, de-icing chemicals or fresh/waste water, unnecessary filling or emptying of tanks may be reduced by up to 50+ % leading to an increase of GSE availability on the apron. Moreover it allows the prioritization of the units according to their existing fluid levels for process efficiency.

### Billing Support

Billing support is a valuable feature for airport ground handlers to electronically capture billing data for value added services usually charged by time according to consumption by the airline customer. Data discrepancies and internal delays until invoicing to the airline can easily be eliminated adding positively to both cash flow and the company's bottom line.



## VALUE PROPOSITION

Our Operations-focused applications offer many other direct and complementary benefits derived from the visualization of all fleet assets on the apron. The real-time information of where your GSE and vehicles are and what they are doing is no longer a 'nice-to-have' but rather a necessity to keep the competitive edge. However, the data available is not exclusively for your Operations team's use but monitoring and analyzing your fleet's utilization pattern inevitably leads to process changes thus improving service levels and efficiency whilst reducing your operational expenses.

# Safety & Security

## INCREASING SAFETY WHILST REDUCING COSTS

THE NEED FOR AIRPORT SECURITY AND SAFETY IS PARAMOUNT. AIRPORTS AND THEIR SERVICE PROVIDERS GENERATE REVENUE FROM THE FACILITIES AND SERVICES THEY PROVIDE, SO THEY SEEK TO MAXIMIZE THEIR POTENTIAL REVENUES BUT MUST DO SO WITH SAFETY AND SECURITY FOREMOST IN THE OPERATORS' MINDS. UNLIKE OTHER COMMERCIAL ENTERPRISES, AIRPORTS ARE VULNERABLE SITES IN TERMS OF SECURITY AND THE VITAL NEED FOR PRECISE AND SAFE OPERATIONS IS OFTEN AT ODDS WITH PROFITABILITY OR ATTEMPTS TO OPTIMISE THE COST OF OPERATIONS.

These contradictory demands have created a critical need for greater efficiency at airports. Where in other industries this equates to leveraging emerging technology to optimize process design, airports have additional complex requirements. Their operators and service providers must attempt to maximize capacity, while simultaneously enhancing safety and security, customer experience and growing revenues. This is a complex task for airport business management especially due to the significant increases in the volume of passengers and freight stretching many of the world's airports beyond their physical limits.

### Access Control

Access control to any fleet asset on the apron is just one of many hot topics these days. How do you as the airport operator, ground handler or third party service provider ensure that only authorized personnel operate specific types of ground support equipment or individual vehicles? Whether through the use of an iButton, swipe card or any other means of identification, our solution offers flexible options to increase airport safety and security through transparency, driver accountability and increased responsibility.

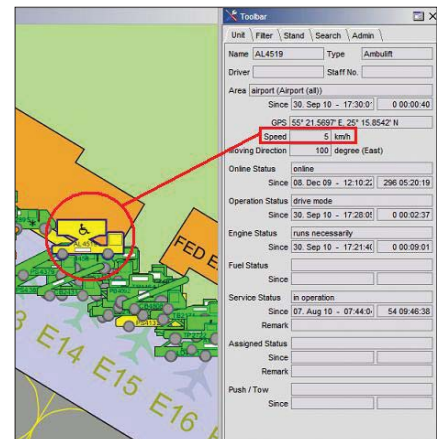
Name	GSE Operator	Start Area	Start Time	End Time	End Area	Duration
T16	Wood M.	A13	21.02.08 07:27:51	21.02.08 07:31:01	A11	00:03:10
T16	Thomson O.	A11	21.02.08 07:44:24	21.02.08 07:51:06	A13	00:06:42
T16	Meath U.	A13	21.02.08 16:28:02	21.02.08 16:28:04	A13	00:00:01
T16	Roberts I.	A13	21.02.08 16:28:13	21.02.08 16:33:48	E	00:05:34
T16	Roberts I.	E	21.02.08 16:37:41	21.02.08 16:39:27	E	00:01:45
T16	Roberts I.	E	21.02.08 16:51:53	21.02.08 16:54:00	B21	00:02:07
T16	Kinlan K.	B21	21.02.08 17:12:27	21.02.08 17:13:56	A13	00:01:28
T16	Lewis R.	A13	21.02.08 21:08:56	21.02.08 21:30:07	A13	00:21:10

### Motion Monitoring

Adherence to speed limits is yet another issue high on the agenda of airport managers. With permanent pressure on time due to slot limitations and faster turnaround times for the aircraft, literally every minute counts. Should this however jeopardize airport safety through non-adherence to basic rules and regulations? Of course not! But how do you monitor drivers' or operators' behavior by sitting in a control room sometimes miles away from where it happens? Let the Infoman do it on your behalf. Our Speed Monitoring application keeps a permanent eye on your fleet and reports on all irregularities over and above a pre-defined threshold.

### Impact Monitoring

Have you always wondered how certain damage to your fleet occurred – those dents or scratches nobody feels responsible for? Zebra's impact sensors will soon give you the answers as to the "where" and "when," and by implementing access control over and above you also know the "who." Finding out the "why" is now made simple ensuring full accountability and responsibility by those concerned.



### Geofencing

Taking safety and security to the next level through geofencing by restricting the movement of a vehicle or other fleet asset within a specified area. The location of the unit is monitored by GPS (Global Positioning System) and an alarm will be raised if it leaves its authorized area. Zebra's Geofencing is available both driver and/or equipment-related.

## VALUE PROPOSITION

There will never be 100% safety and security in any business environment, but Zebra's solution will take you a further step in the right direction to improve the visibility, responsibility, responsiveness and accountability within your airport operations. Moreover fleet accountability by its operators inevitably leads to substantial reductions in GSE repair costs and down time.

# Maintenance Management

## REDUCING YOUR MAINTENANCE EXPENSES BY UP TO 40%

MANAGING FLEET ASSETS ON THE APRON HAS BECOME INCREASINGLY COMPLEX DUE TO ADVANCES IN TECHNOLOGY, CHANGES IN SECURITY, INCREASED TIME PRESSURE AND RISING COSTS. MAXIMISING THE AVAILABILITY AND PERFORMANCE OF THE AIRPORT FLEET, IN PARTICULAR GROUND SUPPORT EQUIPMENT, IS MORE CRITICAL TO SUCCESS THAN EVER BEFORE. TODAY, BOTH FLEET AND MAINTENANCE MANAGERS MUST MAKE IMMEDIATE AND STRATEGIC DECISIONS, REQUIRING EFFECTIVE DATA ANALYSIS CAPABILITIES AND AD-HOC REPORTING. THEY ALSO NEED TO GET ASSET MANAGEMENT INFORMATION INTO THE HANDS OF MAINTENANCE ENGINEERS AS QUICKLY AS POSSIBLE IN ORDER TO REDUCE EQUIPMENT DOWN TIME AND AVOID UNNECESSARY EXPENSES.

With time being of the essence in any airport environment, the dependency on real-time information is mission critical. Long gone are the days when pen and paper took care of the maintenance activities of a few dozen units, engine hour readings were taken manually within an hour or two and the maintenance team knew well in advance when to expect which unit for the next service, inspection or any other planned workshop activity. Nowadays we are dealing with hundreds, if not thousands of equipment, traffic peak periods often span more than 12 hours every day, and the sheer size of today's airports simply does not allow any wasting of time.

### Electronic Capture of Engine Hours and Maintenance Forecasting

Based on each unit's individual past utilization pattern our maintenance forecasting application calculates automatically the due date for the next preventive maintenance job, inspection or any other planned workshop activity. Rather than over or under maintaining your fleet, the Infoman automatically captures all engine hours based on which your maintenance workshop or engineering department will be able to carry out engine hour-based maintenance using electronic data. To derive additional benefits engine hour and maintenance data can also be exchanged with any external maintenance management system through seamless integration.

GSE ID	Overdue	Current Engine Hrs	PM due at Eng Hrs	Remaining Engine Hrs	Average Eng Hrs/Day	PM due in Days	Expected Date
F25	✘	5915	5553	-362	17.23	-21	08.10.2008
D43	✘	4478	4428	-50	16.60	-3	26.10.2008
F21		6194	6194	0	17.53	0	29.10.2008
G20		4625	4625	0	5.88	0	29.10.2008
F75		3254	3254	0	10.55	0	29.10.2008
D10		7829	7829	0	15.20	0	29.10.2008
E32		2875	2875	0	13.00	0	29.10.2008
G42		3456	3456	0	11.25	0	29.10.2008
E86		6835	6835	0	16.75	0	29.10.2008
E14		7854	7860	6	6.20	1	30.10.2008
G25		2568	2581	13	12.75	1	30.10.2008
D31		7851	7859	8	7.80	1	30.10.2008
E58		2698	2716	18	18.20	1	30.10.2008
D62		1035	1046	11	10.75	1	30.10.2008
F44		6752	6766	14	13.70	1	30.10.2008
G68		3854	3869	15	15.08	1	30.10.2008
G71		9254	9266	12	12.26	1	30.10.2008
E74		5678	5708	30	14.87	2	31.10.2008
F08		7185	7204	19	9.64	2	31.10.2008

### Condition Monitoring

Why depend on operators' attention to report a fault, irregularity or malfunction on your fleet? Our condition monitoring capabilities obtain error signals from the GSE and convert them into meaningful alerts and notifications for your maintenance and operation teams. Whether a signal for engine overheating, low oil pressure, failed air-conditioning on a catering truck or any other malfunction is triggered, your response teams and management will know about it as it happens and can take the appropriate action.

Name	Notification	Date	Time	Duration until now
04-60	Oil pressure deficiency	30.09.10	00:00:12	17:52:49
04-60	Cooling water temperature	30.09.10	00:00:12	17:52:49
03-46	Oil pressure deficiency	30.09.10	00:00:55	17:52:06
03-46	Engine excess temperature	30.09.10	00:00:55	17:52:06
04-66	Oil pressure deficiency	30.09.10	00:02:15	17:50:46
04-66	Cooling water temperature	30.09.10	00:02:15	17:50:46
04-56	Cooling water temperature	30.09.10	00:02:23	17:50:38
05-51	Oil pressure deficiency	30.09.10	00:02:26	17:50:35
05-51	Cooling water temperature	30.09.10	00:02:26	17:50:35
07-27	Collective alarm	30.09.10	00:02:49	17:50:12

### VALUE PROPOSITION

A changeover from calendar based to engine hour based maintenance alone may reduce maintenance expenses by up to 40%. Reduced time in the workshop means increased time on the apron – that's where your fleet assets belong so as not to become a liability to your organization.

# Reporting & Analysis

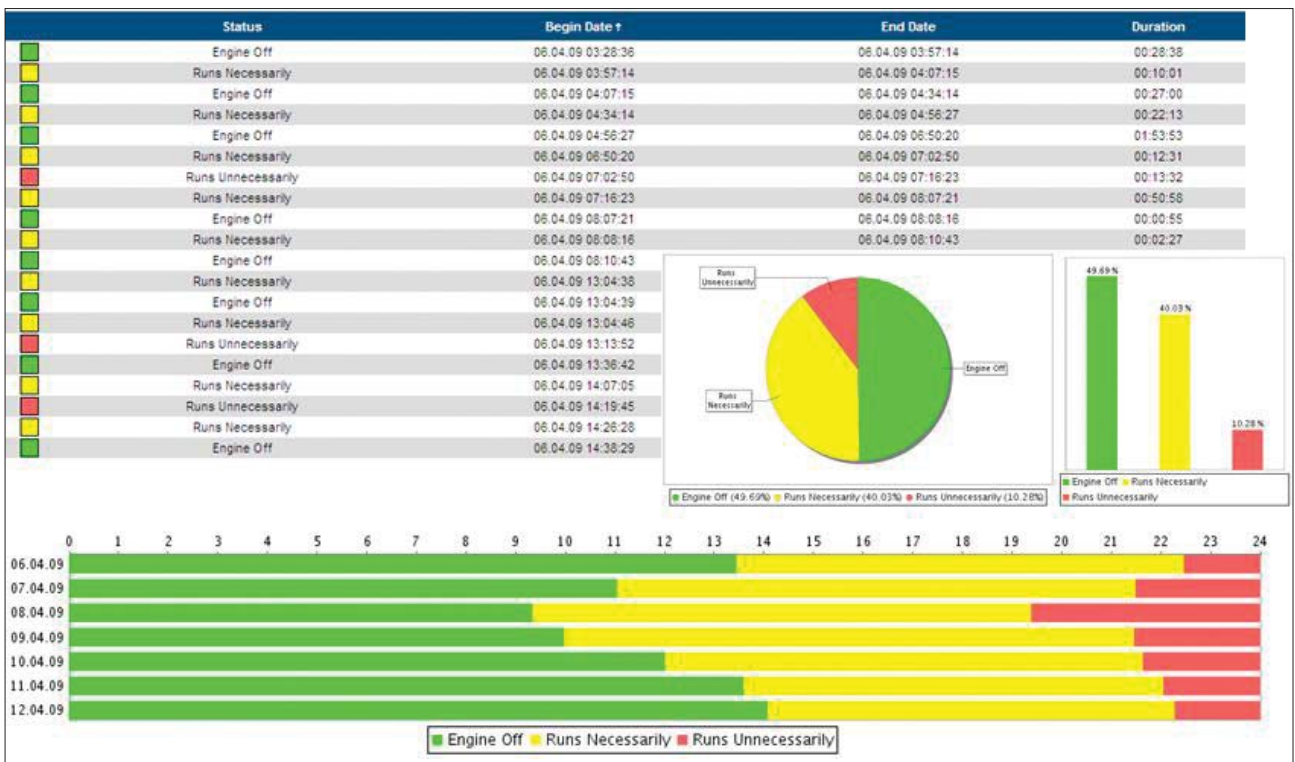
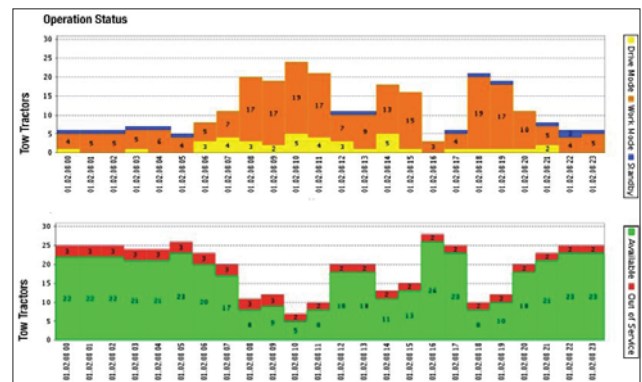
## FACTS RATHER THAN SPECULATION

EXECUTIVES NEED BUSINESS INFORMATION THAT SUPPORTS THE WAY THEY WORK TODAY. NOT JUST ANY INFORMATION THEY WANT, BUT RELEVANT DATA DELIVERED THROUGH ENTERPRISE REPORTING AND ANALYSIS FUNCTIONALITY APPROPRIATE TO THEIR TASK. TODAY'S BUSINESS IS ALL ABOUT COMPLETE VISIBILITY AND TRANSPARENCY INTO ORGANISATIONAL PERFORMANCE AND TO DELIVER THE CRITICAL INSIGHT INTO OPERATIONS THAT YOUR STAKEHOLDERS AND EXECUTIVES DEMAND.

Zebra solutions offer both real-time data as well as historical information about your business processes. Gone are the days when decision making was based on assumptions or because somebody said so'. We offer a comprehensive suite of reporting and analysis tools with an array of features ranging from tabular and graphical business reports, on-line KPIs (Key Performance Indicators) on individually configurable dashboards, historical event analysis, capture of billing data to electronic incident reporting by email or other means of communication.

### Standard Reports

Many standard business reports are readily available within the solution addressing the common issues across the ground handling world, however, due to the flexible architecture of the system further reports may be configured easily according to particular requirements. Moreover through standard interface technology any kind of raw data may be exported to external report writing applications. Standard reports are either in table or graphical format and present both real-time as well as historical data captured by any component within Zebra's Equipment Fleet Manager solution. Key performance indicators on the dashboard give management a unique tool for taking action instantly in case certain pre-defined parameters are reaching or have exceeded a critical level.



## Airport Map Replay

Whereas the airport map would be used in the day-to-day operation in real-time mode, a replay mode is also available for historical event analysis by viewing a particular past incident in a movie-like manner at a speed of between 1:1 and 1:60. Whether investigating an accident, a breach of safety and security or identifying the party at fault in case of a flight delay, the replay feature offers valuable support for accountability and responsibility in many processes on the apron.

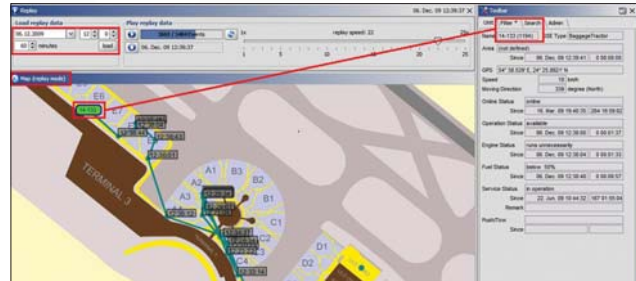
Group Performance Indicators: All Tow Tractors			
Efficiency	Availability	Utilisation	Fuel Efficiency
52.00%	91.00%	64.00%	85.00%

Performance Indicators: Individual Units				
Name	Efficiency	Availability	Utilisation	Fuel Efficiency
LM01-01	71.00%	100.00%	83.00%	87.00%
LM01-02	43.00%	92.00%	62.00%	96.00%
LM01-03	37.00%	89.00%	51.00%	76.00%
LM01-04	52.00%	77.00%	59.00%	91.00%
LM01-05	41.00%	97.00%	44.00%	92.00%
LM01-06	69.00%	88.00%	82.00%	69.00%

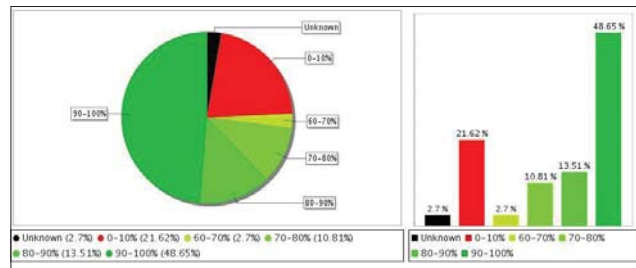
## Equipment Messenger

The equipment messenger works similarly to a common workflow tool by processing error notifications and any other kind of alerts to inform system users, in particular hands-on personnel on the ramp. by email, SMS and other means of communication about important incidents. The moment any pre-defined parameters or event occur the messenger will notify the right people concerned allowing them to take the appropriate action.



## VALUE PROPOSITION

Many standard reports and KPIs form part of the overall Equipment Fleet Manager solution giving management the right information, where they need it, when they need it. Decision making based on assumptions rather than facts is no longer a luxury due to the 24x7 availability of all mission-critical information.



Zebra Enterprise Solutions, a division of Zebra Technologies Corporation, extends Zebra’s reach beyond passive RFID by employing state-of-the-art software and hardware solutions to locate, track, manage, and optimize high-value assets, equipment and people across the world’s largest supply chains. Whether tracking containers through a port, optimizing parts for manufacturing, or managing ground support equipment at an airport, the real-time asset management solutions from the combination of Navis, WhereNet, proveo, and Multispectral Solutions provide improved visibility and velocity to gain measurable business improvements. Utilizing products that are based on ISO/IEC 24730-2, Cisco CCX Wi-Fi, precision GPS, and UWB technologies, Zebra Enterprise Solutions offers a wide range of location solutions that are “application matched,” enabling its customers to put the right asset in the right place at the right time. For more information about Zebra Enterprise Solutions visit <http://www.zebra.com/zes>

For more information please visit us at [www.zebra.com/zes](http://www.zebra.com/zes)

