The 21st century presents us with challenges that require a collective European response: scarcity of resources, traffic congestion and pollution to name just a few. In the transport sector, research lays the foundation for developing innovative technologies and ways of working that will bring about the changes required to preserve our mobility at low cost to society.

The Transport Directorate of the European Commission’s Directorate-General for Research and Innovation makes every effort to support excellent European research projects in the field of transport: projects that contribute to a cleaner, safer and smarter pan-European transport system and to a more competitive Europe. A budget of €4.16 billion has been reserved for this purpose as part of the Seventh Framework Programme for Research (FP7) from 2007 to 2013.

The research funded ranges from completely novel approaches to transport to fine-tuning existing technology. It relies on the hands-on experience of small businesses as much as on the knowledge of academics and real-life needs of manufacturers. The projects showcased in this folder give you an overview of some of the results from European transport research and of the impact they could have on our society and your future mobility.

EUROPEAN COMMISSION
Directorate-General for Research and Innovation
Directorate H — Transport
http://ec.europa.eu/research/transport

Innovation for our future mobility
EU activities in the field of transport research
Every day, Europe’s urban streets are clogged by excessive traffic and blocked by accidents, roadworks and other hazards. It is little wonder that 90% of Europeans think that traffic congestion in their cities and neighbourhoods needs to be improved.¹

At London’s Heathrow Airport, a glimpse of the transport systems of the future is coming into view – while also demonstrating the fruits of Europe-wide technological cooperation.

Marking a world first for automated travel, “pods” shuttle travellers between a car park and Terminal 5 along a dedicated path – without the need for a driver or petrol. Installed in April 2011, these battery-powered vehicles rendered obsolete the two diesel-propelled buses that looped around the airport all day long – regardless of how many passengers were on board. The pods, however, only run when summoned by passengers, saving fuel and reducing pollution.

The pods travel up to 35 km per hour – quietly, comfortably and at the push of a button – following pavement lines with optical navigation. Eventually, these “ULTra” pods could form a network of automated cars connecting Heathrow and other European airports to transport hubs, city centres and other central points.

Heathrow’s automated “cybercars” are the centrepiece of the EU-funded research project, CityMobil. Drawing together experts and expertise in a truly European scientific effort, CityMobil’s unique team of researchers has worked to develop entirely new forms of urban transportation. The idea is to replace conventional cars and buses with vehicles that passengers can use on-demand, and semi-automatic buses that can use both overhead tram wires and internal combustion engines.

“We have shown that these vehicles are technically feasible”, said Suzanne Hoadley of the Brussels-based policy organisation Polis, one of CityMobil’s 29 partners. “In the coming years, we expect to see a steady increase in the number of these systems being installed in Europe.”

To widen the potential, CityMobil researchers have worked to create an ongoing research and development programme to engage more scientists and stimulate more innovation, lower the administrative barriers to automated vehicles, advise government officials on how they can benefit from new forms of transport, and publicise the results of their work to the broader scientific and transport communities. They are also working to increase public acceptance of revolutionary technologies, which may become commonplace in the future.

The commercial possibilities are immense, which could create a true niche market to bring economic development, technological innovations and jobs to Europe. CityMobil is already drawing interest from city and airport officials throughout Europe and the US.

In addition to the Heathrow pods, CityMobil installed hybrid buses in the scenic, oceanside city of Castellón, Spain. Following a route that links a university with a park in the city centre, bus drivers can use the self-guiding system to supervise the route and only use the steering wheel in an emergency. CityMobil was also put on display in Finland, France, Italy, Norway and the UK, where the public could ride in cybercars and other advanced vehicles.

CityMobil researchers envisage a person being able to summon a cybercar to their home or a bus stop, push a button corresponding to their destination, and be driven automatically along the quickest route – a personalised taxi with no driver who may get lost or cause an accident.

These automated pods are cheaper than high-speed rail, making them attractive to budget-tightening governments. They use half the energy of buses and one-fourth that of cars. Eventually they could be used on regular roads. Such a system would be ideal for the elderly, the disabled, and people without a driver’s licence.

CITYMOBIL

Project Total Cost: €40.6 million
Project EU Contribution: €11 million
Partners from: Netherlands, Spain, Italy, France, United Kingdom, Germany, Norway, Switzerland, Belgium, Israel, Sweden

www.citymobil-project.eu
At first sight, train drivers’ cabs and Formula 1 cars may not seem to have much in common. But a research project funded by the European Commission has led to a potential breakthrough for the rail industry – by adapting technology most commonly found in high performance racing cars.

The results promise to provide the rail industry with trains that are more environmentally-friendly, easier and cheaper to produce, and less costly for rail companies in terms of track maintenance. An all round win-win situation.

The rail industry’s needs are clear: lightweight materials for trains in order to increase energy efficiency and reduce the damage to tracks, and reduced costs. All, of course, without compromising safety.

The problem is that conventional train cabs, made from welded steel units, can weigh up to one tonne each. With a cab at each end of the train, the potential for weight reduction is clear. On top of that, traditional cab designs tend to be very complex, incorporating a large number of parts, all made from different materials. That is because they need to meet a range of physical demands, including strength, crashworthiness, aerodynamics and insulation. As a result, assembly costs are high.

Formula 1 cars use extremely strong, lightweight materials known as carbon composites to help achieve the high performance they need. But such materials are highly specialised and uneconomic for extensive use in trains.
The answer for the rail industry came through a multi-year project called DE-LIGHT, which was aimed at developing improved lightweight materials for use in a wide range of transport systems. After three years of research, a team from Newcastle University in the UK, working in collaboration with Bombardier Transportation and Portuguese manufacturing firm AP&M, succeeded in producing a prototype lightweight train cab which reduces the weight of the traditional cab by a remarkable 40%.

The breakthrough technology behind the new cab takes the form of a ‘sandwich’ construction, in which an aluminium honeycomb structure and a polymer foam core are enclosed in outer layers of special glass-reinforced plastic. The effect is similar to the composites used in Formula 1 - but at a much lower unit cost.

Crucially, the inherent strength of the new construction eliminates the need for steel elements. This reduces not only the weight, but also the number of separate parts required. In addition to the 40% weight reduction, the new cab reduces the number of separate component parts by up to 75%. And this in turn reduces overall costs by up to 20%, as assembly and outfitting are far simpler than before.

All of this is achieved while still meeting stringent crashworthiness requirements.

“It’s great to finally see the cab in real life”, says lead designer Conor O’Neill of Newcastle University’s rail research centre. “I’ve been staring at a virtual model on my computer screen for the last three years, and it’s very satisfying to see the real thing.”

It is intended that the cab will first go into commercial use in Bombardier’s Spacium trains on suburban services in Paris.

**DE-LIGHT**

**Project Total Cost:** €3.7 million  
**Project EU Contribution:** €2.5 million  
**Partners from:** Netherlands, Poland, Latvia, Finland, United Kingdom, Germany, Norway, Portugal, Sweden, Croatia, Romania  
**www.delight-trans.net**
One of the most important tasks facing the world today is the need to reduce its dependence on oil and other fossil fuels. Nowhere is this felt more keenly than in the transport sector, which alone accounts for some 25% of global greenhouse gas emissions.

In response, car manufacturers around the world are focusing intensely on developing prototype electric vehicles. China, for example, has set a target that 50% of new vehicles on its roads should be electric by 2020.

Although it is widely recognised that electric cars will only make a significant difference if they are accompanied by a move towards smart grids and cleaner electricity generation, global competition for the electric vehicle market will be intense. The speed with which car manufacturers and their suppliers are able to develop these new vehicles and bring them to market is likely to be a decisive factor.

The European Green Cars Initiative (EGCI), announced by the European Commission in 2008, was an important step in boosting the European industry’s competitiveness in this race. Bringing together the three key industries involved in the effort to introduce electric vehicles onto Europe’s roads – the automotive industry itself, the ICT sector which will be needed to supply the required ‘smart’ technologies, and the electricity supply industry – the aim was to stimulate the development of the common technologies and standards needed to make electric vehicles a practical reality across the continent.

Since this is an objective which cannot be achieved at individual national or company level, cooperation between otherwise competing European companies is vital. Major manufacturers, including Volkswagen, Volvo, Renault and Fiat, are among the partners involved in more than 50 research projects receiving funding from the European Green Cars Initiative, focusing on areas ranging from intelligent electrical re-charging systems and safety of electric vehicles to harmonised standards for batteries which can be used across all makes of vehicle.
To help achieve the goals of the European Green Cars Initiative, the European Commission recognised that research efforts taking place at national level within the Member States needed to be brought together, as far as possible, within a unified, Europe-wide approach. This approach would minimise the risks of duplication or fragmentation of research efforts.

For this reason, one important part of the European Green Cars Initiative was aimed at providing incentives for greater transnational cooperation between individual ministries and other agencies within separate EU Member States, in order to generate closer collaboration between nationally-based research projects.

Known as ELECTROMOBILITY+, the initiative offered EU funding to cover up to one-third of the total project cost, if individual nationally-based consortia were able to find ways of cooperating with counterparts in other Member States.

In response, 20 proposals for such collaborations are eligible for funding, with the first of these transnational projects due to start in spring 2012.

These projects cover key areas such as research into the safety of electrical vehicles, wireless electrical charging systems and development of fuel cells.

Since the results of these projects become the property of all consortium members, the benefits to participants are significant. As ELECTROMOBILITY+ coordinator Oliver Althoff explains, a participant may contribute €500,000 of the costs, but benefit from outcomes worth €2.5 million.

As well as benefiting Europe in terms of the environmental advantages of greener vehicles, the European Green Cars Initiative and ELECTROMOBILITY+ are providing important support to Europe’s global competitiveness. By cooperating within Europe as a result of these initiatives, European companies are enabling themselves to compete on the global stage in a way which otherwise would not have been possible.
Increases in world trade flows mean that more and more ships are sailing on the high seas. As a result, ships are increasingly being monitored and controlled and the crew needs to send a growing number of reports and other data to various shore authorities. Another big cross-border challenge, this time on the shore, is how to move goods as efficiently as possible to generate savings for businesses.

These are just two of many examples where computerised systems could play a role in helping humans take decisions by processing large amounts of complex data.

This is exactly what Flagship, an EU-funded consortium of more than 40 European maritime organisations, is looking into. By drawing on expertise from different partners, which include organisations specialised in regulations, IT and safety as well as port authorities and shipping companies and universities from all over Europe, the consortium has been able to come up with a number of cross-border innovations.

One example of such cross-border innovation, developed by researchers, that could generate considerable savings is an automated computerised system to help ship operators fill in forms that they need to send to port authorities.

“There are currently hundreds of thousands of shipping regulations, including class, territorial and local variations, that ship owners and operators must comply with. Being caught in breach of these regulations can cost a ship owner tens of thousands of pounds in fines”, explains Luke Speller, Senior Research Scientist at BMT Group Ltd, the lead partner in the British-French-Greek project.

The new system could significantly reduce the regulatory compliance and administrative burden ship owners and operators currently face. If every European ship used automated form filling, this could lead to a total time cost saving in the region of €8.94 million per year.
“The system automatically warns the captain when they come to a certain area and advises on what rules they have to comply with. It also prepares messages that ships have to send to ports. This enhances safety and regulatory compliance”, said Herman de Meester, the coordinator of the Flagship project.

The European approach also yielded dividends in the case of a separate project to improve the real-time scheduling of container movements in ports. The project brought together the expertise of the UK logistics planning software company MJC² Limited with the Port of Valencia in Spain, where a new computerised system was trialled. Two depots, the Spanish Depot Service and Trans-Base Soler, which operate trucks and container services in the Valencia area, also took part as did the China Shipping (Spain) Agency, which operates ships.

In a nutshell, the beauty of the real-time scheduling system for containers is that it can help companies ensure, for example, that trucks do not drive to or around ports empty.

Before the trial, the Port of Valencia had a manual decision-making process and no automated system at all. The logistics exercise is a complex one that involves getting hold of trucks, loading them with containers full of imported goods, delivering them and then trying to ensure that the trucks return with full container loads of goods for export. It is also about locating the right truck for a particular load and ensuring the staggered arrival of trucks to avoid congestion at the port.

“A person doing it has a limited number of options in their head. The advantage of a machine is that a computerised system will look at millions of options and pick the best”, said Julian Stephens, Technology Development Manager at MJC² Limited. “The system has shown that it is capable of saving 10-20% of transport costs through improved planning and faster response times.” Making savings is of course high up the list of priorities for European companies, but there is interest in the system from further afield too. In this sense, it is well worth noting that a Chinese shipping company has bought the system and made considerable savings as a result.

But it is not just companies that can benefit in terms of savings. The wider public can benefit too because the system will mean lower emissions of CO₂. “The direct public benefit is a reduction in congestion with 10% fewer truck movements now for the same volume of goods and a 10% reduction in CO₂ emissions”, said Julian Stephens.

**Project Total Cost:** €19.4 million  
**Project EU Contribution:** €10.2 million  
**Partners from:** Belgium, Norway, Greece, United Kingdom, Lithuania, Italy, Spain, Germany, Netherlands, Denmark, Portugal, Finland, France  
[www.flagship.be](http://www.flagship.be)
For huge cargo vessels that carry millions of litres of oil, thousands of shipping containers, or tens of thousands of tonnes of coal or steel, safety is paramount. These ships must comply with rising safety standards that require time-consuming inspections by surveyors, who in turn risk their own safety by climbing inside massive cargo areas and on scaffolding constructed around ships.

To help save time and money, and improve the accuracy and quality of these important inspections, an EU-funded research project has developed a fleet of remote-controlled robots that crawl through cargo ships in search of cracks, corrosion and other defects.

Equipped with robotic arms, cameras and magnetic wheels, the robots roll up and down the high, steep walls of ships, looking for defects on the massive steel plates and measuring their thickness with ultrasound. Controlled from a central station using virtual reality techniques, the robots crawl throughout the ship – taking pictures, videos and measurements without the need for human inspectors to go inside the hold or climb up scaffolding.

The project, known as MINOAS (Marine INSpection rObotic Assistant System), holds the potential to make ships safer while also extending their life at sea.

“MINOAS can help ship surveyors by giving them more tools to conduct more thorough inspections”, said Alessandro Grasso of the Italian classification society RINA, which is coordinating MINOAS. “As far as we know, this is the only project of its kind in the world.”

MINOAS ideally demonstrates how uniting specialists from a variety of different industries throughout Europe can spawn leading-edge innovation while increasing the competitiveness of a critical industry by cutting costs, improving workplace safety for inspectors and lowering environmental risks associated with unsound cargo ships.
Among the four models of MINOAS robots is the “Magnet Crawler”, a two-wheeled, battery-powered device with a miniature video camera, two motors and a handle-shaped elastic tail. Weighing less than a kilogram, it climbs walls at a half-metre per second and transmits videos and images to human inspectors carrying handheld receivers.

In a demonstration of their teamwork, the robots can conduct inspections in pairs – the first using a brush to clear away rust and dirt so that the second robot can use its ultrasonic device to measure the thickness of the wall. The robots’ advanced locomotion abilities enable them to operate in every compartment of ships.

The robots offer other advantages over human inspectors. “With the robots, we expect to obtain more data – quicker”, said Grasso, whose organisation is charged with, among other responsibilities, certifying the safety and environmental worthiness of ships. “By having more detailed data, we can make more accurate comparisons with previous inspections, to see if there have been any changes that need to be addressed.”

This last point carries extra importance. By closely monitoring cracks, weak spots and other types of deterioration over time, ship owners will better be able to estimate future damage and the costs to repair it.

Grasso said MINOAS has received great interest at technology expos, and the project team expects the robots to reach the commercial market in the foreseeable future.

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MINOAS

Project Total Cost: €3 million
Project EU Contribution: €2.1 million
Partners from: Italy, Germany, Greece, Spain, United Kingdom, Bulgaria
www.minoasproject.eu
When Europe’s rail pioneers created the first steam engines some two centuries ago, they gave little thought to whether their inventions might be used in other countries: while their ingenuity helped transform travel, they never got round to introducing uniform rail technologies across the continent.

The consequence is that today, although railway tracks crisscross the world, European trains are stubbornly limited in their range. Cross-border rail traffic is hindered by discrepancies between the national networks, with factors such as power supply, signalling, operational procedures and even track gauge varying from country to country. It means that with rare exceptions – for example, the Eurostar and Thalys trains – it is almost impossible for passengers to take the same train across national borders.

But research is helping overcome the obstacles. A €30.4 million project called MODTRAIN has helped develop standardised, interoperable components for tomorrow’s trains. MODTRAIN, which received a €16.9 million grant from the European Union, brought together 37 partners from 10 European countries, including three big railway operators (France’s SNCF, Germany’s Deutsche Bahn and Italy’s Trenitalia) as well as industry, railway research centres and universities.

By standardising train components and interfaces, the project – which ran from 2004 to 2008 – offered ways to improve performance and lower costs for both railway suppliers and operators. “It’s about making the trains work on different networks”, says Eric Fontanel, who was MODTRAIN’s chairman, and who is also the General Manager of UNIFE, the professional association that brings together rail supply companies. “MODTRAIN helps set common standards and specifications so that a new generation of trains can work anywhere in Europe.”
It ties in with broader European efforts to boost the railway sector, including the European Commission’s 2011 Transport White Paper that says half of all journeys longer than 300 km should be by rail by 2050. At the same time, with EU governments opening up national railway markets to competition, there are now strong business and environmental reasons to ensure new trains can work anywhere in Europe.

These efforts should improve rail services and – with more and more high-speed trains – even help them compete with air transport. MODTRAIN thus supports both railway suppliers and operators by cutting manufacturing costs through economies of scale, boosting productivity of new rolling stock and improving reliability through service-proven components.

So what has MODTRAIN achieved? The researchers redesigned everything from the traction systems to the controls, and even addressed interior design, as they produced a standardised set of components and interfaces. The safety aspects at the front of the train were improved, with a new shell to absorb energy in a crash and protect the driver. The team also redesigned the carriage to ensure passengers would be familiar with it, ensuring that the buttons for opening and closing doors, as well as calling for assistance or requesting an emergency stop, would be easily understood by anyone, anywhere in Europe.

But Eric Fontanel says that beyond its technical achievements, MODTRAIN has also been a precursor to other projects. “MODTRAIN set out new methods for collaboration”, he says. “It has been instrumental in building a cooperative spirit across the industry. We are now seeing a lot of common projects in the sector dealing with the principle of standardisation.”

The designs are currently being studied by Europe’s standardisation bodies, and it may still be years before the designs are systematically applied to all new European trains. However, the research from the MODTRAIN project is already being referred to in new EU-wide regulations. The project could help fulfil the promise of those rail pioneers, by building a new generation of fully interoperable trains that can travel to any corner of Europe where there are train tracks.

MODTRAIN

Project Total Cost: €30 million
Project EU Contribution: €16.9 million
Partners from: Belgium, France, Italy, Germany, Switzerland, Finland, United Kingdom, Austria, Spain, Portugal
www.modtrain.com
You probably don’t give it a second thought as you drive to work in your car. But when you are stuck staring at the back end of a bus in a traffic jam, your eyes might just wander onto the road. It might seem greyish but that asphalt you are looking at is about to get a little greener thanks to a European Commission funded project. Asphalt recycling is getting an upgrade.

Europe has about 5.5 million km of roads and most (90%) are made of asphalt. We all know a bad road when we drive on one so this is why billions of euros are spent each year digging them up and replacing them.

Both industry and governments recognise the potential environmental costs of road building. While traffic pollution often grabs the headlines, extracting new aggregate and disposing of old asphalt from road building can also cause significant environmental issues. It will not escape your attention that, while asphalt is nearly 100% recyclable, routine use of recycled asphalt in road-building projects can be as little as 10% in some European countries.

Costs, lack of awareness, performance worries or even political unwillingness means asphalt is more likely to end up in landfill in some countries than recycled into new road. It is often simply cheaper to extract new aggregate and bituminous binders than recycle it.

This could be about to change. According to the Re-Road project it should be possible to increase the use of recycled asphalt to as much as 99%.

Dr Björn Kalman of the Swedish National Road and Transport Research Institute (VTI) and project colleagues from 13 other European organisations are aiming to develop a suite of innovative technologies to improve the quality of recycled asphalt so it can be used more widely on European roads.

Using a combination of laboratory approaches, computer modelling and field trials, they hope to present recommendations and proven technologies for the use of recycled asphalt in many road-building situations.
In addition to the current costs of recycling, reclaimed asphalts are complex materials according to Kalman, the project’s leader. Impurities can mean that recycled asphalt is unsuitable for inclusion in roads that are under intense use or are exposed to large temperature variations. These lingering doubts about quality mean that some sectors of the asphalt industry have remained cautious about recycled asphalt use.

The Re-Road project hopes to answer these criticisms. Organised largely according to how asphalt is recycled, the project aims to develop technologies for characterising recycled asphalt and analyse how inclusion affects the durability and quality of final mixes. The processes used to produce recycled asphalt are also under scrutiny and it is hoped that an innovative modelling approach will speed up development times of new mixes.

The major concern of the project however, is to look for ways to reduce consumption of natural aggregates and decrease amounts of waste produced when roads are rebuilt. Clearly recycling and re-using asphalt more would help achieve this at a European level.

The successful development of recycled asphalt technologies will help reduce CO₂ emissions from the asphalt laying process, reduce the amount of asphalt disposed of in landfill sites and reduce the risk of dispersion of hazardous substances from waste asphalt, for example.

Currently, reducing construction and demolition waste remains a high priority for the EU because of the quantity ending up in landfill and potential environmental hazards. This is ahead of forthcoming legislation that proposes a ban on landfill disposal of demolition waste by 2020.

The project continues until the end of 2012, when it is expected that recommendations will be made to industry and the EU on how recycled asphalt should be used. With 300 million tonnes of asphalt produced each year in Europe and over 10,000 companies involved in the production or laying of asphalt, it is expected the final project report will be eagerly anticipated.

In the meantime, it is probably wise to cast your eyes back on that road ahead again. That bus has just driven off.

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**RE-ROAD**

**Project Total Cost:** €3.2 million  
**Project EU Contribution:** €2.4 million  
**Partners from:** Sweden, France, Germany, Denmark, Belgium, United Kingdom, Ireland  
**[www.re-road.fehrl.org](http://www.re-road.fehrl.org)**
In the search for innovative forms of transportation, an EU-funded project has found a way for people to drive their cars without actually having to drive them.

Known as “road trains,” a truck driven by a specially trained driver leads a procession of cars or other trucks that automatically follow steering and braking instructions being transmitted wirelessly from the escort vehicle. With their hands and feet completely free, drivers can read, eat, talk on the phone, catch up on work, write letters or watch television, if they so wish.

If the lead vehicle has to turn, speed up, slow down or even brake suddenly, the action is sent instantaneously to the following vehicles, which copy the actions automatically and safely – without the need for the driver to do anything. The following cars constantly measure the lead vehicle’s location, speed and direction, and immediately adjust to any changes – no matter how slight.

“Platooning” or “convoying”, as the road trains are also known, directly addresses the three cornerstone issues of transportation: environment, safety and congestion. With the vehicles drafting a few metres behind each other, SARTRE – short for “Safe Road Trains for the Environment” – can cut fuel consumption by up to 20%. Because the sensor-based system reacts faster than people – who are the cause of 87% of traffic accidents – SARTRE provides safety benefits. And SARTRE can improve how roads are utilised, since vehicles can travel very close together or drive long distances at night when roads are used less.

For drivers, SARTRE can reduce their stress and increase their comfort. It combines the advantages of public transportation, with someone else doing the driving, and the freedom of a privately-owned car that can leave the road train at any time.
The project also provides significant benefits for the EU. SARTRE has brought together leading-edge researchers from four countries, creating meaningful synergies that have already led to spin-off technologies in the rapidly growing field of intelligent transport. Such a wide-ranging project that involves long-distance travel would fit elegantly into Europe’s transportation system.

Recent trials conducted at Volvo’s test track near Gothenburg, Sweden, successfully created a road train comprised of a lead truck followed by three cars travelling up to 90 km/hour entirely autonomously – with a gap of no more than six metres. By autumn 2012, the SARTRE team hopes to add a fourth vehicle to the train, which would complete its current round of tests.

With such complicated technology, a number of challenges – technical and otherwise – have to be worked out. Still unresolved are questions about how the vehicles would respond if the lead truck had an accident, the ideal distance between vehicles, and whether dedicated routes would be established, like traditional public transportation. An EU-wide legal framework will have to be developed to allow road trains to operate throughout Europe.

The system’s biggest advantages may lie in its adaptability and relatively low cost. “SARTRE’s underlying technology can be integrated into vehicles within a few years in a cost-effective manner”, said Eric Chan, chief engineer of Ricardo, a UK-based transportation technology company that is leading the project. “And there is no need to change the road infrastructure, which would allow SARTRE vehicles to use existing highways.”
Powering a car with batteries is basically a question of numbers. The more you have, the further you can expect it to go. However, larger batteries do not necessarily bring more mileage. Their sheer weight and size can cancel out power gains and limit performance; a battery in a 1200 kg Tesla Roadster weighs in at a hefty 450 kg.

This is encouraging the automotive industry to look for other ways to reduce weight and improve performance.

One such approach, which is being explored as part of a European Commission funded project called STORAGE, would be to use lightweight carbon composite body parts that also store electricity.

Carbon composites are already used in products such as sports equipment, aircraft and some high-performance sports cars to provide strength and reduce weight in the products. They tend not to be employed in mass-produced vehicles yet because of current high costs.

According to Emile Greenhalgh of Imperial College, London and the project’s coordinator, this could change if the composites can also be used to provide power to the vehicle. "It could mean that we can get rid of the batteries altogether and power an electric car just from its body work'', he says.

The technology relies on carbon composites acting as super-capacitors to deliver power. The strength of the material and the fact that it can be moulded into any shape could make it ideal for car body parts.

Both batteries and super-capacitors store energy. However, that is just about where the similarity ends. Batteries store energy chemically which is then converted to electrical energy. This is a relatively slow process but it means lots of power can be delivered over a sustained period.
Super-capacitors meanwhile store electrical charge in a layer of ions absorbed on a carbon surface. As there is no chemical reaction, charging can be very quick and recent developments mean that charge can be delivered quickly and stored for much longer.

The €3.4 million EC supported project combines the skills of a number of academic and industrial partners, including Volvo. Since 2010, when the project started, the partners have focused mainly on improving energy density and the structural properties of the material.

The material consists of layers of carbon fibres, separated by a rigid glass-based insulating material, which are then bound together with a glue-like resin rich in lithium ions. Each layer of the sandwich then acts as an electrode between which the ions can flow when they are placed in a circuit. By chemically treating the carbon fibres prior to applying the resin, the surface area can be increased considerably, which translates into increased capacity. The sandwich is then covered in insulating material to ensure it is safe.

“The challenge has been to find new ways of reinforcing the materials, while maintaining the amount of energy stored in them. We now know how to store the energy. The next steps are about power (i.e. speed of delivering the energy) and improving the mechanical properties of the material”, says Greenhalgh.

Reducing weight is a key factor in determining the final performance of any electric vehicle, and the project has already shown quite how much weight might be saved using this material. On a prototype test vehicle they replaced the plastic plenum (a cover that distributes air to the engine), with one made of the carbon composite. The original weighed over 6 kg. The replacement weighed 2.5 kg and has the added benefit of acting as a power source for the vehicle.

According to Greenhalgh, that scale of saving made on much larger body parts could bring performance improvements if it becomes possible to eventually remove the batteries altogether and power the car completely through the composite material. Interest in the project has indeed been considerable, particularly following the widespread media coverage it has received.

Numerous issues with electric cars, including their cost, range, power and charging times, mean they have not been a popular choice with drivers in Europe in the past. Weight reduction and improved performance will be crucial for electric cars becoming widely adopted.
Used all over the world to ship goods stamped with “Made in ...”, containers are at the very heart of global trade. They have been around since the 1950s and have literally revolutionised the way we manufacture, trade and consume goods.

However, if you compare a container from then with one now, you would be hard pressed to spot the difference. The designs of Keith Tantlinger and Malcolm Maclean have essentially remained unchanged since their invention in 1956.

With this in mind, it may surprise you to learn that containers might be about to finally get a revamp. Backed by European Commission funding, the Tellibox project (literally ‘Intelligent Box’) has come up with a new design that is easier to load, can hold much more than a standard container and can still be transported via current infrastructure.

The project’s senior consultant, Mr Heiko Sennewald says, “we basically took the elements of design from an easily loadable articulated truck and applied them to a container that can be switched between road, rail and inland maritime transport methods.”

It should result in considerable efficiency savings for potential future owners, he continues.

At present, the fact that containers are standardised means that they are not always loaded and packed in the most efficient way. Clearly this raises concerns among manufacturers over costs and among governments and the public over the potential environmental impact of the sector.
The new design of the Tellibox takes elements of various current technologies and combines them to give a 100 m³ container that can be loaded from three sides, has a flexible lid and is compatible with the current intermodal transport system. In comparison to a standard 65 m³ container, it now means it should be possible to stack pallets three high as opposed to two. Similar gains have been possible with standard racks that car manufacturers use.

The €3.1 million grant from the European Commission meant that the 10 partner organisations could significantly collaborate in the design and evaluation stages of the project. The partners included a number of commercial organisations, a private rail operator, specialist engineering firms and a number of scientific organisations.

The advisory board of the project, which included representatives of major European car and white goods manufacturers, gave valuable design input to make sure the resulting boxes fitted their needs as much as possible according to Mr Sennewald.

Continuing he says: “The difference in size means that one can expect to transport more goods, more efficiently, which in the long run will make it more profitable than using a standard container. The really interesting outcome is that we can now potentially design a Tellibox to exactly meet the needs of a client and know that it can be shipped via road, rail or inland maritime routes without the need for modification of that infrastructure. That makes it truly tri-modal and unique.”

“It was great that we were able to work with so many organisations. We were able to accommodate many of their requests and use their expertise in finalising the design.”

The project was completed in 2011 with the final design being extensively tested and certified. Successful test runs across Poland, Germany, the Netherlands and the UK helped prove its performance under realistic European transport conditions. At the final demonstration of the Tellibox that took place in Duisburg, Germany in March 2011, a number of vehicle manufacturers reportedly showed interest in the concept and designs.

According to Mr Sennewald, “In terms of success, Tellibox has really worked out in that we have a proven design that is on sale and can be manufactured immediately upon an order being taken. It would not have been possible to achieve this without the high level of collaboration experienced and the support from the European Commission’s funding.”

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**TELLIBOX**

**Project Total Cost:** €4.4 million  
**Project EU Contribution:** €3.1 million  
**Partners from:** Germany, Netherlands, Poland, Slovakia, Switzerland, Belgium  
**www.tellibox.eu**