

# DRIVE

OSCar eO in Dakar  
eO. Future  
The family

MAGAZINE









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# OSCar's eO timeline

**1992**

the company OSC is founded

**2001**

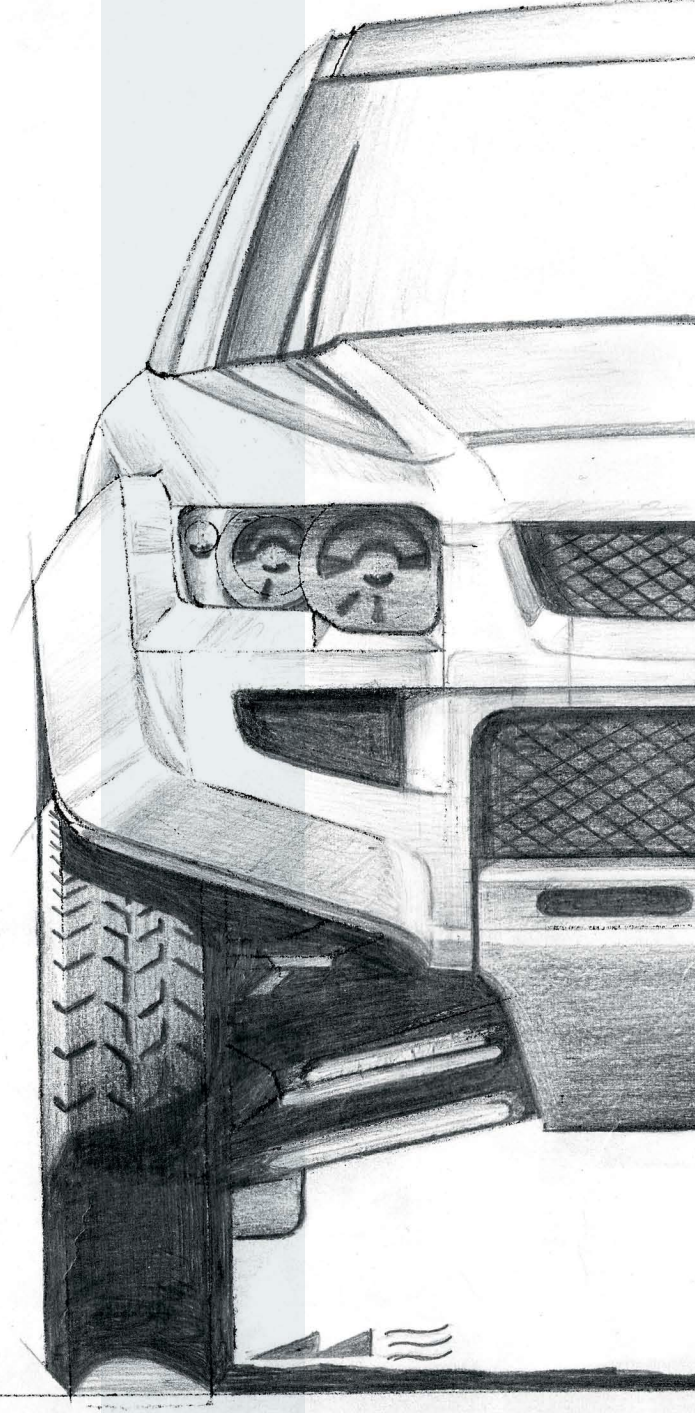
the idea to participate in international rally raids and The Dakar was born

**Spring 2002**

the idea of an OSCar draws its first breath

**August 2002**

Rally Raid Team Latvia and OSC debut in Master Rallye





**September 30<sup>th</sup> 2002**  
the building of OSCar starts

**May 29<sup>th</sup> 2003**  
first OSCar launched

**August 2003**  
OSCar debut in Rally d'Orient

**October 2003**  
OSCar debut in UAE Desert Challenge

**January 2004**  
OSCar debut in The Dakar Rally

**January 2005**  
OSCar participates in The Dakar Rally

**August 2005**  
OSCar debut & win in Hungarian Baja

**October 2005**  
OSCar debut in Baja Anta Da Serra 500 Portalegre

**November 2005**  
OSCar debut in 24-hour off-road endurance race in Portugal

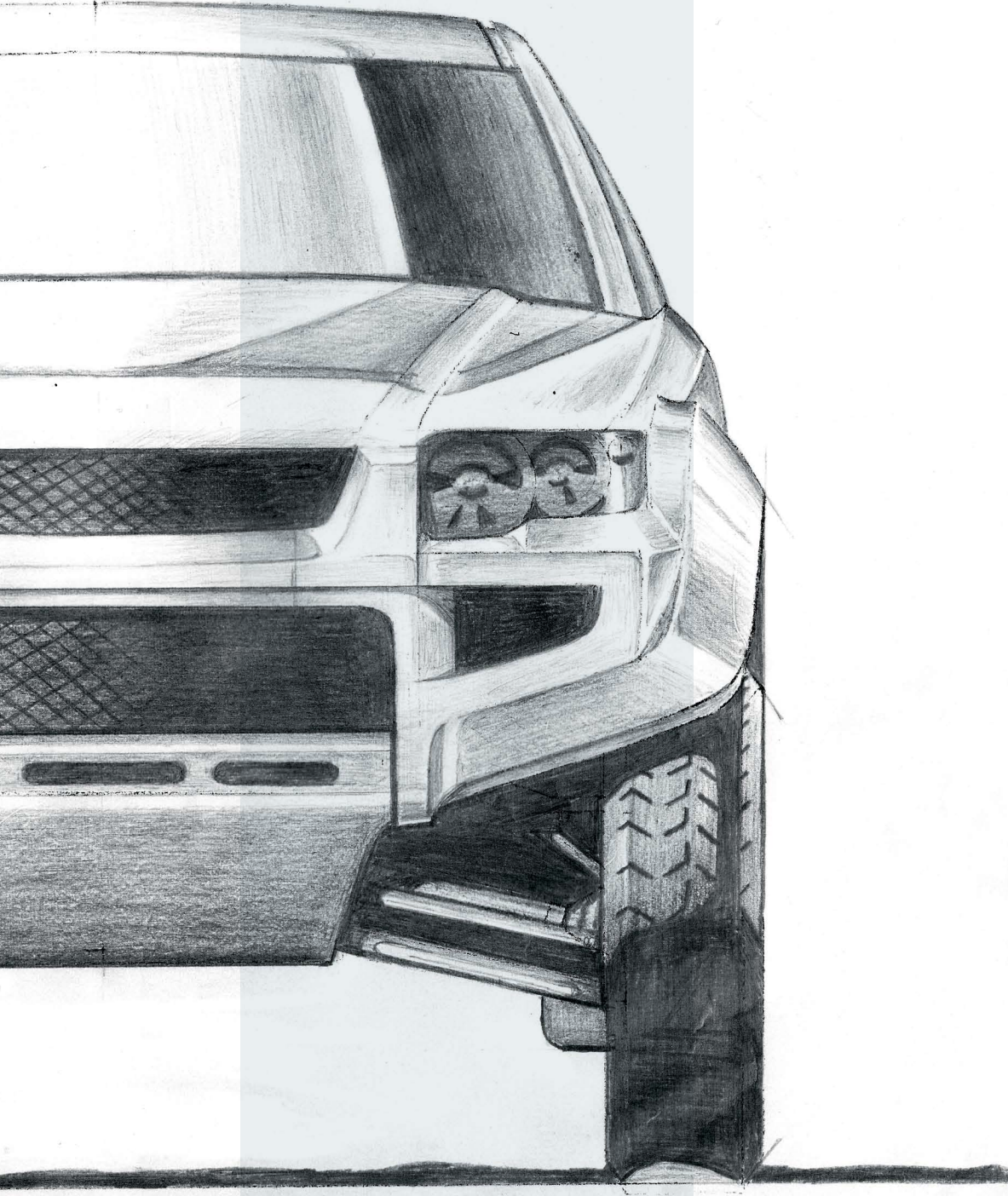




PHOTO BY MAINDRU



### January 2006

OSCar participates in The Dakar Rally

### June 2006

OSCar debut in Baja de France

### January 2007

OSCar O3 debut in The Dakar Rally

### January 2008

OSCar O3 in The Dakar Rally (canceled)

### June 2008

OSCar O3 debut in The Trans-Oriental Rally (*St Petersburg-Astana-Beijing*)

### January 2009

OSCar O3 in The Dakar Rally


### September 2009

OSCar 24H built for 24-hour off-road endurance races in France and Portugal

### September 2009

OSCar O3 debut in 1<sup>st</sup> Silk Way Rally





**Summer 2010**  
the idea to build OSCar eO  
was born

**October 2010**  
start of the OSCar eO project

**April 5<sup>th</sup> 2011**  
building of OSCar eO starts

**August 2011**  
electric test car Nissan Navara  
launched

**November 15<sup>th</sup>  
2011**  
OSCar eO launched

**November 16<sup>th</sup>  
2011**  
president of FIA, Jean Todt,  
visits OSCar eO

**January 2012**  
OSCar eO debut in The Dakar  
Rally (O3 also participates)

**January 15<sup>th</sup> 2012**  
OSCar eO – the world's first  
electric off-road rally car,  
successfully finishes The Dakar  
Rally 2012



# Latvia's OSCar eO becomes the electric-drive vehicle to complete the Dakar Rally

To be the first is exciting. To achieve the unachievable is even more exciting. That is what stimulated the designers at eO, a Latvian company, to create the *OSCar eO* – the world's first electric rally-raid vehicle and the first to complete the Dakar Rally in 2012. This was not an easy task, but the experience gained during the designing, building and racing of the alternative energy-powered vehicle has allowed eO and its sister company OSC to be proud of something that many others have not yet achieved – in producing a viable electric race car, eO has laid the foundations for a new future in motor sports.

The idea was born in the summer of 2010 and didn't let the *OSCar* project initiator, Andris Dambis, sleep properly for over two months, until he finally understood that it

might be possible to realize it. "In October, I began to engineer an electric sports car and in April of the following year we began its construction, even though the design project wasn't really completed. The time frame from the idea to the Dakar Rally was very short and that's why, once the basics were designed, the construction of a new vehicle began immediately. Designing and inventing lasted almost up until the last moment," remembers Dambis.

Even though visually the *OSCar eO* is similar to *OSCar O3* rally raid vehicle, its construction is radically different, because the O3, which had previously been tested at a Dakar Rally, could not be converted to electric drive. The *OSCar eO* building process could be compared to a big *LEGO* construction









game – its general parameters and desired result were clear to the author, but component and supplier selection continued right up to the project's completion. Therefore, some parts were allocated the maximum possible space in the vehicle, assuming that the largest of

the lack of various data made the builders choose the safest option – one electric motor with a transmission.

"If one wants to drive use an electric motor without a gearbox, the generated torque needs to be known precisely. In theory, it is possible to

"During the race we noted and recorded all of the data that no one had previously registered. That is an advantage, because nobody else has this information yet."

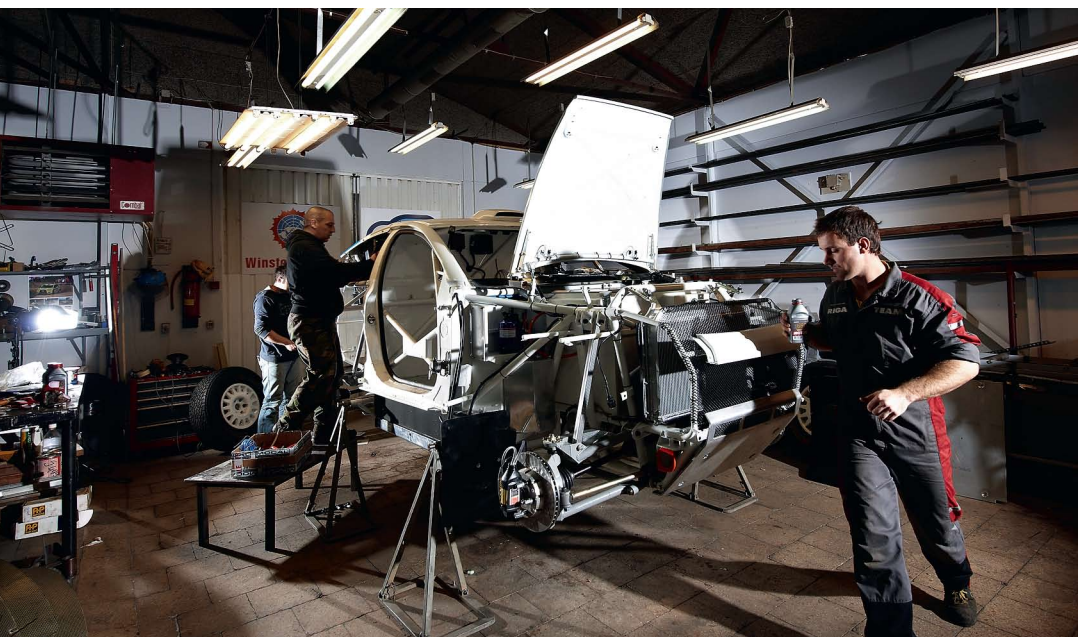
"In order to have the *OSCar eO* delivered to the Dakar Rally on time, and considering the tight

issues were clarified. The actual *OSCar eO* was mostly tested on a rolling road dynamometer and only driven outside of the workshop for a week. After that, the engineering team felt sufficiently confident about the vehicle's ability to operate effectively," says Dambis.

Rules of the Dakar rally require vehicles to have an 800 kilometre autonomy. The commercially available battery technologies make it a virtually impossible task for an electric-drive car. For that reason, *OSCar eO* was fitted with a range extender unit, comprising of an electric generator and an internal combustion engine as the prime mover.

When asked about the selection of the engine, Andris Dambis answers confidently. According to his calculations, a diesel engine could not be built in, because there was insufficient space. The other consideration was that of wanting to be the first in the Dakar Rally's history to complete the race in an electric drive vehicle. Therefore, the engineering team decided not to experiment with alternative fuels, but to make use of a well-tested gasoline internal combustion engine. In addition, the engine was selected with a substantial power and resource reserve to avoid overloading it during the race.

The geography of the *OSCar eO*'s components is



## Every shipment felt like Christmas. Every parcel was immediately opened and some of the items were tried on the *OSCar eO* while it was still under construction

the available components might have to be installed. In total, the construction of the vehicle took 7 months and 10 days. One cannot say that there were no hidden surprises during the project. In the beginning, two electric motors were going to be used, but the limited experience and

calculate everything. However, it is impossible for the calculations to take all of the track conditions into account. I know only now, after the Dakar Rally, what torque and what gear ratio is needed for this rally," discloses Dambis. The grueling 8400-km race was a testing range and laboratory.

schedule we had to complete it, very little time was left for road testing. That is why we made a test vehicle based on the *Nissan Navara*. The same batteries, motor and inverters as in the *OSCar eO* were built into the test vehicle. All the important things were tried out on the test car and the key



extensive, in the sense that the suppliers come from all around the world. During the project, the eO workshop received many shipments, not only from European countries, but also from the USA, Japan and of course, China, which was represented by *Winston Battery's* Li-ion batteries. Every shipment felt like Christmas. Every parcel was immediately opened and some of the items were tried on the *OSCar eO* while it was still under construction. Of course, the engineers and mechanics had no surprises in this process, because only the best components available on the market were ordered after careful selection. Real-life models were also prepared for some of them, so that their size and the space they take up in the vehicle wouldn't be verified only in a computer simulation.

Andris Dambis also remembers carefully preparing for one particular problem discussed by many electric automobile constructors – battery temperature management. Considering that no one had ever used electric vehicles so intensively, several methods and instruments to solve any potential mishaps were developed. OSC admits that the most complicated part of the project was programming the electric drive system – that continued even during the Dakar Rally. The project also developed a battery charging system

## The wind tunnel and the OSCar O5

In 2009, OSC began developing the *OSCar O5* on the base of the existing *OSCar O3* model, with the assistance of a wind tunnel. The *OSCar* body was streamlined and gained a new shape, reducing its aerodynamic drag. Unfortunately, this project has been on hold for the past three years, because FIA has since changed the technical regulations that stipulate the dimensions of race cars. *OSCar* founder Andris Dambis believes that if the *O5* was built according to the new regulations, then the vehicle would not look good. That is the main reason why the development of the *O5* has been suspended. However, Dambis hopes that work on the car will resume some day and that this vehicle will live to see the race track. In the meantime, a model of the *OSCar O5's* body shape has been built on a 1:5 scale – a fact that until now had been kept a complete secret.

## Technical specifications of the OSCar eO

AC PM drive motor with two power inverters  
Torque: 440 Nm nominal / 800 Nm peak  
Power: 150 kW nominal / 335 kW peak  
Recuperative braking  
Winston Battery Li-ion battery pack (160 cells) with BMS  
Nominal voltage: 512 VDC  
Nominal capacity: 100 Ah  
Total energy: 51.2 kWh  
AC PM generator with one power inverter  
Nominal output: 60 kW  
Driven by a Nissan VQ35DE 1C engine  
240-litre safety fuel cell  
OSCar vehicle CAN control  
Gross weight: 2800 kg  
Autonomy: up to 1000 km (terrain dependant)  
OSCar tubular spaceframe & suspension  
Donnerre shock absorbers, two per wheel  
Hydraulic disc brakes  
Hydraulic power steering  
Water/oil, oil/air and oil/water heat exchangers  
Six-speed sequential dog-engagement gearbox  
Limited slip axle drive differentials

## OSCar eO geography

China – Winston Battery Li-ion batteries  
USA – inverters, battery management system  
Great Britain – electric motor, fuel tank  
Switzerland – off-board chargers  
Germany – CAN screens, insulation resistance monitoring system, high voltage cables  
Japan – circuit breakers, internal combustion engine  
France – transmission, shock absorbers  
Latvia – chassis master controller, *OSCar*

that would allow the *OSCar eO* battery to be charged between the rally stages at bivouacs. However, this system was never used, because a balance between energy consumption and its generation was attained during the race. Andris Dambis, who is not only the chief engineer of the *OSCar eO*, but also the co-pilot, handled the energy management himself, because this task could not be entrusted to any computer program while in the race.

What's next? For starters, *eO* is actively continuing to improve its electric sports car and will be present in other rally-raids, such as the Silk Way Rally in July of 2012. However, the *OSCar eO* is only the visible part of the iceberg in the company's *Drive eO* project. *eO* is actively working in the electric automobile niche and plans to manufacture electric automobiles by converting conventional vehicles to electric drive.

Many race car drivers have also taken great interest in these Dakar experiences and have already sought advice from *eO*. One of the first collaboration agreements has been signed with the Russian company *Yo Mobile*, which plans to begin electric vehicle manufacturing and to participate in the rally-raid with an electric-powered vehicle in the very near future.

# eO. Future



**Known** in the car industry as skilled innovators, the Latvian motor sports specialists at OSC recently founded a sister company, eO, with the purpose of launching the first electric rally raid car in the world and manufacturing alternative energy vehicles. This bid proved successful in 2012, with the introduction of the OSCar eO at the Dakar Rally in South America. The

new electric car completed the grueling 8400-km off-road course and finished a respectable 77<sup>th</sup> out of 174 initial participants in the automobile category. Now, eO aims to capitalize on the debut success of its OSCar eO and plans a busy year of further innovations in the electric car industry. Further rally raid appearances will certainly bring the

company more exposure. Work is already underway to rebuild and upgrade the OSCar eO in time for the seven-day Silk Way Rally from Moscow to Sochi in July 2012. Driver Andris Dambis wants to prove that the car is capable of even better sporting results. In search of a faster pace, he is now revisiting all the electric drive components to optimize their performance.

The true scope of the technical expertise of eO's engineers will become evident when they complete the construction of their second hybrid off-road car for the next Dakar Rally in January 2013. The vehicle will be significantly upgraded, based on the invaluable experience learnt during the first attempt. eO expects the alternative energy category to attract multiple entries and



aims to remain at the top of this class.

Motor sports are certainly a strong platform for showcasing a company's engineering capabilities and technologies. The tight deadlines and unforgiving design criteria mean that companies supplying the industry are required to focus on efficiency, performance and reliability. A socially responsible development cycle includes transferring new technologies to road-going vehicles. Electric cars are seen as the most viable alternative form of transportation in the next decade, so rapid advances are in high demand to drive down manufacturing costs and boost sales figures. eO is fundamentally committed to providing quality electric cars and expects to establish a significant presence on the world's streets and motorways. eO is already negotiating with several private companies in Latvia to assist them with the electrification of their vehicle fleets. The *RBS Skals* building contractor and the *Laima* confectionery maker have been among the first to see the potential of these automobiles, thus enhancing the sustainability of their operations. eO has been serving as a one-stop consultant, guiding the companies through the vehicle selection process and helping them to capitalize on government and other grants. eO hopes that *Laima* and *RBS Skals* will be able to start enjoying reduced running costs and an enhanced public image as early as the summer of 2012.



Olegs Dorofejevs, electrical engineer



Egons Martinsons, design engineer



Andris Deduskevics, CAD engineer

Founded primarily as an engineering company, eO is focusing on its own solutions for road-going applications. Vehicle conversions are often the most efficient approach, as they permit each electrical package to be tailored to the specific requirements of the user. eO plans to complete two conversions this summer, resulting in two pure electric cars and incorporating the latest developments from

a worldwide network of technical partners. A *Mini Cooper*, which already has the first test kilometers under its belt, will represent the city commuter segment, while a *Volkswagen T5* van will offer unparalleled corporate transportation of larger groups of people. Both cars will serve as illustrative examples of alternative drive technologies for anyone interested in converting their cars.

While eO's good working relationship with component suppliers around the globe is a great asset, its Latvian engineers are nevertheless left with the task of integrating the vehicle's systems, and the Dakar project proved just how good they are at it. Some of the hybrid drivetrain components, like the chassis master controller and the range extender engine control unit, were fully developed in-house to fill the gap of commercially unavailable products. eO now reckons

eO is fundamentally committed to establish a significant presence on the world's streets and motorways

that more components can be manufactured internally, to achieve full control over the performance of its cars, ensure higher reliability and reduce unit costs. A market research study is therefore well underway to decide on a larger development program. Early candidate products include power electronics, chassis controllers and battery management systems.



PHOTO BY MAINDRU

The first Latvian-built electric car

# OSCar eO

## wows the South Americans



When Māris Saukāns and Andris Dambis raced in the Silk Way Rally, aka “the half-Dakar Rally”, in July of 2011, many noticed the sign on their petrol-fueled OSCar – “This car will be electric in Dakar”. Some saw it as more of a slogan or advertising gimmick rather than a real promise. Even the team’s closest friends in the rally raid community shook their heads at such an unrealistic plan – to build the world’s only electric motor rally raid car in

less than a year, *and* to drive it to the finish in its first Dakar marathon. Eleven months after presenting the project at the Skandi-Motors showroom in Riga, and just two months after premiering the actual car at the Riga Motor Museum, the goal had been reached. On January 15, 2012, after two grueling weeks of driving the 8400+ kilometer Dakar Rally course through Argentina, Chile and Peru, team number 370 crossed the finish line.







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Big wins at the Dakar Rally – which has been taking place in South America since 2009 – are often fought off the track. That includes passing the technical inspection. To the amusement of all, the rally's commissar fruitlessly searched for anything resembling an engine under the hood of the eO. In fact, the eO does have an engine, but it's found in the back and is used for running the generator – that is, it charges the *Winston Battery* batteries found in the front of the car and under its floor. It was precisely this component, not directly related to the electric drive, that caused the greatest headaches at the start of the race.

"We suffered a great setback due to lack of testing in real conditions," admitted Andris Dambis. "We didn't have time to take the eO to Morocco – where it's hot and sandy – for test runs. In Latvia, it simply wasn't possible to get data on the cooling capabilities of the enerator engine in temperatures that exceed 40 degrees." The 46-degree heat in the first stages of the rally raid in Argentina caused the 3.5 liter motor, taken from a Nissan 350Z sports car, to overheat. This forced the team to slow

down, or at times, to even come to a complete stop. After completing two stages like this, the eO's engineers came up with a solution of utilizing the air flow in the back of the car. Feeling yourself along sand dunes in the Atacama Desert is akin to finding a safe crossing from the roof of one seven-storey building to another – especially if there isn't a safe crossing to be found.

"However, the dunes were nothing compared to the mountains... In places, small airplanes were flying lower than us," recalls Ainārs Princis, driver of the accompanying *OSCar O3*.

A jump into the unknown would be an apt description for the initial stages of the Dakar rally raid that, for the first time ever, concluded in Peru. After the wild scene of roaring *Minis* and *Hummers* blasting off at full speed, a hellish reality followed. The track was so mangled that even the rally support trucks could barely drive it.

During the Dakar Rally, everyone – the journalists, the organizers and the participants – must survive on little sleep. Sometimes, the mechanics don't sleep at all. If some team members get the opportunity to doze off

(although that's usually in a slumped sitting position) while waiting for the support car to arrive at the next bivouac, the drivers who have the bad luck to reach the bivouac late – for instance, early in the morning after a grueling night spent digging through sand – don't even have that small luxury.

In a newspaper interview, driver Māris Saukāns and the pilot of the other OSCar described the last five days of the rally race as a nightmare: "On the third day, you begin to lose the ability to recognize the faces of your own team members. Your brain is so tired that you cut off all information that isn't necessary for the most basic of operations – all that's left is washing, eating and climbing into the car to get to the next special stage."

However, after finally crossing the finish line in Lima and then sleeping for 16 hours straight, Saukāns could look back at those last few days with humor:

"While driving one night in the dark, I realized that it had become too quiet. I looked to my right. Dambis had fallen asleep with the map in his hand, even though the car was



"However, the dunes were nothing compared to the mountains... In places, small airplanes were flying lower than us," recalls Ainārs Princis





bumping across brain-jarring ruts in the road. During some stretches we changed places, or stopped to sleep for a few minutes. Dambis had even learned to wave to the crowds while asleep!”

The OSCar eO’s batteries, made by the Chinese company *Winston Battery* and cause of the greatest pre-race worries, never topped more than 56 degrees. During the 8400-kilometer race, none of the electric drive’s components broke down. Aside from the aforementioned radiators and air filters, the sand clogged up only the regular 12-volt alternator, which the drivers were able to repair on site, in the dunes.

The internationally crewed accompanying T4 truck played its part as well.





"There were two times when it pulled us out in a way that only a truck can. One of the times was so dangerous that it completely justified the expense of entering a T4," says Saukāns.

"Only under these conditions did I begin to truly appreciate the eO's electric drive. This car almost never got stuck, as it has 800 Nm of torque. No other vehicle in Dakar's car class has this." However, improvements are needed and have already been conceived: "We need a gearbox that is programmable and can withstand this kind of torque. The car has to go faster," he adds. In practice, the *OSCar eO* proved that a 240-liter fuel tank is sufficient for driving 1000 kilometers. Accordingly, the eO is 50% more efficient than any other rally raid vehicle in its class.

Of the 467 crews and motorcycles that started Dakar Rally Raid in 2012, less than half reached the finish line. The eO was among them, a very decent showing for an electric car that had only recently been put together, and that had not previously been tested in such harsh conditions.





During some stretches we changed places, or stopped to sleep for a few minutes. Dambis had even learned to wave to the crowds while asleep!





PHOTO BY RAIMO LIELBRIEDIS, F64



From the left: Kaspars, Andris and Kristaps Dambis



# Three men, one engine

With their earliest childhood memories being of the garage that belongs to their automobile obsessed father – Andris Dambis, one could safely say that Kaspars and Kristaps were born with cars and racing in their blood. The three Dambis men now form the backbone of the family's race-car business, their individual strengths combined to overcome any weaknesses. The following is a story about the “fast”, but without any hint of the “furious”.

“If it hadn't been cars, he would have made it big in some other business,” states my photographer on the way from Riga to the OSC headquarters. He's speaking about Andris Dambis and how the famously scrupulous perfectionist (and giant in Latvia's car manufacturing sector) approaches his self-set goals. However, 20 minutes later, as we sit in Dambis' office, I begin to think that it just couldn't have been any other business than cars. The office in question is jam-packed with sketches, drafts, books and cork flooring samples for an upcoming exhibition. Any and all of my attempts to veer away from the topic of four wheels comes to a dead-end. I must say, however, that it is one of those dead-ends where you'd like to stay a while. Dambis speaks about cars with such intelligence and enthusiasm that he

could probably make a conversation about virtually any topic pleasant and interesting.

## Three generations

On a bookshelf in Dambis' office is a picture of four-year-old Kaspars giving a ride to two-year-old Kristaps on a Soviet-era bicycle that their father had fitted with a motor. The family's legacy of speed goes back two generations to Andris' father, who was a bus driver. While still a boy, Andris often accompanied his father on his trips, sometimes even sleeping on top of the engine hood in the wooden cabin of the Latvian-made bus from the 1950s. The drone of the bus' motor turned out to be just as potent to Andris as his own garage's tools, smells and conversations would later be to his sons. “I never pushed them into the field. It's just the way things turned out. We've always been together

in this, since they were little,” he would later say about his sons Kaspars, a physicist and Latvian autocross champion; and Kristaps, a motorsport engineer and Northern European rallycross champ. Unlike their peers, Kaspars and Kristaps dismantled, and then put together, their first gear box when Kaspars was nine. They look upon this early education as a trump card. “Kaspars' strong side is formulating and communicating ideas – i.e. visual presentation, whereas Kristaps' is logistics, organization and documentation. We have business meetings where the arguments get pretty heated, but that is our strength. As a trio, we are smarter and more competent,” says Andris Dambis. Even though Kristaps now lives and works between Latvia and the UK, the Dambis Family's ideas continue to take shape, unhindered, in a gray, low-rise building in Ogre, Latvia.







## Mountains and a clear head

While Kristaps works at Dad's co-owned *Mitsubishi* rally team in Warwickshire, England, it is Kaspars who has veered away the most from car engineering. And again, his father is "at fault" here. "Dad was the first who showed me a computer and how web programming works. I felt the same as when I first opened the hood of a car – with the right tools and knowledge, you can make things operate the way you want them to." Alongside his job at *OSC*, Kaspars is a web designer. "I'm the creative one in the family, while Kristaps is the smart one. He learned to read and do math at the same time as me, even though I'm two years older than him," laughs Kaspars. Kaspars has played tennis since his childhood and then got carried away with the guitar for awhile. "Meanwhile, Dad and Kristaps are just into cars. That amazes me," says Kaspars.

When I ask Andris Dambis what other interests he has besides his work, he unhesitatingly answers – "*Raffies*". Made by Latvia's legendary *RAF* factory, various models of these Soviet-era vans – in differing stages of repair – take up a considerable amount of space in the yard of the *OSC* premises. Restoring and refurbishing them has

been Andris Dambis' hobby for years. When queried on interests outside of the world of automobiles, Dambis Sr. needs more time to come up with a reply. Races, including the Dakar Rally, require long periods of time spent abroad, which is why Andris' favored form of relaxation is being at home, in Latvia, and doing simple jobs around the house and yard. A few years ago, the Dambis Family bought some land deep in the countryside – a huge field with small hillocks, brush and a stream – in other words, a perfect place for test-driving the *OSCars* far from the eyes of unwanted strangers. "Staying out there in the summer and mowing the grass for three days straight is what I enjoy doing the most in my spare time."

In Latvia, Andris Dambis likes to be where the gravel roads are. They bring the promise of few people and a natural environment that has been left largely untouched. He also feels the same passion for mountains – a bug that he caught from his wife. "It's not the summits that I'm interested in, as actually, I'm afraid of heights. I simply like walking along the trails. In the mountains, the beauty is never-ending. When you're there, you realize what a small speck of dust you really are. And you come back with a clear head, unable to understand why

anybody would have anything to worry about."

Neither Andris Dambis nor his sons stick out while driving along the streets of Riga. Speed may be a commonly shared skill in this family, but it is the ability to control it that shows the maturity of a real driver. It's the same way with the music they listen to while driving – they certainly don't fall into the stereotype of listening to something heavy and brazen. "My perfect driving music is calm, like a rainy day; along the lines of *Sting* or Chris Rea's *Road to Hell*," says Andris Dambis.

However, he does drive an *Audi A4* with the most powerful engine available. "I'd love to drive around in a *Porsche* or an *Aston Martin*. I really like those are cars, but unfortunately, they're too conspicuous in Latvia. A small, gray car is better suited to my personality. However, it has to be a really good car – in terms of power, engine size and road grip. It's the invisible things that are most important to me, and which those who are in-the-know can appreciate," says the founder of *OSC*. After the interview, on our way back to Riga in Kaspars' small, yet powerful *Ford Focus*, I come to the realization that these same values have been successfully passed down to the next generation.





From the left: Ainārs Princis, Anton Grigorov, Andris Dambis, Māris Saukāns



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