

The Dispatcher

Special interest features covered in each issue:

- Autonomous and Self-driving Cars
- Big Data
- DSRC versus Wireless Communication
- Connected Vehicles – V2V and V2I
- Third party services for eCall

Individual Highlights:

Car Hacking	1
NEVs	2
Business Models	3
Vehicles as Robots	5
Musings	6
The Newsletter	6

In the next issue:

- Telematics Valley
 - Digital Map Data
- The ITS World Congress will take place in Bordeaux from the 5th to the 9th of October. Stop by the ERTICO stand and pick up some information about MOBiNET and the newly active MOBiNET Provider Community.

Telematics Industry Insights by Michael L. Sena

A Car Hacking in St. Louis

WHAT SHOULD NEVER HAVE HAPPENED DID HAPPEN. Two researchers (see sidebar) were able to successfully break through whatever security shields Fiat Chrysler Automobiles and Sprint set up around its **UConnect** on-board systems and wireless network to take control over the most mission critical functions of a Jeep Cherokee. Starting with the climate controls, the radio and the windshield wipers, the attackers moved to the transmission and the brakes. Eventually, the car was brought to a standstill on a major artery in St. Louis, Missouri in the US. The driver of the vehicle, Andy Greenberg, a journalist with **Wired Magazine**, was a willing victim, but his description of his experience in **Wired** indicated that he was truly frightened while he sat helpless in the vehicle while it was being controlled remotely from ten miles away.

The entire process appears to have been extremely well planned and executed over a two-year period, culminating in having the author of the article that would describe the experience serving as, in his own words, the 'crash dummy'. Miller and Velasek first had to learn to speak 'CAN' (Controller Area Network),² the vehicle bus standard intended to link microcontrollers and devices in vehicles to communicate with each other without a host computer. They had to find the most likely candidate for their experiment, which they did, according to Greenberg, by applying for and obtaining "mechanic's accounts on the websites of every major automaker and downloaded dozens of vehicles' manuals and wiring diagrams." They used this information to determine how the on-board systems connected to the Internet, and then which vehicles were the most vulnerable. Jeep Cherokee won the door prize.

They identified one vulnerable access point that lets anyone who knows the car's IP address gain access to a chip in the vehicle's head unit where the chip's firmware is rewritten and new code can be deposited. The new firmware can send commands through CAN to any mission critical component, like the brakes, engine, transmission or sensors. The pair will identify the vulnerability during a Black Hat talk they are giving. Before the test drive, Miller and Valasek provided FCA with enough information to allow the company to issue a recall on July 16th for 1.4 million vehicles.

Continued on P.4

WHO ARE THE CAR HACKERS?

Charlie Miller and Chris Valasek are the dynamic duo responsible for performing the feat of hacking the Jeep Cherokee. According to the **Wired** article, Charlie Miller is a security researcher for Twitter and a former US National Security Agency (NSA) hacker. Chris Valasek is the director of vehicle security research at IOActive, a consultancy. This is not the first time they have teamed up to show that connected vehicles are vulnerable to cyber-attacks. They applied for and received a grant in 2012 from the US Defense Advanced Research Projects Agency (DARPA) to try to advance work done in 2011 by another group of researchers at the University of California San Diego and the University of Washington. This earlier research showed that it was possible to disable the locks and brakes of an unidentified vehicle. In the 2012 research, Miller and Valasek demonstrated they could hack into vehicles with a direct wire connection to the CAN. They demonstrated their results at the DefCon hacker conference in 2013, but it did not appear to have a meaningful effect on car makers, who, according to Miller and Valasek, discounted it because it required physical access to the vehicle. It was then they decided to hack a vehicle remotely, which they have done.

I hope they will be richly rewarded for their research, and I also hope they will continue to work to find—and eventually help close—any and all security gaps in connected vehicles until there are none. It looks like they will be getting help through government legislation.

Neighborhood Electric Vehicles (NEVs)

Working NEVs

This is how our mail is delivered in Vadstena and Strängnäs, in a **Club Car Carryall LSV**. The vehicle zips silently around the narrow streets, and has enough space to carry the mail and any packages that have eluded DHL and FedEx.



Club Car, LLC is based in Augusta, Georgia, which also happens to be the home of the Augusta National Golf Club where the Masters in golf is played each year. Club Car was founded in 1958 as a golf cart producer. Today it is owned by Ingersoll Rand.



I took this photo at Hannover Airport. It is a Renault Twizy. There are two seats, one in front and the other in the back. With the open frame, it looks more like a four-wheeled motorbike. There are climates where such a vehicle might be perfect, I thought, but Hannover isn't the first one that comes to mind. I did some further investigations and saw that it comes with doors. There is even an optional design with one seat and a cargo space reachable by a hatch door.



THE BEST THING ABOUT NEVs is that they are not bicycles. You don't need to wear special clothes in the winter or in the rain; you don't need to have your outerwear dry cleaned after a tour from home to work; you don't need to carry a clean shirt and have a shower before you can attend a meeting with your colleagues or clients. Most importantly, you don't feel like you are taking your life in your hands in a duel with trucks and buses and cars and even pedestrians. Some cities are flat and have bicycle paths that are not crossed by other vehicles. It never rains or snows in these cities and it is never too hot or too cold. It is always just right. Those lucky souls who live in these cities can ride their bikes, owned or shared or rented, to their hearts' content. For the rest of us, NEVs are another alternative to our own cars or to public transport.

In the US and Canada, a NEV (also referred to as a Low Speed Vehicle) is defined as a vehicle that is capable of travelling at a maximum of 25 miles per hour (40kph). It is equipped with safety features, like headlights, turn signals and seat belts. They may be operated on roads that have a speed limit of 35mph (56kph). If you think this sounds slow, nibble on this factoid (US Department of Transportation, Bureau of Transportation Statistics): The average US driver travels 29 miles (47 kilometers) per day and is driving a total of 55 minutes per day, which works out to be 32 miles per hour (50kph). If you look at this statistic you might think that spending close to an hour in a little electric vehicle tooling along at such a painfully slow speed would be unbearable. But this is an aggregate. A detailed view shows a very different picture.

A 2009 study performed by the US National Household Travel Survey (NHTS) found that return travel home accounted for 34% of all trips and the mean trip length was 8.2 miles for urban dwellers and 12.7 miles for rural. (Urban and rural are US Census Division classifications, and rural includes suburban). Errands (getting around during the day, mostly to shop) accounted for 22% of trips with a mean distance per trip around 60% of the home travel, and urban trips half the distance of rural. The longest trips by distance were for social and recreational purposes (visiting friends or escaping to the mountains), but represented only 9% of total trips.

A whopping 58% of US households have two or more cars, and over 35% own three or more. There are 2.28 vehicles per household in the US, and there are around 275 million registered cars in the US and 115 million households. Imagine if one of the cars in a two-plus car household was a NEV. That would mean 70 million little NEVs running around instead of 70 million full-size regular vehicles. This

There is another meaning for NEVS: National Electric Vehicle Sweden. This is the company that was formed in 2012 when it purchased the assets of Saab Automobile after it was driven into bankruptcy by Spyker Cars in December, 2011. Spyker had bought Saab from General Motors in 2010 with the help of a loan from the Swedish government. Production never began in earnest because of problems with payments to suppliers, which affected sales. In the end, money just ran out and the only option that remained for the company was to declare bankruptcy.

NEVS bought the rights to the Saab 9-3 platform and to the name, Saab (which it subsequently lost when Saab AB revoked the rights to the name when NEVS entered bankruptcy protection in late 2014). Its stated goal was—and still is—to build an electric version of this car at Saab's former Trollhättan, Sweden plant and sell these cars in China. There have been bumps along the way, like the bankruptcy reorganization. With the recent addition of two new owners, there will likely be a slight change of plans regarding where all the cars will be built. The new owners are the city of Tianjin, where there will be a new global factory, and Beijing State Research Information Technology (SRIT).¹⁰



"NEVS initially wanted to keep the old Saab logo but the iconic griffin symbol belongs to Scania, a truck and bus manufacturer that was part of Saab until 1995. Scania explained that it turned down NEVS's request to use the griffin because it doesn't want it to appear on a non-Swedish vehicle."

On 21 August, the owners of the Saab name decided that NEVS may not use the name Saab.

Continued on P. 4

Disruptive Business Model or Business as (almost) Usual

THINGS ARE NOT ALWAYS what they seem.³ Tesla Motors, Inc. is seen as a disrupter of the traditional and staid automotive business, while General Motors is viewed as the arch defender of that industry's status quo. GM was founded in Flint, Michigan in 1908 and has its headquarters in the one of the old economy fortresses, Detroit. Tesla was founded in 2003 and is based in Palo Alto, California, the bastion of the new economy and the heart of Silicon Valley. GM is led by CEO Mary Barra, who started working for GM as a co-op student in 1980 at the age of 18 and has been there ever since (following college and earning an MBA at Stanford). Tesla's CEO is Elon Musk made his fortune from PayPal, an online payment company he founded in 1998 that went public in 2002 and was then acquired by eBay. He bought his way into Tesla and then took it over. He also owns SpaceX, a company that shoots rockets into space.

Tesla's market capitalization was \$33.64 billion on 31 July 2015 with a share price of \$266. On the same day, GM's market cap was \$49.91 billion with a share price of \$31.51. Tesla's revenue for 2014 was \$3.2 billion, and it lost \$294 million producing around 32,000 cars (average cost per car of \$100,000). GM's revenue for 2014 was \$155.93 billion on which it earned \$3.95 billion in profit selling 9.92 million cars worldwide (average cost per car of \$16,000).

With its high valuation, money-losing ways and high profile leader, you might think that Tesla is a game changer. It's not. GM occupies that square in the graphic, while Tesla can only claim to be using new technical competencies, but not a new business model.⁴

In Business 101, we learned that a 'business model' is based on a selected strategy. It is the logic of a company, how it operates and creates

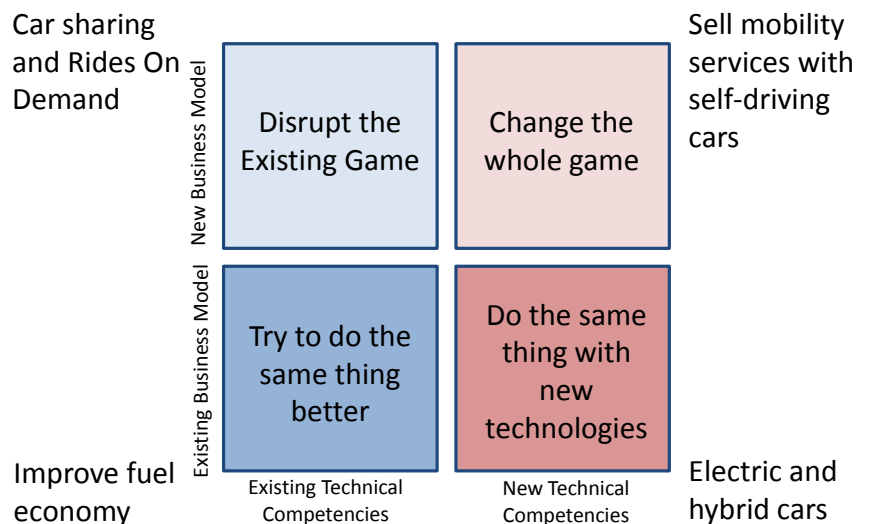
and captures value for stakeholders in a competitive marketplace. A 'strategy' is nothing more than a commitment to a set of coherent, mutually reinforcing policies or behaviours aimed at achieving a specific goal. The choices open to a company by virtue of the business model it employs are its 'tactics'. I like to use the example of the Swedish furnishings company, IKEA, to illustrate this. IKEA's strategy is to sell well-designed furniture at an affordable price. Its business model is based on letting customers pick up the pieces and assemble its products themselves. Its tactic is to locate its big box stores on the peripheries (low cost and plenty of parking) of those cities where there are sufficient customers who fit the profile of potential customers. Not every country and not every city in a country fit their criteria. (Boston was among the last locations in the US to get a store.)

Tesla's strategy is to sell a very expensive, high performance car that is powered by an electric motor. Its business model is the same as any car company: sell as many cars as possible for a profit. Where it differs from all other car makers is in its sales tactics. It does not sell through dealers, but through its own retail stores, mostly

located in shopping malls. Tesla does not meet any of the disrupter criteria.⁵ It is a sustaining innovation, in Clayton Christensen's terms, offering incremental improvements in performance at a higher price, rather than good enough performance at a lower price.

It's GM that is changing the automotive game through OnStar. Its disruption was not to offer a lower-priced alternative to an existing product, but to deliver a totally new product to customers who had no way of receiving emergency assistance in their vehicles. Since it started in 1996, no other car company has been motivated to copy its innovation by setting up an independent unit offering services to customers. Its competitors still break up the pieces among the various departments, and share the business responsibilities with their national sales companies. OnStar has been able to add new features and services while maintaining its low cost structure.

One day, when GM starts offering self-driving cars, OnStar will be driving the services business. Maybe GM would have bought Tesla by then and using its battery technology.



Update on Here (fka Navteq)

On August 3rd, Nokia announced it had reached an agreement with the German car company consortium comprised of BMW, Daimler and Audi to acquire **Here** for the price of €2.8 billion (\$3.1 billion). The consortium has indicated it is open to other car companies joining in. Good to hear.

Do it yourselves, or we will do it for you!

Sound familiar? In August 2009, the European Commission Directorate General Information Society and Media, Unit ICT for Transport, stated it would monitor the effectiveness of the voluntary approach to implementing eCall, and if significant progress was not made by the end of 2009, it would consider introducing regulatory measures in 2010 for making the eCall system standard in new type-approved vehicles in Europe to ensure it is deployed in all European countries. Well, no progress was made and now it is a European Regulation. After the first hack attack occurred in 2013, US Senator Edward Markey of Massachusetts sent a letter to twenty automakers asking them about their connected car security practices. His office said that the responses were not encouraging, and, as a result, Markey along with Senator Richard Blumenthal of Connecticut, introduced on 21 July a measure called the Security and Privacy in Your Car Act (aka SPY Act), which will, if passed, require auto OEMs to build IT security standards into connected cars⁶.

Neighborhood Electric Vehicles (Continued from P.2)

fact attracted Chrysler for a while. It owned Global Electric Motorcars (GEM) between 2000 and 2011, when it sold it to Polaris Industries, Inc. In 2008, Chrysler helped GEM develop a prototype called *Peapod* that had a lot in common from a design standpoint with Renault's Twizy. Unfortunately, the Peapod never made it into production, probably due to the

tanking of the economy and Chrysler's reorganization.

Toyota has entered the space with its *I-Road* three-wheeler, two-seater. It is testing the concept of a microcar-on-demand, (like bike rentals), in Grenoble, France. Booking and payment is made with an app. Cars are driven from and to prescribed parking spots with chargers. More on this test in a future issue.

A Car Hacking in St. Louis (Continued from P.1)

Why shouldn't this have happened, you might ask? By 'this' I mean taking over mission-critical vehicle functions. It was predictable but not inevitable. It was predictable because every Internet-connected device has already been hacked. It was only a matter of time for Internet-connected vehicles to suffer the same fate. However, it is one thing to start the windshield washer or turn up the radio; it is a totally different matter to cut the brakes or push down on the accelerator. It was not inevitable that this should have been possible.

A few years ago I sat in a room with a car OEM and a telematics service provider. The TSP was trying to answer the question posed by the IT person working for the OEM why they could not just use IP to communicate with the on-board device and forget about GATS, NGTP, ACKs and security keys. That IT person would not accept the answer. Perhaps, if he has read the account of the car hacking in St. Louis, he might now understand what the TSP was talking about.

There are two principal safeguards that the earliest telematics systems set up in order to prevent unwanted communications with the vehicles over the wireless network. The first was to create a single data channel between the vehicle's on-board modem and a telematics service provider. Data passed over this channel, whether it was via SMS or GPRS, and the commands at both

ends needed to be both encrypted and acknowledged. Second, any messages between the on-board unit and mission-critical functions occurred through a gateway that monitored all commands coming in and all data going out. As long as these two safeguards were in place and adhered to by system designers, the chances of hackers taking over a car were remotely small, perhaps infinitesimal. In any case, in over fifteen years, they never happened.

Enter the new paradigm of the Connected Car, the *Internet of Things*, with the car just one of those 'things', and everything is changed. The bad guys are lurking everywhere. They know when you are sleeping and when you are awake. Now, you really need to check all the doors and windows, to make absolutely sure they are all securely locked, even if you are only going out for a walk around the block. You need to hide the family jewels in a place that is totally invisible and impenetrable if the lurkers do manage to pry open the cellar door.

What the St. Louis car hacking shows is that taking control of a car is not easy, but it is possible--if the car is connected to the Internet and if there is the slightest opening in the security system. Every car company needs to take a step back, test extensively and eliminate any holes, even if it means shutting down some services while weak points in the service infrastructure are strengthened.

Vehicles as Robots

THINK OF A VEHICLE AS A ROBOT that follows the three laws of robotics defined by the great visionary, Isaac Asimov (see sidebar). If it's carrying you, according to the first law, it's not going to crash, injuring you, and it is not going to hit another car or pedestrian. According to the second law, it is not going to respond to hackers telling it to drive itself off the road into a river, and if the driver says stop, it will stop, as long as heeding that command doesn't hurt anyone. And according to the third law, it is not going to crash unless that is the only way to save lives, including yours as the driver.

Anyone who has read Asimov's robot books (His day job was as a Columbia University professor of biochemistry so he wrote on many subjects.) knows that they are about the inherent conflicts between well-defined laws and their interpretation in real situations. How does a good robot behave when an evil person builds a robot that does not follow the rules? If a robot looks like a human and acts like a human—and begins to feel like a human—should they still be expected to obey laws that do not apply to humans, even if it is obvious that if humans followed the same laws the world would be a much better place in which to live?

Studies have shown that humans trust robots that look more human and less machine-like.⁷ Maybe that is why Google has given its robot vehicle 'carmorphic' characteristics. Perhaps that is why, with all of the money and super bright people at Google's disposal, the people in charge of their self-driving car decided to model it after the 'Folks' Wagon', the VW Beetle, rather than NASA's *Curiosity Mars Rover* or Disney's *WALL-E*. On the other hand, other studies show that humans are less threatened by robots that do not have humanoid features, like *WALL-E* or *R2-D2*, and are scared out of their wits by androids like those in *The Terminator*.

So I climb into a car that looks for all the world like a Fiat 500, but someone has



nicked the steering wheel. The engine starts and a soothing voice says: *Sit back and relax, Michael, and whatever happens, don't panic.* It's a car and not a strange looking contraption, so I am trusting. But if it's a car, I'm supposed to be in control, so I feel uncomfortable, maybe even threatened.

Has Google or any of the people developing autonomous cars and trucks come this far with their homework?⁸ I, for one, would prefer to see a *personal mobility transporter* that did not look like a Nissan Micra without all the controls that that cute little vehicle needs to operate. I would be much more comfortable if the vehicle was surrounded by super soft bumpers and that all the other vehicles on the same roadway (or skyway) were also similarly equipped. I would like to have the VW Bug's nose back. That's where the trunk (aka boot) was located since the motor was in the rear. There needs to be much more space to be able to carry stuff around, otherwise I could just as easily walk or take the bus.

Actually, maybe the perfect combination is to have C-3PO at the controls of a *Landspeeder*⁹ with a Thule box pulled behind. It would be good to have a hand from 3-CPO loading and unloading and holding the umbrella on my way to the door with my arms full of the day's shopping, and it's always more enjoyable having company in the car.



The Three Laws of Robotics (often shortened to **The Three Laws** or **Three Laws**) are a set of rules devised by the science fiction author Isaac Asimov. The rules were introduced in Asimov's 1942 short story "Runaround", although they had been foreshadowed in a few of his earlier stories. The Three Laws are:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.



Bruce Willis's taxi in *The Fifth Element* is designed for bumper bumping.



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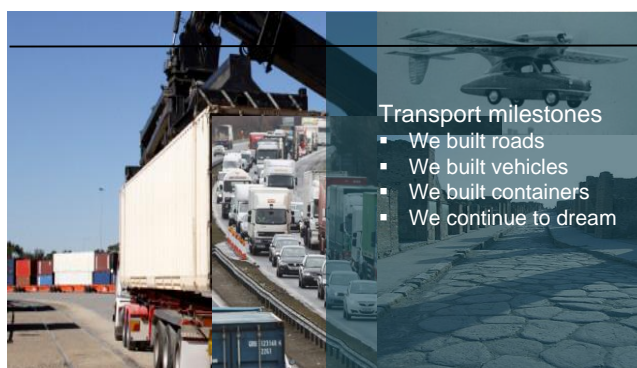
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Michael Sena works hard for his clients to bring clarity to an often opaque world of vehicle telematics. He has not just studied the technologies and analyzed the services. He has developed and implemented them. He has shaped visions and followed through to delivering them. 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 for your organization, are what we do together.

Transport in the Digital Age: Reflections from a Summer School

Aalto University is located in Espoo, Finland. It was the site of a week-long summer school course on *Transportation in the Digital Age*, held from 10-14 August. The course was organized and administered by the Aalto University School of Engineering, Transportation Engineering. In the words of the organizers, the 2015 theme is a "recognition that the concept of mobility as a service, with or without autonomous vehicles, is likely to transform all aspects of the transport sector." The course is intended for transportation professionals, citizen advocates, educators and graduate students. I was asked to give one of the lectures, *Transport in the Digital Age: An Industry View*. I was joined by transport professionals Richard Mudge (US) and Eric Sampson (UK).



The theme of my talk was transport is a means not an end, and people choose the best mobility option for their particular situation at a particular time. The digital age of transport began in 1995, and we are now at the end of the beginning. Big changes are coming.

The first day's presentations were all on mobility as a service with city case studies. The second day was devoted to policy issues and included my presentation on the view from the transport industry. Commercial fleet, public transport and policy issues followed for the remainder of the week. Course attendees were diverse in age, country of origin and occupation. They were actively engaged, asked good questions and seemed to genuinely appreciate the efforts we put into preparing our course material.

This was the ninth summer school executive course organized by Aalto University and my first time attending. The organizers set ambitious goals: to provide an intensive learning experience; to search for innovative and practical approaches; and, to create a place where lifelong contacts are made. To achieve such lofty objectives you need to have a very high caliber of course leaders, but also an equally high caliber of students. There also needs to be a good level of guidance on the content of the presentations so that they cover the subject in enough detail to make them both interesting and useful. I will let my peers and the students deliver their judgment on my presentation. If you would like to have a look, here is the link to my site <http://michaellsena.com/presentations> and click on Transport in Digital Age_Industry View.

Footnotes:

1. Andy Greenberg, *Wired Magazine*: After Jeep Hack, Chrysler Recalls 1.4 million vehicles for Bug Fix. (24 July 2015).
2. CAN development started in 1983 at Robert Bosch GmbH. The first CAN controller chips, produced by Intel and Philips, came to market in 1987.
3. Attributed to Phaedrus (c. 15 B.C – c. 50 A.D), who lived in Rome and is best known for translating Greek fables to Latin. The full quote is: "Things are not always what they seem; the first appearance deceives many; the intelligence of a few perceives what has been carefully hidden.
4. Innovation Landscape Map: *You Need an Innovation Strategy*, Gary P. Pisano; Harvard Business Review (June 2015). Gary Pisano is the Harry E. Figgie Professor of Business Administration and a member of the U.S. Competitiveness Project at Harvard Business School
5. Clayton Christensen is the author of articles and books on 'disruptive innovation'. Disruptive innovations target overserved customers, offering lower price for 'good enough' lower performance. While disrupters have the motivation to improve performance, existing companies are not motivated to counter it. A disrupter can keep a low cost structure while offering improved performance, and it can open up new sales channels.
6. Tracking and Hacking: Security and Privacy Gaps Put American Drivers at Risk; A report written by the staff of US Senator Edward J. Markey (February 2015).
7. When Your Boss Wears Metal Pants: Insights from the frontier of human-robot research; Walter Frick. Harvard Business Review (June 2015).
8. In 2012, a project called RoboLaw was set up and funded by the European Commission. It consisted of experts in areas such as law, engineering, philosophy, regulation and medicine. It produced a report called *Guidelines on Regulating Robots*, with recommendations designed to help legislators 'manage the introduction of new robotic and human enhancement technologies into society'.
9. C-3PO was one of the main character robots, along with R2-D2, in the Star Wars movie series. The Landspeeder was Luke Skywalker's anti-gravity craft.
10. On 18 August, NEVS announced that it had signed a partnership agreement with Dongfeng, one of China's largest vehicle concerns. Dongfeng is a part owner in PSA and has a long-established partnership with Volvo Trucks. Dongfeng is not an owner. The majority of the company is owned by NME, which is owned of Swedish-Chinese Kai Johan Jiang. The city of Tianjin will own 30% following the new emission, and SRIT 10%.