

May 2017

Volume 4, Issue 6

The Dispatcher

Special interest features covered in each issue:

- Driving automation
- Map data and navigation
- Data privacy
- Third party automotive services
- Regulations and Standardization

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An attendee of the **SMMT Connected 2017 conference on autonomous vehicles** in London, U.K., on Thursday, March 30, 2017 gazes at an autonomous vehicle developed by Oxbotica. Behind him is an RDM Autonomous Vehicles Pod vehicle. (Photograph by Chris Ratcliffe - Bloomberg)

Telematics Industry Insights by Michael L. Sena

Report from Dispatch Central

TRUCKS AS WEAPONS

ON THE FIRST week after a stolen truck was used as a weapon by an assailant to kill four people and injure fifteen others by driving it at high speed down Stockholm's principal pedestrian thoroughfare, the Swedish government invited the country's vehicle manufacturers and other interested parties to meet and discuss what measures might be taken to prevent a recurrence of Friday's tragedy. In January of this year, the U.K.'s Home Office's scientific wing began investigating technologies that would stop a vehicle's engine if it was hijacked. The project was dubbed 'RESTORE' (REmote STOPping of Road Engines). A so-called 'kill switch' (not the best term to use in this case) might have helped in Stockholm, where the truck's driver drove around the block before entering the pedestrian precinct, but not in the Westminster Bridge and Parliament attack in March, where there was no pre-warning.

It has been technically possible to remotely stop or slow down vehicles ever since the first two-way wireless systems were installed over twenty years ago. It is also technically possible **today** to force vehicles to stop at red lights and stop signs, to travel no faster than the speed limit, to inhibit them from driving on pedestrian-only

streets and sidewalks (geofencing), to prevent them from crossing into the opposite direction of travel lane and crashing into an on-coming vehicle, to not start if the person behind the wheel is too inebriated, drugged or sleepy to drive safely, and to make it impossible for them to slam into buildings while loaded with explosives. It is not the vehicle industry that is inhibiting these measures from being taken; it is the lawmakers and their libertarian view on personal privacy and integrity that stops all attempts at controlling vehicles so that they are not used as weapons.

It is very interesting that these same lawmakers are now falling all over themselves to open their roads to robot-driven vehicles that will, in principle, obey the very laws that humans have difficulty accepting and dwindling police forces struggle to enforce. We do not need government task forces. The vehicle industry simply needs to be told the rules of the road even when their drivers have other thoughts. It is not a matter of turning our vehicles over to robots, but making our vehicles safe to drive by humans.

TomTom and Its Sphere

TOMTOM'S MAP DIVISION and Bosch have good reason to be partners (see diagram on page 5). They were hatched from the same egg. That was more than 20 years ago, and there are few who remember and many fewer who care. I believe it is an important factor to consider when evaluating the relative strengths and weaknesses of the two major digital map spheres, TOMTOM's and HERE's. In 2015, TOMTOM and BOSCH extended their cooperation to cover map

data for highly automated driving.

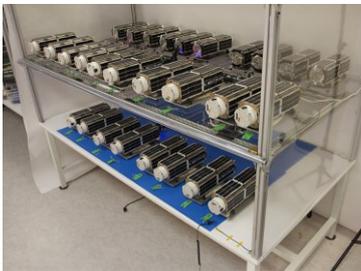
APPLE uses TOMTOM's maps for its iPhone/Pad map application. Whether it was price or the fact that MICROSOFT uses HERE, it opted for TOMTOM and has a strong interest in improving the map data. Qualcomm's rival, INTEL, is now an owner of HERE, so it was easy to choose to work with its rival. In February of this year, the companies announced a part-

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PLANET LABS AND ITS SWARMING SATELLITES

PLANET LABS INC. is a company founded in 2010 by a team of ex-NASA scientists. It is headquartered in San Francisco. The founders set themselves a mission: Image the earth land area every day. (The USGS Landsat 8 and Landsat 9 satellites image the entire Earth every 16 days.1)

They took a novel approach, compared to many start-ups. They actually design and manufacture their own product, rather than outsourcing production to a low-cost country. Their satellites are called Doves, shown here on shelves. These miniaturized satellites can fit in a shoebox.



They learned how to manufacture them at scale; constructed the world's second largest private network of ground stations; custom built an automated mission control system; created a massive data pipeline able to process the vast amount of imagery which satellites collect; and developed a software platform that lets customers, researchers, governments and NGOs access imagery quickly.

On February 14, 2017, Planet Labs successfully launched 88 Dove satellites to orbit—the largest satellite constellation ever to reach orbit.

Have a look at their site. The high resolution imagery is really impressive. www.planet.com

Car Makers: Don't Forget the Other Half

CAR MAKERS IGNORE—or miss—demographic trends at their peril. When a car was used during the week to get one or the other parent to work, and on the weekend to take the family to religious services and visit the grandparents, a sedan was perfect. Station wagons (a.k.a. estates, carryalls, suburbans) started out as commercial vehicles, but became popular alternatives to sedans in the U.S., U.K. and Sweden in the '50s and '60s as do-it-yourself and driving vacations began in earnest and more carrying space was needed. Also in the '60s, when baby boomers headed off to colleges in big numbers, used VW Beetles offered a cheap and cheerful entry-level vehicle for the cash-strapped students.

In the late '70s and early '80s, Baby Boomers began getting married and leaving their post-college apartments in cities for homes in the suburbs. If they had a car at all before, they needed a multi-duty one now, and the minivan fit the bill to a T. Chrysler, which introduced the first minivan in 1983, had the market to itself for a while, but then most of the other OEMs piled in. Sales of the minivan segment peaked in 2000 but SUVs entered the scene in '97 and quickly took hold. Chrysler, which had bought the Jeep brand from American Motors in 1985, led the way with SUVs as well. Some companies, like Saab, Volvo, BMW and Audi, missed the minivan era and were half-hearted, late starters in SUVs until they convinced themselves it wasn't a fad led by over indulgent YUPPIES, but a product that met the requirements of a wide range of demographics: young and old; single and married; urban and rural; wealthy and not-so-wealthy. Crossovers and pickups are now having their surges.

There is a lot at stake for car companies to get their model mix right. Saab never did. The key is to have the right vehicle ready to sell at the right time. That Ford's F-150 and the other pickups are selling so well has everything to do with demographics, but you don't see any New York or London car analysts making the point because it's not a big city phenomenon. Travel to Framingham, MA, thirty-five kilometers west of Boston, and you will find pickups everywhere. In 1989, GM shut its assembly plant in the city putting 2,100 employees out of work. Today, 16% of the population is below the official poverty line, compared to 2.4% in wealthy Wellesley only ten kilometers to the east. Hispanic and Latino families, especially Brazilians, have taken advantage of depressed house prices and access to the wealthier suburbs to start their own businesses built around a pickup: gardening, roofing, painting, masonry, carpentering and fix-it-all operations. When there are no jobs to be had, make your own. I saw the same phenomenon in the 1990s in the Maynard, MA area where Digital

Cars reflect our lives



1957 Chevrolet Bel Air Townsman. Two-toned and too cool. (Photo by Josephew)



A VW Beetle, cheap and cheerful entry into the world of car ownership. The Author's first set of wheels. \$300, six years old.



Yuppiemobile in the U.S. of the early '90s. It took a decade for the Europeans to accept it.



Ford F-150 at home on the range. No condos in sight.



Jaguar F-PACE took home two 2017 World Car Awards honors: World Car Design of the Year and World Car of the Year.

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Blockchain Beyond Bitcoin: Is there a life?

WHEN YOU HEAR the word 'Bitcoin', what comes to mind? High risk; money laundering; sinister plots to undermine national governments? Or do you simply think 'digital currency'. It's money, isn't it, just not money controlled by a country? Money is "something generally accepted as a medium of exchange, a measure of value, or a means of payment".² The payment can be for goods and services or repayment for debts. Money systems are almost all based on 'fiat money', which is without use value as a physical commodity and derives its value by being declared by a government to be legal tender. That means it must be accepted as a form of payment within the boundaries of the country for all debts, both public and private. The money supply of a country consists of currency and bank money. Currency is bank notes (e.g., a \$10 bill or a £10 note) and coins. Bank money comprises the balances held in checking accounts, savings accounts and other types of bank accounts, which are mostly computerized records.

Bitcoin is most often referred to as a 'digital money'. What does that mean? Since it is not physical, it is not a currency. It is more like bank money. It can be used in many of the same ways as bank money, to pay for goods and services, but not all goods and services

accept payment with digital money in general or bitcoin in particular. The reason this is so has mostly to do with risk. With a physical currency, the main problem one has is the fluctuations of its value that result from government actions or world events causing inflation or deflation. However, within a country, one unit of currency today will be one unit of the same currency tomorrow. That unit may buy more or less, particularly goods and services purchased from other countries, depending on its value relative to the currency of the other countries. The cost of buying one bitcoin today can be one-half or twice as much as buying one bitcoin tomorrow. The price depends on demand, like that of a stock, and like stock, bitcoin is intangible property. The U.S. Internal Revenue Service defines bitcoin as property, not as a currency. The U.S. Federal Reserve says that it has no authority to regulate digital money. A bitcoin account is not insured by government agencies, like FDIC in the U.S., and the Financial Industry Regulatory Authority has issued a warning stating that digital money is 'more than a bit risky'.

In order for a digital money system to work at all, people have to have faith that whatever money they put into it will not leak out. They should be aware of and accept the risks of the value fluctuations before

they exchange their real money for digital money, but they should be confident that the organization that has created the digital money won't steal it from you or allow third parties to do so. If you put a U.S. Dollar in a bank and the bank is robbed, the bank (not the FDIC) will make sure you get your Dollar back. If the bank fails, all of your money up to \$250,000 will be returned. If someone hacks bitcoin and transfers the bitcoins in your account to their account, you are out of luck.

So this is why the inventor(s) of bitcoin decided to invent a technique for managing transactions that, at least in theory, is difficult to compromise. The invention is **blockchain**. The inventor is a person or a group of people known as Satoshi Nakamoto.³ His/their real identity is not known. The invention was not patented before it was released in 2009. According to Don Tapscott (author of *Wikinomics*) and his son Alex who have written the definitive book on the subject, "At its most basic, the blockchain is a global spreadsheet—an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value and importance to humankind. This ledger represents the truth because mass collaboration constantly reconciles it. We will not need

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BLOCKCHAIN BASICS

Blockchain is a made-up word, concatenating 'block' and 'chain'. The two words provide a good place to start when trying to understand what 'blockchain' actually means. Blockchain is often referred to as a global spreadsheet or a distributed digital general ledger. Having tried to grasp the basic concepts of the technology, I feel these analogies are unhelpful. Blockchain was created for bitcoin, so it is necessary to refer to the bitcoin process when describing what blockchain is and how works.

A 'block' is a list of transactions that have transpired during a certain period. These transactions must be confirmed or validated, and this is what the so-called miners do. A transaction to send bitcoins from Jane to Joe has three pieces of information:

- An input, which is a record of the bitcoin address used to send the bitcoins to Jane, say from Julie;
- An amount, how many bitcoins Jane is sending to Joe; and,
- An output, Joe's bitcoin address.

Every bitcoin owner has a private key. Alice sends the input, amount and output using her private key. This information is sent to the bitcoin network, which is a group of miners (nodes) with their on-line computers waiting around for something to do. They have a copy of the general ledger into which the result of their work will be placed. They take the block they just received and make a hash of it.⁴ Each block's hash is made using the hash of the block before it, which is already stored in the general ledger copies distributed all over the planet.

Miners currently receive 25 bitcoins for completing the validation. That's around \$30,000. Making hashes is relatively easy. Bitcoin has made it harder so that the miners feel they had to sweat like real miners, instead of ersatz ones, to earn their pay. The extra step is called 'proof of work', and it involves an extra piece of data called a 'nonce'. The miners must iterate to find the correct value of the nonce, and all the while a number of them are competing to complete the transaction first. When it's done, the block is added to the chain of blocks in the ledger and sent to all of the nodes. That's it.

**PRINCETON
SMARTDRIVINGCARS SUMMIT
17-18 MAY 2017
PRINCETON UNIVERSITY
PRINCETON, NJ**

PROF. ALAIN L. KORNHAUSER, PHD is the Director of the Transportation Program and Faculty Chair of Autonomous Vehicle Engineering in the Princeton Department of Operations Research and Financial Engineering. For the past five years he has edited a weekly news feed on the subject of 'smart driving cars', including all things autonomous and driverless. He decided it was time to move past the talk to the action and has organized a conference to bring together buyers, sellers and facilitators of SmartDrivingCars. (I would be attending if previous commitments had not put me in the U.S. for two weeks prior to the conference and required me to be back in Sweden while the conference was running.)

During the morning of the first day there are presentations on the general state of the issues related to autonomous vehicles, including the business case, safety, community impacts and technology. In the afternoon there are discussions on the topics of regulations, insurance and what is actually available today.

The morning of the second day is divided into three parallel workshops: community planning and near-term deployment; insurance (where Jacques Amselem, head of IoT for Allianz, is scheduled to take part); and artificial intelligence and component technology. The closing session in the afternoon addresses modeling urban mobility districts.

You will find the program on the site: www.summit.smartdriving-car.com. If you have the possibility to do so, I would urge you to apply to attend.

Blockchain Beyond Bitcoin (continued from p.3)

to trust each other in the traditional sense, because the new platform ensures integrity." They go on to say: "Picture a spreadsheet that is duplicated thousands of times across a network of computers. Then imagine that this network is designed to regularly update this spreadsheet and you have a basic understanding of the blockchain." The blockchain is not a database that is stored in a single, centralized location. It cannot be accessed centrally and it cannot be controlled by a single entity.

Digital money is not a new concept, and neither is a distributed general ledger. What is new is the method developed by Nakamoto to verify transactions, which are purchases or sales of goods or services, or purchases or sales of bitcoins, or the creation of new bitcoins. It was a stroke of genius to connect the creation of new bitcoins with the task of verifying transactions. A new job category was created with a title: *Bitcoin Miner*. (The only rationale I have seen for the bitcoin inventors using this term is because the people who do it receive new bitcoins and bitcoins are a finite resource, like coal or gold, that once 'mined' cannot be replaced. (See the sidebar on previous page for a description of how the transaction process works in practice.)

It seems to me that the bitcoin implementation of blockchain is two steps away from a centralized database, and one step away from a centralized platform enabling peer-to-peer service (e.g. Uber or eBay), but still not as far it could potentially go for a true peer-to-peer functionality. The reason is that the miners serve as a distributed centralized platform because they must perform the verifications. They are getting paid now in bitcoins, but when the limit of bitcoins is reached, they will need to get paid with transaction fees. Full peer-to-peer is reached when everyone transacting on the blockchain can validate their own and others' transactions.

What applications of such a technology, especially of the full peer-to-peer type, could possibly be of interest to the connected car industry? Applications for which we must be certain of the identities of message senders and receivers and when the highest level of privacy should be maintained. Some applications will require immediate validation, such as communication between vehicles, and for these the concept of the 'miner' is antithetical. I have one application in mind that seems to be a perfect fit with a full peer-to-peer blockchain. In the January 2017 issue of *The Dispatcher*, in the article on

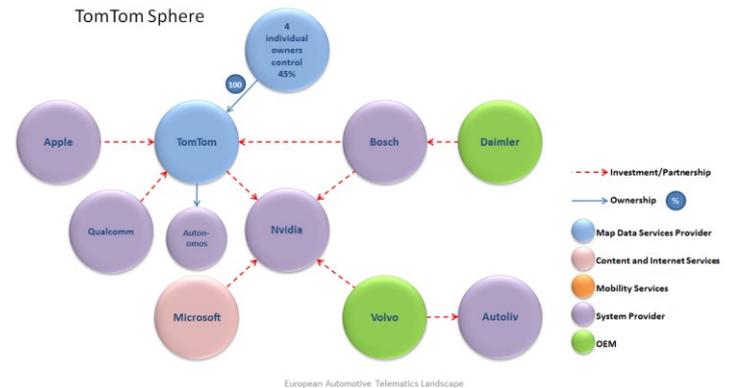
the future of navigation, I wrote about a talk I gave at a meeting of TISA on the future of traffic information. I proposed a system of pre-determined priority for vehicles using a road network. The idea is that vehicles (either the drivers or riders or controllers) of these vehicles would be able to pre-book an arrival time at a desired destination. Start time and route would be pre-defined, and the vehicle would negotiate the route by communicating its priority to all other vehicles. The booking and payment (in digital currency) for the journey would be made with the operator of the transport network. All booked journeys would be entered into the blockchain. Every vehicle would have a copy of the blockchain ledger that includes all the vehicles within its vicinity, constantly updated as the vehicles travel. Every vehicle communicates in real time its cooperative awareness message using its public key ID, signed with its private key and including its pre-established priority.

Depending on the terms of the contract for the journey, intersecting vehicles would either yield or have priority. The route would be modified as needed (due to non-recurring problems that always seem to happen) in order to meet the arrival time. Sound utopic? We'll see.

Automated Driving News: TomTom and Its Sphere (continued from p.1)

nership to use data generated by QUALCOMM chips to feed into TOMTOM's High Definition map data. QUALCOMM Technologies Drive Data is a platform for car sensor analysis based on the *Snapdragon 820 Automotive Processor*. NVIDIA, with its powerful Graphics Processing Unit (GPU) chips, seems to be the darling of the automotive self-driving car enthusiasts. It is also engaged in the HERE sphere. It is in a partnership as well with MICROSOFT in a non-automotive application, using the NVIDIA HGX-1 hyperscale GPU accelerator to drive MICROSOFT's AI cloud computing. More on Volvo and Autoliv in the next issue. A big difference between HERE and TOMTOM is the ownership. The original founders of TOMTOM control it all.

If the TomTom sphere is going to compete, it's time to bring in additional capital through expanded ownership.



Car Makers: Don't Forget the Other Half (continued from p. 2)

Equipment Corp began closing down offices and laying off masses of workers, but the new business owners were mostly college graduates.

Big bets are being made on small electric cars that will be shared or serve as taxis, shuttling city dwellers between home, work and the gym, but the three top selling light vehicles in the U.S. are all pickups. Three out of the top ten are SUVs. Is it just possible that there is a little too much irrational exuberance surrounding the urbanization sensation? There is no doubt that mega cities are growing in size and number, and the proportion of the world's population will be living in urban areas is growing quickly.⁵ However, only two, New York/Newark and Los Angeles, will be in the U.S. and there will be none in Europe.

Trends other than urbanization deserve a look. There are places, such as Italy, Spain and Greece,

where educated professionals are moving to the countryside to find something they cannot find in or near cities: work. These places have endemic unemployment, especially for the young, both with and without professional qualifications. Although most are moving to countries where there are jobs to be had, such as Sweden and Germany, the number of under -35s working in agriculture has grown since 2013. Between 2015 and 2016, the increase was 9.1%. These are not hippie dropouts moving to Vermont. They are looking to find a life, earn a living and contribute to society. Robots need not apply.

At the other end of the spectrum there are a relatively new kind of dropout who work minimally or not at all, live with parents or relatives and spend most of their time submerged in video games. Between 2000 and 2015, the employment rate in the U.S.

for men in their 20s without a college degree dropped ten percentage points from 82% to 72%! 22% of these men had not worked at all in the prior twelve months. This is while the unemployment rate as a whole in the U.S. is 4.8%. Video gaming is an alternative reality that substitutes for careers, friendships and families. This cohort is not going to be buying or sharing cars; they are going to be borrowing their parents' vehicles and mooching rides. It is no wonder that the major proponents of the so-called 'universal basic income' are the companies pushing video opiates and the countries or states that have the greatest numbers of pushers.

Then there is the *Marshrutka* phenomenon. It means 'routed taxi' in Russian. In Moscow the vans are called *GAZelles* because the company GAZ produced the first minivans that drove along the primary and secondary roads

of Moscow picking up and dropping off passengers along the way. These vehicles provide an important supplement to the over-capacity underground and slow, crowded and under-capacity public bus system. Routed taxis have come to New York, where they are called 'Dollar Vans', and carried 125,000 passengers in 2016. They are being used as shuttles for principally new immigrants who cannot afford to own a car or take a taxi, but who still need to get to work and from, mostly in places where public transit does not operate. It's the drivers who make this system work. No robots wanted.

Car and truck companies have done a good job of following societal trends. With driverless cars, car sharing and mobility services, they have been trying to do more leading than following, pushed by both IT companies and stock analysts. Misjudging a market swerve can be as or more painful as missing one. There is a lot happening outside of the big cities where most of the people still live and work. Ignore this at your peril.⁶

Michael L. Sena Consulting AB

Sundbyvägen 38
SE-64551
Strängnäs
Sweden

PHONE:

+46 733 961 341

FAX:

+46 152 155 00

E-MAIL:

ml.sena@mlscab.se

We're on the Web!

See us at:

www.michaellsena.com

Footnotes

1. USGS took over operation of Landsat from NASA in May 2013.
2. Merriam-Webster Dictionary
3. Nakamoto, Satoshi (2008-10-31). "Bitcoin P2P e-cash paper". The Cryptography Mailing List
4. According to Bitcoin Wiki, 'A hash algorithm turns an arbitrarily-large amount of data into a fixed-length hash. The same hash will always result from the same data, but modifying the data by even one bit will completely change the hash. Like all computer data, hashes are large numbers, and are usually written as hexadecimal.'
5. UN Population Division and World Economic Forum: Outlook of the Global Agenda 2014. Study predicts that by 2025, one-half of the world's people will live in urban areas with 8% of them living in 37 mega cities with populations of over 10 million residents.
6. A photo taken by your editor in Lincoln, Maine on a Sunday morning in May of this year. While we were filling up the tank of my friend's Chevy Suburban, which was carrying four people and all their gear for a week of fishing in Canada, the folks owning all those pick-up trucks were in church.



Musings of a Dispatcher: The Car, Once a Miracle

I WONDER WHAT it was like to live in a big city at the turn of the last century when horsepower was measured in the number of horses not in watts (1 horsepower = 745.7 watts). In New York City, there were approximately 100,000 horses in the city around 1900, and they resulted in a major urban planning nightmare that had strained governments to the breaking point, vexed the media, tormented the citizenry and brought society to the brink of despair: mountains of horse manure, seas of horse urine and dead horse carcasses on the streets. Those 100,000 horses produced an estimated 2.5 million pounds of manure and 60,000 gallons of urine per day. About 15,000 dead horses were removed from the streets of New York each year. An important cause of diarrhea, a serious health problem among children at the time, was 'street dust' consisting in the main of germ-laden dried horse dung. The flies

that bred on the ever present manure heaps carried more than thirty communicable diseases.

"At the beginning of the twentieth century, writers in popular and scientific periodicals were decrying the pollution of the public streets and demanding 'the banishment of the horse from American cities.'" And then a miracle occurred: motorcars began replacing horses. **The automobile was widely hailed as an environmental savior.** Cities became mostly livable again, maybe for the first time since the start of the Industrial Revolution.

I grew up in a city of 140,000. In the early 1950s, it was the third largest city in Pennsylvania, following Pittsburgh and Philadelphia. There were still some horses around pulling wagons for farmers and rag pickers, but cars, buses and trucks were self-propelled and the trolley lines were all electrified. It was at the tail end of the time when there

were steam-driven locomotives. Where we lived, we had trains all around us, so it didn't matter which way the wind blew; soot still ended up on the laundry hung out on the clothes line.

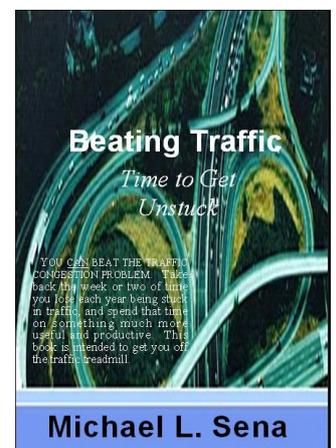
Then diesel locomotives replaced the steam trains. I remember thinking the diesels were not nearly as interesting to watch as the steam ones, but everyone's clothes were cleaner and, until there were too many of them emitting over 400 grams/mile of CO₂, everyone breathed a lot easier. They still breathe easier in Scranton; there's no traffic congestion, but that's because there are half as many people who live there today compared to the early 1950s.

Herein lies the conundrum. The more successful a city or region becomes, the more people it attracts until it cracks under the weight of its own growth. Government officials and citizens pray for new miracles, like driverless, electric cars, when the answer lies in front of their noses: put things in the right places.

About Michael L. Sena Consulting AB

Michael Sena works hard for his clients to bring clarity to an often opaque world of vehicle telematics. He has not just studied the technologies and analyzed the services. He has developed and implemented them. He has shaped visions and followed through to delivering them. What drives him—why he does what he does—is his desire to move the industry forward: to see accident statistics fall because of safety improvements related to advanced driver assistance systems; to see congestion on all roads reduced because of better traffic information and improved route selection; to see global emissions from transport eliminated because of designing the most fuel efficient vehicles.

This newsletter touches on the principal themes of the industry, highlighting what is happening. Explaining and understanding the how and why, and developing your own strategies, are what we do together.



Michael L. Sena

Download your copy of Beating Traffic by visiting www.michaellsena.com/books